

Information, Uncertainty, and Subjective Entitlements in Bargaining

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Abstract

More often than not production processes are the joint endeavor of people having different abilities and productivities. Such production processes and the associated surplus production are often not fully transparent in the sense that the relative contributions of involved agents are blurred; either by lack of information about the actual performance of collaborators or because of random noise in the production process or both. These variables likely influence the surplus sharing negotiations following the production. By means of a laboratory experiment, we systematically investigate their role for the whole bargaining process from opening offers to (dis)agreements and find that uncertainties in surplus production and (even) a very coarse performance information lead to bargaining asymmetries. In addition, we find that bargainers' subjective entitlements are also influenced by performance information and the randomness inherent in the production process. These differences in subjective entitlements together with the differences in entitlements between better and worse performers influence the whole bargaining process and significantly contribute to the differences in bargaining outcomes.

JEL-Code: C79, C92, D01, D29, D63, D89, M59.

Keywords: bargaining, performance information, randomness in production process, entitlements, experiments.

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1 Introduction

In the season of 1998–1999, a players’ strike lasting 191 days shook the National Basketball League (NBA). Due to the strike the players lost in total about USD 500 million of income, the owners lost about USD 1 Billion and the NBA lost billions of dollars because of dropped ratings. Ironically, the strike set in at a time when the NBA was experiencing very high ratings and generating large revenues from broadcast and advertisement agreements (Donovan 1998). One important reason for the strike was that the players thought that “the league has had enormous growth, globally even” and “players just want their fair share” (Donovan 1998), whereas the team owners argued that they are already paying too much to the players.¹ A major disagreement underlying this dispute concerned the question of the relative contributions of players and team owners to the success of the NBA. In a completely different business area, a similar conflict was reported between the voice actor of a popular computer game and the company owning the rights of the game. The involved parties strongly disagreed on their relative contribution to the sales success of the game, and in consequence, on the relative fair share of the gains they felt entitled to (Schiesel 2008).²

Disagreements about how to share a jointly produced surplus do not only occur in cases of unexpected success but also, and probably more fiercely, in situations of economic distress. Discussions and disputes about how to share the burden between white collar and blue collar workers or between management and workers during business and economic crises come to mind (Corfman and Shmeltzer 2002; Buhayar 2009; Lyons 2009). A recent example is the economic crisis in Greece: on February 10, 2010, thousands of people hit the streets of Athens to protest the Greek government’s belt-tightening program amid a deep economic crisis. Their message was that the crisis is mainly due to the wrong-doings of the high-level managers and corrupt business practices in the financial sector and hence the burden should be put on them, not on the low-income, blue-collar workers. Also in the (semi-)public sphere discussions about how to share the fruits of success and the burden of distress are frequent. In academic institutions financial distress leads to less liquidity and, hence, necessary cuts in departments’ budgets. In such situations, while most agree on the necessity of cuts, there is much disagreement about the distribution of the burden and how it is going to be determined (Jan 2009). Another example are arising discussions and conflicts when it comes to

¹The cited statements are taken from the speech of Atlanta Hawks forward and member of the union’s executive committee, Tyrone Corbin.

²The computer game Grand Theft Auto IV became the fastest selling game to date when it was released on December 2, 2008 in the United States. It sold about 3.7 million copies on its first day, generating at least USD 500 million revenue in the first week (Ortutay 2008; Totilo 2008). The voice actor (Michael Hollick) and the company (Rockstar Games) haggled about the relative contributions of the “human performance” and the “conception of the art director” to the success of the game.

reforms of public pensions or health insurance systems, where the conflict often centers around the question of the relative burden different generations and different income groups have to carry.

How different these examples are, they are all related to the fact that economic surplus is the joint product of different people whose interests diverge when it comes to the division of the jointly created surplus. Agreements on how to divide the surplus may seem easy if it is without doubt determined by the contributions of all involved parties and when there is complete information of the relative contributions. However, often, if not most of the time, the relative contributions of the involved parties cannot be precisely determined and success and failure is at least partly determined by random factors inherent to the production process. The (lack of) information and the (un)certainities in the production process may lead to disagreements among the parties and, hence, may influence the outcomes of negotiations on how to share the produced surplus. In addition, there is evidence that such negotiations can be influenced by entitlements and obligations parties bring to the bargaining table (Thompson and Loewenstein 1992; Babcock et al. 1996; Gächter and Riedl 2005).

Interestingly, there is no clean evidence on how relative performance information and information about the influence of exogenous factors in surplus creation affects bargaining outcomes. Such evidence is important, however, because a good understanding of the influences of these factors on bargaining behavior may help to avoid discussions and potentially costly conflicts as reported above. In addition, in the reported examples the involved parties often explicitly or implicitly refer to their (perceived) entitlements when arguing in their own favor. For instance, in the NBA conflict players claimed that they only wanted their fair share and in political discussions around pension reforms it is often the older generation which argues that they have contributed to the increase in wealth and are, hence, now entitled to their fair share. In view of this, it is surprising that little is known about the interaction between information on relative contributions and uncertainties in surplus creation and entitlements in bargaining.

In this paper we implement a 2×2 experimental design to investigate the effects of relative performance information and random noise in the production process on bargaining behavior, and to explore how these factors interact with subjective entitlements.³ Specifically, in one condition the surplus is produced by the performance of two subjects in a real effort task in a deterministic way, whereas in another condition the surplus size is also influenced by a random factor. To investigate the effect of relative performance information, in one condition we inform subjects in a bargaining

³In the literature, the term “entitlement” is not always used in the same way. In our study we use the term as defined by Schlicht (1998, p.24): “Entitlements are rights, as perceived by the individual. They are not, however, abstract legal rights. Rather they denote the subjectively perceived rights that go along with a motivational disposition to defend them.”

pair whether (s)he has been the better or worse performer, whereas such information is not given in another condition. In addition, in all conditions we elicit subjects' subjective entitlements by way of a fairness question as in Gächter and Riedl (2005). After production subjects have to bargain on the distribution of the surplus in a computerized free-form bargaining environment, where we can trace all important elements of the negotiation process from opening proposals, concession behavior, bargaining duration, and (dis)agreements.

We find that information about the relative performance as well as (the absence of) noise in the surplus production affect bargaining behavior at all levels. Compared to the situation without performance information, in the condition with performance information opening proposals and agreements are skewed away from an equal split in favor of the party that performed better in the real effort task. In addition, relative performance information leads to smaller and later concessions and longer bargaining duration. Furthermore, in comparison to surplus production with noise, opening proposals favor the better performing party, concessions are smaller and later, and bargaining duration is longer, when the surplus creation is deterministic.

Subjective entitlements play an important role in explaining differences in bargaining outcomes within as well as between conditions. First, probably unsurprisingly, entitlements of better and worse performers differ and they differ most in the condition with relative performance information. Second, and more importantly, we can trace the differential influence of entitlements among the different conditions through the whole bargaining process. In all conditions, opening proposals of better performers are significantly positively influenced by their entitlements. This does not hold for worse performers. Concession behavior and bargaining duration are strongly related to the tension in entitlements between better and worse performers, but only in conditions with performance information and deterministic surplus production. In consequence, in these conditions, bargaining durations are also influenced by entitlements. When the production process is deterministic also agreements are strongly influenced by entitlements of the better performing subject, but not by the worse performing subject. In summary, we find that the knowledge of relative performances in the real effort task as well as the randomness of the production process differentially influence bargaining behavior, and that much of this differences are mediated by subjective entitlements bargainers derive in the production process.

The rest of the paper is organized as follows. The next section provides a brief overview of the related literature. Section 3 presents the experimental design and procedures, Section 4 reports the results and Section 5 concludes.

2 Related Literature

There are only a handful of papers, which examine the influence of fairness judgments (or subjective entitlements) on negotiations. Messick and Sentis (1979) report results from an experiment showing that subjects' fairness judgments are self-servingly biased. Thompson and Loewenstein (1992) also find that subjects' fairness interpretations are egocentric and that these biases cause delays in settlement and that the magnitude of these biases predicts the length of delays in agreements. Along the same lines, Babcock and Loewenstein (1997) show that self-servingly biased assessments of fairness can delay agreements and cause impasse even when the fairness assessments are common knowledge or impartial. More recently, Gächter and Riedl (2005) find strong entitlement effects that shape all layers of the negotiation process and they argue that entitlements constitute a "moral property right" that is influential independent of negotiators' legal property rights.

Standard bargaining theory predicts that more information leads to more efficient bargaining by reducing information asymmetries between bargaining parties and, hence, strategic delays (Rubinstein 1985; Admati and Perry 1987). However, Camerer and Loewenstein (1993) show that increasing the information available to bargainers may lead to less efficient bargaining. The main reason for this is that the information provided to bargainers may strengthen the tension between their fairness judgments and this effect may offset the positive effect information is supposed to have.⁴ Babcock, Loewenstein, Issacharoff and, Camerer (1995) and Loewenstein and Moore (2004) are other studies, which also showed that sharing information may lead diverging perceptions of fairness and, hence, make settlements less likely.

To the best of our knowledge, there is no study that examines the influence of noise in the surplus production process on the bargaining of how to share the produced surplus. Diekmann et al. (2004) argue that when people face increased uncertainty, fairness becomes more important to them and fairness judgments affect their reactions more strongly. However, their study investigates the influence of uncertainty about performance standards and appropriate behaviors on the relationship between fairness and job satisfaction. Babcock, Loewenstein and Wang (1995) study the effect of uncertainty about the bargaining opponent's reservation value and show that uncertainty

⁴When motivating their argument they present the following interesting example about the potentially negative influence of information on bargaining outcomes: "For example, suppose two people contribute different amounts of time to a joint project. The person who worked less will typically think that equal compensation is fair, while the person who worked more will think that payments should be proportional to effort (Messick and Sentis 1983). If the parties bargain over how to split the proceeds from the project and each know how much the other worked, they may have difficulty in agreeing up on a split, since the one who worked more will demand a larger share of the proceeds while the one who worked less will demand an equal share. If the parties did not know how much the other put in, however, they could not base compensation on input levels and they might be more likely to settle."

decreases bargaining efficiency. A related literature concerns people’s tendency to overestimate their own inputs (see Ross and Sicoly 1979) and that the interpretation of “deservingness” is often controversial (see Bazerman and Neale 1992). Both of these effects may be intensified under uncertainty.

3 Experimental Setup

In our experiment, randomly and anonymously paired subjects take on the role of department heads of a company who have to bargain over a salary budget. This salary budget is either completely or only to some extent determined by the department heads’ joint performance in a real effort task. In addition, we vary the information about the relative performance of the department heads. Specifically, in the *noinfo* condition subjects receive no information on their relative or absolute performances in the real effort task, whereas in the *info* condition subjects get informed who in a pair had the better and who had the worse performance. In the deterministic (*det*) condition the salary budget is completely determined by department heads’ joint performance, whereas in the stochastic (*stoc*) condition the salary budget is determined by department heads’ joint performance only with a 25% chance and randomly determined with a chance of 75%. Hence, we have a 2×2 experimental design with four treatments, which are labeled as *noinfo-stoc*, *noinfo-det*, *info-stoc* and, *info-det*.

At the beginning of the experiment, subjects are informed that their firm has a salary budget of 2050 points available and that this budget can change depending on their performances or some factors external to the firm. In any event, the top management of the firm does not want to impose a salary distribution. Instead, the department heads are asked to bargain over the distribution of the salary budget.⁵ In the experiment 100 points are worth 65 euro cents. Hence, the default salary budget of 2050 points corresponds to € 13,33.

Table 1 summarizes the main elements of the experiment in the sequence they were presented to the subjects.⁶ Below, we explain each part in detail.

Performance and Outcome Determination: After reading the instructions aloud, the performance of each department head is determined with a general knowledge quiz (Hoffman et al. 1994; Clark 1998; Gächter and Riedl 2005). Before taking the quiz subjects are informed that their performances will affect the salary budget either for sure (in *det*) or with some chance (in *stoc*).

⁵This framing and some other details of the experimental design are borrowed from Gächter and Riedl (2005).

⁶After stage 7 we conducted another bargaining round, which was not pre-announced. The results of this stage are reported elsewhere.

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.	Measurement of entitlements
7.	Bargaining
8.	De-briefing questionnaire

[†]This information is given only in *info* condition

The general knowledge quiz consists of 16 multiple choice questions. For each question five possible answers are provided, with exactly one being the correct answer. The questions concern several fields of knowledge, such as politics, music, religion, astronomy and, geography. Each participant receives the same set of questions in the same order. Subjects have at most 30 seconds to answer each question. Unanswered questions count as wrong answers. The head of department with the most correct answers in each pair has a better performance. All subjects are informed of these details.

After the quiz, subjects get to know the actual salary budget, which could be 1390, 2050, or 2710 points. In the *det* condition, the salary budget is determined completely by the joint performances of department heads in a pair and described to subjects in the following way:

- (i) *If the total number of correct answers by you and the other department head is from 0 to 10, then the salary budget will be 1390 points.*
- (ii) *If the total number of correct answers by you and the other department head is from 11 to 20, then the salary budget will be 2050 points.*
- (iii) *If the total number of correct answers by you and the other department head is from 21 to 32, then the salary budget will be 2710 points.*

In the *stoc* condition, subjects are informed that with a chance of 25%, their salary budget is determined by their joint performances and with a chance of 75% randomly, in which case each salary budget size has an equal chance to be chosen.

Elicitation of Beliefs on Performances: Knowing the salary budget, each subject is asked to report his or her beliefs about the own number of correct answers as well as the number of correct answers of the other department head. The rationale for asking subjects' beliefs about their

performances after informing them about the value of the salary budget is that attributions may be reflected by these beliefs. These belief elicitation are incentivized: for each precise estimation, a subject earns 60 points, for each estimation with 1 (2) error(s), a subject earns 30 (15) points; estimates with larger errors do not earn any points.

Relative Performance Information: In the *noinfo* condition, subjects are not given any information about their relative performances in the quiz. In the *info* condition, they are given information indicating whether they are the better or worse performer in their pair.⁷ Specifically, the department head with more (less) correct answers in each pair receives a message saying that “*You had more (less) correct answers in the general knowledge quiz than the other department head*”. In case of ties, subjects are also informed about that.

Measurement of Subjective Entitlements: We measure subjective entitlements of bargainers by an *arbitrator question*, adapted from Babcock, Loewenstein, Issacharoff and, Camerer (1995). All subjects answer the following question:⁸

“According to your opinion, what would be a ‘fair’ distribution of the salary budget from the vantage point of a non-involved neutral arbitrator? (Please use exact amounts; no intervals! The amounts have to sum up to the salary budget!)”

The answer given to this question informs us about subjective fairness judgments that are likely to influence bargaining behavior (cf. Gächter and Riedl 2005).

Bargaining: Subjects in each pair have to bargain over the available salary budget. Bargaining can take at most ten minutes and if subjects reach an agreement, they are paid their agreed shares. If they do not reach an agreement within ten minutes, they are ‘fired’ by the top management and do not earn any points from bargaining. Bargaining is free-form because it avoids exogenous first-mover effects and gives subjects as much bargaining freedom as possible (e.g., in the timing, sequence and number of proposals). Subjects are seated in computer cubicles and bargain anonymously over a computer network by sending proposals that consist of an amount for themselves and an amount for the other department head. Verbal communication is not allowed.⁹

⁷The rationale for presenting this information after eliciting beliefs on performances is two-fold. First, the salary budget information already reduces performance uncertainty and we did not want to present more information that might influence subjects’ beliefs, and second, we did want to have a certain level of symmetry in belief elicitation between the *info* and *noinfo* conditions.

⁸Subjects were not informed about this question beforehand. They answered it after they stated their beliefs about performances in the *noinfo* condition and after they received the relative performance information in the *info* condition, respectively. Hence, subjects’ fairness judgments may depend on the role (they believe) they are in. For this reason, we call this entitlements *subjective*.

⁹For bargaining instructions and a bargaining screen-shot, see the Web Appendix on the authors’ websites.

De-briefing Questionnaire: After all parts of the experiment are finished, subjects are asked to report their satisfaction about the bargaining outcome, their opinion about the quiz and their bargaining behavior. They are also presented the Machiavelli personality test (Christie and Geis 1970) to measure certain personality traits such as toughness, self-orientation, competitiveness, etc., which could be important in bargaining, and a risk attitude questionnaire (Dohmen et al. 2005). Finally, subjects answer a few questions about their personal background.

The experiment was computerized and programmed in z-Tree (Fischbacher 2007). We conducted the experiment in the BEElab (Behavioral and Experimental Economics laboratory) of Maastricht University in April 2009 and February 2010. In total 348 subjects participated in 16 randomized experimental sessions. Most of our subjects were undergraduates in economics, business and international business. A typical session lasted about 90 minutes. The average earnings per subject were approximately € 16 (including a show-up fee of € 3).

4 Results

We first present some descriptive statistics using the pooled data from all conditions and then move on to a more detailed analysis of important aspects of the bargaining process (that is, opening proposals, concessions, bargaining duration, agreements). In the analysis of the different conditions we focus on differences between the *info* and the *noinfo* conditions (aggregating over *det* and *stoc*) and the *det* and the *stoc* conditions (aggregating over *info* and *noinfo*). The reason for this focus is that it allows us to examine, on the one hand, the effect of performance information, and, on the other hand, the effect of uncertainty in the budget determination process. Thereafter, we relate differences in the bargaining process across different conditions to differential influences of subjective entitlements.

In what follows, we refer to the subject with more (less) correct answers in the general knowledge quiz as the “winner” (“loser”) and express all allocations in shares to the winners (“winner share”). Throughout the paper, when referring to statistical tests, we use two-sided Mann-Whitney signed rank, Wilcoxon rank-sum, and Spearman rank-order correlation tests where appropriate and unless otherwise stated.

Overall, in 22 (out of 174) pairs both subjects had the same number of correct answers. On average, the fairness judgment of these subjects is 0.53. 19 of these pairs agreed on an equal division of the salary budget. Whenever we analyze winners’ and losers’ behavior (e.g., their fairness judgments, opening proposals etc.) we exclude these pairs from the analyzes. Furthermore, in regression analyzes where we use pair-level data (e.g., bargaining duration, concession behavior

etc.) these pairs are included and their impact is controlled for with a dummy variable, *tie*. It takes the value 1 for pairs where both subjects had the same number of correct answers, and 0 otherwise.

4.1 Descriptive Statistics

The average number of correct answers in the quiz was 7 (out of 16). On average, subjects predicted that they had 7.26 correct answers and that the other department head had 7.54 correct answers ($p = 0.015$). That we do not observe overconfidence is in line with findings in other studies indicating that there is no (or negligible) overconfidence at success levels of around 50% (cf. Moore and Healy 2008; Blavatsky 2009). Importantly, subjects' answers to the de-briefing questions about the quiz show that they perceive it as a legitimate measure of general knowledge, which is also confirmed by subjects' opinion on the difficulty of the quiz.¹⁰

The salary budget of 1390, 2050, and 2710 points occurred in 55, 81, and, 38 pairs, respectively. In the statistical analysis we pool all salary budget sizes because there are no significant differences with regard to any main behavioral aspects, as fairness judgments, bargaining duration, agreements, etc., across different budget sizes.¹¹ Overall, the average duration of bargaining was 5.48 minutes and the average number of proposals in a pair was 11.6. Out of 174 bargaining pairs, 169 reached an agreement, with an average winner share (of the salary budget) of 0.53. We exclude the five pairs which did not reach an agreement from our analyzes of agreement times and agreements.

4.2 The Effects of Information and (Un)certainly on Bargaining Outcomes

Opening Proposals: Figure 1 depicts the distribution of the *very first* proposals (opening proposals) made in a bargaining pair, separately for losers and winners in the pooled data. As the figure shows, winners' opening proposals are always at or to the right of 0.50 (mean 0.63) and losers' opening proposals are mostly at or to the left of 0.50 (mean 0.45). The equal-split (50-50) is the modal opening proposal of losers, who made an opening proposal in 26 out of 73 cases.

The share proposed in the very first offer clearly depends on the role the subject is in. In all four conditions, the opening proposals of winners are highly significantly larger than the opening proposals of losers ($p < 0.0001$). In addition, 11 (1) of 12 equal-split proposals in *info* came

¹⁰In a 7-point Likert scale where "1 = do not agree at all" and "7 = agree very much", the average (median) degree of agreement with the statement "In my view the knowledge questions have been difficult" is 5.10 (5). On the same scale, the average (median) degree of agreement with the statement "The one with the better general knowledge is able to answer more questions correctly" is 5.42 (6).

¹¹Across all three salary budgets, Kruskal-Wallis rank tests fail to reject the null hypotheses of equality of fairness judgments of winners ($p = 0.57$) or losers ($p = 0.93$), bargaining durations ($p = 0.60$), and agreements ($p = 0.54$).

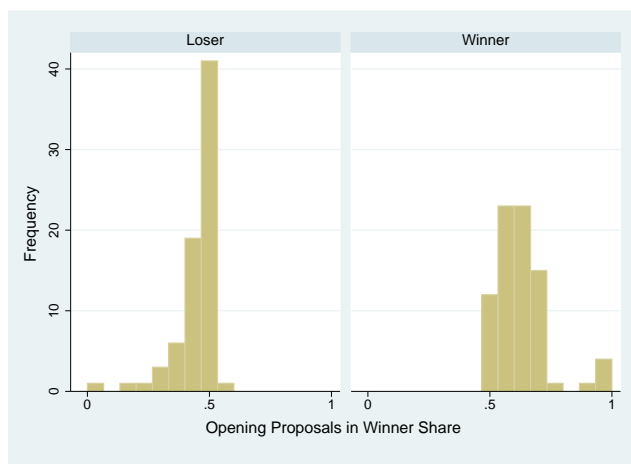


Figure 1: Distribution of Opening Proposals (pooled data)

from losers (winners) and 14 (3) of 17 equal-split opening proposals made in *noinfo* came from belief-losers (belief-winners).¹²

Table 2 shows the average opening proposals (in winner shares) by winners and losers in the different conditions and treatments. The results depicted in the table show that both the presence of relative performance information and the way the salary budget is determined cause differences in opening proposals. For winners and losers they are higher in the *info* condition than in the *noinfo* condition ($p = 0.0001$ for winners and $p = 0.006$ for losers), and they are also higher in the *det* condition than in the *stoc* condition (winners: $p = 0.1040$, losers: $p = 0.003$). This indicates that whenever there is performance information or outcome certainty, winners' opening proposals become more aggressive and losers' opening proposals become more accommodating.

Concessions: We employ three concession indices introduced by Gächter and Riedl (2005), which incorporate both the size of a concession and the time at which a concession is made. These three measures are (i) the sum of average relative concessions, (ii) the sum of average concession times, and (iii) the sum of average time-weighted relative concessions, where the sum is taken over the individual statistics of the two bargainers in a pair.¹³ These indices combine individual-level data

¹²Belief-winners (belief-losers) are subjects whose predictions of number of own correct answers are greater (less) than their predictions of other department head's number of correct answers.

¹³The exact definitions are as follows (adapted from Gächter and Riedl 2005): A relative concession of a winner is defined as the difference between a winner's standing offer (in winner share) and his new offer (in winner share) divided by the current bargaining area. The current bargaining area is given by the difference between the standing offer of the winner (as winner share) and the standing offer of the loser (as winner share). A relative concession of a loser is defined analogously. For example, if the standing offers of a winner and a loser are 0.7 and 0.5, respectively (i.e., the current bargaining area is 0.2), and the winner now demands only 0.6 for himself, then the absolute concession

Table 2: Average Opening Proposals (Winners and Losers)

		Winners			Losers			
		<i>noinfo</i>	<i>info</i>	<i>both</i>				
					<i>noinfo</i>	<i>info</i>	<i>both</i>	
<i>stoc</i>		0.59	0.64	0.61	<i>stoc</i>	0.41	0.45	0.43
		(20)	(18)	(38)		(23)	(19)	(42)
<i>det</i>		0.60	0.69	0.66	<i>det</i>	0.48	0.48	0.48
		(18)	(23)	(41)		(17)	(14)	(31)
<i>both</i>		0.59	0.67		<i>both</i>	0.44	0.46	
		(38)	(41)			(40)	(33)	

Note: Numbers in parentheses are the numbers of observations.

in each pair and summarize the concession behavior in a pair, which circumvents the problem of reciprocal behavior in bargaining when analyzing individual concession behavior (Kuon and Uhlich 1993; Hennig-Schmidt 1999).

Table 3 shows descriptive statistics for all three concession indices in all four conditions. Note, that a larger value of the sum of average relative concessions (*relative-concession*) indicates larger concessions, a larger value of the sum of average concession times (*concession-time*) indicates later concessions and, a larger value of the sum of average time-weighted relative concessions (*time-weighted*) indicates earlier and/or larger concessions.

The figures in the table show that, concessions in the *noinfo* condition are larger (*relative-concession* = 1.06) and earlier (*concession-time* = 258.9) compared to those in the *info* condition (0.75 and 420.0, respectively). The average time-weighted relative concessions are also larger in the *noinfo* condition (*time-weighted* = 512.3) than in the *info* condition (284.6). All differences are statistically highly significant ($p \leq 0.0001$). Qualitatively, the same relationships hold for all three

is 0.1 and the relative concession is 0.5 (= 0.1/0.2). The magnitude of 0.5 can be interpreted as going halfway toward an agreement. The initial bargaining area is assumed to be equal to the salary budget (i.e., 1). A concession leading to a new offer that precisely matches the opponent's standing offer gives a relative concession of 1. Therefore, an acceptance is calculated as a relative concession of 1. The summary statistics average relative concession of a bargainer is just the average of all of his relative concessions made during the bargaining process.

The average concession time of a bargainer is defined as the sum of concession times divided by the number of concessions.

A time-weighted relative concession is a relative concession (as defined above) multiplied by (600 - time of concession) if the concession is positive and multiplied by time of concession if the concession is negative, respectively. This measure has the property that a given positive (negative) relative concession gets the less (more) weight the later the concession is made. The statistic we use is the average of all time-weighted relative concessions of a bargainer.

Table 3: Average Concession Behavior in each Condition

	<i>noinfo</i>	<i>info</i>	<i>stoc</i>	<i>det</i>
<i>relative-concession</i>	1.06 (0.50)	0.75 (0.59)	0.94 (0.60)	0.87 (0.52)
<i>concession-time</i>	258.9 (219.1)	420.0 (215.3)	300.5 (209.4)	376.5 (248.2)
<i>time-weighted</i>	512.3 (335.6)	284.6 (369.4)	424.0 (390.6)	377.6 (345.8)

Note: Standard deviations in parentheses.

concession indices when comparing the *stoc* condition with the *det* condition. Here, the differences in *concession-time* and *time-weighted* concessions are also statistically significant ($p = 0.0483$ and $p = 0.0671$, respectively).

Bargaining Duration: The mean bargaining duration is 329 seconds, which is slightly more than half of the 600 seconds of bargaining time given to the subjects. Agreement times are widely dispersed (standard deviation: 232 seconds) and range from agreements already after 12 seconds to last-second agreements. Table 4 reports the distribution of agreements over time (in minute blocks). The statistics shown in table indicate that agreements are reached most frequently either at the very beginning or at the very end. 49 pairs (out of 169 pairs that reached agreements) agreed in the first two minutes. In the next seven minutes, only 57 pairs reached agreements, whereas the number of pairs that stroke an agreement in the last minute is 63. 54 of these 63 last-minute agreements are reached in the last five seconds. This tendency to reach agreements in the last minute is in line with observations in many other free-form bargaining experiments (see, e.g., Roth et al. 1988).

Importantly, the frequency of last-minute agreements strongly varies across conditions. In the

Table 4: Distribution of Agreements over Time

time blocks	<u>0 – 1</u>	<u>1 – 2</u>	<u>2 – 3</u>	<u>3 – 4</u>	<u>4 – 5</u>	<u>5 – 6</u>	<u>6 – 7</u>	<u>7 – 8</u>	<u>8 – 9</u>	<u>9 – 10</u>
<i>Pooled Data</i>	28	21	15	9	14	8	3	4	4	63
<i>noinfo</i>	20	16	12	6	6	4	0	1	2	22
<i>info</i>	8	5	3	3	8	4	3	3	2	41
<i>stoc</i>	14	13	9	7	7	5	3	3	2	27
<i>det</i>	14	8	6	2	7	3	0	1	2	36

info condition they are almost twice as frequent as in the *noinfo* condition (41 vs. 22) and in the *det* condition they are more frequent than in the *stoc* condition (36 vs. 27). Tests of equality of proportions confirm that these differences are statistically significant ($p = 0.0002$ and $p = 0.0184$, one-sided tests). The differences across conditions are also reflected in average bargaining durations. The average bargaining duration in the *noinfo* condition is 255 seconds whereas it takes subjects 424 seconds to strike an agreement in the *info* condition ($p < 0.0001$). Similarly, in the *stoc* condition, on average, an agreement is reached after 307 seconds but this takes, on average, 369 seconds in the *det* condition ($p = 0.09$). Hence, bargaining was tougher in *info* and *det* than in *noinfo* and *stoc*.

Agreements: Figure 2 depicts the distribution of agreements (in winner shares) across all conditions. It shows that although about half of all agreements (82 out of 169) are equal-splits, agreements are clearly twisted in favor of winners. On average, the agreed share to a winner is 0.53 and it is significantly greater than 0.50 ($p < 0.0001$). In 73 cases (out of 169) the agreed share to the winner is more than 50% of the available salary budget.

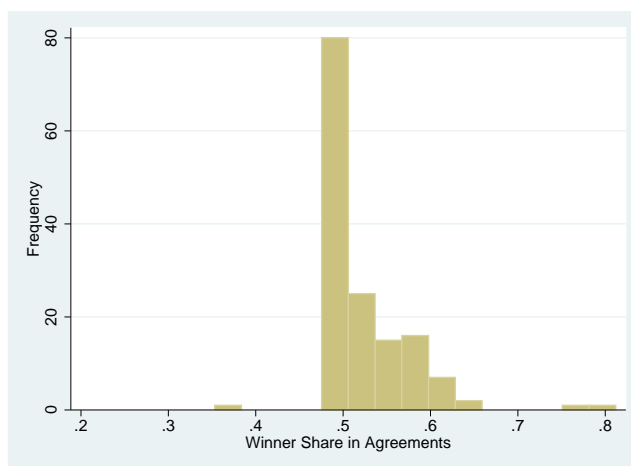


Figure 2: Distribution of Agreements (pooled data)

The pooled data conceal quite some differences in agreements across conditions, however. Figure 3 depicts the distribution of agreements (in winner shares) in the *info* and *noinfo* conditions (Panel (a)) and in the *det* and *stoc* conditions (Panel (b)), separately.

Figure 3(a) indicates a clear difference in agreements between the *info* and the *noinfo* condition. In *noinfo* all agreements are close to the equal split, whereas agreements in *info* they are mostly spread out between 0.5 and 0.65. Equal splits occurred only 17 times in the *info* condition, but 65 times in the *noinfo* condition. A test of equality of proportions shows that this difference is significant ($p < 0.0001$, one-sided test). On average, the agreed share to the winner is 0.55 in

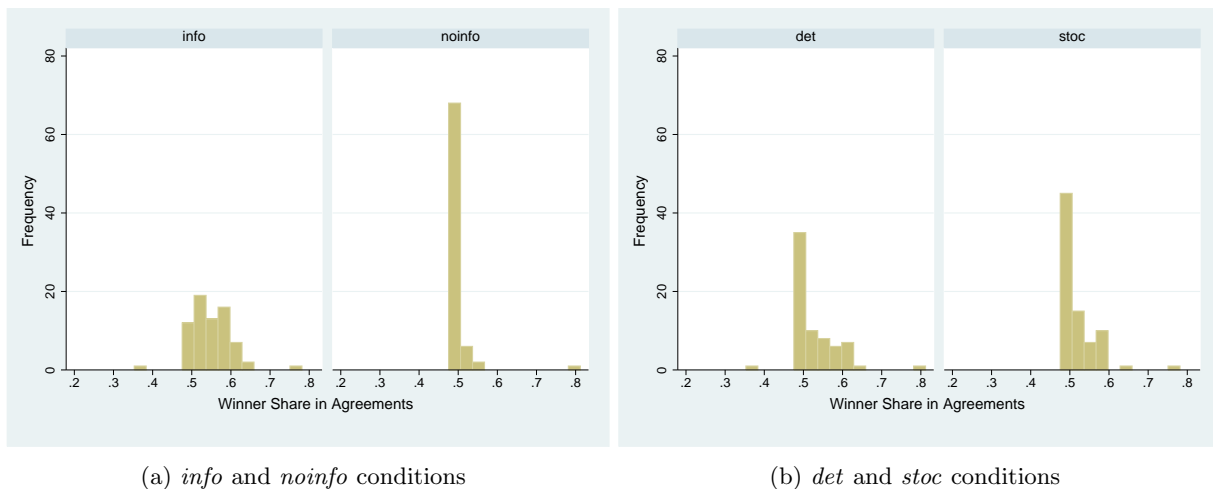


Figure 3: Distributions of Agreements in each Condition

the *info* condition, but only 0.51 in the *noinfo* condition. This difference is statistically significant ($p < 0.001$). Furthermore, in the *info* condition the average agreed share is significantly larger than 0.50 ($p = 0.000$), whereas this is not the case in the *noinfo* condition ($p = 0.7788$).

Figure 3(b) suggests only little differences in agreements between the *det* and *stoc* conditions. Indeed, on average, the agreed share to the winner is 0.52 in condition *stoc* condition and 0.53 in condition *det*. These averages are significantly different from 0.50 in both conditions ($p < 0.0001$). However, the average agreed shares do not significantly differ between the two conditions ($p = 0.3786$).

Table 5 summarize our main findings reported in this subsection.

Table 5: Significant Differences between Conditions

	difference between	
	<i>info</i> and <i>noinfo</i>	<i>det</i> and <i>stoc</i>
opening proposals	yes	yes
concessions	yes	yes
duration	yes	yes
agreements	yes	no

4.3 Explaining Differences in Bargaining Outcomes

We hypothesize that the influence of relative performance information and (un)certainty on bargaining behavior operates – at least to some extent – through derived subjective entitlements. In this subsection, we analyze the derived entitlements and examine the link between the differences in bargaining outcomes across conditions reported in the previous subsection and these entitlements.

The Subjective Entitlements

Figure 4 depicts the distribution of subjective entitlements (in winner shares) for winners and losers as measured by the answers to the arbitrator question. It shows that for winners as well as

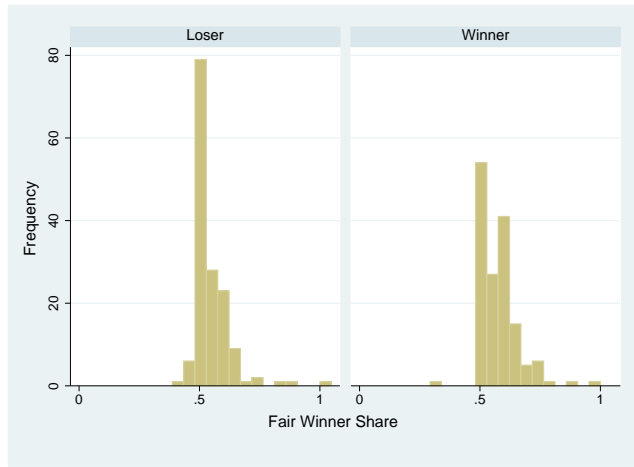


Figure 4: Distribution of Subjective Entitlements for Losers and Winners (pooled data)

losers subjective entitlements are skewed away from the equal split in favor of the winner. The average subjective entitlement of winners is 0.57 and of losers is 0.54. This difference is statistically significant ($p = 0.0001$).

If relative performance information or certainty about the outcome lead to stronger entitlements for winners, we should observe winners' entitlements to be more skewed away from the equal split in *info* and *det* conditions than in *noinfo* and *stoc*, respectively. We also expect that entitlements are more inconsistent between winners and losers when there is information about the performance (*info*) or when it is certain that performance determines the salary budget (*det*) than when this is not the case.

Table 6 shows the average subjective entitlements of winners and losers in each treatment and condition. Winners' and losers' entitlements indeed differ systematically across conditions. In particular, the winner share of the salary budget winners believe to be fair is significantly higher in the *info* condition (0.61) than in the *noinfo* condition (0.54) ($p < 0.0001$). In contrast, for losers average entitlements (in winner share) are significantly smaller in the *info* condition (0.53) than in

the *noinfo* condition (i.e., 0.56) ($p = 0.0207$). On the other hand, there are no significant differences in subjects' entitlements between the *stoc* and the *det* conditions ($p = 0.2831$ and $p = 0.9364$ for winners and losers, respectively).

Table 6: Subjective Entitlements of Winners and Losers in each Condition

		Winner			Losers			
		<i>noinfo</i>	<i>info</i>	<i>both</i>				
					<i>noinfo</i>	<i>info</i>	<i>both</i>	
<i>stoc</i>		0.53	0.59	0.56	<i>stoc</i>	0.57	0.52	0.55
		(43)	(37)	(80)		(43)	(37)	(80)
<i>det</i>		0.55	0.62	0.59	<i>det</i>	0.54	0.53	0.54
		(35)	(37)	(72)		(35)	(37)	(72)
<i>both</i>		0.54	0.61		<i>both</i>	0.56	0.53	
		(78)	(74)			(78)	(74)	

Note: Numbers of observations in parentheses.

The observed differences in subjective entitlements across conditions between winners and losers clearly suggest a role-specific self-serving bias. As already reported above, for the pooled data, when comparing entitlements of winners and loser we find a small (3 percentage points) but statistically significant self-serving bias ($p = 0.0001$). For individual conditions, we observe a larger self-serving bias in *info* and *det*. In the *info* condition the difference between winners' and losers' subjective entitlements amounts to 7.8 percentage points ($p < 0.0001$), and in condition *det* it amounts to 4.7 percentage points ($p = 0.0006$). There are no significant differences in entitlements between winners and loser in the *noinfo* and *stoc* conditions. The non-existence of a self-serving bias in the *noinfo* condition is hardly surprising, because subjects had no information about their relative performance. However, on an individual level there may be some relation between the beliefs about ones relative performance and derived subjective entitlements. To analyze this we use the elicited beliefs about the number of correct answers in the quiz to examine if there is a self-serving bias present for those who believed that they were the winners or losers. In the *noinfo* condition, the subjective entitlements of such belief-winners is 0.56 and that of belief-losers is 0.54. The difference is small and not significant ($p = 0.1548$).

The Role of Subjective Entitlements in the Bargaining Process and Outcome

In subsection 4.2, we have seen that with relative performance information (*info*) or outcome certainty (*det*) bargaining was tougher and that agreements differed across conditions. We now examine if these differences in the bargaining process and outcome are mediated through subjective entitlements. Specifically, in comparison to the *noinfo* and *stoc* conditions, we expect a stronger

correlation in conditions *info* and *det*, between subjective entitlements and (i) opening proposals, (ii) concessions, (iii) bargaining duration and, (iv) agreements.

Opening Proposals: Opening proposals are likely influenced not only by entitlements but also by strategic considerations. The data are indeed consistent with this idea. In all conditions, winners' opening proposals are higher than their entitlements, whereas losers' opening proposals are lower than their entitlements. These differences are statistically significant for winners and losers in all conditions ($p \leq 0.0111$).

Table 7: Subjective Entitlements and Opening Proposals in each Condition

	Winners				Losers			
	<i>noinfo</i>	<i>info</i>	<i>stoc</i>	<i>det</i>	<i>noinfo</i>	<i>info</i>	<i>stoc</i>	<i>det</i>
subjective entitlement	0.54	0.61	0.56	0.59	0.56	0.53	0.55	0.54
opening proposal	0.59	0.67	0.61	0.66	0.44	0.46	0.43	0.48
difference	0.05	0.06	0.05	0.07	-0.12	-0.07	-0.12	-0.06

Note: difference = average opening proposal – average subjective entitlement.

We also find that the differences between opening proposals and subjective entitlements are different across conditions. If entitlements matter, we should see a positive relationship between them and the opening proposals. In addition, as argued above, we expect this effect to be stronger in the *info* condition than in the *noinfo* condition, and in the *det* condition than in the *stoc* condition.

Table 8 reports robust Tobit regression results, where we regress the opening proposals on subjective entitlements of winners and losers, separately for each condition. In line with our hypotheses the coefficient estimates for winners' subjective entitlement (denoted W_Fair) are positive and statistically significant in conditions *info*, *det* and, *stoc* ($p < 0.036$). Hence, in these conditions, winners' opening proposals are significantly and positively affected by their subjective entitlements. In contrast, losers' entitlements (denoted L_Fair) are not significant in the *info*, *noinfo*, and *det* conditions and significant with the wrong sign in condition *stoc* ($p = 0.011$). Our interpretation of these results is that fairness judgments did not influence losers behavior in a systematic way. Subjective entitlements did also not affect opening proposals of winners in the *noinfo* condition, indicating that entitlements are only important when they can be related to the role one has according to the performance measure.

Concession Behavior: We know that information on the relative performance of department heads as well as certainty regarding the process of the salary budget determination lead to smaller and later concessions (cf. Subsection 4.2), and that it also increases the difference in winners' and losers'

Table 8: Explaining Opening Proposals in each Condition

		Dependent Variable: <i>opening share to winner</i>							
		<i>noinfo</i>		<i>info</i>		<i>stoc</i>		<i>det</i>	
		Winner	Loser	Winner	Loser	Winner	Loser	Winner	Loser
∞	<i>Constant</i>	0.41 ^{***} (0.14)	0.49 ^{***} (0.12)	0.26 (0.15)	0.38 ^{***} (0.09)	0.28 (0.16)	0.76 ^{***} (0.13)	0.23 (0.12)	0.38 ^{***} (0.07)
	<i>W-Fair</i>	0.34 (0.23)		0.67 ^{***} (0.24)		0.58 ^{**} (0.27)		0.74 ^{***} (0.21)	
	<i>L-Fair</i>		-0.08 (0.21)		0.19 (0.16)		-0.61 ^{**} (0.23)		0.19 (0.11)
	<i>Log-L</i>	28.8	52.64	34.8	41.2	34.9	34.3	29.1	45.0
	<i>F</i>	2.18	0.13	8.09 ^{***}	1.53	4.72 ^{**}	7.12 ^{**}	12.01 ^{***}	3.06
	<i>N</i>	38	40	41	33	38	42	41	31

Note: *** (**) indicates 1% (5%) significance level; robust standard errors in parentheses.

subjective entitlements (cf. Subsection 4.3). We hypothesize that these differences in concession behavior across conditions are influenced by derived entitlements. Thus, we should find a stronger effect of entitlements in the *info* condition in comparison to the *noinfo* condition and in the *det* condition in comparison to the *stoc* condition.

In Table 9 we report robust Tobit estimates where we regress our most encompassing concession measure, the *time-weighted* concessions, on the tension in subjective entitlements between winners and losers, denoted as *Diff_Fair*.¹⁴ The results for the other two concession measures, *relative-concession* and *concession-time* are qualitatively the same and reported in Table A1 in Appendix A. The regression results show a strong influence of the tension in subjective entitlements in conditions *info* and *det* in the expected direction ($p < 0.001$ for both). Hence, if it is known who the better performer was and/or if it is known that joint performance determined the salary budget with certainty, then the further apart the subjective entitlements of winners and loser are the less conceding a bargaining pair appears. There is no such significant influence of subjective entitlements in the other two conditions.

Table 9: Explaining Concessions in each Condition

	Dependent Variable: <i>time-weighted</i> concessions			
	<i>noinfo</i>	<i>info</i>	<i>stoc</i>	<i>det</i>
<i>Constant</i>	512.7*** (45.3)	329.6*** (55.5)	431.5*** (49.7)	391.6*** (42.3)
<i>Diff_Fair</i>	-3.60 (313.4)	-889.3*** (296.7)	-486.1 (318.0)	-888.7*** (257.5)
<i>Tie</i>	120.7 (88.4)	130.7 (99.2)	105.6 (85.5)	160.6 (112.7)
<i>Log-L</i>	-649.7	-602.8	-668.9	-587.4
<i>F</i>	0.94	6.09***	2.16	6.28***
<i>N</i>	90	84	91	83

Note: *** indicates 1% significance level; robust standard errors in parentheses. *Tie* equals 1 if both department heads had the same performance, 0 otherwise.

Bargaining Duration: We observed significant differences in average agreement times between *info* and *noinfo*, one the one hand, and between *det* and *stoc*, on the other hand (cf. Subsection 4.2).

¹⁴*Diff_Fair* is equal to $W_Fair - L_Fair$. It is positive when there are inconsistent entitlements and negative (or zero) when there are consistent entitlements in a pair.

In the following, we examine whether these differences across conditions are due to a differential influence of entitlements in the different conditions. Similarly to concessions, we expect bargaining duration to be correlated with the tension in subjective entitlements of winners and losers in a pair (i.e., *Diff_Fair*). The stronger this tension, the longer bargaining should take. In addition, the effect of entitlements should be stronger in *info* than in *noinfo* and stronger in *det* than in *stoc*.

Table 10 reports robust Tobit regression results where we regress bargaining duration on the difference in subjective entitlements, in each condition. Note first, that if both department heads

Table 10: Explaining Bargaining Duration in each Condition

Dependent Variable: <i>bargaining duration</i>				
	<i>noinfo</i>	<i>info</i>	<i>stoc</i>	<i>det</i>
<i>Constant</i>	272.1*** (26.4)	389.6*** (33.8)	324.0*** (25.3)	360.7*** (29.6)
<i>Diff_Fair</i>	37.9 (222.2)	799.4*** (257.2)	358.5 (228.3)	705.1*** (203.0)
<i>Tie</i>	-140.5*** (51.5)	-195.9*** (54.1)	-167.5*** (47.6)	-186.5*** (65.7)
<i>Log-L</i>	-600.1	-516.4	-603.3	-522.6
<i>F</i>	3.72**	21.78***	11.32***	8.28***
<i>N</i>	89	80	90	79

Note: *** (**) indicates 1% (5%) significance level; robust standard errors in parentheses. *Tie* equals 1 if both department heads had the same performance, 0 otherwise.

have the same performance, i.e. if there is no winner (and loser), bargaining duration is significantly shorter in all conditions (cf. the significant coefficients of *Tie*). Second, and more important, the coefficients for *Diff_Fair* have the expected sign in all conditions, but are significant only in *info* and *det* ($p = 0.003$ and $p = 0.001$, respectively). Hence, as hypothesized the subjective entitlements of winners and losers strongly influence bargaining duration in condition *info* and *det* only, which indicates that the difference in bargaining duration between conditions is strongly due to a differential influence of these entitlements.

As reported in Subsection 4.2, we observe a large number of last-minute agreements. In addition, the frequency of such last-minute agreements was much larger in the *info* condition than in the *noinfo* condition, whereas the difference between conditions *det* and *stoc* was only marginally significant. Hence, it is natural to ask if subjective entitlements also play a role here, or if late

agreements are solely due to strategic considerations as reported in Roth et al. (1988) and argued by Fershtman and Seidmann (1993). To examine this we compare the tension in entitlements (i.e., *Diff_Fair*) in pairs that reached agreements in the last minute with those in pairs that reached agreements before the last minute.

In the *info* condition, the difference in entitlements for pairs that reached agreements in the last minute is 9.5 percentage points whereas it is only 3.4 percentage points for pairs that reached agreements before the last minute ($p = 0.0001$). In contrast, in the *noinfo* condition, there is no significant difference ($p = 0.6339$). Hence, the difference in last-minute agreements between these two conditions is likely to be affected by a differential influence of entitlements in these conditions. In the *det* and *stoc* conditions the differences in tension in entitlements between early and late agreeing bargaining pairs are significant ($p = 0.0007$ and $p = 0.003$), which is consistent with the observed small difference in frequencies of early and late agreements in these conditions.

Overall, we can conclude that relatively small tensions in subjective entitlements made a substantial impact on bargaining duration in conditions *info* and *det*.

Agreements: Finally we examine whether subjective entitlements influence agreements and if this influence differs across conditions. As reported in Subsection 4.2, we observe unequal agreements more often in the *info* and *det* conditions than in the *noinfo* and *stoc* conditions, respectively. Hence, we hypothesize that the effect of subjective entitlements on agreements is strongest, or perhaps even only observable, in the *info* and *det* conditions. Figure 5 plots the relationships between winners' subjective entitlements (horizontal axes) and the agreed share to winners (vertical axes) in the *info* and *noinfo* conditions (Panel (a)) and the *det* and *stoc* conditions (Panel (b)). Figure 5(a)

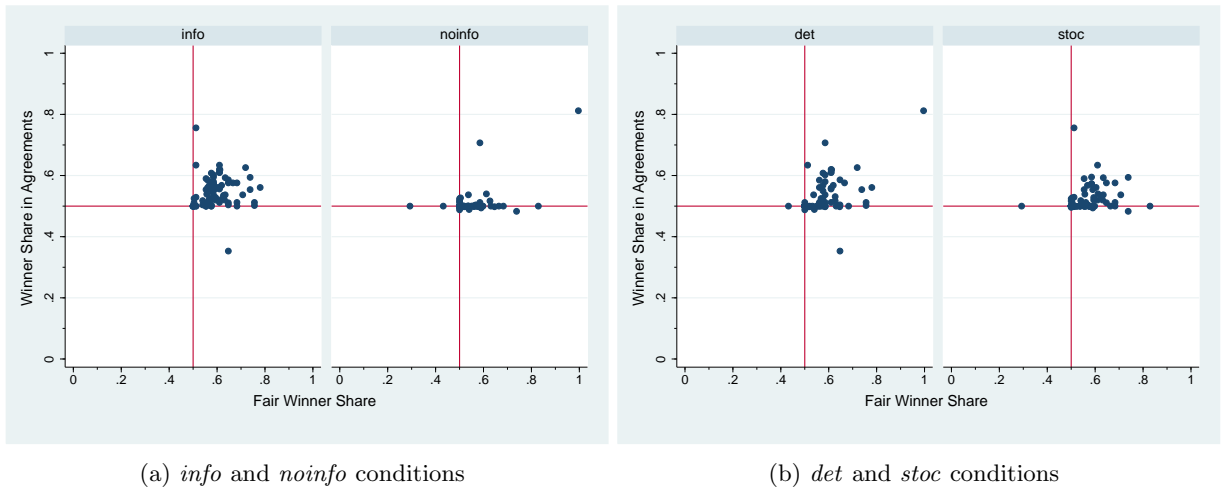


Figure 5: Agreements and Subjective Entitlements

suggests a positive relationship between subjective entitlements and agreed winner shares in *info* (Spearman’s $\rho = 0.38$, $p = 0.0005$) but no such relationship in *noinfo* (Spearman’s $\rho = -0.03$, $p = 0.7741$). Figure 5(b) suggests a positive relationship between subjective entitlements and agreed shares to winners in condition *det* (Spearman’s $\rho = 0.53$, $p = 0.0000$) and *stoc* (Spearman’s $\rho = 0.39$, $p = 0.0001$).

Table 11 reports robust Tobit regression results where we regress agreements on winners’ and losers’ subjective entitlements, in each condition. The coefficient estimates for winners’ subjective entitlements (*W_Fair*) are positive but statistically insignificant in conditions *noinfo* and *info*. In contrast, it is highly significant in conditions *det* ($p = 0.000$) and *stoc* ($p = 0.038$). The coefficient estimates for the losers’ fairness judgments (*L_Fair*) are positive and statistically significant in condition *det* ($p = 0.005$). In all other cases they are insignificant. These regression results indicate that the subjective entitlements make the strongest impact on agreements when the surplus production is deterministic. Surprisingly, given the results on opening offers, concessions, and bargaining duration, entitlements seem not to have a significant influence on agreements in the *info* condition. However, when we exclude some subjects who could be interpreted as being outliers, the

Table 11: Explaining Agreements in each Condition

	Dependent Variable: <i>agreed share</i>			
	<i>noinfo</i>	<i>info</i>	<i>stoc</i>	<i>det</i>
<i>Constant</i>	0.30*** (0.10)	0.49*** (0.06)	0.50*** (0.04)	0.13 (0.09)
<i>W_Fair</i>	0.26 (0.16)	0.01 (0.10)	0.11** (0.05)	0.37*** (0.09)
<i>L_Fair</i>	0.11 (0.07)	0.12 (0.10)	-0.07 (0.04)	0.35*** (0.12)
<i>Tie</i>	0.01 (0.02)	-0.05*** (0.01)	-0.02*** (0.01)	0.01 (0.02)
<i>Log-L</i>	178.5	129.2	169.4	132.3
<i>F</i>	1.37	26.01***	9.52***	8.00***
<i>N</i>	89	80	90	79

Note: *** (**) indicates 1% (5%) significance level; robust standard errors in parentheses. *Tie* equals 1 if both department heads had the same performance, 0 otherwise.

Table 12: Explaining Equal Splits in each Condition

	Dependent Variable: <i>equal split</i>			
	<i>noinfo</i>	<i>info</i>	<i>stoc</i>	<i>det</i>
<i>W_Fair</i>	-1.57*** (0.63)	-1.19 (0.62)	-3.78*** (1.16)	-5.71*** (1.40)
<i>L_Fair</i>	-0.62 (0.56)	-1.04 (0.88)	0.43 (0.76)	-1.91 (1.09)
<i>Tie</i>	0.16 (0.10)	-- --	-- --	0.38*** (0.14)
<i>Log-pseudo-L</i>	-47.9	-21.8	-46.8	-36.0
<i>Wald</i> χ^2	10.4**	6.83**	10.79***	23.67***
<i>N</i>	89	71	79	79

Note: *** (**) indicates 1% (5%) significance level; robust standard errors in parentheses. *Tie* equals 1 if both department heads had the same performance, 0 otherwise; in *info* and *stoc*, *Tie* predicted the variation in the dependent variable perfectly and is therefore dropped.

coefficient estimate of *W_Fair* in *info* takes on the value, 0.18 and becomes statistically significant at the 5% level ($p = 0.049$).¹⁵

In Subsection 4.2 we report that 82 out of 169 agreements are equal splits. This suggests an alternative way of looking at agreements, namely asking for the determinants of equal splits. In Table 12, we report the results of robust Probit estimates where we regress the binary variable *equal split*, which takes on the value 1 for an equal split and 0 otherwise, on *W_Fair*, *L_Fair* and *Tie*. As expected, winners' entitlements (*W_Fair*) have a negative impact on the probability of observing an equal-split. This effect is most prevalent in condition *det*. The variable *Tie* is dropped in conditions *info* and *stoc* because it predicts the variation perfectly and is statistically significant with the expected sign in condition *det* ($p = 0.011$).

Overall, we find that subjective entitlements affect agreements. This holds especially for the subjective entitlements winners hold. The strength of their influence differs across conditions and is most prevalent in the condition where it is certain that the joint performance of department heads determine the salary budget. Interestingly, and in contrast to the entitlements' influence on opening offers, concessions, and bargaining duration, subjective entitlements have only limited influence on

¹⁵In the alternative regression five subjects (all winners) are excluded. One of them, despite being a winner, accepted a share of less than 0.40. Another one reported a subjective entitlement of about 50% but received a share larger than 0.75, and three others reported extreme subjective entitlements larger than 75%.

agreements in the *info* condition. Nevertheless, the presented evidence strongly suggests that differences in agreements across the different conditions are mediated by subjective entitlements.

4.4 The role of beliefs, personality traits, risk attitudes, and gender

Subjects' Beliefs on Performances: In the *noinfo* condition subjects do not receive relative performance information, which raises the question of the importance of their beliefs on performances. Here we report subjects' beliefs and briefly discuss their influence on subjects' entitlements and bargaining behavior. In condition *noinfo* there are 33 (48) winners (losers) who also believe that they were winners (losers) and 18 (12) winners (losers) who believe that they were losers (winners). Actual winners, on average, predict that they have 8.36 correct answers and that their opponents have 8 correct answers ($p = 0.0472$). Actual losers, on average, predict that they have 7.10 correct answers and that their opponents have 8.18 correct answers ($p = 0.0000$). These results indicate that subjects' predictions are pretty accurate.

If subjects' beliefs on performances have an influence on entitlements one would expect that the predictions for their own performance are positively correlated with these entitlements (in winner share) for belief-winners and negatively correlated for belief-losers. We only find a significantly positive correlation for belief-winners (Spearman's $\rho = 0.3855$, $p = 0.0048$), whereas for belief-losers the correlation is negative but insignificant (Spearman's $\rho = -0.04$, $p = 0.690$).

We also investigate whether beliefs played a role in the bargaining process. In particular, in condition *noinfo* beliefs on performances may be important because in this condition subjects receive no performance information. To investigate this we re-run the regression analyzes reported in Tables 8, 9, 10, and 11 but replaced actual winners and losers with belief-winners and belief-losers in the *noinfo* condition. We do not find any significant changes in results.

In our analyses of beliefs in other conditions (i.e., *info*, *det*, and *stoc*) we find that as far as the bargaining process is concerned, subjects' beliefs on performances have an influence only on opening proposals and only when the surplus production is deterministic. In this condition, on average, a belief-winner's opening proposal is 0.62 and a belief-loser's opening proposal is 0.57, where the difference is marginally significant ($p = 0.0622$). Concessions, bargaining duration and agreements are not influenced by subjects' beliefs on performances.

Personality Traits and Risk Attitudes: As mentioned in Section 3, we included post-experimental questionnaires to obtain information about individual characteristics that may influence bargaining behavior. To examine whether these characteristics indeed exert any influence on bargaining behavior, we re-run the reported robust Tobit regression, by including Machiavelli personality test scores, risk attitude questionnaire scores, gender, income, and age as additional explanatory vari-

ables. We do not find any significant effects of these variables in explaining opening proposals, concessions, bargaining duration, or agreements.

Gender Pairing Effects on Bargaining Outcomes: Some studies suggest gender effects in bargaining (see, e.g., Ayres and Siegelman 1995; Walters et al. 1998; Stuhlmacher and Walters 1999; Ben-Ner et al. 2004, Sutter et al. 2009). Therefore, we also examine more closely whether gender and/or gender-pairing affects bargaining outcomes. Before reporting direct effects we examine other factors that may differ between genders and, hence, may exert an indirect influence on bargaining behavior. First, we find that subjects' predictions about their performance in the real effort task differ between male and female subjects. On average, male subjects overestimate their number of correct answers in the quiz by 0.6 answers, while female subjects underestimate their performance by 0.06 answers. This small difference in predictions across genders is statistically significant ($p = 0.03$). There is also a significant difference between male and female subjects' predictions of their opponent's performance. Male subjects overestimate other subject's performance by 0.82 and female subjects overestimate other subject's performance by 0.23. The difference between these two figures is also significant ($p = 0.0638$). Second, we find no gender difference in subjective entitlements: male winners' (losers') average fairness judgment amounts to 0.58 (0.56) and female winners' (losers') average fairness judgment is 0.57 (0.54). The difference between male and female subjects is not significant, neither for winners ($p = 0.5365$) nor for losers ($p = 0.4597$). Finally, on average, in bargaining agreements male and female subjects (winners and losers) receive the same shares.

Interestingly, gender differences become more pronounced when looking at gender pairings instead of individuals' gender.¹⁶ The average difference between winners' and losers' fairness judgments in *female-female* pairs (0.02) and *male-male* pairs (0.03) do not significantly differ ($p = 0.4108$). However, on average the difference between first proposals in a pair significantly differ across *female-female* (0.11) and *male-male* (0.26) pairs ($p = 0.0000$). In comparison to *male-male* pairs, in *female-female* pairs relative concessions are larger, concession times are much earlier and, time-weighted relative concessions are much larger (*male-male* relative-concessions: 0.73, *female-female* relative-concessions: 1.12, $p = 0.0151$; *male-male* concession-time: 406.7, *female-female* concession-time: 242.4, $p = 0.0018$; *male-male* time-weighted concessions: 262.4, *female-female* time-weighted concessions: 551.8, $p = 0.0018$). Moreover, in *female-female* pairs, the average bargaining duration is much shorter (235.3 seconds) than in *male-male* pairs (403.7 seconds) ($p = 0.0009$). However, the average winner's share in agreements is almost identical in

¹⁶Note that in our experiment subjects do not know their opponent's gender. Moreover, with 180 female and 168 male subjects, we have a very balanced sample with respect to gender. Therefore, the probability of having a male or a female opponent is almost equal. In contrast, in Sutter et al. (2009), all subjects know the opponent's gender.

female-female and *male-male* pairs (0.525 in *female-female* pairs: 0.525, *male-male* pairs: 0.523; $p = 0.3263$).

Subjects' Behavior as They Explain It: In the post-experimental questionnaire we asked subjects some questions about their behavior in the experiment. Most subjects gave detailed answers to these questions. Here, we briefly summarize subjects' answers to the question, "Which factors influenced your bargaining behavior?". The answers can be categorized in to four major groups emphasizing, (i) the importance of relative performance information (by far the largest group), (ii) the (un)certainty in the surplus production process, (iii) the focalness and/or fairness of the equal-split, and (iv) strategic concerns, such as making an unchanging sequence of proposals, influencing opponent's aspirations, taking strong positions, testing the opponent's risk attitude, and waiting until the last seconds etc. (see, e.g., Schelling 1956; Sebenius 1992). It is interesting and consistent with our data on behavior that all winners mentioned the relative performance information as an important factor influencing their behavior. In addition, almost all losers also mentioned the relative performance information as a factor influencing their behavior. This suggests that losers felt some obligations which were, next to the entitlements of winners, also important in the bargaining process. Furthermore, in the *noinfo* and *stoc* conditions, a considerable number of subjects mentioned the unavailability of performance information and the presence of uncertainty as factors influencing their behavior.

5 Concluding Remarks

In this paper we investigate how bargaining about a jointly produced surplus is affected by relative performance information and randomness in the production process. In addition, we examine how subjective entitlements influence the bargaining process under the different conditions regarding relative performance information and noisy production. There is little doubt that subjects in our experiment adjust their entitlements *and* bargaining behavior to the external conditions. Specifically, the presence of relative performance information and the knowledge that the surplus production is free of random factors significantly influences almost all layers of the bargaining process as well as derived subjective entitlements. The effect of performance information is to some extent surprising because (i) the actual information given is very coarse — subjects only learn if they are the better or worse performer —, (ii) no explicit property right is given to better performers (as opposed to e.g. Hoffman et al. 1994), (iii) no potential anchoring point is presented to the subjects (as opposed to Gächter and Riedl 2005), and (iv) subjects did not believe that they performed very well in the real effort task determining the joined surplus. Uncertainty about the surplus production also has influence on bargaining behavior. The (un)certainty in surplus production significantly influenced

opening proposals, concessions, bargaining duration and the likelihood of last-minute agreements. Interestingly, despite the fact that there are no significant differences between agreements (and fairness judgments) across the *det* and *stoc* conditions, we find that (un)certainty influenced agreements through the entitlements channel.

We find strong evidence that the differences in the bargaining process and bargaining outcomes across conditions are mediated by a differential impact of subjective entitlements on bargaining behavior. This shows that even economically irrelevant entitlements can influence bargaining behavior. The entitlements exert the strongest impact when the production process is deterministic and when there is relative performance information. These influences are in effect for opening proposals, concession behavior and bargaining duration, where stronger entitlements reduce subject's inclination to concede and lead to later agreements. Agreements are also influenced by entitlements of better performers (and sometimes by those of worse performers) in the real effort task. Especially, when the production process is deterministic these entitlements work in favor of better performer, in the sense that (s)he receives a larger share of the surplus. In addition, in all circumstances, stronger entitlements of better performers strongly decrease the likelihood of equal splits. Interestingly, beliefs about their own performance do exert some influence on entitlements and opening proposals but not to play a role in the rest of the bargaining process.

Our findings suggest an interesting and important interaction between relative performance information, uncertainties in the surplus production process and subjective — economically irrelevant — entitlements. When entering negotiations agents bring their entitlements to the bargaining table, but how these entitlements enter bargaining behavior crucially depends on the details of and the information on the production process.

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Appendix

A Additional Robust Tobit Regressions for Concessions

Table A1: Explaining Relative Concessions and Concession Time in each Condition

Dependent Variable: <i>Relative Concession</i>				
	<i>noinfo</i>	<i>info</i>	<i>stoc</i>	<i>det</i>
<i>Constant</i>	1.05*** (0.06)	0.88*** (0.07)	0.98*** (0.05)	0.89*** (0.06)
<i>Diff_Fair</i>	0.05 (0.44)	-1.54*** (0.47)	-0.57 (0.43)	-1.18*** (0.42)
<i>Tie</i>	0.21 (0.13)	-0.01 (0.15)	0.08 (0.13)	0.20 (0.18)
<i>Log-L</i>	-64.1	-51.7	-62.3	-60.4
<i>F</i>	1.41	5.51***	1.24	4.04**
<i>N</i>	90	84	91	83

Dependent Variable: <i>Concession Time</i>				
	<i>noinfo</i>	<i>info</i>	<i>stoc</i>	<i>det</i>
<i>Constant</i>	278.6*** (26.0)	408.4*** (32.8)	300.2*** (21.6)	367.9*** (29.3)
<i>Diff_Fair</i>	151.3 (224.0)	443.8** (254.1)	318.7** (162.6)	616.7*** (219.6)
<i>Tie</i>	-122.4** (56.7)	-152.2*** (58.5)	-155.0*** (43.0)	-118.0 (58.5)
<i>Log-L</i>	-610.2	-564.8	-610.0	-569.8
<i>F</i>	2.37*	6.23***	10.79***	4.57***
<i>N</i>	90	84	91	83

Note: *** (**) indicates 1% (5%) significance level; robust standard errors in parentheses. *Tie* equals 1 if both department heads had the same performance, 0 otherwise.

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