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Charlotte Klempt, Kerstin Pull, Manfred Stadler

Faculty of Economics and Social Sciences
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Asymmetric Information in Simple Bargaining Games: An Experimental Study

Charlotte Klempt*[1], Kerstin Pull[2] and Manfred Stadler[2]

[1]Institute for Applied Economic Research, Germany
[2]Eberhard Karls University of Tuebingen, Germany

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Abstract

Bilateral bargaining situations are often characterized by informational asymmetries concerning the size of what is at stake: in some cases, the proposer is better informed, in others, it is the responder. We analyze the effects of both types of asymmetric information on proposer behavior in two different situations which allow for a variation of responder veto power: the ultimatum and the dictator game. We find that the extent to which proposers demand less in the ultimatum as compared to the dictator game is (marginally) smaller when the proposer is in the superior information position. Further we find informed proposers to exploit their informational advantage by offering an amount that does not reveal the true size of the pie, with proposers in the ultimatum game exhibiting this behavioral pattern to a larger extent than those in the dictator game. Uninformed proposers risk imposed rejection when they ask for more than potentially is at stake, and ask for a risk premium in dictator games. We concentrate on proposers, but also explore responder behavior: We find uninformed responders to enable proposers' hiding behavior, and we find proposer intentionality not to play an important role for informed responders when they decide whether to accept or reject an offer by an (uninformed) proposer.

JEL classification: C72; C91; D03

Keywords: Bargaining; Information; Experimental Games

*Correspondence to: Charlotte Klempt, Institute for Applied Economic Research, Ob dem Himmelreich 1, 72074 Tuebingen, Germany, charlotte.klempt@iaw.edu, phone +49 - 07071 9896 35 , Fax +49 - 07071 9896 99

1 Introduction

Bargaining situations are often characterized by informational asymmetries, or – as Mitzkewitz and Nagel (1993, 172) put it – "in real life bargaining, private information is the rule and not the exception" (for an early review of the role of information in bargaining, see Roth and Malouf, 1979). In our paper, we focus on private information concerning the size of what is at stake, i.e., the size of the "pie". Specifically, we consider two types of informational asymmetries: In the *first* information condition, the *proposer* knows the size of the pie but the responder/recipient does not. In the *second* information condition, the *responder/recipient* is fully informed about the size of the pie when he makes his acceptance decision but the proposer is not.

In real-life bargaining situations, both information conditions are of relevance. For instance, consider wage-bargaining situations where the first information condition will typically prevail with the employer having private information about firm profitability (i.e., on what is at stake) when making a wage offer. Also for the second information condition the wage bargaining analogy is conceivable, e.g., when managers are offered a new wage contract and are better informed about firm or division profitability than the owners. A further example would be the real estate market where either seller or buyer might be in a superior informational position concerning the market value and/or private valuation. Still another example is a situation where two firms bargain over how to share the prospective benefits of a joint venture. Here, too, either side may be better informed than the other: The firm that proposes a division of joint venture profits or the firm that decides on whether to accept the offer or not.

In our paper, we analyze how the two types of informational asymmetry influence the outcome in two baseline situations: the ultimatum game (see Gueth et al., 1982) and the dictator game (see Shapiro, 1975). While in the ultimatum game one party (the proposer) makes an offer and the other party (the responder) may either accept it or walk away in which latter case both parties would be left with their outside options, the dictator game represents a non-strategic reference treatment assigning no veto power to the responder or recipient who has no alternative but to accept the proposed distribution. While real-life bargaining is of course far more complex than what ultimatum and dictator games may capture, in the experimental literature, both the dictator and especially the ultimatum game serve as important workhorses to study basic behavior in two – admittedly highly stylized – bargaining situations (see Gueth and Kocher 2014 for an extensive survey on the ultimatum game): (i) a situation where one contractual party is in a position to make a take-it-or-leave-it offer where the responder can accept the distribution, or reject it, in which case both parties leave empty-handed (the ultimatum game) and (ii) a situation where one party, in lack of alternatives, is literally forced to accept a contract whose terms and conditions have been fixed by the other party (the dictator game).[1] Systematically varying information conditions on the one hand and

[1] As an intermediate case and likewise highly stylized bargaining situation one might also study the Yes-No game (see, e.g., Gueth and Kirchkamp 2012) where the responder does have veto power but does not know what is being offered to him. However, we decided to restrict ourselves to study dictator and ultimatum games.

responder veto power on the other allows us to analyze a series of (interrelated) research questions which have not been explored in the literature so far.

First, we analyze the effect of both types of information asymmetries on the degree to which demands in the dictator game exceed those in the ultimatum game (see, e.g., Gueth and Tietz, 1990; Camerer and Thaler, 1995).[2] While Gueth and Huck (1997) find proposer demands in dictator games to exceed those in ultimatum games in a situation where only the proposer knows the size of the pie (our first information condition), there is so far no indication in the literature whether this is also true when only the responder knows the size of the pie (our second information condition). Moreover, our design allows us to analyze whether the type of information asymmetry affects the *extent* to which demands in the dictator game exceed those in the ultimatum game. We find that proposer demands in the dictator game exceed those in the ultimatum game under both information conditions, and that the extent to which they do is (marginally) larger when the responder is in a superior information position (second information condition).

Second, we concentrate on *informed* proposers (our first information condition) and analyze whether and in how far they exploit their superior information. As already suggested in the literature (see Mitzkewitz and Nagel, 1993; Rapoport and Sundali, 1996; Gueth et al., 1996), informed proposers may pretend to offer a division that would be fair in the case of a small pie when actually being confronted with a large one. Informed proposers who know the size of the pie to be large, may hence try to "hide" a large pie by offering an amount that would seem acceptable in case of the small pie but is not in case of a large one. Unlike in the previous literature (see, e.g., Gueth and Huck, 1997), our design allows us to compare the behavior of both, proposer and responder, when either is confronted with a small or a large pie. Further, our setting allows us to compare the extent of "hiding behavior" in the ultimatum as opposed to the dictator game setting. To the best of our knowledge, this has not been accomplished so far. We find indication for hiding behavior, and it is more prominent in the ultimatum game setting.

Third, with respect to *uninformed* proposers (our second information condition) we analyze how these react to the additional risk of conflict arising in this specific information condition, i.e. the risk of having asked for more than is actually at stake which leads to imposed rejection. Our experimental design allows us to compare demands when the proposer is only confronted with one type of risk (the risk of imposed rejection in the dictator game) to a situation when the risk of imposed rejection adds to the risk of responder rejection in the ultimatum game. While the fact that individuals may ask for a

[2]The literature on informational asymmetries (e.g., Mitzkewitz and Nagel, 1993; Rapoport and Sundali, 1996; Straub and Murnighan, 1995; Gueth et al., 1996; Gueth and Huck, 1997; Croson et al., 2003; Ockenfels and Werner, 2012) concentrates on situations where the proposer is privately informed about the pie size. Only Kagel et al. (1996) allow the responder to decide in a superior information position. However, the information asymmetry in their study does not concern the pie size but rather its valuation. Further, except for Gueth and Huck (1997), none of the existing papers allows for a comparison of ultimatum and dictator game offers, i.e., an analysis of the extent to which offers in the ultimatum game exceed those in the dictator game, as all of them exclusively analyze ultimatum-game settings.

premium when being exposed to a risk is well documented in the literature, the potential trade-off between asking for a risk premium on the one hand and fairness considerations on the other (own fairness considerations in the dictator game, own and others' fairness considerations in the ultimatum game), has hardly been analyzed as yet.[3] We find that proposers in the dictator game who do not know the size of the pie, demand more than what they would ask for if they knew to be confronted with a large pie. To the contrary, proposers in the ultimatum game do not ask for such a risk premium.

While we concentrate on proposer behavior, we also explore responder behavior. First, concerning *uninformed* responders in the first information condition, we find that these in fact enable proposers to "hide" a large pie behind a seemingly fair small offer. Second, we explore how *informed* responders in the second information condition react to offers by uninformed proposers. While the literature has repeatedly shown that intentionality plays an important role when individuals evaluate the decisions of others (see, e.g., Rabin, 1993; Kagel et al., 1996; Falk et al., 2008; Sutter, 2007), our results hint at informed responders largely ignoring alleged proposer intentions.

The paper is organized as follows: In section 2, we introduce the considered games, present our experimental design and develop the hypotheses in the specific context of our design. In section 3, we start with a description of the data, then confront our hypotheses with the experimental evidence on proposer behavior, and subsequently analyze responder behavior. Section 4 presents a heuristic explanation for proposer and responder behavior by using the logit agent quantal response equilibrium and shows that the experimental evidence is compatible with a medium degree of agent rationality. Section 5 concludes.

2 Framework

2.1 The experimental games

We implement a dictator game DG and an ultimatum game UG. In stage 1 of both games, nature determines the size of the pie π: it is either 8 with probability $\frac{1}{3}$ or it is 20 with probability $\frac{2}{3}$. The probabilities and the two potential pie sizes are common knowledge. In stage 2, the proposer chooses his (integer) demand x where $0 < x < 20$. In $G1$ games, the proposer knows the size of π when stating his demand x but the responder/recipient does not know it. He is only informed about the resulting offer y. In $G2$ games, to the contrary, the responder/recipient knows π but the proposer does not. Implementing both, DG and UG, in each of the two information conditions, we have a 2x2 factorial design with four games altogether: $DG1$, $DG2$, $UG1$ and $UG2$.

[3] Becker and Miller (2009) as well as Krawczyk and Le Lec (2010) have provided evidence for this potential trade-off: in their experimental analysis, they show that dictators ask for a risk premium at the expense of recipients. However, dictators were not asked to allocate a share of the pie to the recipient (as is typically the case in dictator games) but rather to set the probability with which the recipient receives the whole pie. In this setting, dictators in fact asked for a higher expected payoff than in the traditional dictator game setting. In our paper, the dictators/proposers themselves decide to expose themselves to a risky situation (by asking for more than is potentially at stake).

The dictator games $DG1$ and $DG2$ end after stage 2: If $x < \pi$, the proposer receives his demand x and the recipient gets $y = \pi - x$. If, however $x \geq \pi$, what might happen in $DG2$ games where the proposer does not know π, both, proposer and recipient get zero-payoffs (imposed rejection).[4]

In the ultimatum games $UG1$ and $UG2$, there is a stage 3 where the responder is confronted with the offer y that results from the proposer's choice of x and may then accept or reject it with rejection leading to zero-payoffs for both players. In $UG1$ games where only the proposer knows π, the responder decides on acceptance or rejection of y not knowing x. However, any offer $y \geq 8$ of course reveals that the pie is large. In $UG2$ games where only the responder knows π, responders can infer proposers' demands x when they decide between accepting or rejecting the offer y. In addition to responder rejection, in $UG2$, proposers also face the risk of imposed rejection if they demand $x \geq 8$.

2.2 Experimental design

The experiment was programmed in z-tree (see Fischbacher, 2007) and run at the computer laboratory of the Max Planck Institute of Economics in Jena with students from various faculties of Friedrich Schiller University of Jena. For each of the four games, $UG1$, $UG2$, $DG1$, and $DG2$, we ran two sessions with 32 participants each (no participant played more than once).

Thus, for each of the four games we had 32 proposers as well as 32 responders/recipients. Participants received a show-up fee of €2.5 and earned on average €7.43 per session. A session lasted approximately 40 minutes.

Upon arrival, the instructions were read aloud to the participants. Participants also received a hard copy of the instructions (see Appendix A) which they were asked to read carefully. After answering a control questionnaire checking whether participants understood the rules of the game, they were randomly assigned to the proposer and responder/recipient role. With no learning being involved in the dictator game and for the sake of comparability, participants played the respective game only once with one randomly assigned partner.

For the sake of complete data sets we employed the strategy method, i.e., we asked participants for all of their possible choices along the decision tree. While the use of the strategy method might affect the results (results in the literature are mixed, see e.g. Gueth and Kocher 2014), we expect the advantages of a richer data to outweigh the potential disadvantages of a comparatively "cold" design.

- For the *proposers*, employing the strategy method means that in $DG1$ and $UG1$ proposers choose two demands: $x_{G1(8)}$ for the case that the pie size is small and $x_{G1(20)}$ for the case that the pie size is large. That is, proposers condition their demands on the pie size π and make two separate decisions. In $DG2$ and $UG2$, proposers only choose one demand x, not knowing the pie size π and hence not being able to condition their choice on π.

[4]We imposed rejection in $G2$ games not only for infeasible demands $x > \pi$ but also for demands $x = \pi$ in order not to make responders in $UG2$ indifferent between accepting and rejecting the offer.

- For the *responders*, the strategy method in $UG1$ means that they decide whether to accept or reject all possible offers y, not knowing whether an offer $y < 8$ corresponds to a large or a small pie (for offers $y \geq 8$ they can of course infer that the pie is large). That is, responders condition their acceptance decision on the size of the offer (and not on the pie size) and make 19 separate decisions. In $UG2$, responders decide whether to accept or reject all possible offers y separately for the two different pie sizes. That is, responders condition their acceptance decisions on the size of the offer *and* on the size of the pie and hence make 26 separate decisions (7 decisions for the small pie size and 19 for the large pie size).

2.3 Hypotheses

Concerning our *first* research question, it is one of the well-established empirical facts that in dictator games demands x exceed those in the ultimatum game (see, e.g., Camerer and Thaler, 1995; Forsythe et al., 1994). While we expect to observe this effect in both information conditions, we hypothesize that the extent to which demands x in the dictator game exceed those of the ultimatum game will be larger in $G2$ games. While in $G2$ games the proposer does not know the size of the pie when stating his demand x, the responder knows the realized pie size and might not care about proposer intentionality when deciding on whether or not to accept the corresponding offer y. Hence, an ex ante potentially fair demand x (based, e.g., on the expected pie size) might ex post be regarded greedy when the pie turns out to be small. As a consequence, a proposer in $UG2$ might not base his demand x on the expected pie size, but might be willing to demand less for himself. This leads us to the following hypothesis:

Hypothesis 1: (a) In both information conditions, dictator game demands are larger than those in ultimatum games: $x_{DG} - x_{UG} > 0$. (b) The extent to which demands in the dictator game exceed demands in the ultimatum game will be larger in a situation where the responder is in a superior information position ($G2$ games) than in a situation where the proposer is in a superior information position ($G1$ games): $x_{DG2} - x_{UG2} > x_{DG1} - x_{UG1} > 0$.

With respect to our *second* research question, we explore in how far proposers in $G1$ games try to exploit their superior information, by asking for an amount x which translates into an offer y that indicates a small pie being at stake (e.g., $y \leq 4$) in a situation where the pie is actually large. Unlike an informed responder who knows the size of the pie to be large, an uninformed responder may not dare to reject a potentially fair offer. While such "hiding" might not only be found in $UG1$ but also in $DG1$ as people generally like to be perceived as fair (see, e.g., Andreoni and Bernheim (2009)), we expect hiding behavior to be more substantial when proposers face the risk of rejection as is the case in $UG1$. As a consequence, we expect proposers in $G1$ games (and particularly in $UG1$ games) to ask for relatively more when confronted with a large pie (i.e., in $G1(20)$) than when confronted with a small one (i.e., in $G1(8)$), and we take this as a first indication of hiding behavior.

However, one further interpretation of such behavior might be the existence of a pie dependent sharing norm,[5] potentially differently affecting dictator and ultimatum game demands. In an attempt to exclude that our findings on relative shares demanded in $G1(20)$ games as opposed to $G1(8)$ games are the result of such an effect, we additionally analyze the share of demands $x \geq 16$ in $G1(20)$ as a further, second indication of hiding behavior.

Hence, hiding behavior will manifest itself in two ways: (a) the extent to which proposers in $G1$ games will ask for relatively more when confronted with a large pie ($G1(20)$) than when confronted with a small one ($G1(8)$) and (b) a significantly larger share of proposers demanding $x \geq 16$ in $G1(20)$ games as compared to the respective share in $G2$ games. This leads us to the following hypothesis:

Hypothesis 2: (a) In $G1(20)$ games, proposers demand *relatively* more than in $G1(8)$ games, that is: $x_{G1(20)}/20 - x_{G1(8)}/8 > 0$. The effect is stronger in UG than in DG: $x_{UG1(20)}/20 - x_{UG1(8)}/8 > x_{DG1(20)}/20 - x_{DG1(8)}/8 > 0$. (b) Proposers demand $x \geq 16$ more often in $G1(20)$ games than in $G2$ games. Again, this effect is stronger in UG than in DG.[6]

Our *third* research question concerns one specific feature of our experimental design: in $G2$ games where the proposer does not know the size of the pie, any demand $x_{G2} \geq 8$ entails the risk that the pie size is small leading to imposed rejection. Hence, any demand $x_{G2} \geq 8$ incorporates risk taking, with proposers facing an exogenous probability of 1/3 to end up with a zero payoff (in addition to the risk of responder rejection in $UG2$). We expect that proposers asking for $x_{G2} \geq 8$ will attempt to compensate this risk by demanding more than they would if they knew the pie size to be large. However, this might result in compromising on other-regarding behavior and sacrificing fairness norms. As this is more easily accomplished in dictator games where only own fairness norms are concerned, we expect to observe uninformed proposers demanding a self-serving "risk premium" more often in $DG2$ than in $UG2$ where such an attempt might be sanctioned by the responder. This leads us to our final hypothesis:

[5]While Oosterbeek et al. (2004) hint at the existence of pie dependent sharing norms, Hoffman et al. (1996), Slonim and Roth (1998), Cameron (1999) and Munier and Zaharia (2002) show that, at high stakes, proposer behavior is hardly affected but that responders tend to lower their acceptance threshold.

[6]Re-arranging terms in (a) leads to $(x_{DG1(8)} - x_{UG1(8)})/8 > (x_{DG1(20)} - x_{UG1(20)})/20 > 0$. That is, Hypotheses 2 and 1 are interrelated in that hiding behavior reduces the extent to which dictator game demands exceed ultimatum game demands in $G1(20)$ as compared to $G1(8)$ games. As $G2$ games do not allow for hiding behavior, the extent to which dictator demands exceed ultimatum demands will be higher in $G2$ games than in $G1$ games – just as postulated in Hypothesis 1. The same is true when hiding behavior is measured by (b) and if we take into account that the difference between the incidence of demands $x \geq 16$ in $G1(20)$ games as compared to $G2$ games is postulated to be larger for UG than for DG. Again, the larger share of demands $x \geq 16$ in $UG1(20)$ dampens the extent to which dictator demands exceed ultimatum demands in $UG1(20)$ such that the extent to which dictator demands exceed ultimatum demands will be higher in $UG2$ than in $UG1$.

Hypothesis 3: (a) In $DG2$, proposers stating demands above a feasible small pie division ($x_{DG2} \geq 8$) ask for higher amounts as compared to proposers in $DG1$ confronted with a large pie: $x_{DG2} - x_{DG1(20)} > 0$ for ($x_{DG2} \geq 8$. (b) The effect is smaller in $UG2$: $x_{DG2} - x_{DG1(20)} > x_{UG2} - x_{UG1(20)}$ for $x_{DG2} \geq 8$ and $x_{UG2} \geq 8$.[7]

3 Experimental Results

3.1 Strategic Demands and Asymmetric Information

Table 1 contains the average demands x by proposers and - in brackets - their standard deviations as well as the medians and modes for all games, separately for both pie sizes in $G1$ games. The difference of proposer behavior in the dictator game as compared to the ultimatum game, as claimed in Hypothesis 1a, is obvious:

- When the proposer is the fully informed player ($G1$ games), average proposer demand x in $UG1$ is considerably smaller than in $DG1$ for both pie sizes: dictators in $DG1(8)$ on average demand 28% more than proposers in $UG1(8)$ (5.88 instead of 4.59). In case of the large pie ($DG1(20)$ as compared to $UG1(20)$), the respective percentage is 17% (15.66 instead of 13.34). A t-test shows these differences to be statistically significant both in case of the small pie ($p<0.001$) and the large pie ($p=0.003$).

- In a situation where the responder is the fully informed player ($G2$ games), average proposer demands x are also lower in $UG2$ than in $DG2$: dictators in $DG2$ on average demand 42% more than proposers in $UG2$ (14.09 instead of 9.91). A t-test shows this difference to be statistically significant ($p<0.001$).

Further exploring the distribution of proposer demands in $G1$ and $G2$ ultimatum and dictator games, Table 2 displays the frequencies of demands x subdivided into four sections. Proposer demands above a feasible small pie division ($x \geq 8$) in games where they are not informed ($G2$ games) involve the risk of losing the whole stake when the small pie is realized. Proposer demands, when informed and confronted with a small pie ($G1(8)$ games), are restricted to $x < 8$.

- Regarding $G1$ games, where the proposer is the fully informed player, Table 2 shows that in case of the small pie ($G1(8)$), only 9% of proposers choose the maximum demand x of 7 in $UG1(8)$ as opposed to 41% in $DG1(8)$. Proposers' choices regarding the large pie show the same pattern: only 16% choose 17 or more in $UG1(20)$ while such choices are far more frequent in $DG1(20)$ (50%).

[7] Hypotheses 3 and 1 are also interrelated: Re-arranging terms in (b) leads to $x_{DG2} - x_{UG2} > x_{DG1(20)} - x_{UG1(20)}$. That is, demanding a risk premium when asking for $x \geq 8$ in $DG2$ increases the extent to which dictator game demands exceed ultimatum game demands in $G2$ games as compared to $G1(20)$ games – thus reinforcing Hypothesis 1.

Proposer demands x				
Game		G1		G2
Pie size		$\pi = 8$	$\pi = 20$	
UG	average	4.59	13.34	9.91
	std.dev.	(1.24)	(3.31)	(3.86)
	median	4	13	10
	mode	4	10,13	7
DG	average	5.88	15.66	14.09
	std.dev.	(1.16)	(3.05)	(5.39)
	median	6	16.5	17
	mode	7	19	19

Table 1: Averages, (standard deviations), medians, and modes of proposer demands x, separately for the small ($\pi = 8$) and the large pie ($\pi = 20$) in the ultimatum and dictator game for both information conditions

- For $G2$ games, where the responder is the fully informed player, Table 2 shows that 19% of proposers in $UG2$ demand $x < 7$ whereas no proposer does so in $DG2$. Concerning demands of 17 or more, only 9% of $UG2$ participants choose demands $x \geq 17$ as opposed to 50% in $DG2$.

Therefore, we can state the following:

Result 1a: In both information conditions, proposers in the dictator game make systematically higher demands x than those in the ultimatum game.

As far as Hypothesis 1(b) is concerned, we observe that the extent to which proposers in the ultimatum game demand less than dictators in the dictator game varies between the two information conditions, i.e., the difference between demands x is larger in those games where the responder is in a superior information position. Average proposer demands x in $DG1$ are 28% higher than those in $UG1$ in case of the small pie and 17% higher in case of the large pie while average proposer demands x in $DG2$ are 42% above those in $UG2$. A t-test compares the differences between relative ultimatum and dictator game demands x in $G2$ as compared to $G1$ games, for $G1$ games separately for small and large pie demands[8] and finds it to be marginally statistically significant (10-percent level) for large pie demands (p=0.097), but not for small ones. We hence state:

Result 1b: When proposers are in an inferior information position, the extent to which dictator game demands x_{DG} exceed ultimatum game demands x_{UG} in case of large pie demands is larger than when proposers are in a superior information position. There is

[8]Specifically, we distinguish the differences in ultimatum and dictator game demands in $G1$ and $G2$ games by contrasting $(x_{UG1(20)} - x_{DG1(20)})/20$ with $(x_{UG2} - x_{DG2})/20$ and $(x_{UG1(8)} - x_{DG1(8)})/8$ with $(x_{UG2} - x_{DG2})/20$.

Proposer demands x						
Game	UG1		UG2	DG1		DG2
Pie size	$\pi = 8$	$\pi = 20$		$\pi = 8$	$\pi = 20$	
$x < 7$	29 (91%)	1 (3%)	6 (19%)	19 (49%)	0 (0%)	0 (0%)
$x = 7$	3 (9%)	0 (0%)	8 (25%)	13 (41%)	0 (0%)	10 (31%)
$8 \leq x < 17$	–	26 (81%)	15 (47%)	–	16 (50%)	6 (19%)
$x \geq 17$	–	5 (16%)	3 (9%)	–	16 (50%)	16 (50%)

Table 2: Frequencies and percentages of proposer demands subdivided into four sections, $x < 7$, $x = 7$, $8 \leq x < 17$, and $x \geq 17$

no difference in case of small pie demands.

3.2 Informed Proposers and Hiding Behavior

Concerning the incidence of "hiding behavior" in $G1$ games, we first plot from top to bottom the relative demands of informed proposers regarding the small pie $x_{G1(8)}/8$ (black) and the large pie $x_{G1(20)}/20$ (white) for the ultimatum and dictator game ($UG1$ and $DG1$) in Figure 1. Relative demands are rounded in order to classify them into the nine sections.

Regarding Hypothesis 2a, we tested whether for the large pie $\pi = 20$ the relative demands by proposers are larger than for the small pie $\pi = 8$, separately for the ultimatum and dictator game ($UG1$ and $DG1$). In $UG1$, proposers ask for a relative share of 57% on average when a small pie is given ($UG1(8)$) and for 68% on average when a large pie is given ($UG1(20)$). In the dictator game, the respective shares are 73% in $DG1(8)$ and 78% in $DG1(20)$. A paired t-test confirms the difference between relative demands to be statistically significant in $UG1$ ($p<0.001$) and in $DG1$ ($p=0.006$). Further, a t-test shows hiding behavior to be more pronounced in $UG1$, as the difference in relative demands is marginally significantly larger (10-percent level) in $UG1$ than in $DG1$ ($p=0.06$). Thus, the strategic interaction in $UG1$ appears to increase the incidence of hiding behavior as compared to $DG1$.

We can thus state the following:

Result 2a: Informed proposers in the ultimatum and dictator game ($UG1$ and $DG1$) on average demand relatively more when confronted with the large pie than when confronted with the small pie. For proposers in $UG1$, the effect is marginally larger.

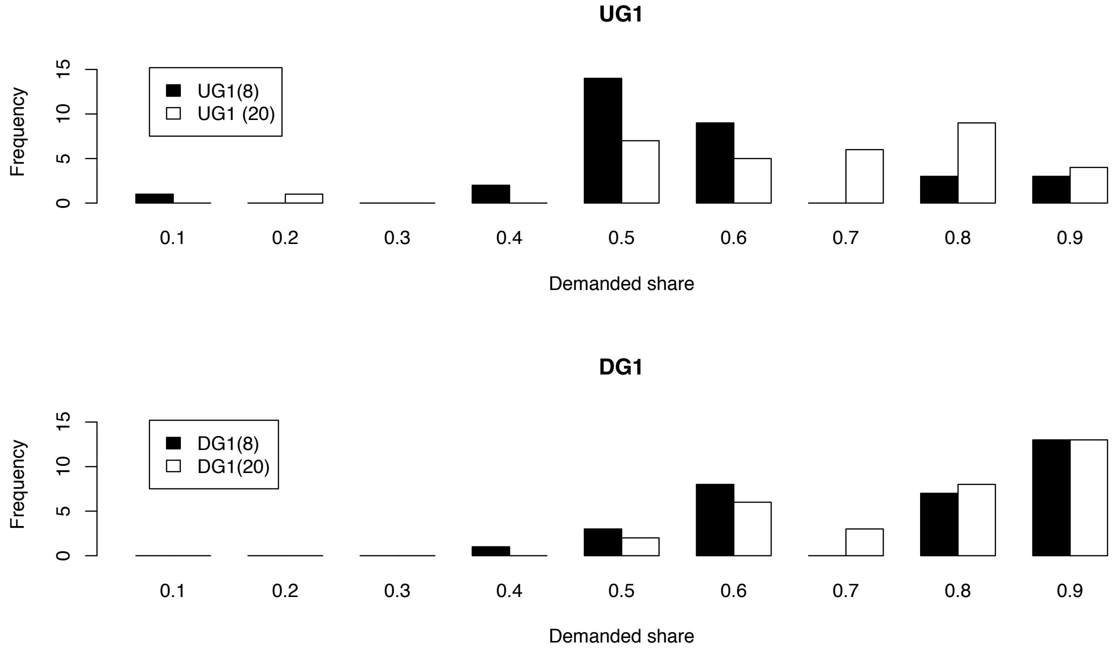

Figure 1: Relative demands of informed proposers in $UG1$ and $DG1$ regarding the small and large pie size ($x_{G1(8)}/8$ and $x_{G1(20)}/20$)

To further investigate the incidence of hiding behavior without the interference of a pie dependent sharing norm, we studied Hypothesis 2b by comparing the number of demands $x \geq 16$ in $UG1(20)$ and in $UG2$, with demands $x \geq 16$ not conveying any information about the actual size of the pie. Hence, a larger incidence of demands $x \geq 16$ in $UG1(20)$ compared to $UG2$ would suggest that proposers fear the rejection of these demands less in $UG1(20)$ - presumably because responders cannot tell whether these are based on a small or a large pie. In fact, we observe 28% of proposers demanding $x \geq 16$ in $UG1(20)$, whereas only 9% of proposers do so in case of $UG2$ (the exact distributions of demands $x \geq 16$ in $G1(20)$ games and $G2$ games are displayed in Figure 2). A Fisher's Exact test shows these shares to be marginally significantly different (10-percent level) from each other (p=0.053).

Concerning dictator game demands, we do not observe a significantly different share of dictators demanding $x \geq 16$ in $DG1(20)$ (56% compared to 53% in $DG2$).[9] This

[9]When we restrict our analysis to those offers $y \leq 4$ that would be close to the equal share in case of a small pie, i.e. $y = 3$ or $y = 4$, and compare their incidence in $UG1(20)$ vs. $UG2$ and in $DG1(20)$ vs. $DG2$, we find that 15% of proposers in $UG1(20)$ and 15% of proposers in $DG1(20)$ offer $y = 3$ or $y = 4$, while only 6.2% in $UG2$ and only 3.1% in $DG2$ do so. Due to the small numbers (five participants offer $y = 3$ or $y = 4$ in the $G1(20)$ games vs. two participants in $UG2$ and one participant in $DG1$), it is, however, not surprising that the differences between $G1(20)$ and $G2$ games are not significant in a statistical sense.

suggests that proposers display hiding behavior by demanding an amount that does not signal the true size of the pie in the ultimatum game where they face responder veto power, but not in the dictator game. Hence, we state:

Result 2b: Informed proposers in the ultimatum game who are confronted with a large pie size ($UG1(20)$) demand $x \geq 16$ significantly more often than proposers in the ultimatum game who do not know the size of the pie ($UG2$). For proposers in the dictator game who are confronted with a large pie size ($DG1(20)$), a comparable effect cannot be substantiated.

3.3 Uninformed Proposers and the Risk of Imposed Rejection

How do proposers act when they do not know the size of the pie ($G2$ games)? For $UG2$ and $DG2$ we illustrate proposer behavior in Figure 2, showing the absolute frequencies of demands x for the two different games and compare them with the demands in $G1(20)$ games where the proposer knows the pie size.

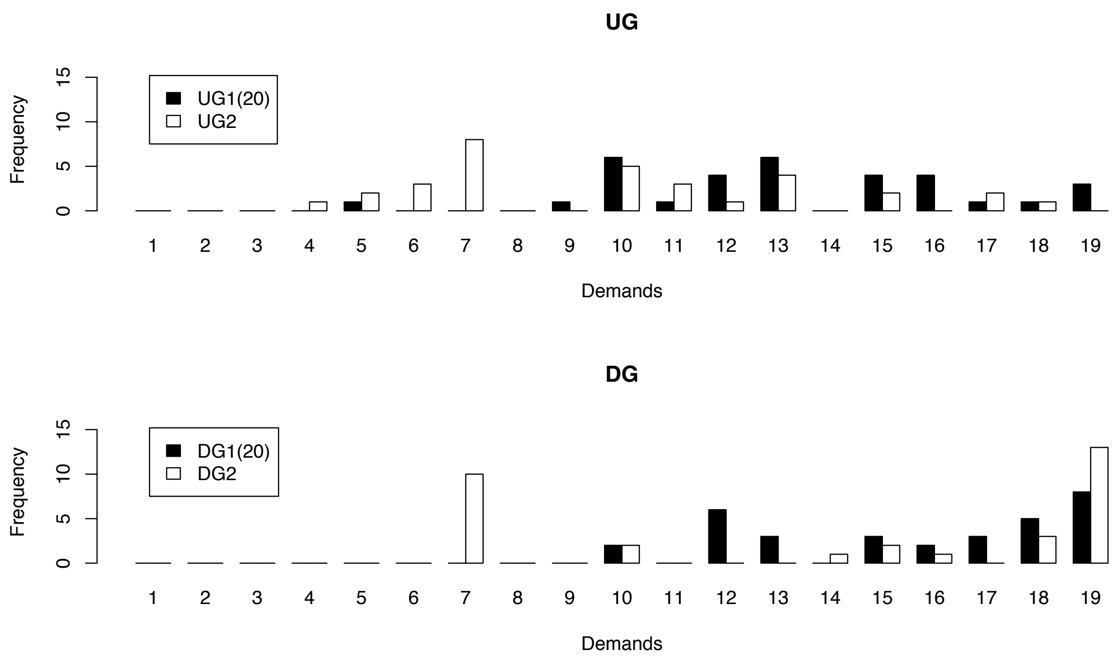

Figure 2: Uninformed proposer demands in $UG2$ and $DG2$ (white) compared to informed proposer demands in $UG1(20)$ and in $DG1(20)$ (black).

To substantiate whether proposers ask for a premium when faced with the risk of imposed rejection, we compare proposer demands $x \geq 8$ in $G2$ games to demands $x \geq 8$ in $G1(20)$ games. Proposers who ask for $x \geq 8$, demand significantly more in $DG2$ than proposers who demand $x \geq 8$ in $DG1(20)$. When informed and dividing the large pie, dictators in $DG1$ asking for $x \geq 8$ on average demand 15.66, while uninformed dictators in $DG2$ asking for $x \geq 8$ on average demand 17.32. A two-sample t-test shows this difference to be statistically significant (p=0.023). These observations correspond to Hypothesis 3a. We can therefore state the following:

Result 3a In $DG2$, proposers who do not know the pie size and ask for $x \geq 8$, systematically demand more than those who know that they will be confronted with a large pie and ask for $x \geq 8$ in $DG1$.

In $UG2$, however, proposers do not ask for such risk premia, i.e., they do not demand more compared to the respective $G1$-choices. When informed and dividing the large pie, proposers in $UG1$ asking for $x \geq 8$ on average demand 13.61, while uninformed proposers in $UG2$ asking for $x \geq 8$ on average demand 12.72. A two-sided t-test shows this difference to not be statistically significant (p=0.288). These observations correspond to Hypothesis 3b.

Result 3b In the ultimatum game, proposers who do not know the pie size and ask for $x \geq 8$, do not demand more for themselves than those who know that they will be confronted with a large pie and ask for $x \geq 8$ in $UG1$.

3.4 Responder Behavior: Explorative Evidence

While our research questions focus on proposer behavior, the data we collected also shed light on the use of responder veto power. We briefly comment on some results that are of interest for our research questions.

First, we calculate the probability that the actual demands x in ultimatum games will be rejected (see Table 3)[10]. Interestingly, the risk of responder rejection differs substantially between $UG1$ and $UG2$ when comparing small and large pie agreements. As responder rejections provide evidence on mutual (dis-)agreement in ultimatum bargaining, these differences show that information does indeed matter for bargaining efficiency. In particular, the risk of responder rejection differs significantly between $UG1(8)$ and $UG2(8)$: it is 0.11 in $UG1(8)$ as compared to 0.40 in $UG2(8)$ (Fisher's Exact test, $p<0.001$). The comparatively high risk of responder rejection in $UG2(8)$ might result from responders disregarding proposers' informational disadvantage and ignoring their potentially good intentions - fostering Results 1a and 1b.

Second,, we look at uninformed responder rejections in $UG1$. The upper part of Figure 3 shows the average frequencies of rejections in $UG1$, where responders are not

[10] To that aim, we match all decisions of proposers and responders in a specific game and count how often a specific demand would have been rejected.

Risk of responder rejection		
Game	UG1	UG2
$\pi = 8$	0.11	0.40
$\pi = 20$	0.13	0.08

Table 3: Risk of responder rejection

informed about the pie size. We expect responders to show non-monotonic rejections in $UG1$. While offers $y \geq 4$ might already hint at a large pie being at stake, offers above a feasible small pie division ($y \geq 8$) clearly indicate the presence of a large pie. Although non-monotonic responses would be plausible, we only find four responders who display non-monotonic responses in the sense that they attempt to avoid rejecting potentially fair small pie offers (e.g., they show a pattern of rejecting $y \leq 3$, accepting $y = 4$, and again rejecting $5 \leq y \leq 7$). As far as non-monotonic responses in the sense of not being willing to accept an overly generous offer are concerned, this type of behavior only manifests itself in two individual responders who reject $y > 17$ (see Gehrig et al., 2007, for a comparable observation).

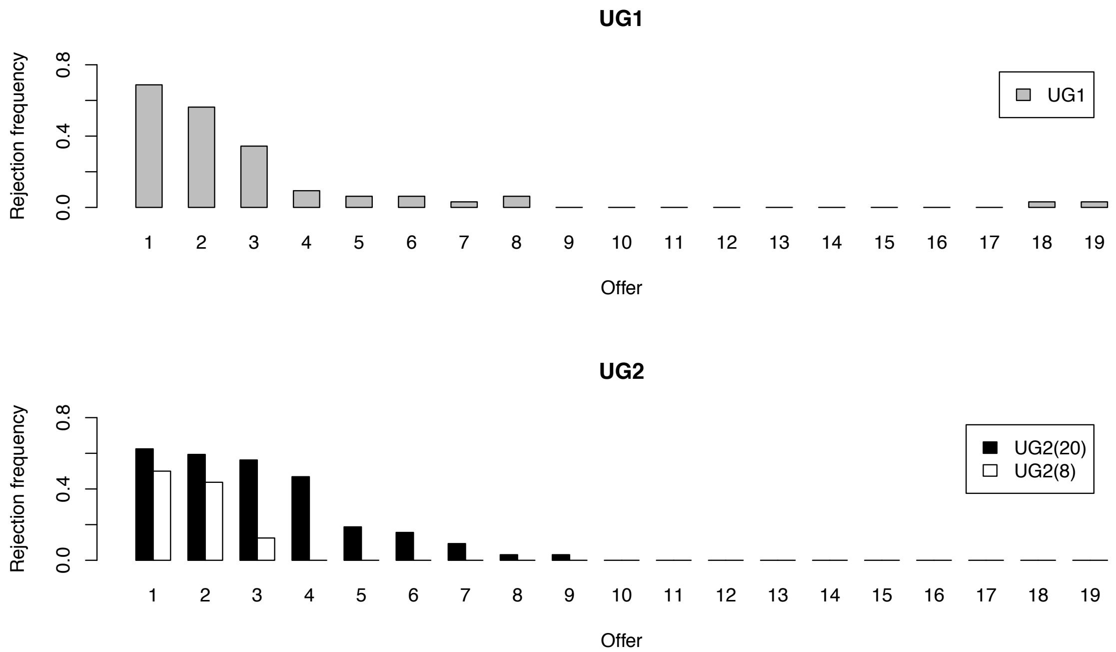

Figure 3: Average rejection frequencies of proposer offers by offer and game

Third, we compare responder behavior in the ultimatum game between G1 and G2 games. The lower part of Figure 3 shows the average frequencies of rejections in $UG2$

when responders are informed about the pie size and proposers are not. Responder rejections in $UG2(8)$ are restricted to $y < 8$. One can easily see that rejection behavior differs across treatments. In $UG2(8)$, fully informed responders only reject offers below 4 - the equal split. In $UG2(20)$, 65% of rejections concern offers below 4, and no one rejects the equal split ($y = 10$). While responders in $UG2(8)$ do not reject any offer $4 \leq y < 8$, 33% do so in $UG2(20)$. In $UG1$, where responders do not know if the offer relates to a large or small pie division, 81% of rejections concern offers $y < 4$ and 13% concern offers $4 \leq y < 8$. A Wilcoxon rank-sum test hints at the distribution of rejections being significantly different between $UG1$ and $UG2(20)$ (p=0.016)[11]. Apparently, responders make use of their veto power in $UG2(20)$ more often than in $UG1$, leaving room for the observed hiding behavior in $UG1$ (Hypothesis 2). Further, the difference in the use of veto power between $UG1$ and $UG2$ might also explain the behavior observed in the context of Hypothesis 1: since offers are more likely to be rejected in $UG2$ than in $UG1$, proposers might anticipate this and, as a result, reduce their demands in $UG2$ to a greater extent than in $UG1$ to avoid rejection.

Fourth, regarding $UG2$, we are interested in whether informed responders insist on the same pie share with respect to both pie sizes, or whether they are more tolerant in light of the realization of a small pie. After all, proposers in $UG2$ make their offers without knowing the pie size, and hence a demand of, e.g., $x = 6$ translates into an offer of $y = 2$ in case of $UG2(8)$ but into an offer $y = 14$ in case of $UG2(20)$, and would as such not have to be sanctioned by an informed responder as being intentionally low. Ex-ante, such an offer might be regarded as generous, but ex-post, in case of a small pie, it proves to be small. As the intentionality of actions has been repeatedly shown to play a role when individuals evaluate others' decisions (see, e.g., Falk et al., 2008), it might be expected that *any* positive offer in case of the realization of a small pie would indicate "good intentions" as it would imply $y_{UG2(20)}/20 > 1/2$. Responders who care about the intentionality of proposer decisions could be expected to be cautious with rejections when facing a small pie.

Assuming that individuals evaluate the fairness of an offer in relation to what is at stake and what others receive, as, e.g., Bolton and Ockenfels (2000) propose, we compare the acceptability of relative offers $y_{UG2(20)}/20$ and $y_{UG2(8)}/8$, depending on whether the size of the pie is known to be large or small. In Figure 4, we distinguish between three different types of responders: (1) responders who always accept the respective share regardless of the size of the pie (black), (2) responders who only accept the respective share in case of a small pie but not in case of a large one (gray), and (3) responders who never accept the respective share (white).[12] If we were to observe a large fraction

[11]We test whether responders tend to differently reject offers in $UG1$ and $UG2$ by merging all rejections per treatment and comparing the resulting list of rejection decisions between treatments using a Wilcoxon rank-sum test. An alternative approach is to construct an acceptance threshold (smallest acceptable offer) by removing data of subjects with non-monotonic responses. A t-test verifies that acceptance thresholds are different in $UG1$ and $UG2(20)$ (p=0.020).

[12]As there were only two responders who accepted a given share in case of a large pie but not in

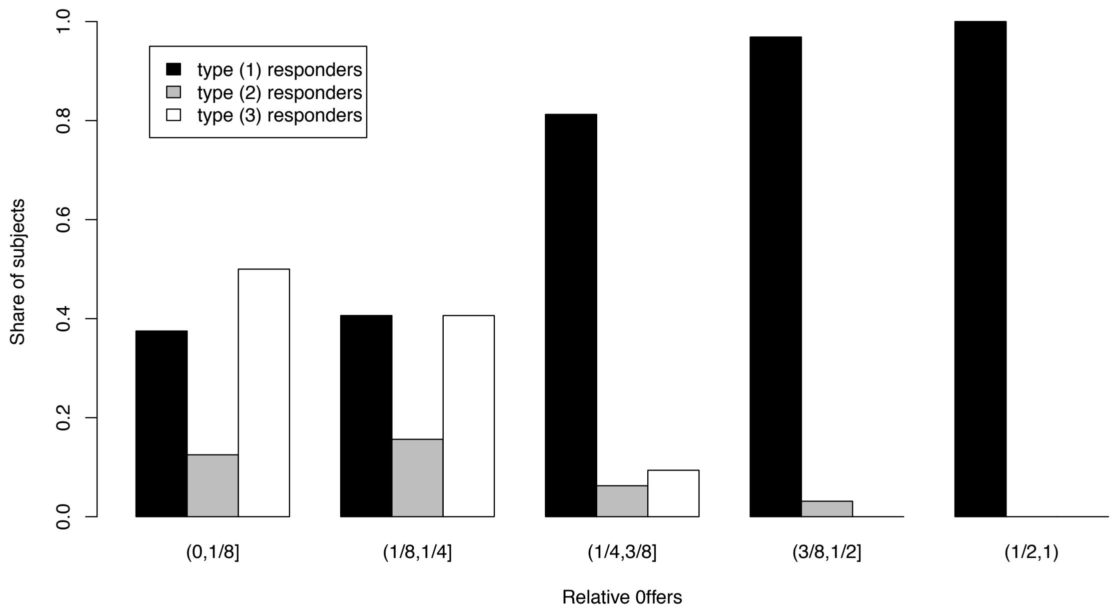

Figure 4: Share of informed responders in $UG2$ who accept relative small and large pie offers $y_{UG2(8)}/8$ and $y_{UG2(20)}/20$ (black, type (1)), who only accept relative small pie offers $y_{UG2(8)}/8$ (gray, type (2)) and who neither accept $y_{UG2(8)}/8$ nor $y_{UG2(20)}/20$ (white, type (3)).

of proposers of type (2) who condition their decision on the size of the pie, this would provide evidence for responders in fact caring about proposer intentions.[13] Figure 4, however, shows that the majority of responders do *not* condition their decision to reject a given share on the size of the pie. Thus, unlike suggested in the literature, for most of the responders in $G2$ games, questions of intentionality do not play a role when they decide on acceptance or rejection - fostering offers in $UG2$ to be more "strategic" than those in $UG1$.

case of a small one (the two subjects accept a small pie share in the range [1/8, 1/4] and [1/4, 3/8] respectively, but not in case of a large pie share), we refrained from including this fourth "type" in our analysis.

[13] Why? Consider a situation where a small pie is to be distributed and an uninformed proposer demands $x = 6$ for himself, translating into a relative offer of $2/8 = 0.25$. In a situation where a large pie is to be distributed, an informed proposer would have to demand $x = 15$ for himself in order to arrive at the same relative offer of $5/20 = 0.25$. An informed responder who accepts a share of 0.25 in case of a small pie but not in case of a large one, honors the good intentions of the proposer who, apparently, was willing to offer a relative share of $14/20 = 0.7$ in case the large pie would be realized. By contrast, the proposer who offered a share of 0.25 in case of a large pie had no intentions to leave the greater part of the pie to the responder: in case the small pie is realized, both would have been left with nothing, and in case the large pie is realized, the proposed division would have meant that the proposer received the biggest part.

4 A Heuristic Explanation Approach of Agent Behavior

The sequential equilibrium of the considered games is simple: The proposer demands $x = 7$ in $G1(8)$ games and $x = 19$ in $G1(20)$ games and - in case of ultimatum games - the responder accepts. The solution of $G2$ games depends on the risk aversion of the proposer. A risk neutral proposer (or one with low risk aversion) demands $x = 19$ and - in case of ultimatum games - the responder accepts. As a matter of fact, this prediction is typically violated in previous as well as in our experiments. Several studies have attempted to explain the deviations from the sequential solution by assuming that players' preferences depend not only on their own payoffs but also on the other players' payoffs (see, e.g., Rabin 1993, Fehr and Schmidt 1999, and Bolton and Ockenfels 2000). Alternative explanations build on learning dynamics (see, e.g., Roth and Erev 1995 and Gale et al. 1995) or on limited cognition (see, e.g., Johnson et al. 2002). A different explanation approach as introduced by McKelvey and Palfrey (1998) relies on the concept of an agent quantal response equilibrium (AQRE) which itself is an extension of the quantal response equilibrium of static games with boundedly rational strategic behavior (see McKelvey and Palfrey 1995) to dynamic games such as the ultimatum game.

In an AQRE, players' strategy choices are noisy, and the noisy behavior of their counterparts is taken into account in equilibrium. In most applications of this concept, the noise in the strategy choices is assumed to follow a specific distribution where the degree of rationality is represented by a single parameter. When the distribution is logistic, i.e., when the AQRE is calculated with logit response functions, the equilibrium concept is called logit agent quantal response equilibrium (LAQRE). Following Yi (2005) who has applied this concept to the standard ultimatum game, we apply this concept to our dictator and ultimatum games with asymmetric information on the pie size.[14] We are aware that LAQRE (as well as the alternative approaches mentioned) is a rather heuristic explanation approach but as will be shown the experimental data can be interpreted fairly well in terms of this concept.

Of particular interest is the parameter $\mu \in (0, \infty)$ of the logistic distribution which can be thought of as the rationality parameter. As μ approaches zero, players become perfectly rational and act in accordance to the sequential equilibrium. As μ approaches infinity, however, players become completely irrational in the sense that they play each strategy with equal probability. Most experiments lead to results which can best be approximated by medium parameter values of μ which indicate the degree of irrationality of players. In the following we assume that proposers and responders are risk neutral and share the same μ-value.

In the dictator games $DG1(\pi)$, $\pi = \{8, 20\}$, the proposer demands the amount x

[14] We are indebted to an anonymous referee for this suggestion.

with probability

$$p_x = \frac{e^{(1/\mu)x}}{\sum_{k=1}^{\pi-1} e^{(1/\mu)k}} \; ; \quad x = 1, ..., \pi - 1 \; .$$

Mean demand of the proposer is therefore $E(x) = \sum_{x=1}^{\pi-1} p_x x$.

In the dictator game $DG2$, the proposer receives each demand $x < 8$ with certainty, whereas demands $x \geq 8$ are received only with probability (2/3) such that the proposer demands the amount x with probability

$$p_x = \begin{cases} \frac{e^{(1/\mu)x}}{\sum_{k=1}^{7} e^{(1/\mu)k} + \sum_{k=8}^{19} e^{(1/\mu)(2/3)k}} \; , & x = 1, ..., 7 \\ \\ \frac{e^{(1/\mu)(2/3)x}}{\sum_{k=1}^{7} e^{(1/\mu)k} + \sum_{k=8}^{19} e^{(1/\mu)(2/3)k}} \; , & x = 8, ..., 19 \; . \end{cases}$$

Mean demand of the proposer is $E(x) = \sum_{x=1}^{19} p_x x$.

In the ultimatum games $UG1(\pi)$, $\pi = \{8, 20\}$, the responder accepts the offer $y = \pi - x$ with probability

$$q_x = \frac{e^{(1/\mu)(\pi - x)}}{e^{(1/\mu)(\pi - x)} + 1} \; ; \quad x = 1, ..., \pi - 1 \; ,$$

such that the proposer demands the amount x with probability

$$p_x = \frac{e^{(1/\mu)q_x x}}{\sum_{k=1}^{\pi-1} e^{(1/\mu)q_k k}} \; ; \quad x = 1, ..., \pi - 1 \; .$$

Mean demand of the proposer is $E(x) = \sum_{x=1}^{\pi-1} p_x x$.

In the $UG2$ game, the proposer expects acceptance of demand x with mean

$$E(q_x) = (1/3) q_x^{UG2(8)} + (2/3) q_x^{UG2(20)} \; ,$$

where

$$q_x^{UG2(8)} = \begin{cases} \frac{e^{(1/\mu)(8-x)}}{e^{(1/\mu)(8-x)} + 1} \; , & x = 1, ..., 7 \\ \\ 0 \; , & x = 8, ..., 19 \end{cases}$$

and

$$q_x^{UG2(20)} = \frac{e^{(1/\mu)(20-x)}}{e^{(1/\mu)(20-x)} + 1} \; , \quad x = 1, ..., 19 \; .$$

The proposer demands the amount x with probability

$$p_x = \frac{e^{(1/\mu)E(q_x)x}}{\sum_{k=1}^{19} e^{(1/\mu)E(q_k)k}} \; ; \quad x = 1, ..., 19 \; .$$

Mean demand of the proposer is $E(x) = \sum_{x=1}^{19} p_x x$.

μ	0	1	2	3	3.5	4	5	∞
$DG1(8)$	7.00	6.42	5.68	5.22	5.07	4.95	4.78	4.00
$UG1(8)$	7.00	5.73	4.96	4.65	4.56	4.49	4.39	4.00
$DG1(20)$	19.00	18.42	17.46	16.50	16.06	15.65	14.92	10.00
$UG1(20)$	19.00	16.70	15.09	14.02	13.60	13.25	12.70	10.00
$DG2$	19.00	17.91	16.25	14.88	14.36	13.92	13.25	10.00
$UG2$	19.00	16.33	14.12	12.84	12.44	12.13	11.69	10.00

Table 4: Mean proposer demands x in the different games

Table 4 shows mean proposer demands x in case of $\mu = 0$ (sequential equilibrium), $\mu \to \infty$ (equal probabilities) as well as for intermediate values $\mu = \{1, 2, 3, 3.5, 4, 5\}$. For $\mu \approx 3.5$, the means are fairly close to the empirical values (see Table 1).[15] That is, the demands x chosen by the proposers in the different games may well be explained by assuming that players do not behave completely rational ($\mu = 0$), but also not completely irrational ($\mu \to \infty$), but rather display a medium degree of irrationality. An exception are the $UG2$ games where players seem to act completely irrational. Presumably this reflects the cognitively overburdening combination of being faced with asymmetric information and with two types of risk (risk of imposed rejection and risk of responder rejection) at the same time.

5 Summary

We analyzed the effects of asymmetric information on experimental behavior in two different bargaining situations: the ultimatum game and the dictator game. Concerning asymmetric information, we studied two information conditions: one where only the proposer is informed about the size of the pie and one where only the responder/recipient is. Our design allowed us to explore the effects of asymmetric information concerning the size of the pie, while at the same time varying the veto power of responders. Concluding, we find the following behavioral patterns which have not been analyzed before:

In both information conditions, responder veto power in ultimatum games leads to smaller demands as compared to dictator games. However, the extent to which proposers demand less in the ultimatum as compared to the dictator game is marginally smaller in a situation where the responder does not know the size of the pie than in a situation where the proposer does not know the size of the pie.

[15] The value $\mu = 3.5$ was suggested by an anonymous referee. Maximum likelihood estimations for μ are 1.7 in $DG1(8)$, 3.3 in $UG1(8)$, 4.0 in $DG1(20)$, 3.9 in $UG1(20)$, 3.8 in $DG2$ and ∞ in $UG2$. We thank Michael Haylock for computational assistance.

Moreover, our design has also allowed us to show that in a situation where the *proposer* is the informed party, he may try to exploit his informational advantage by demanding an amount that leads to an offer that does not indicate the true size of the pie. A proposer may hence attempt to hide behind a rather small offer - even when actually being confronted with a large pie. As expected, proposers in the ultimatum game exhibit this behavioral pattern to a larger extent than those in the dictator game.

With regard to uninformed proposers, we observe proposers asking for more than potentially is at stake - hence risking imposed rejection. In dictator games, proposers further demand a risk premium by asking for even higher shares as compared to a situation where proposers know the pie to be large. Conversely, proposers in the ultimatum game do not ask for a risk premium.

While we concentrated on proposer behavior, we also explored responder behavior. With respect to responders, we find that uninformed responders in fact enable proposers' hiding behavior and that proposers' intentionality does not seem to play a role for informed responders when they decide whether to accept or reject an offer by an (uninformed) proposer.

A Appendix

[All] Welcome and thank you for participating in this experiment!

Please read the instructions carefully. They are identical for all participants. For having shown up on time you receive €2.50. During the experiment, you have the possibility to earn further money. These additional payoffs depend on your own decisions and the decisions of other participants.

We kindly ask you not to talk to other participants throughout the experiment, to switch off your mobile phone, and to remove all non-required material from your desk. We strongly recommend that you follow these rules, otherwise you will be excluded from the experiment and you will not receive any payment. Whenever you have a question, please raise your hand. An experimenter will come to your desk and will answer your questions privately.

All participants in the experiment will be assigned one of two roles, which specify what kind of decisions you will be confronted with. At the beginning of the experiment, the role X or Y you play will be randomly selected.

Each participant X is randomly paired with a participant Y, and they interact only once. Participants X and Y divide an amount of money between each other, where X proposes the division to Y. [UG1-UG2] Participant Y can accept or reject the proposed division. In case of acceptance, the proposed division is paid out. In case of rejection, neither will receive any payment (except payments for being on time). [DG1-DG2] Both participants are then paid out as proposed.

[All] The monetary amount is not fixed: an amount of either €8 or €20 is available for a division. The €8 amount is given with probability of one third, and the €20 amount is given with probability of two thirds. The variable x specifies what participant X proposes for himself. The variable y specifies what participant X offers to Y. Thus, participant X can propose different integer (x, y)- divisions.

[UG1-DG1] In case of having €8 at disposal, participant X can propose one of the following seven integer (x_8, y_8) divisions:

x_8	1	2	3	4	5	6	7
y_8	7	6	5	4	3	2	1

In case he has €20 at his disposal, participant X can propose one the following 19 integer (x_{20}, y_{20}) divisions to participant Y:

x_{20}	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
y_{20}	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Participant X chooses a division for both possible amounts. Hence, in X's role, you have to propose a division of the €8 amount, on the one hand, and a division of the €20 amount, on the other. After your choice, chance decides which of both chosen divisions will define the payoffs, i.e., which monetary amount is given.

[UG2-DG2] Due to the fact that participant X is not aware of the exact amount of money given, he only states his own demand x. The stated demand and the given monetary amount then define the proposed division of the €8 amount (x_8, y_8) or the €20 amount (x_{20}, y_{20}), as depicted in the following table:

x	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
x_8	1	2	3	4	5	6	7	×	×	×	×	×	×	×	×	×	×	×	×
y_8	7	6	5	4	3	2	1	×	×	×	×	×	×	×	×	×	×	×	×
x_{20}	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
y_{20}	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

The table shows that participant X receives his demand x when this does not exceed the amount given ([UG2] and participant Y accepts the division). The rest of the money is offered to participant Y. Otherwise, no one receives any payment (except payments for being on time). For example, column $(x = 5; x_8 = 5; y_8 = 3; x_{20} = 5; y_{20} = 15)$ describes the payoffs for both participants, resulting from a demand of $x = 5$. For both amounts participant X receives his requested payoff $x = x_8 = x_{20} = 5$. Participant Y receives the rest of the money, i.e., he receives $y_8 = 3$ in case of the €8 amount and $y_{20} = 15$ in case of the €20 amount. If participant X demands more than the €8 amount would allow for (e.g., column $(x = 10; x_8 = 0; y_8 = 0; x_{20} = 10; y_{20} = 10)$), no one receives further payment in case of the €8 amount. In case of the €20 amount, both participants receive $x_{20} = y_{20} = 10$.

[UG1] For each possible division participant Y decides whether to accept or reject it. As participant Y, you take the decision without knowing the exact proposal of your counterpart. In contrast to participant X, you cannot condition your decision on the amount available. Without knowing the amount given, you make a choice from all 19 possible divisions whether to accept or reject them. As participant Y, you therefore either accept a (x_8, y_8) division of the €8 amount or a (x_{20}, y_{20}) division of the €20 amount. All possible Y decisions are depicted in the following table:

x_8	×	×	×	×	×	×	×	×	×	×	×	×	1	2	3	4	5	6	7
y_8	×	×	×	×	×	×	×	×	×	×	×	×	7	6	5	4	3	2	1
x_{20}	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
y_{20}	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
A																			
R																			

The acceptance of participant X's proposal in column $(x_8 = 3; y_8 = 5; x_{20} = 15; y_{20} = 5)$ implies a payoff of €3 for participant X in case of the €8 amount and a payoff of €15 in case of the €20 amount; in both cases, participant Y accepts a payoff of $y_8 = y_{20} =$ €5. In case of acceptance of participant X's proposal in column $(x_8 = \times; y_8 = \times; x_{20} = 5; y = 15)$, no one receives further payment when the €8 amount is given; in case of the €20 amount participant X receives €5 and participant Y €15. Overall, participant Y takes 19 decisions about acceptance or rejection of the proposals.

[UG2] For each possible division participant Y decides whether to accept or reject it. As participant Y, you take the decision without knowing the exact proposal of your counterpart. In contrast to participant X, you can condition your decision on the amount available. In case of having €8 at your disposal, you make a choice from all seven possible divisions (x_8, y_8) whether to accept (A) or reject (R) them:

x_8	1	2	3	4	5	6	7
y_8	7	6	5	4	3	2	1
A							
R							

In case of having €20 at your disposal, you make a choice from all 19 possible divisions (x_8, y_8) whether to accept (A) or reject (R) them:

x_{20}	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
y_{20}	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
A																			
R																			

For all possible divisions and both monetary amounts participant Y has to decide whether to accept or reject them. After participant Y's choice chance determines which monetary amount defines the payoffs.

[All] After participants have made their decisions, payoffs will be determined: First, chance defines the size of the monetary amount with the €8 amount given with probability of one third and the €20 amount given with probability of two thirds. [UG1-UG2] Second, it will be compared whether participant Y accepts or rejects the division proposed by participant X. In case of participant Y's rejection of the proposal, no one receives any payment; in case of acceptance, the division is paid out as negotiated. [DG1-DG2] Third and last, the division proposed by participant X of the randomly selected amount is paid out.

[All] Please consider that you interact with your partner just once. After your decision, there will be no further trials.

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