The Attraction and Compromise Effects in Bargaining: Experimental Evidence

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Abstract
The Attraction Effect and Compromise Effect (AE and CE) were introduced for individual choice situations. We define and experimentally investigate the AE and CE for bargaining situations. Our data suggest that the AE and CE are significant in bargaining, when certain conditions, related to focal equilibrium selection criteria based on payoff equality, efficiency, and symmetry, are met.

JEL classification codes
C70; C72; C92

Keywords
Bargaining; attraction effect; compromise effect; focality; equality; efficiency; symmetry.

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Abstract

We experimentally investigate the Attraction Effect and Compromise Effect (AE and CE) in bargaining situations, namely the propensity of bargainers to agree to an intermediate option (CE), or to an option that dominates another option (AE). The data suggest that the AE and CE are more likely to occur if none of the feasible agreements offer equal payoffs, and if the agreement targeted by the CE or AE is the least unequal one. In general, the CE is more robust than the AE.
Keywords: bargaining; attraction effect; compromise effect; focality; equality; efficiency.

JEL Classification: C70; C72; C92.

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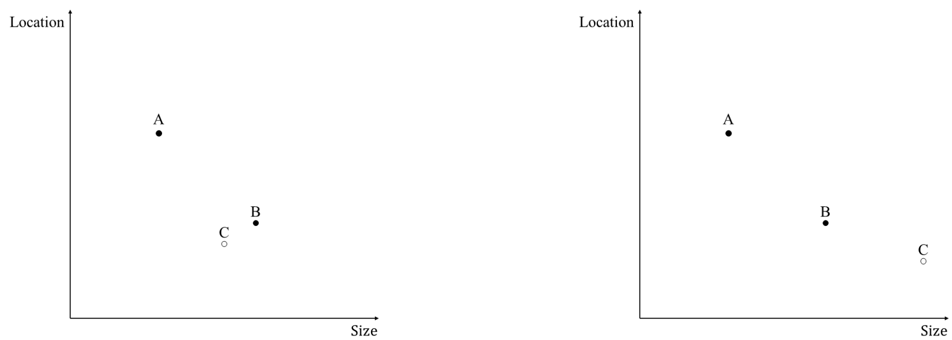
1 Introduction

The motivation for this paper comes from two behavioral regularities, found in individual decision making studies, namely the Attraction Effect (AE) and the Compromise Effect (CE) (see Huber et al., 1982; Huber and Puto, 1983; Simonson, 1989). Suppose a person must choose between say two apartments, A and B, that differ in two salient attributes, such as size and location. Two such apartments are shown in Figure 1 (where higher values of both size and location are assumed to be more desirable). The choice is non-trivial since A is smaller but better located than B.



(a) Attraction Effect.

(b) Compromise Effect.

Figure 1: Attraction and Compromise Effects in individual choice.

Suppose a third apartment, C, which is dominated by say apartment B but not by A, is added to the choice set (see Figure 1a).[1] The *Attraction Effect* (AE) arises when the decision maker is more likely to choose B when the set of alternatives is $\{A, B, C\}$ than $\{A, B\}$. This violates the axiom known as Regularity (see Luce, 1977), which states that the probability of choosing an option cannot increase when the choice set is expanded.

Consider then the case where adding the third alternative C makes option B a compromise (second best on each attribute dimension), as shown in Figure 1b. The *Compromise Effect* (CE) occurs when the decision maker is more likely to choose B when the set of options is $\{A, B, C\}$ than when it is $\{A, B\}$, once more a violation of regularity.

The AE and CE have been found to significantly influence choice in

[1] C is dominated by B in the sense that B is strictly better than C on both attribute dimensions.

a variety of situations, such as product choice (Doyle et al., 1999), contingent valuation (Bateman et al., 2008), job candidate selection (Highhouse, 1996), sampling decisions (Noguchi and Stewart, 2014; Trueblood et al., 2013), elections (Herne, 1997; Pan et al., 1995), choice among gambles (Beauchamp et al., 2015; de Haan and van Veldhuizen, 2015; Herne, 1999; Wedell, 1991), and partner choice (Sedikides et al., 1999). Various explanations for these effects have been put forward (see Section 2 below).

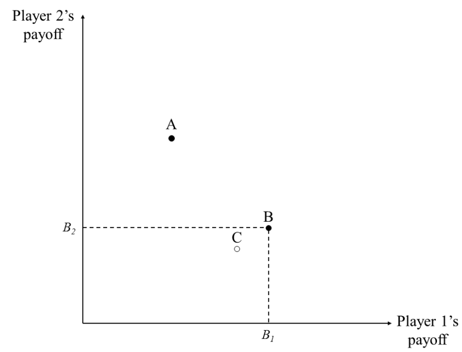
As far as we are aware, all the existing research on the AE and CE has (with only two exceptions, described in the next section) been concerned with individual choice situations.[2] In this paper we ask: are there also AE and CEs in *interactive* decision settings, where a *group* of decision makers must arrive at a *joint* decision? We consider a fundamental class of joint decision making situations, namely *bargaining*. Two or more individuals can collaborate in a number of mutually beneficial ways, but there is a conflict about exactly what form the collaboration should take. As an example, consider a couple who are about to buy a new car and who are considering a number of options. If they prefer different cars, they need to negotiate. Another example is parents deciding which school to send their child to, or a committee deciding among a number of policy proposals, or job candidates. In all these cases the decision makers must agree on an option from a finite set, and if they cannot agree, no choice is made, and they receive low payoffs.

We believe an investigation of the AE and CE in bargaining could be interesting and useful. Negotiation researchers as well as practitioners might be interested in learning the conditions under which adding a dominated option to an existing menu of options is likely to affect the bargaining outcome, and when one can expect to be able to increase the likelihood of an agreement on a certain 'target' option by manipulating the menu of feasible agreements such that the target becomes a compromise.

In order to study the AE and CE in bargaining we take a very simple approach, where the attributes are not size, quality and so on, but simply quantities of money. More precisely, players negotiate over a set of options ("contracts"), where each option has only two attributes, namely

[2] Another paper by the authors, Galeotti et al. (2016), based on a previous experiment designed to investigate the trade-off between equality and efficiency in bargaining, empirically documents a CE, but the AE was not investigated. The current paper launches a systematic investigation of the CE and AE in bargaining.

how much money each player gets if they agree to the option in question.[3] See Figure 2 below. The set of feasible contracts (the *contract set*) either consists of two, $S = \{A, B\}$, or three contracts, $T = \{A, B, C\}$. An *agreement* is an element from the contract set (the players cannot agree to more than one element, or to a lottery over contracts). If they agree to say contract B, then player 1 (2) gets a monetary payoff, B_1 (B_2). If they fail to agree, each bargainer gets zero.



(a) Attraction Effect. (b) Compromise Effect.

Figure 2: The Attraction and Compromise Effects in bargaining.

In Figure 2a the contract C is strictly dominated by B, but not by A. We define the AE as follows: the bargainers are more likely to agree on B when the contract set is $T = \{A, B, C\}$ than when it is $S = \{A, B\}$. In terms of the data, the CE means that the proportion of agreements on B is higher in the first than the second case. In Figure 2b, adding contract C makes B a compromise (i.e., each player's second best option in terms of money payouts). The CE arises when the bargainers are more likely to agree on B when the contract set is $\{A, B, C\}$ than when it is $\{A, B\}$. As we explain below, we see both the AE and the CE as a violation, at the level of the aggregate data, of the Independence of Irrelevant Alternatives condition, IIA (Nash, 1950), which states that if the bargainers agree to some option when there is a large set of alternative options available, then the same option is agreed to when the set of alternatives is reduced.[4]

[3]This specification is of course unrealistic for some settings (the negotiations may involve real items with no clearly defined monetary values). The advantage is that it allows us to transparently manipulate the attributes of the available options, and see how this in turn affects the AE and CE. Future work can broaden our investigation to other domains.

[4]IIA is the analogue to the Regularity axiom for interactive settings, and says that the

Why might we expect there to (not) be an AE and CE in bargaining in the first place? Consider first bargaining theory. As we show in Section 5 below, two leading cardinal cooperative bargaining models, the Nash Bargaining Solution and the Kalai-Smorodinsky Bargaining Solution (Nash, 1950; Kalai and Smorodinsky, 1975) both rule out the AE. Moreover, they yield different predictions regarding the CE.[5] Furthermore, two ordinal bargaining solutions, the Fallback Solution (Brams and Kilgour, 2001) and the Ordinal Egalitarian Solution (Conley and Wilkie, 2012), predict the CE but disagree on the AE. So theory provides an unclear picture.

Second, empirical research on bargaining (and other settings, see Camerer, 2003) has found that certain outcomes (payoff divisions) are often more *focal* (Schelling, 1960) than others. Typical payoff-based sources of focality are equality, efficiency, and total earnings maximization, see for example Isoni et al. (2014) and Roth and Murnighan (1982). We conjectured that properties such as being a compromise, or domination, could also confer focality on a contract, and might thus give rise to the CE and AE.

Based on these models and findings from existing research, we develop a number of hypotheses that are tested by collecting and comparing data from bargaining games with different contract sets.

Our main finding is that there are significant AE and CEs under certain conditions that relate to the money payoffs offered by the contracts.

Significant CE: First, we observe no significant CE when one of the two base contracts (A or B) offers the players exactly the same payoffs. Such a contract is so focal and universally agreed on that there is little or no 'room' for raising its popularity further by making it a compromise. It is also not possible to increase the frequency of the unequal contract by making it a compromise. Second, when neither A nor B offers equal payoffs, a significant CE then arises when the target contract (the one that is made a compromise by adding C) is the least unequal of the contracts in S. There is also a significant CE when the two contracts are 'equally unequal' (i.e., located symmetrically around the 45 degree line).

Significant AE: As for the CE, there is no significant AE if one of the base contracts offers the players exactly equal earnings. We observe a sig-

probability that the bargainers agree to a contract can never increase when the contract set expands.

[5] As we explain below, these models cannot be directly applied to our setup, since our set of feasible payoff is not convex. We instead apply the appropriate extensions of these solutions, from Mariotti (1998) and Nagahisa and Tanaka (2002).

nificant AE in only one case, when the target contract is the least unequal contract and neither the C contract nor the target are exactly equal.

As already mentioned this is, to the best of our knowledge, the first systematic investigation of the AE and CE in bargaining. We see our investigation as establishing an empirical bridgehead, and believe that there are many opportunities for further exploration. These are described in Section 8 below.

The rest of the paper is organized as follows. In Section 2 we describe the related literature. We define the AE and CE in bargaining situations in Section 3, and introduce the experimental bargaining games in Section 4. Section 5 describes our predictions and hypotheses. Section 6 describes the experimental design and logistics. The experimental findings are described in Section 7. Section 8 discusses the findings, and suggests some future research. The Appendix contains the experimental instructions and some details of the relevant bargaining theory.

2 Related Literature

Several explanations have been proposed for the AE and CE in individual choice.[6] Reason-based choice (see Shafir et al., 1993) assumes that the decision maker when faced with a difficult choice looks for reasons that allow him or her to make a decision; such reasons can be based on dominance or compromise. Loss aversion has also been invoked as an explanation (see Simonson and Tversky, 1992).

Models of reference-dependent individual choice (see for example Bushong et al., 2015; Ok et al., 2015; Bordalo et al., 2013; Cunningham, 2013; Kőszegi and Szeidl, 2013; Tversky and Simonson, 1993; Wedell, 1991) allow the attractiveness (utility) of a choice alternative to depend not only on its own absolute properties, but also on how it is related to the other options. These models can sometimes generate an AE and CE in individual

[6]A recent overview of AE research can be found in Frederick et al. (2014). Most of these studies use hypothetical choice methods. Some exceptions are Lichters et al. (2016), Beauchamp et al. (2015), de Haan and van Veldhuizen (2015), Doyle et al. (1999), Herne (1999), and Simonson and Tversky (1992). These studies find significant AEs with incentivized choice (Lichters et al., 2016, find that the effect is stronger with incentivized than with unincentivized choice). Some other criticisms of the existing studies are raised in Lichters et al. (2015), Frederick et al. (2014), and Yang and Lynn (2014).

choice. Moreover, psychological research has shown that the AE and CE (and other effects) can arise from the processes and heuristics that individuals employ when comparing choice options – see for example Ronayne and Brown (2016), Noguchi and Stewart (2014), Soltani et al. (2012), Stewart et al. (2006), Busemeyer et al. (2005), and Usher and McClelland (2004).

Colman et al. (2007) and Amaldoss et al. (2008) consider simultaneous-move games with 'strategic asymmetric dominance'. This means that a player has a strategy x that is strictly or weakly dominated by just one of the other strategies, y. There is 'strategic asymmetric dominance' if the presence of x makes the player more likely to choose y. This is similar to the AE. Neither of these studies however consider the CE. Our strategic environment differs from Colman et al. (2007) and Amaldoss et al. (2008) in several ways. While they consider one-shot tacit coordination or abstract games, we use an unstructured bargaining protocol, where subjects can make as many offers and counter-offers as they like within the given amount of time, can communicate via chat, and sign a binding agreement. Thus coordination in our set-up is much less of an issue.[7]

3 The Attraction and Compromise Effects in Bargaining

3.1 The Bargaining Game

A *contract* specifies how much money Player 1 and 2 gets. Player 1 and 2 negotiate either over a set of two contracts, denoted $S = \{A, B\}$, or over a set of three contracts, $T = \{A, B, C\}$. The only difference is thus whether contract C is feasible or not. We refer to the contracts in S as the *base contracts*. The bargaining game based on a given contract set is referred to simply as the 'game' (G). We refer to the game based on contract set S as the 'base game' (BG). Contract C is referred to as the *decoy*, and the base contract that the decoy is intended to make more focal is the *target*.

Player 1 and 2 negotiate which contract they should agree on. An agreement is binding. Each player can make as many contract propos-

[7]We conjecture that using a one-shot instead of an unstructured bargaining game would produce stronger AE and CE than what we observe, since subjects would be 'desperate' to use any clue in their environment in order to achieve coordination. This hypothesis can be investigated in future work.

als as he or she likes, and freely decides when to do so, during the fixed amount of time they have to negotiate. If they agree to a contract, each player gets the corresponding payoffs, and the game ends. If they fail to agree before time runs out, each player gets zero. There is no discounting of time. The bargainers are constrained to either agree to one of the contracts, or to disagree. They cannot make a binding agreement to randomize between contracts.

3.2 Attraction and Compromise Effect

Denote by p_i^S the proportion of bargaining pairs who agree to contract i, where $i = A, B$, when the contract set is $S = \{A, B\}$. Similarly, let p_j^T denote the proportion of bargaining pairs who agree to contract $j = A, B, C$ when the contract set is $T = \{A, B, C\}$. All these proportions are calculated out of all interactions, including those that ended in disagreement. We define the AE and CE in terms of these aggregate contract agreement proportions.

In what follows we assume that contract B is the target (as in Figure 2). We say that a contract strictly dominates another if the former offers each player a strictly higher amount of money than the latter, and that it is a compromise if for each player its money payouts are the second highest, while each of the other contracts gives one player its highest payoff and the other its lowest.

Definition 1. *(Attraction Effect, AE) Suppose the decoy C is strictly dominated by B, but not by A. The AE arises when* $p_B^T > p_B^S$*.*

Definition 2. *(Compromise Effect, CE) Suppose the decoy C makes B a compromise. The Compromise Effect arises when* $p_B^T > p_B^S$*.*

We detect AE and CE in the data by comparing the proportions of agreements on the target contract when the contract set is S and when it is T. If the latter proportion is significantly larger than the former, we reject the null hypothesis in favor of the alternative hypothesis, that there is an AE or CE.

4 The Bargaining Games

The bargaining games were constructed so as to allow us to test hypotheses that we in the following section derive from theories of bargaining and from existing empirical studies.

We collected data from 22 games, shown in Table 1 and Figure 3. There are four *Base Games* (BG), 1, 4, 7, and 16 (marked in grey in the table), each with contract sets $S = \{A, B\}$. In Game 1 (BG1) the two contracts are 'symmetrically unequal'. In BG4 there is an equal and total earnings maximizing contract (B). BG7 is similar to BG4, except that the equal contract is efficient but not total earnings maximizing.[8] Finally, BG16 has a contract that offers nearly equal payoffs. We can by adding different C contracts to the base games, assess how the strength of the AE and CE depends on the nature of the added contract C, and how these effects vary across different base games.

We think of BG1 as one where CE and AE would be likely, if only as symmetry-breaking devices. BG4 is one where we expect CE and AE to be very unlikely (if a contract is equal and total-earnings maximizing, it is expected to be strongly focal). With respect to BG4, BG7 reduces the total payoffs of the equal contract, and thus its focality, so CE and AE become more likely. BG16 then takes the equal contract in BG7 and makes it nearly equal, so we expect CE and AE to be even more likely. We elaborate on these hypotheses in Section 5 below.

We also collected data for two games, G15 and G22, where the C contract was strictly dominated by *both* base contracts. We thought it would be interesting to see if the presence of such clearly inferior contracts could still exert a significant influence on the bargaining outcome.

5 Theory and Hypotheses

Our unstructured bargaining protocol gives the subjects complete freedom to make offers whenever they wish. This, with the fact that communication via chat messages is allowed, and that any agreement can be

[8] If a contract maximizes the sum of the players' money earnings, then it is also efficient (Pareto optimal, defined in terms of the monetary earnings), but the converse is not true. In BG4 the equal earnings contract is total earnings maximizing (and so efficient), while in BG7 it is efficient but not total earnings maximizing.

Game	Contracts			Target	Hypothesized effect
	A	B	C		
1	(40,60)	(60,40)		–	–
2	(40,60)	(60,40)	(80,20)	B	Compromise
3	(40,60)	(60,40)	(50,30)	B	Attraction
4	(40,120)	(80,80)		–	–
5	(40,120)	(80,80)	(20,140)	A	Compromise
6	(40,120)	(80,80)	(20,100)	A	Attraction
7	(40,120)	(60,60)		–	–
8	(40,120)	(60,60)	(5,155)	A	Compromise
9	(40,120)	(60,60)	(30,130)	A	Compromise
10	(40,120)	(60,60)	(120,40)	B	Compromise
11	(40,120)	(60,60)	(155,5)	B	Compromise
12	(40,120)	(60,60)	(70,40)	B	Compromise
13	(40,120)	(60,60)	(30,110)	A	Attraction
14	(40,120)	(60,60)	(50,50)	B	Attraction
15	(40,120)	(60,60)	(30,30)	B	Decoy strictly dominated by A and B
16	(40,120)	(65,55)		–	–
17	(40,120)	(65,55)	(30,130)	A	Compromise
18	(40,120)	(65,55)	(120,40)	B	Compromise
19	(40,120)	(65,55)	(50,50)	B	Attraction
20	(40,120)	(65,55)	(55,45)	B	Attraction
21	(40,120)	(65,55)	(30,110)	A	Attraction
22	(40,120)	(65,55)	(30,30)	B	Decoy strictly dominated by A and B

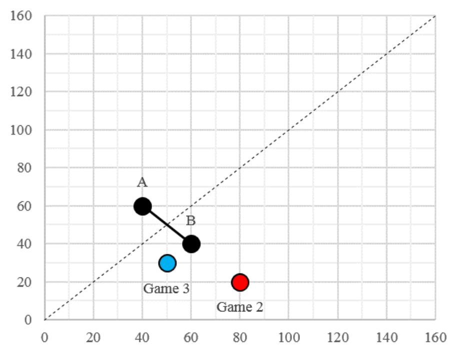
Note: Base games (1,4,7,16) are in gray.

Table 1: The bargaining games.

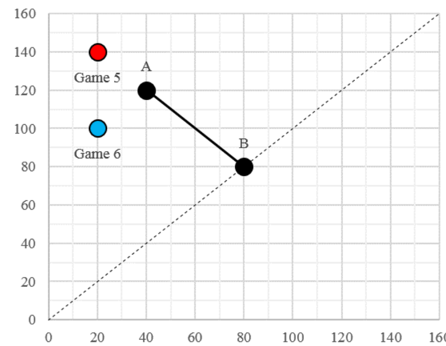
made binding, makes predictions from cooperative bargaining theory (see Thomson, 1994) relevant.

5.1 The IIA Axiom

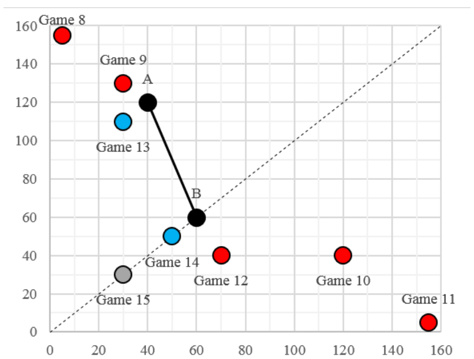
We start by considering what the well-known axiom of *Independence of Irrelevant Alternatives* (IIA)—as defined in Nash (1950) and interpreted as a positive statement about what will (not) happen in an actual bargaining situation—implies for the AE and CE.



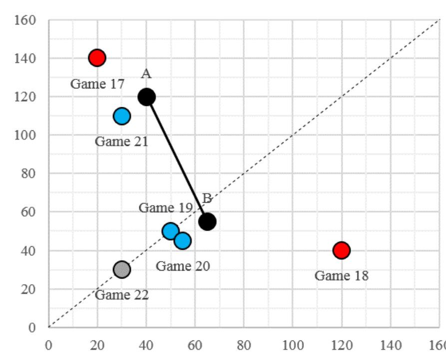
(a) Games 1-3.



(b) Games 4-6.



(c) Games 7-15.



(d) Games 16-22.

Figure 3: Graphical illustration of the bargaining games.

Note: The axes measure (in experimental points) how much each Person (1 and 2) gets for a given agreed contract. The base contracts A and B are in black. The decoy contract C is in red (blue) when it is hypothesized to generate a CE (AE). It is in gray when it is dominated by both A and B.

Definition 3. *(IIA) If a contract, say B, where $B \in S \subset T$, is agreed on when the contract set is T, then B is also the agreement when the contract set is S.*

There is a quite simple intuition behind IIA. If the bargainers find a contract, say B, attractive enough to agree on it when there is a large set of alternative contracts (contract set T), then the bargainers should find B at least as attractive when some of the 'rival' contracts are not available (contract set S), and so they will again agree to B.[9] In terms of our data, IIA predicts that

$$p_A^S \geq p_A^T \text{ and } p_B^S \geq p_B^T,$$

which clearly rules out both the AE and CE.[10]

Hypothesis 1. *(IIA) There are neither AE nor CE in any of the bargaining games, regardless of the contract payoffs.*

5.2 The Nash and Kalai-Smorodinsky Bargaining Solutions

We next consider the predictions of two leading cardinal bargaining solutions, the Nash and Kalai-Smorodinsky Bargaining Solution (Nash, 1950; Kalai and Smorodinsky, 1975), in what follows referred to as NBS and KSBS, respectively. See Thomson (1994) for details. We assume throughout this section that the bargainers are rational, self-regarding, and risk neutral, and that this is common knowledge.[11]

The NBS and KSBS assume that the set of feasible payoffs is convex, which does not hold in our finite set-up (recall that randomization is not allowed). We therefore consider extensions of the original solutions to a finite set of feasible payoffs.

5.2.1 The Extension of the Nash Bargaining Solution

Mariotti (1998) extends the NBS to a finite set of feasible payoffs.[12] His solution selects the contract(s) with the highest Nash product, which, un-

[9] We note that even though Nash (1950) assumes a convex set of payoffs, the IIA condition is independent of whether the set of feasible payoffs is convex or not. For example, Mariotti (1998), whose extension of the Nash Bargaining Solution we consider in the next section, also assumes IIA, but on a non-convex domain.

[10] Since, as we shall explain below, in our experiment subjects are rematched from round to round, we do not observe the same pairs bargaining over the two sets of contracts, so we expect IIA to hold only in a probabilistic sense. Suppose IIA holds for each possible pair in the population; then any pair that agrees on a base contract in contract set T agrees on the same contract in set S. The actual frequency of agreements on the base contract can occasionally be lower in S than in T because we are looking at a sample rather than at all possible pairs in the population, but it should not be systematically lower. If it is, IIA is violated.

[11] The restrictiveness of these assumptions is discussed below.

[12] Another extension of the NBS to a non-convex domain is Conley and Wilkie (1996),

der our assumptions on preferences, coincides with the product of money payoffs; if there is more than one such maximizer, the solution consists of the entire set of maximizers. The interpretation of a set-valued solution is that the final agreement will lie in the set.

Some straightforward calculations reveal that the NBS predicts contracts $\{A, B\}$ in BG1–G3, contract B in BG4–G6, and contract A in BG7–G22, except G10 and G18, where the prediction is $\{A, C\}$.

Mariotti's solution never generates an AE, since a dominated contract always has a smaller Nash product than the contract that dominates it. The same is true for the CE if there is only one contract that maximizes the Nash product. Note, however that the solution is $\{A, B\}$ in both BG1 and G2. Since Mariotti's model is silent on what the empirical agreement proportions on A and B will then be, an observation that there are significantly more agreements on B in G2 than in BG1, is not inconsistent with the model's predictions.

In order to deal with this indeterminacy, we appeal to the principle of insufficient reason and introduce the following auxiliary assumption.

Assumption 1. *If the solution contains two or more contracts, then the bargainers agree on each of them with the same probability.*

With this assumption, Mariotti's model predicts that there will not be a CE.[13]

Hypothesis 2. *((Nash Bargaining Solution; Mariotti, 1998) There is no AE, and, when Assumption 1 holds, no CE in any of the games.*

While the NBS predictions for the individual games clearly depend on our assumption that agents are self-interested and risk neutral, the prediction that there is no AE and no CE holds for other preferences, such as inequity

but they assume that the set is comprehensive, which means that the players can dispose of utilities (see Thomson, 1994). This is not possible in our experiment.

[13]The Nash product of a contract does not depend on what other contracts are available. Thus, either i) C does not maximize the Nash product in T, in which case the solutions for S and T must be identical (and, if the solution is set-valued, frequencies of individual contracts are unchanged because of assumption 1), ii) C is the only contract that maximizes the Nash product in T, or iii) C and one or more other contracts maximize the Nash product in T, in which case any contract in the solution for S must still be part of the solution for T, and its predicted frequency must decline by assumption 1.

averse or social welfare preferences (see Fehr and Schmidt, 1999; Charness and Rabin, 2002).[14]

5.2.2 The Extension of the Kalai Smorodinsky Bargaining Solution

Nagahisa and Tanaka (2002) extend the KSBS to a finite domain.[15] Their solution selects the contract(s) that maximize the payoff of the player getting the lower proportion of his or her maximal possible ('ideal') payoff.[16] As in Mariotti (1998), the solution can be set-valued, in which case we again invoke Assumption 1.

The KSBS predictions for our games are as follows (see the Appendix). BG1: $\{A, B\}$; G2: B; G3: $\{A, B\}$; BG4 = G5 = G6: B; BG7 = G8 = G9: A; G10 = G11: B; G12 = G13 = G14 = G15: A; BG16 = G17: A; G18: B; G19-G22: A.

As for the NBS, the KSBS extension cannot generate any AE. This follows since adding a strictly dominated decoy does not affect the ideal point, so the solution remains the same. The KSBS extension can, however, generate a CE.

Hypothesis 3. *(Kalai-Smorodinsky Bargaining Solution; Nagahisa and Tanaka, 2002): There is no AE in any of the bargaining games. However, there is for some games a CE.*

If we consider the KSBS solutions (see above), it is clear that there are CEs in BG1 and G2, BG7 and G10, BG7 and G11, and BG16 and G18. In all the other games there is no CE.[17] As stated, most of these CEs do not depend on whether Assumption 1 holds or not: in fact, in all games, except BG1 and G2, contract B is the unique solution for contract set T but not part of the solution for S. This is the 'strongest' possible form of CE that can arise.

[14] The comparison of Nash products that leads to this conclusion (see previous footnote) holds for any fixed preferences.

[15] Anant et al. (1990), Conley and Wilkie (1991), and Hougaard and Tvede (2003) also dispense with convexity, but assume properties of the feasible set (comprehensiveness and certain regularity conditions) that are not satisfied in our bargaining experiments.

[16] Geometrically, the solution(s) lie on the highest Leontief level curve, with kinks on the line connecting the disagreement point (the origin in our case) and the ideal point (the point of maximum payoffs to the bargainers). See the Appendix for more details.

[17] In some cases, the absence of a CE is due to the fact that the decoy is not extreme enough to change the solution (cf. BG4 and G5; BG7 and G12). In others, the target contract is already uniquely selected in the base game (cf. BG7, G8, and G9, and BG16 and G17).

Recall again our self-interest assumption. The NBS predictions (that the decoy is ineffective in increasing the frequency of the target in all cases) are robust to assuming other preferences. In contrast, the KSBS predictions may change if we instead assume inequity averse social preferences.

5.3 Ordinal Bargaining Solutions

We next consider models where only the players' ranking of the contracts matters. By definition these models disregard cardinal payoff information, such as whether a contract equalizes or maximizes total earnings. Although our experiment makes such information available, the ordinal models may still be relevant if participants tend to rely mostly or exclusively on ordinal relationships between the contracts. Whether they do this or not is an empirical issue that our experiment will shed light on.

5.3.1 The Fallback Bargaining Solution

According to the Fallback Bargaining Solution (see Brams and Kilgour, 2001; Kıbrıs and Sertel, 2007; de Clippel and Eliaz, 2012), each player has a strict ranking of the contracts. The players first consider if a contract is ranked first by both players; if so, they agree to it. Otherwise, they look for a contract that is ranked either first or second by both players. If such a contract exists, it becomes the agreement. If not, they consider if there are contracts that are ranked first, second, or third, by each player, and so on.

The Fallback Solution is not necessarily single-valued. For example, if there are only two contracts, A and B, with the players ranking them differently (such as BG1), then the solution is the set $\{A, B\}$. As before, such a set-valued solution yields an empirically indeterminate prediction. In what follows we therefore again invoke Assumption 1. The Fallback Solution then generates an AE and CE. Suppose Player 1's ranking is $A \succ B$, and 2 has the opposite ranking. If they bargain over S, the fallback solution is $\{A, B\}$. Suppose then the set of contracts is T and that contract C is dominated by B. Player 1's ranking is $B \succ C \succ A$, while 2's is $A \succ B \succ C$. The decoy drives a wedge between Player 1's ranking of A and B, and A is now relatively worse for player 1 than before. The Fallback solution is B. Similarly, there can be a CE. If a contract C is added such that player 1's ranking is $C \succ B \succ A$, and 2's is $A \succ B \succ C$, the solution is again B. For player 1 the decoy pushes A to the bottom.

Hypothesis 4. *(Fallback Bargaining Solution): There is an AE or a CE in all possible cases.*

5.3.2 The Ordinal Egalitarian Bargaining Solution

The Ordinal Egalitarian Solution (OES), due to Conley and Wilkie (2012), selects the middle ranked contract among the set of efficient contracts if there is an odd number of contracts, and otherwise selects the 50/50 lottery over the two middle ranked contracts (i.e., randomizes over A and B for contract set S).[18] The following is then immediate.

Hypothesis 5. *(Ordinal Egalitarian Solution; Conley and Wilkie, 2012) There is a CE in all possible cases, but never an AE.*

5.4 Focal Point-Based Hypotheses

The theories described above are cooperative, so it is natural to also consider non-cooperative theories. Due to the complexity of our unstructured bargaining game (which allows players to freely decide when to move and what offers and counter-offers to make), it is however not possible to obtain clear predictions.[19]

What we will do instead is to refine our predictions by introducing the concept of a focal point (Schelling, 1960), by which we mean features of a contract's payoffs, or relationships between these payoffs, that make a contract appealing. We hypothesize that there are two main sources of focality: *payoffs* (salient properties of the contracts' payoffs), and *choice set*, based on dominance and compromise relationships between the contracts.

[18] The difference between the OES and the Fallback in solution lies in whether the solution considers strictly dominated contracts. The Fallback solution does this, since adding a strictly dominated contract decreases some player's relative ranking of the non-target contract, and this generates an AE. As stated, the OES by construction disregards dominated options, and so is immune to this effect.

[19] Sharper theoretical predictions can be obtained if one imposes a more restrictive bargaining protocol. For example, Anbarci (2006) analyzes the equilibrium outcomes of a game with a finite set of alternatives, assuming that only ordinal preference information is available. Under his Alternate Strike protocol, the players take turns in proposing and rejecting outcomes. A rejected alternative is removed, and if an agreement is not reached before then the last remaining alternative becomes the agreement. The equilibria of this game generate attraction and compromise effects.

Our conjecture is that the AE and CE operate through the second channel, but that they interact and potentially 'compete' with payoffs for the players' attention. Ceteris paribus, the stronger the payoff-based source of focality is, the less likely the AE and CE are to matter.

5.4.1 One of the Base Contracts Offers Equal Payoffs

Consider first the case where there is a base contract with equal and total earnings maximizing payoffs (BG4–G6). Suppose, as has been found in existing research (see for example the references above), that these properties will be perceived by bargainers as strongly focal. Then we may expect that a vast majority agree to this contract in the base game, regardless of whether it, or the other unequal payoff contract, is the target.[20] This gives part a of the hypothesis stated below. The second, slightly stronger, part of the hypothesis states that the AE and CE also disappear if the contract is efficient but not necessarily total earnings maximizing.

Hypothesis 6. *(Equal payoff base contract) Suppose one of the base contracts offers equal payoffs to the players. a) If this contract maximizes total payoffs, there is no AE or CE regardless of which base contract is the target. b) The AE and CE disappear as soon as the equal contract is efficient.*

According to part a), there are no AE and CE in BG4–G6, while they may be present in BG7–G15. Part b) states that there are no AE and CE in BG4–G15. A variant of Hypothesis 6 is that it may not be possible to raise agreements on the equal contract via an AE or CE, but it will be possible to raise agreements on the other unequal base contract by targeting it.

5.4.2 No Equal Payoff Base Contract

If no base contract offers equal payoffs, the payoff-based focal criterion of equality that potentially 'competes' with the AE and CE is removed. A conjecture is that this makes the AE and CE significant.

Hypothesis 7. *(No equal payoff base contract) Suppose no base contract offers equal payoffs. Then the AE and CE are significant, for both base contracts.*

[20]Intuitively, the equal contract is so focal that that there is no room for making it more focal by making it a target, and the high focality also implies that one cannot 'pull' agreements away from it by targeting the unequal rival base contract.

According to this hypothesis, there will be AEs and CEs in BG1–G3 and BG16–G21.

5.4.3 Nearly Versus Exactly Equal Payoffs

We also wish to compare the AE and CE when instead of perfectly equal payoffs, a base contract offers only *nearly* equal payoffs (BG16). The comparison of BG16 and BG7 will inform us if the focality of perfect equality is stronger than focality due to inequality minimization.

The null hypothesis is that there is no difference between BG7 and BG16, and no difference in the associated AE and CE for either base contract. The alternative hypothesis is:

Hypothesis 8. *(Perfect vs. nearly equal payoffs) There are ceteris paribus more agreements on an exactly equal than on a nearly equal payoff contract. Moreover, the AE and CE for either base contract are stronger with a nearly equal contract than with an exactly equal contract.*

This hypothesis implies that there should be a significant difference between BG7 and BG16. Moreover, the AE and CE for either base contract should differ between G9 and G17, G10 and G18, and G13 and G21.

5.4.4 Additional Hypotheses About Decoy Properties

In addition to the hypotheses stated above, we introduced games that allowed us to explore some additional aspects of the AE and CE.

First, we hypothesized that in order for a significant AE to arise the decoy must not possess more potentially focal properties than the target contract, such as offering more equal payoffs – otherwise it could 'steal' agreements from the target, and eliminate the AE. We test this by comparing BG16–G19 and BG16–G20. The target is the same and offers unequal payoffs, while the decoy is either equal or nearly equal.[21] Second, we wished to investigate if the strength of the CE depends on how attractive the decoy itself is. We conjecture that a very extreme decoy is ignored (because of its implausibility as an agreement), and hence there is no CE.

[21] There is another difference between the two pairs. In pair BG16–G20 the target offers equal gains relative to the decoy, but the other pair does not. This might also serve to make the target more attractive in BG16 and G20 than BG16 and G19. Unfortunately our games do not allow us to distinguish between these two hypotheses.

Another possibility is that the more extreme the decoy is, the more attractive it makes the target. We examine this by comparing G8 and G9 (where the compromise is contract *A*), and G10, G11, and G12 (the compromise is *B*).

Finally, we wished to consider games with contracts *C* that were dominated not just by a single but *both* base contracts. These are not decoys as we have defined them (a decoy is dominated by only one base contract). A natural null hypothesis is that there is no effect of adding these contracts. An alternative hypothesis is that such *C* contracts can still affect behavior by being *closer* to one of the base contracts, and in this sense still act as a 'decoy' for that base contract. We test this by comparing BG7 with G15, and BG16 with G22.

6 The Experiment

6.1 Design and Procedures

The experiment was conducted at the Centre for Decision Research and Experimental Economics (CeDEx) of the University of Nottingham (United Kingdom). 272 subjects participated in 17 sessions (16 participants per session). We used the software z-Tree (Fischbacher, 2007) to program and conduct the experiment, and ORSEE (Greiner, 2015) to recruit the participants. Subjects earned on average £13 (including a show-up fee of £4) and each session lasted just below an hour.

Upon arriving to the lab, subjects were allocated to different desks separated by partitions. They received printed instructions (see Appendix) which were read aloud by the experimenter. Each subject encountered the 22 bargaining games in a different order. Subjects did not know the content of the 22 games in advance, and only knew that, in each game, they would be matched at random with a different co-participant. Since different subjects encounter the games in a different order, learning effects in the data affect all games to a similar extent and hence should not lead to systematic aggregate effects that would bias comparisons across games.[22]

[22] We designed the matching protocol algorithm in order to minimize the re-matching between the same participants in order to curtail repeated-game effects. More details on this algorithm can be found in Galeotti et al. (2016). Since as mentioned earlier we rematched subjects in each round it would be unlikely to observe the same pairs negoti-

In each game that a subject encountered, one randomly selected subject was referred to as Person 1 and the other as Person 2. Hence, a subject could be Person 1 in some games, and Person 2 in others. We used these player labels to simplify the description of and reference to the contracts. When two subjects were matched, it was randomly decided which feasible payoffs were assigned to Person 1 or 2. As an example, G4 came in two versions: Person 1 has feasible payoffs 40 and 80 (so 2 has 80 and 120), and Person 1 has payoffs 80 and 120 (2 has 40 and 80). We analysed the data and found no significant effect of the labels on behavior. In particular, the earnings of subjects labeled Person 1 and 2 are not significantly different (Wilcoxon signed-rank test, $p = 0.687$).[23] When we analyze the data, we thus pool the data across player labels.

Each pair of subjects were presented with a set of either two or three contracts. The contracts were displayed, in the same random order, on the matched subjects' computer screens. In each game subjects were given 120 seconds to negotiate. They made contract proposals by clicking with their mouse on a contract, and could write free chat messages to each other. Subjects could write as many or as few messages as they wanted. They were asked not to reveal their identity, physically threaten the other subject, or discuss what might happen outside the lab. Subjects were informed that failure to comply would result in exclusion.

Figure 4 shows the computer screen the subjects saw. Note that the contracts were not given any particular labels. In order to reach an agreement, subjects had to click on the same contract. The agreement was binding and could not be changed. As long as subjects had not clicked on the same contract, they could withdraw their contract proposal or change it with a new one, in real time and as many times as they wanted. Subjects were also free to make no proposals at all. If no agreement was reached before the end of the 120 seconds, the two paired subjects earned no points from that game.

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ating over both the set $S = \{A, B\}$ and $T = \{A, B, C\}$. As a result, IIA can only hold in a probabilistic sense.

[23] Similarly, we find no labeling effect on who first starts the chat ($p = 0.421$) or sends a proposal ($p = 0.461$).

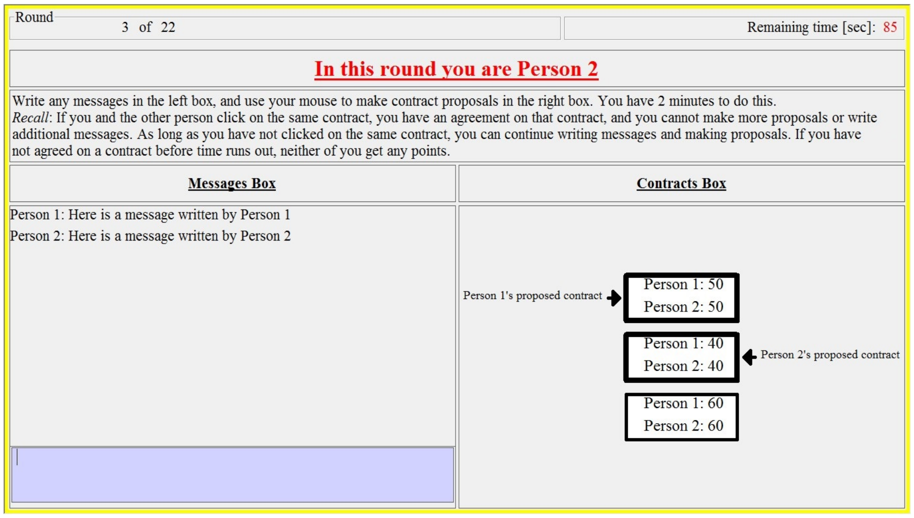


Figure 4: Decision screen.

At the end of the experiment, the computer randomly selected three of the twenty-two rounds (the same for all subjects in a given session) for payment. Points were converted in pounds at the exchange rate of 20 points = £1.

7 Experimental Findings

7.1 Overview

Table 2 shows descriptive statistics for the 22 games. The feasible contracts for each game are shown in the 'Contracts' column, followed by the percentage of bargaining pairs who did not reach an agreement, and who agreed on the contract A, B, and C, respectively (columns 'Disagree', 'Agree on A', 'Agree on B', and 'Agree on C'). Recall that since we found no effects of labels (Person 1 vs 2) on behavior, we pool the data across player labels 1 and 2.[24]

Table 2 also shows how long it on average took for people to reach an agreement ('Time to agree' column). Note that pairs who disagreed are excluded from this average.

A visual representation of how agreements (and disagreements) vary between each BG1, BG4, BG7, and BG16 and the other games is given in

[24]Note that G1 and 10 are symmetric, so as a result of the pooling the agreement proportions on the unequal payoff contracts are identical.

Game	Contracts A	B	C	Disagree	Agree on A	Agree on B	Agree on C	Time to agree (in sec.)
1	(40,60)	(60,40)		8.09%	45.96%	45.96%	0%	89.93
2	(40,60)	(60,40)	(80,20)	6.62%	35.29%	55.15%	2.94%	90.21
3	(40,60)	(60,40)	(50,30)	7.35%	38.24%	52.21%	2.21%	88.38
4	(40,120)	(80,80)		0%	2.21%	97.79%	0%	34.71
5	(40,120)	(80,80)	(20,140)	0.74%	1.47%	97.06%	0.74%	35.63
6	(40,120)	(80,80)	(20,100)	0%	1.47%	98.53%	0%	37.09
7	(40,120)	(60,60)		0.74%	7.35%	91.91%	0%	63.67
8	(40,120)	(60,60)	(5,155)	5.15%	8.09%	86.76%	0%	63.28
9	(40,120)	(60,60)	(30,130)	1.47%	11.03%	87.5%	0%	53.38
10	(40,120)	(60,60)	(120,40)	1.47%	3.68%	91.18%	3.68%	49.04
11	(40,120)	(60,60)	(155,5)	0.74%	7.35%	91.18%	0.74%	52.86
12	(40,120)	(60,60)	(70,40)	2.21%	4.41%	91.18%	2.21%	51.23
13	(40,120)	(60,60)	(30,110)	3.68%	9.56%	86.76%	0%	54.19
14	(40,120)	(60,60)	(50,50)	3.68%	5.88%	90.44%	0%	44.34
15	(40,120)	(60,60)	(30,30)	2.94%	7.35%	89.71%	0%	52.19
16	(40,120)	(65,55)		7.35%	17.65%	75%	0%	73.51
17	(40,120)	(65,55)	(30,130)	6.62%	17.65%	75%	0.74%	65.04
18	(40,120)	(65,55)	(120,40)	5.88%	5.15%	87.5%	1.47%	50.35
19	(40,120)	(65,55)	(50,50)	4.41%	8.82%	72.79%	13.97%	57.58
20	(40,120)	(65,55)	(55,45)	0.74%	11.03%	88.24%	0%	55.92
21	(40,120)	(65,55)	(30,110)	2.21%	17.65%	79.41%	0.74%	74.83
22	(40,120)	(65,55)	(30,30)	2.21%	12.5%	84.56%	0.74%	61.35

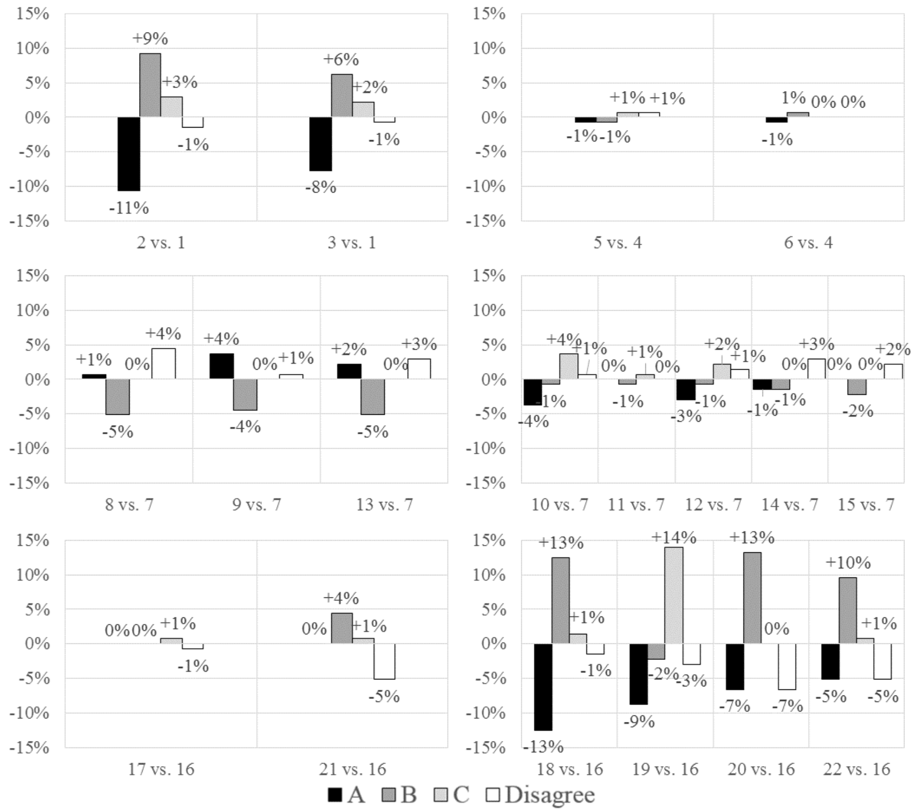
Notes: For each game there are 136 observations (number of pairs). Base games are shaded in gray. The contract labels *A*, *B*, and *C* were not used in the experiment.

Table 2: Aggregate bargaining outcomes.

Figure 5.

To test our hypotheses, we conduct Wilcoxon signed-rank tests using session averages as the units of observation to account for the correlation across bargaining pairs (as described earlier, subjects played 22 games and were rematched from round to round).[25] Our hypotheses predict an effect in a particular direction (the AE and CE are directional effects), except in cases where C is dominated by both A and B. Hence, all statistical tests regarding AEs and CEs are one-tailed (this is specified when we report the results). In all the other cases where we do not have a-priori or directional

[25]As a robustness check, we also conducted parametric tests (available from the authors upon request). In particular, we checked the statistical significance of marginal effects computed from multinomial logit regressions on the pair-level data of each 'block' of games (i.e., games BG1–G3, BG4–G6, BG7–G15, and BG16–G22). The dependent variable is the outcome of the bargaining (disagreement, agreement on *A* or agreement on *B*), while the independent variables are dummies for the different games. Standard errors are clustered at the session level. The results of parametric and non-parametric tests are qualitatively similar. Full details are available from the authors upon request.



Note: the difference in the agreement rate on C between a game and its corresponding base game is obtained by setting the agreement rate on C equal to zero in the base game.

Figure 5: Changes in agreements on A, B, C and disagreements for each game, compared to the base game

hypotheses, the tests are two-tailed. Significance is evaluated at the 5% level, unless otherwise specified.

We think of the AE and CE as effects that benefit the target, so in order to claim that an AE or CE has occurred, we require that the relative frequency of agreements on the target increases, computed as a fraction of *all* interactions, not just those interactions that end in an agreement. Intuitively, in order for B to be favoured by the addition of C, B should become more popular overall, not just as a fraction of the interactions that ended in an agreement. For example, if B is a job applicant we think of the introduction of C as favouring B only if B becomes more likely to be hired overall (not just conditional on the vacancy being filled) as a result of C being added to the shortlist.[26]

We first observe that there are games where there is a significant AE (16–20) and CE (1–2 and 16–18). More specifically, regarding the CE we find that contract B is agreed on more frequently in G2 compared to BG1 (one-tailed test, $p = 0.050$). A similar pattern is observed when we compare G18 and BG16 (one-tailed test, $p = 0.007$). The AE in G20 is also significant (one-tailed test, $p = 0.009$).

Finding 1. *There are games where the AE and CE are significant.*

These findings reject IIA (Hypothesis 1), the NBS predictions (Hypothesis 2), and the KSBS' AE predictions (Hypothesis 3). Regarding the ordinal bargaining models, both the Fallback and OES predictions of a CE in all games (Hypotheses 4 and 5) are clearly rejected. Moreover, neither manages to capture the observed AE pattern well (recall that the Fallback solution predicts there should be an AE in all games, and the OES predicts the exact opposite).

7.2 Games with an Equal Payoff Contract

In order to explain why the CE and AE are observed in some but not other games we need to consider in more detail the contracts' money payoffs. We first consider games with a contract that offers the players exactly the same earnings. The following is immediate from Table 2.

Finding 2. *There are no significant AE or CE in any games with an equal and total payoff maximizing contract (Games 4–6). If the equal payoff contract is not total payoff maximizing (Games 7–15), a decoy targeting the other contract has some ability to reduce agreements on the equal contract, but not to significantly increase the frequency of agreements on the target.*

This finding strongly support Hypothesis 6, part *a*. An equal and total-earnings maximizing contract is extremely focal, and introducing a decoy that targets the unequal contract has no effect. The agreement rates on A

[26] We also analyzed the data excluding the interactions that ended in a disagreement. The results are qualitatively the same, and are available from the authors upon request.

and B are not statistically different between BG4, G5 and G6 (one-tailed tests, $p > 0.1$ for all comparisons).

In BG7, subjects still agree mostly on the equal contract B, but less often than in BG4 ($p = 0.033$). This confirms the earlier finding that the focality of an equal and efficient payoff contract depends on whether the contract possesses the additional property of maximizing total earnings (see Galeotti et al., 2016).

Our data also support Hypothesis 6, part *b*. A decoy targetting the unequal contract A has no effect on the target (and thus there is no CE or AE according to our definition), but may decrease the frequency of the equal contract. The decrease in the frequency of the equal contract is (weakly) significant in G8 and G13 but not in G9 (one-tailed tests, $p = 0.051$, 0.079 and 0.140 respectively). Note that the decoy itself is never chosen in these three games, and thus the decrease in the agreements on the equal contract translates into an increase in the frequency of disagreement. Finally, a decoy targetting the equal contract B has no significant effect on either the target or the alternative contract.[27]

The finding that an equal contract is very focal and there is consequently little room for a significant CE or AE to occur (this is particularly true of BG4, where almost 100% of agreements are on B) is quite intuitive.[28] What may be less obvious is that the decoys did not manage to significantly increase the frequency of agreements on the other contract (A) even though there is plenty of room for that to occur.

We also observe that both the Nash and Kalai-Smorodinsky solutions systematically fail to capture the focality of the equal payoff contracts; recall that in BG7–G15 both solutions almost always predict the unequal contract A, while a vast majority of bargainers agree to the equal contract B.[29]

[27] The only exception is G10, where we observe a significant drop in the agreements on A (one-tailed test, $p = 0.020$). This is due to the fact that, in comparison to BG7, some agreements on A are replaced by agreements on C.

[28] The data in Galeotti et al. (2016) showed a significant CE in some (but not all) games with an equal but not total-earnings maximizing contract. Such contracts were less focal than in the current paper, and this leaves more room for their frequency to increase via a CE. This lower focality could be due to game differences (the earlier paper included games where the equal contract offers much lower total earnings than the unequal one) or to different subject pools being used.

[29] An obvious way to improve the prediction of the models is to replace self-interested preferences with inequity-averse (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000)

7.3 Games without an Equal Payoff Contract

7.3.1 The Case of a Nearly Equal Payoff Contract

Let us first consider if it matters whether a contract offers exactly, or only nearly equal payoffs. We compare BG7 and BG16.

Finding 3. *Observed agreements in BG16, which has a nearly equal payoff contract, are significantly different from those in BG7, which has an equal payoff contract.*

This supports Hypothesis 8. In BG7 more than 90% of bargaining pairs agree to the equal contract, while only 75% do so in BG16. The agreement rate on B drops by about 17% in BG16 compared to BG7 ($p = 0.001$), while the agreement rate on A increases by about 10% ($p = 0.009$). A similar finding for an experimental mini-Ultimatum game is reported in Güth et al. (2001). One interpretation is that the property of offering equal payoffs to the players confers focality over and beyond what it gets from being inequality minimizing.

Not only are agreements in BG7 and BG16 different, but the corresponding AEs and CEs are also different in magnitude. The nearly equal payoffs contract (65,55) can be made significantly more agreed on by making it a compromise (G18 vs. BG16; one-tailed test, $p = 0.007$). Similarly, the same contract can be made more popular by introducing a decoy that is strictly dominated (G20 vs. BG16; one-tailed test, $p = 0.009$). We summarize this in the following finding:

Finding 4. *Unlike BG7, BG16 has significant AE and CE (G18 and G20), but only for the nearly equal base contract, not for the more unequal base contract.*

This again supports Hypothesis 8. One interpretation is that there is more 'room' for the AE and CE to work in BG16 than in BG7. In BG16 it is therefore possible to raise agreements on the equal contract significantly via the AE and CE. Note that, while there are significant AEs and CEs for the nearly equal base contract, it is still not possible to make the other, more unequal, base contract more attractive to the bargainers (cf games BG17 and G21).

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preferences, or allow for a mix of these different preference types.

7.3.2 Two Symmetrically Unequal Payoff Contracts

Consider now BG1, with two unequal base contracts, (40,60) and (60,40). The CE is significant (cf. G2): subjects agree more on *B* than in BG1 (one-tailed test, $p = 0.050$ for *B*). The AE (G3) is not significant (one-tailed test, $p = 0.112$), although there is a marginal decrease in the frequency on *A* ($p = 0.070$).

Finding 5. *In BG1, with two symmetrically unequal contracts, there is a significant CE (G2), but no significant AE (G3).*

This supports Hypothesis 7 for the CE. With respect to the AE, the observed increase in the frequency on contract *B* goes in the predicted direction, but is not large enough to achieve statistical significance.

We find the latter somewhat surprising, since we thought that subjects would have been keen to use any 'symmetry breaker' they could find to resolve the coordination problem.

7.4 Decoy Properties

In G19 the decoy offers equal payoffs, 14% agree on it, and *fewer* (although not significantly, $p = 0.509$) people agree on the target contract *B* than in the absence of the decoy (BG16). The decoy is thus, if anything, 'counter–productive'. In G20, the base contracts are the same as in G19, but the decoy is now only nearly equal. We observe a significant increase in agreements on *B* (one-sided test, $p = 0.009$) and a decrease in agreements on *A* (one-sided test, $p = 0.051$).

Finding 6. *The AE for BG16 with a nearly equal payoff contract is significantly stronger when the decoy offers only nearly as opposed to exactly equal payoffs (cf G20 vs. G19).*

We think it is striking how such a little difference in the payoffs offered by the decoy makes a significant difference for the sign and magnitude of the AE. This suggest there is a significant behavioral difference between exactly and nearly equal payoffs not only for base contracts, but also for the decoy.[30]

[30] As already remarked earlier, we cannot with the current set of games say whether the significant AE in G20 is due to the target offering each player the same gain relative to the decoy, or whether it is because the decoy offers unequal earnings and hence does not compete in focality with the target.

We next consider if the strength of the CE depends on how extreme the decoy is. G8 and G9, and G10, G11 and G12, all based on BG7 with base contracts (40,120),(60,60), differ in this respect. In none of the cases is there any CE, due to the overwhelming focality of contract (60,60). We unfortunately do not have games that allow us to examine the effect of the extremeness of the decoy for other base games.

We finally consider the role played by contracts that are strictly dominated by both base contracts. In G15 and G22 the contract (30,30) is strictly dominated by *both* base contracts. In G22 this makes contract (65,55) more frequently agreed on ($p = 0.049$), and (40,120) less, although not significantly so ($p = 0.120$). Since (30,30) is dominated by both base contracts, this is not a 'standard' AE. One conjecture for why adding (30,30) makes agreements on (65,55) more attractive is that (30,30) is closer to (65,55) than to (40,120). In this sense (30,30) serves as reference point for the bargainers.[31] G15 is similar to G22, but in the former game there is no significant effect of adding a dominated contract, since the focality of the equal payoff contract (60,60) in BG7 is already so high.

Finding 7. *Adding a contract C that is dominated by both base contracts, but closer to one of them, say B, can raise agreements on B at the expense of A, if neither base contract is strongly focal, as for the AE.*

This suggests that the forces that influence the AE based on reference points that are not decoys are of the same nature as for proper decoys that are only dominated by one base contract.

7.5 Agreement Times

Although we are primarily interested in final bargaining outcomes, it is interesting to look also at the agreement times (cf Table 2). Note that there is no time pressure in our experiment other than the deadline. Provided that subjects agree on a contract before the deadline, they receive the points specified in the agreed contract (without any discounting); furthermore, even if they agree on a contract, they need to wait until the 120 seconds run out before starting the next round. In spite of this, there are clear differences in agreement times between the base games. In BG4 the strong

[31] It is also the case that agreeing on (65,55) gives players more similar gains than (40,120), relative to (30,30). Our data do not allow us to distinguish between the relative roles of closeness and equality of gains.

focality of the equal and total earnings maximizing contract is confirmed by the very fast agreement time (on average 34.71 secs.).

In BG7, where the equal contract does not maximize total earnings, it takes almost twice as long on average to reach an agreement (63.67 secs.), and this difference is highly significant ($p = 0.002$). In BG16, the lack of an exactly equal contract makes the problem even harder than BG7, and it takes slightly longer to reach an agreement (73.51 secs.), although not significantly so ($p = 0.177$). Moreover, unlike in BG4 and BG7, in BG16 the proportion of interactions that end in disagreement is not negligible (7.35%). Finally, BG1 is the most difficult of all base games: there are two unequal allocations and nothing to choose between them. As a result, this base game has both the highest average time to agree (89.93 secs.), and the highest frequency of disagreement (8.09%). The average agreement time in BG1 is significantly higher than in BG4, BG7, and BG16 ($p < 0.01$ in all cases).

How does the addition of a third contract affect agreement times? It has no significant effect in the two extreme cases, where there is either a very clear answer to the question "what should the agreement be?" (G5-G6 compared to BG4), or no clear answer at all (G2-G3 compared to BG1).

The effect of adding a third contract to BG7 is mixed: it reduces the time it takes to agree on average (pooling G8-G15 versus BG7, $p = 0.044$) but also increases the frequency of disagreement ($p = 0.012$).

Adding a third contract appears to help bargainers in the case of BG16, where one contract is nearly equal and the other maximizes total earnings (pooling G17-G22 and comparing the average time to agree with BG16, agreement times are shorter, $p = 0.009$, and disagreement is not more frequent).

Thus, the evidence suggests that adding a decoy may speed up the process of reaching an agreement in some cases, possibly by providing reasons to choose one base contract over the other (cf. Shafir et al., 1993).

8 Discussion and Conclusion

This paper reports on what we believe is the first systematic experimental investigation of the Attraction and Compromise Effects (AE and CE) in bargaining, namely the propensity of bargainers to agree to an intermediate option (CE) or to an option that dominates another option (AE).

We observe that the power of the AE and CE in bargaining is fundamentally constrained by the payoff focality of the feasible agreements. If an agreement is strongly payoff focal, which in our data set means that it offers the bargainers exactly equal and efficient payoffs, then this contract is very likely to be agreed on, and this wipes out any CE or AE.[32] On the other hand, if no feasible contract offers the players exactly equal payoffs, then the CE becomes significant. For the AE to be significant, additional conditions on the payoffs need to be met, so in this sense the AE is less robust than the CE. We believe that our finding that "context matters in bargaining" is of interest to theorists and practitioners alike.

To what extent can we interpret these findings as suggesting that the AE and CE are generic bargaining phenomena? Our data suggests that this depends on whether the bargainers can achieve an efficient outcome that is known to perfectly equalize the bargainers' payoffs. The CE and AE become significant (under some additional conditions) as soon as there is a slight inequality in the payoffs of the least unequal contract. One interpretation of this is that bargaining behavior when there is an option that offers perfectly equal payoffs may not be robust to slight perturbations in these payoffs.

There are several important features of the experimental bargaining environment, whose impact on the importance of the AE and CE can be studied in future work. First, the players' monetary payoffs are commonly known. This may not be a good assumption for many real bargaining settings. For example, each bargainer may know only his or her own payoffs from a given agreement, see for example Roth and Murnighan (1982). One conjecture is that private payoff information weakens the focality of the main "competitor" to the CE and AE, namely contracts with equal payoffs, since it is less likely to become common knowledge that such a contract exists. Of course, another effect of imprecise payoff information is that it may not become common knowledge that a particular contract is dominated or a compromise. The net effect on the AE and CE is therefore an empirical issue.

Second, in our experiment 'time is not money' (since it does not matter *when* some agreement is reached, only that it is reached before time runs

[32]The earlier paper, Galeotti et al. (2016), which only examined the CE, did find some evidence of a significant CE with an equal and efficient target contract (see also footnote 28).

out). Depending on the specifics of the bargaining situation, this may be unrealistic. There can be opportunity costs of bargaining, or the surplus may 'shrink' due to discounting or physical decay. A conjecture is that when time is money (see Rubinstein, 1982) players are more likely to be influenced by the AE and CE, since they wish to identify and reach an agreement quickly. Of course, the same considerations may strengthen the focality of equal payoff contracts, so it may continue to matter whether such contracts are feasible or not.

Third, our entire investigation has been based on a finite set up with a small number of feasible agreements. Of course, many real bargaining situations have a very large set of possible agreements. A question for future research is whether context effects of the type studied in this paper (bargainers choosing an intermediate alternative, or an alternative that dominates others) would become stronger or weaker in such more complex situations.

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Appendix

Appendix 1: Instructions

INSTRUCTIONS

Welcome and thank you for taking part in this decision making experiment. The amount of money you earn will depend on your decisions and the decisions made by the other participants in the room. Please do not talk to the other participants during the experiment. Everyone gets the same instructions, and all decisions are anonymous. If anyone has any questions, please raise your hand, and we will help you.

THE TASK

Rounds

There are 22 rounds. In each round you will be paired with one of the other participants in the room. It has been randomly decided by the computer which participants in the room you will be paired with in which rounds. You will not be paired with the same participant in all the rounds. You will never know who you are paired with.

In each round one of you will be called *Person 1*, and the other will be called *Person 2*. The computer will decide randomly if you are going to be Person 1 or 2. You can be Person 1 in some rounds, and Person 2 in other rounds. The names "Person 1" and "Person 2" are simply labels that allow us to identify your decision while preserving your anonymity, and allow you and the other person to know who does what.

Contracts

There are 22 different lists of *contracts*. Everyone in the room will encounter the same 22 lists of contracts, one list in each round, but in a different order.

A contract specifies a certain number of *points* to Person 1 and to Person 2. At the end of the experiment, the points that you have earned will be converted into pounds; we explain this below. A contract is shown on your screen like this:

Person 1: X Person 2: Y

This means that Person 1 gets X points and Person 2 gets Y points.

Here is an example of a list of three contracts:

Person 1: 50 Person 2: 50

Person 1: 40 Person 2: 40

Person 1: 60
Person 2: 60

The specific numbers are just for illustration.

Proposing a contract

In each round you and the other person can each *propose* a contract from the list. In any round you have *two minutes* (120 seconds) to make proposals.

Messages

You can also send messages to each other during the 120 seconds. How to do this is explained below.

Agreeing on a contract

If you and the other person propose the *same* contract, then you have reached an *agreement* on that contract.

Your earnings

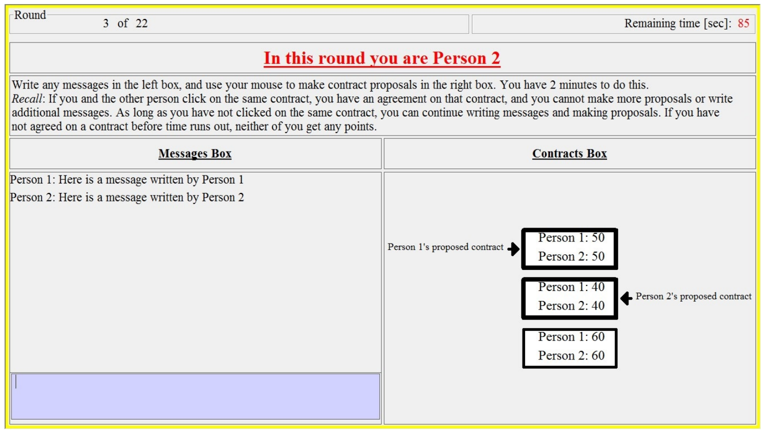
If there is agreement on a contract, each of you gets the points that the chosen contract specifies.

If you have not reached an agreement before the two minutes have gone, neither of you get any points for that round.

THE COMPUTER SCREEN:

We now explain how you make decisions. Here is an example of a round: On top of the screen you can see which round you are in (in this example, the 3rd of the 22 rounds) and how much time is left (in this example there are 85 of the 120 seconds left).

You can also see if you are Person 1 or 2. Recall that your role, 1 or 2, can change as you encounter different rounds, so please pay attention to



this whenever a new round starts. In this example, you are Person 2, so the other person is Person 1.

The Messages Box

During the 120 seconds you and the other person can write messages to each other. You write a message by first clicking in the text field (light blue colour), then you write the text, and hit the "Enter" key to send it. All messages are shown on your and the other persons screen.

You can write as many or as few messages as you want during the 120 seconds. Please do not send messages that reveal your name, that contain threats, or that say what might happen outside the lab. If we see that you send such messages, we reserve the right to exclude you from the rest of the session, in which case you will not get any money.

The Contracts Box

This box shows the list of contracts. There are three contracts in the example. The numbers are just for illustration. Person 1 and Person 2 always see the contracts arranged in exactly the same way on their screens.

How to propose a contract using the mouse

You click with your mouse on the contract you want to propose. An arrow pointing to that contract then appears, and the contract gets a thick border. Similarly, when the other person proposes a contract an arrow pointing to the contract appears on the screen, and it gets a thick border. All this is shown on both your and the other persons screens. In the example above, Person 1 has proposed the contract that gives 50 points to Person 1 and 50 points to Person 2 (the left arrow), and Person 2 has proposed the contract that gives 40 points to Person 1 and 40 points to Person 2 (right arrow). If a person has not made a contract proposal, then there is no arrow for that person.

You and the other person can make as many or as few proposals as you want during the 120 seconds. If you want to change your proposal, you simply click on the contract you now want to propose (the arrow then also moves). You can also remove a proposal, by clicking on the contract you have currently proposed (the arrow then disappears). You can decide not to make any proposals at all.

Reaching an agreement

If Person 1 and Person 2 click on the *same* contract (so both arrows point to the same contract), then there is an *agreement* on that contract. The screen then "freezes", and no one can change their proposals. In other words, an agreement is *binding it cannot be undone*. Each of you then gets the points specified by the contract you agreed on.

If you do not both click on the same contract before the 120 seconds have gone, then there is no agreement, and you each get zero points.

If you and the other person reach an agreement before the 120 seconds have gone, you are both asked to wait until the 120 seconds have gone. You then move to the next round. We ask you to remain silent while you wait.

Note: even if you and the other person have agreed on a contract by exchanging messages, you must both still formally record your agreement by clicking on the agreed contract before the 120 seconds have gone. In other words, you must make sure that both arrows point to the same contract before the 120 seconds expire. Otherwise you get no money.

Selecting rounds for payment

When you have made decisions in all 22 rounds, the computer randomly selects *three* rounds. These three rounds will be the same for everyone in the room. At the end of the experiment you will be informed about which rounds were selected, and then you get the sum of the points you earned in these three rounds.

When you make decisions in any given round, you should treat that round in isolation from the other rounds. This is because each of the 22 rounds can be among the three that are selected for payment, and your earnings in each of these randomly selected three rounds only depend on what you do in that round (and not on the 21 other rounds).

Converting points to pounds

Your total earnings in points from the three selected rounds will be converted into pounds using this exchange rate: 20 points = £1.

You will receive your money earnings, and the £4 show-up fee, in cash at the end of the session.

Are there any questions?

Before we start the first round, there will be some on-screen test questions, and a practice round.

8.1 Test Questions

Test Questions

Before we start the experiment, we ask you some questions, in order to make sure that everyone understands what we have just described.

Click with your mouse to answer the questions. The computer will tell you if your answer is right or wrong. If the answer is wrong, read the instructions once more, and try again. If you have any difficulties, raise your hand and we will help you. When you have answered all questions correctly, please wait until everyone else has done the same.

Question 1:

Suppose Person 1 and 2 agree on the following contract:

Person 1: 50
Person 2: 120

Which of these statements is correct?

- Person 1 gets 120 and Person 2 gets 50 points.
- Person 1 gets 50 and Person 2 gets 120 points.
- Person 1 and 2 both get zero points.

Question 2:

Which of these statements is correct?

- If I am Person 2 in my first round, then I know that I will also be Person 2 in all the remaining 21 rounds.
- My role, Person 1 or 2, can change from round to round.

Question 3:

Is this statement correct or incorrect?

In any round, I and the person I am matched with in that round always see the contracts listed in the same way on our screens.

- Correct.
- Incorrect.

Question 4:

Which of these statements is correct?

- In order to agree on a contract, we must both click on the same contract before the 120 seconds expire.
- In order to agree on a contract, it is enough that we in our messages can agree on a contract before the 120 seconds expire.

Question 5:

Is this statement correct or incorrect?

If I and the other participant click on the same contract after for example 48 seconds, then we have an agreement.

- Correct.
- Incorrect.

Question 6:

Indicate whether the following statements are correct or incorrect.

Everyone in the room encounters the 22 lists of contracts in the same order.

- Correct.
- Incorrect.

I will be matched with the same person in all 22 rounds.

- Correct.
- Incorrect.

Question 7:

Is this statement correct or incorrect?

As soon as I and the other person have reached an agreement in a round, we move on to the next round.

- Correct.
- Incorrect.

Question 8:

If I and the other person have clicked on the same contract, then that agreement is binding: I cannot cancel it.

- Correct.
- Incorrect.

Question 9:

Which of these statements is correct?

- I will get the sum of the points I earned in all 22 rounds, and they will then be converted into pounds.
- I will get the points I earned in three rounds that I do not know in advance, and they will then be converted into pounds.

Appendix 2: Predictions of the Kalai-Smorodinsky Model

In this appendix we compute the predictions of the Kalai-Smorodinsky solution, as extended to a finite domain by Nagahisa and Tanaka (2002).

Let S be the set of feasible contracts. An element of S is of the form $x = (x_1, x_2)$, where x_i is the money amount that player i receives in contract x. Since players receive no monetary payoffs in case of disagreement in our games, the disagreement outcome is $d = (0, 0)$. The set $X = S \cup \{d\}$ is the set of feasible monetary outcomes. Given utility functions $u_i : X \to \mathbb{R}$, define each player's ideal utility as his or her maximum achievable utility, denoted by m_1 and m_2. Formally, for contract set S and disagreement outcome d, let

$$m_1(S) = \max_{x \in S, u(x) \geq u(d)} u_1(x)$$

and

$$m_2(S) = \max_{x \in S, u(x) \geq u(d)} u_2(x).$$

Similar expressions hold for contract set T. Next, define the rescaled utility functions (in what follows we omit the contract set notation; note however that the normalization below does depend on the contract set)

$$v_1(x) = \frac{u_1(x) - u_1(0,0)}{m_1 - u_1(0,0)}$$

and

$$v_2(x) = \frac{u_2(x) - u_2(0,0)}{m_2 - u_2(0,0)}.$$

These new utility functions represent the same preferences as the original ones, and they give a measure of how close each player is to their ideal payoff, relative to the disagreement utility ($v_i(x) = 1$ corresponds to the case in which player i achieves the maximum possible utility and $v_i(x) = 0$ corresponds to the case in which player i is achieving the disagreement utility.[33])

The Kalai-Smorodinsky solution, KS, selects an agreement that brings all bargainers as close as possible to their ideal point, that is, maximizes the minimum payoff. Equivalently, KS minimizes the maximum concession. Formally,

$$KS = \arg\max_{x \in S, u(x) \geq u(d)} \min\{v_1(x), v_2(x)\}.$$

A geometrical characterization is as follows. In the space of feasible utilities (u_1, u_2), the KS is the set of contracts that maximize a Leontief type function where all the kinks of its level curves are on the segment that connects the disagreement point $u(d)$ and the ideal point (m_1, m_2).

Assuming $u_i(x) = x_i$ for $i = 1, 2$, the calculations and predictions are given in the table, where the rescaled utility functions v have been subscripted with the contract set, S or T, and where $m(k)$ is the ideal point for contract set $k = S, T$. Note that we have not included Games 3, 6, 13, 14, 15, 19, 20, 21 and 22. These are games with a strictly dominated decoy, and as pointed out in the main text such contracts cannot affect the Kalai-Smorodinsky solution (since the ideal point remains the same).

[33]One could also say that $v_i(x) = 1$ corresponds to player i making no concessions and $v_i(x) = 0$ corresponds to player 1 making the maximum possible concession.

Game	$\mathbf{m(S)}$	$\mathbf{v_S(A)}$	$\mathbf{v_S(B)}$	$\mathbf{KS(S)}$	$\mathbf{m(T)}$	$\mathbf{v_T(A)}$	$\mathbf{v_T(B)}$	$\mathbf{v_T(C)}$	$\mathbf{KS(T)}$
1	60,60	2/3,1	1,2/3	$\{A, B\}$					
2					80,60	1/2,1	3/4,2/3	1,1/3	*B*
4	80,120	1/2,1	1,2/3	*B*					
5					80,140	1/2,6/7	1,4/7	1/4,1	*B*
7	60,120	2/3,1	1,1/2	*A*					
8					60,155	2/3,24/31	1,12/31	1/12,1	*A*
9					60,130	2/3,12/13	1,6/13	1/2,1	*A*
10					120,120	1/3,1	1/2,1/2	1,1/3	*B*
11					155,120	8/31,1	12/31,1/2	1,1/24	*B*
12					70,120	4/7,1	6/7,1/2	1,1/3	*A*
16	65,120	8/13,1	1,11/24	*A*					
17					65,130	8/13,12/13	1,11/26	6/13,1	*A*
18					120,120	1/3,1	13/24,11/24	1,1/3	*B*

Note: $KS(k)$ is the Kalai-Smorodinsky solution for contract set $k = S, T$.

Table 3: Calculations for the Kalai-Smorodinsky bargaining solution.