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A ‘divide and choose’ approach to compromising☆

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HIGHLIGHTS

- We study two-party dispute resolution.
- The settlement must either be the favored position of one party, or a compromise.
- We propose a settlement protocol that can be implemented without an arbitrator.
- Our protocol has a unique equilibrium for a vast range of informational environments.
- Equilibrium welfare nears first best level as information gets more concentrated.

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ABSTRACT

We study dispute resolution in the compromise model of Börgers and Postl (2009), which provides an alternative framework for analyzing the real-world procedure of tri-offer arbitration studied in Ashenfelter et al. (1992). Two parties involved in a dispute have to choose between their conflicting positions and a compromise settlement proposed by a neutral mediator. We ask how an adaptation of the familiar ‘divide and choose’ mechanism (DCM) performs as a protocol for dispute resolution in the absence of an arbitrator. We show that there is a unique equilibrium of the DCM if the parties' von Neumann Morgenstern utilities from the compromise settlement are drawn independently from a concave distribution, or from any Beta-distribution (which need not be concave). Furthermore, for Beta-distributions that concentrate increasing probability mass on high von Neumann Morgenstern utilities of the compromise, the social choice rule implied by the DCM is asymptotically ex post Pareto efficient.

1. Introduction

The study of different arbitration procedures for settling two-party conflicts occupies a prominent position in the literature on dispute resolution. These procedures differ with regard to the amount of discretion they allow the arbitrator in imposing a binding settlement on the two parties (Farmer and Pecorino, 2008). Two commonly used procedures are: conventional arbitration, where the arbitrator can impose any settlement he deems appropriate; and final offer arbitration, where the arbitrator must select one of the two parties' conflicting positions (see Ashenfelter et al. (1992), Brams et al. (1991), and Chapter 3 in Brams (2003), for an overview of these procedures). A third procedure – one that curtails arbitrator freedom while still allowing for the possibility of a compromise settlement – is tri-offer arbitration. Under this procedure, which is used to resolve public sector labor disputes in Iowa (Ashenfelter et al., 1992), the arbitrator must select either one of the two parties' favored positions, or a compromise settlement proposed by a neutral mediator prior to the start of the arbitration process.

In this note, our focus is on the collective choice problem at the heart of tri-offer arbitration: should the two parties to the dispute choose a settlement favored by one of the parties, or should they select the compromise settlement? Our objective is to devise a protocol for dispute resolution that does not require the presence of an arbitrator, and which can be implemented by the parties themselves. One motivation is that with arbitration, there remains the issue of arbitrator selection regardless of the chosen arbitration procedure.[1] If the two parties must engage in some protocol for arbitrator selection, why not let them engage directly in a dispute resolution protocol? To address this question,

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[1] de Clippel et al. (2012) study this problem, along with specific procedures for selecting an arbitrator.

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we follow the approach to fair-division procedures in Brams and Taylor (1996) by assuming that any settlement emerging from such a protocol is binding on the two parties, just like the settlement imposed by an arbitrator would be.

A natural framework for studying tri-offer dispute resolution (both with and without an arbitrator) is the compromise setting of Börgers and Postl (2009). The mechanism design approach taken there offers a perspective on the arbitrator's decision problem that is different from, but complementary to the way arbitrator behavior is modeled in Ashenfelter et al. (1992): there, the arbitrator has exclusive knowledge of what constitutes a true 'fair' settlement in the dispute, and he will choose whichever feasible settlement is closest to it. In contrast, Börgers and Postl (2009) assume that the two parties hold privately relevant information about their preferences, such as their respective von Neumann Morgenstern utilities derived from the neutral mediator's compromise settlement. Under arbitration, the onus is on the arbitrator to elicit this information truthfully.[2] The main impossibility result in Börgers and Postl (2009) implies that incentive compatible tri-offer arbitration generally fails to implement (ex post) Pareto efficient settlements.

We propose here a conflict resolution protocol for the compromise setting of Börgers and Postl (2009) that combines aspects of classic 'divide and choose' mechanisms with aspects of ultimatum bargaining.[3] Under our protocol, a proposer (selected randomly from among the two parties involved in the dispute) suggests a lottery involving only the two parties' respective favored settlements. If the other party (the 'responder') agrees to the proposed lottery, then his favored settlement will be implemented with the probability specified by the proposer's lottery. If, instead, the responder rejects the proposed lottery, the compromise settlement previously suggested by the neutral mediator is implemented.

In what follows, we show that under our 'divide and choose' protocol, both proposer and responder have a unique type-contingent equilibrium strategy for a vast class of distributions of von Neumann Morgenstern utilities (namely for all concave distributions, as well as the entire class of Beta-distributions, which contains concave and convex distributions, in addition to distributions that change curvature from one to the other). We then investigate the performance of our protocol with respect to the ex ante expected welfare it generates. While under the uniform distribution our protocol is outperformed by a mechanism proposed in Börgers and Postl (2009) (the so called 'cropped triangle rule'), we show that for Beta-distributions which concentrate increasing amounts of probability mass on high realizations, our protocol converges to an (ex post) Pareto efficient settlement.

2. Model

2.1. Basic setup

Two agents $i = 1, 2$ must choose one alternative from the set $\{a_0, a_1, a_2\}$. Each agent i prefers alternative a_i over alternative a_0, and alternative a_0 over alternative a_{-i} (subscript $-i$ refers to the agent other than i). These ordinal preferences are common knowledge. We refer to alternative a_0 as the compromise because it is the middle-ranked alternative for both agents. Agent i's von Neumann Morgenstern utility function is $u_i : \{a_0, a_1, a_2\} \to \mathbb{R}$. Utilities are normalized so that $u_i(a_i) = 1$ and $u_i(a_{-i}) = 0$ for all i. These aspects of the von Neumann Morgenstern utility functions are common knowledge. For each agent i we denote by t_i the utility of the compromise $u_i(a_0)$. We refer to t_i as agent i's type. We assume that t_i is a random variable which is only observed by agent i. The agents' types are stochastically independent, and they are identically distributed with cumulative distribution function G. We assume that G has support $[0, 1]$, that its derivative g is continuous, and that $g(t_i) > 0$ for all $t_i \in (0, 1)$. The joint distribution of $t \equiv (t_1, t_2)$ is common knowledge among the agents. In most of the following, we assume that G is the parameterized Beta-distribution, which has density $g(t_i) = h(t_i)/B(\alpha, \beta)$ and cumulative distribution function $G(t_i) = H(t_i)/B(\alpha, \beta)$, where $h(t_i) \equiv t_i^{\alpha-1}(1-t_i)^{\beta-1}$, $H(t_i) \equiv \int_0^{t_i} \tau^{\alpha-1}(1-\tau)^{\beta-1} d\tau$, and $B(\alpha, \beta) \equiv H(1)$ for $\alpha, \beta > 0$.

2.2. Divide and choose mechanism (DCM)

We consider here an adaptation of the familiar 'divide and choose' mechanism as a way of making a collective choice in the compromise setting described above. The rules of this adapted DCM are as follows: one of the two agents is chosen randomly as the 'proposer'. Each agent has probability 1/2 of being proposer. If agent i is selected as proposer, he suggests to the other agent a lottery over their respective favorite alternatives $\{a_i, a_{-i}\}$. That is, the proposer chooses a probability $p \in [0, 1]$ with which the *other* agent's favorite alternative is chosen by the lottery. The other agent, the 'responder', then chooses between saying 'yes' or 'no'. If the responder says 'yes', then the responder's favorite alternative a_{-i} is implemented with probability p, and the proposer's favorite alternative a_i is chosen with probability $1-p$. If the responder says 'no', then the compromise a_0 is implemented.

2.3. First best mechanisms and welfare

In order to evaluate the performance of the DCM, we shall draw below on comparisons with *first best social choice rules*. A social choice rule (SCR) is a function that assigns to every pair of the agents' types a lottery over the set of alternatives. That is, $f : [0, 1]^2 \to \Delta(\{a_0, a_1, a_2\}), t \mapsto (f_0(t), f_1(t), f_2(t))$, where $f_i(t)$ $(i = 1, 2)$ is the probability that agent i's favorite alternative is selected, and $f_0(t)$ is the probability that the compromise is selected. An SCR is *first best* if $t_1+t_2 > 1 \Rightarrow f_0(t) = 1$ and $t_1+t_2 < 1 \Rightarrow f_0(t) = 0$. In addition to a comparison of first best SCRs with the SCR implied by the DCM, we wish to compare the performance of these rules according to the ex ante expected social welfare they generate. Noting that the components $f_0(t)$, $f_1(t)$, and $f_2(t)$ of any SCR f sum up to 1 for all t, we can express as follows the ex ante welfare of f, given by the sum of the agents' ex ante expected utilities:

$$W \equiv 1 + \int_0^1 \left(\int_0^1 f_0(t)\,(t_1 + t_2 - 1)\,g(t_2)\,dt_2 \right) g(t_1)\,dt_1. \qquad (1)$$

3. Results

3.1. Equilibrium

In this section, we characterize the equilibrium of the DCM:

Proposition 1. *For all concave distributions, and all Beta-distributions, the unique equilibrium of the DCM features the following strategies:*

[2] The idea of taking a mechanism design approach to arbitration in a two-party dispute when the arbitrator lacks information about the parties' preferences can be traced back to Rosenthal (1978).

[3] See Brams and Taylor (1996) for an overview of divide and choose mechanisms, under which one agent partitions a (possibly heterogeneous) good into two, while the other agent chooses whichever partition he wants. Divide and choose mechanisms have also been proposed for the dissolution of indivisible partnerships, with one partner proposing a price, and the other partner deciding whether to sell his share or purchase the other partner's share at that price. See, e.g., Morgan (2004).