Searching for Pareto-Optimal Settlements in Negotiations: The Extreme Payoffs Method

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ABSTRACT

Decision-making analysts are generally familiar with the maximin and minimax criteria used in the selection of alternative courses of action when payoffs depend on different states of nature. This paper applies these criteria to the collaborative negotiation problem in which two parties negotiate the resolution of several issues each with defined payoffs, and where the alternative choices for each party are qualitative attributes or non-differentiable variables. The proposed method assumes that the negotiators do not know each other’s payoffs and are generally unwilling to disclose information about their preferences. The search procedure for Pareto-optimal settlements and the role of the mediator in assisting the parties to achieve an improved negotiated agreement are analyzed and illustrated through an example.

Keywords: Efficient Frontier, Mediator, Negotiation Analysis, Negotiation Support Systems, Pareto Optimal, Post-Settlement Settlements

INTRODUCTION

The concept of Pareto-optimum has had a long and prominent place in the field of economics. The Pareto criterion holds that “any change which harms no one and which makes some people better off must be considered to be an improvement” (Baumol, 1977, p. 527). In mathematical terms, \( x^* \in X \) is Pareto-optimal if and only if there exists no other \( x \in X \) such that \( u(x) > u(x^*) \), where \( u(x) \) is the utility function of two or more people. In simpler terms, a solution is called Pareto-optimal when there is no other solution that provides a higher utility without harming someone else. In the negotiation context, an agreement among \( n \) parties is Pareto-optimal when there is no other agreement where it would be possible to increase any party’s utility without decreasing the utility of at least one other party. Since in many instances negotiators are rational, experienced and well informed, why wouldn’t the outcome of most negotiations be Pareto-optimal? Notwithstanding, one of the most consistent findings in the negotiation field is that negotiating parties often fail to reach efficient settlements (Sebenius, 1992). In the words of Raiffa (1982, p. 358), “often, disputants fail to reach an agreement when, in fact, a compromise does exist that could
be to the advantage of all concerned. And the agreements they do make are frequently inefficient: they could have made others that they all would have preferred.”

There have been numerous conceptual and empirical studies in the negotiation literature analyzing the dynamics of two-party and multiparty negotiations from different perspectives. The mathematics and economics of negotiations is rooted in the pioneering works of von Neumann and Morgenstern (1947), Nash (1950), and Kalai and Smorodinsky (1975). These game theoretical contributions based their analysis on different axioms to define the desirable properties of equilibrium solutions. While game theorists laid the theoretical foundations for rational bargaining, a rich and varied research tradition led by psychologists and economists has provided many behavioral findings about the actual negotiation process. This line of inquiry was introduced by Tversky and Kahneman (1974, 1991) and is well represented in the negotiation literature by Bazerman and Neale (1983), Neale and Bazerman (1991), Cameron (2003), and Bazerman (2006) among many others. It concentrates on documenting the conditions that lead to less than optimal outcomes, and on explaining the perceptual, psychological, and emotional causes of the limitations and systematic errors of negotiators.

Another stream of research studies has focused on the more practical problem of assisting negotiators to find Pareto-optimal settlements when facing particular situations. Raiffa (1996) proposed a straightforward method to identify the optimal settlements in negotiations that deal with discrete attributes. In a number of studies, Ehtamo and his colleagues introduced a highly analytical procedure for generating Pareto-optimal settlements in the case in which utilities and constraints can be expressed by continuous decision variables (Ehtamo et al., 1999; Ehtamo & Hamalainen, 2001; Heiskanen, 1999, 2001). In another study, Tajima and Fraser (2001) proposed the “logrolling” method, an iterative quantitative trade-off approach for generating Pareto optimal solutions in multi-issue two-party negotiations where the parties’ preferences are assumed to be linear. Using empirical data, Metcalf (2000) provided an analysis of different methods for generating Pareto-optimal settlements in two-party negotiations and highlighted their limitations and applicability in multiparty negotiations.

The effects of the shape of preferences of the negotiators and their strategies for reaching settlements have been the focus of several studies since early 1990s. Mumpower (1991) studied the interaction between negotiators’ judgment policies and the structure of the negotiation problem. He identified several shapes of preference structures and demonstrated their impact on the ability and strategy of the parties to achieve efficient settlements. Northcraft et al. (1995, 1998) and Teich et al. (1996) also examined the relationship between shapes of parties’ marginal utility functions and negotiation outcomes. Stuhlmacher and Stevenson (1997) analyzed the impact of negotiating parties’ preference structures on the negotiation process in terms of their utility ratings and sequence of offers. Based on empirical research, Mumpower et al. (2004) studied negotiating parties’ understanding of each other’s payoffs while considering different shapes of preference structures. Using a quantitative model, Vetschera (2005) examined the effect of the strategic manipulation of preference information by negotiating parties on the negotiation outcome. Neves and Nakhai (2008, 2009) extended the study of the effects of preference shapes on negotiation outcomes by examining sigmoid and other mixed preference structures.

There have been some limited efforts directed at developing computer based negotiation support systems (NSS) to aide negotiators and mediators to achieve Pareto-optimal settlements (Rangaswamy & Shell, 1997; Kersten & Noronha, 1999; Hamalainen, 2003). Experimental research conducted by Vetschera (2006) analyzed the effect of different preference structures
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