

Research on the Selection of Arbitrators Based on Game Theory

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Abstract. This paper established a model to describe a specific problem called the selection of arbitrators in general classes. This model involves a party of two choosing among a list of arbitrators with their opponents' vetoes and their preference ranking. Firstly, this paper founded mechanisms to depict social properties, which concentrate on the social choice rule (SCR) to choose results that are at least as efficient as the median outcome for both players, and two criteria Pareto efficiency and minimal satisfaction test (MST) are used to measure the mechanisms. Secondly, the paper evaluated two mechanisms of Veto-rank Mechanism (VR) and Short-listing mechanism (SL), respectively. After evaluating the two mechanisms, the paper proposed two main propositions which supplemented the current research results with the previous research results. Finally, some limitations of the paper have been stated and concluded that more considerations and circumstances can be discussed further in the future, and whether the results of this paper can still be reasonable in more complex situations.

Keywords: selection of arbitrators, Veto-rank Mechanism, Short-listing mechanism

1. Introduction

The social choice rule (SCR) is a method for selecting desirable outcomes in different situations which maps the preferences of the participants to a subset of possible results. Pareto efficiency refers to a quality of allocations where no option can be made better off without making at least one other option worse off. The minimal satisfaction test (MST) indicates the options of two parties at least better than or equal to the worst choice.

2. Veto-rank Mechanism (VR) Vs. Short-listing Mechanism (SL)

The paper evaluated two mechanisms of Veto-rank Mechanism (VR) and Short-listing mechanism (SL). To deliver the result, Clippel, Eliaz, and Knight (2014) conducted a series of controlled laboratory experiments at NYU's Center for Experimental Social Science, on the relative performance of veto-rank (VR) and shortlisting (SL)[1]. The experiments yield three main results highlighting both disadvantages of VR procedures and advantages of SL procedures. First, the results have shown that the majority of participants in the VR treatment will not truthfully report their preferences, instead, they follow a strategic behavior, thus indicating that VR, the most commonly used procedure has some deficiencies in theoretical predictions. Second, as the observed outcomes for VR procedures might be in inefficient and/or fail the minimal satisfaction test (MST), SL, the new sequential procedure, performed way better compared to VR mechanism in terms of both Pareto efficiency and MST, and the difference between those two procedures is shown to be statistically significant for a large fraction of preference pairs. Third, based on the idea of intentions-based reciprocity, the fairness concern will affect individual behaviors of some participants and that may lead to an underperformance of SL.

2.1 Veto-rank Mechanism (VR)

The paper first tested VR, which is the most widely used mechanism for assigning arbitrators. Under this mechanism, n (an odd number) is a list of potential arbitrators which two parties receive. Each party independently vetoes or removes $(n-1)/2$ names from the list and ranks the rest $(n+1)/2$ candidates, and the lowest-ranked candidate who has not been vetoed is the selected arbitrator.

2.1.1 Two Assumptions are Examined Using the VR Procedure

The paper then used an empirical approach and conducted two tests to examine the two assumptions underlying the theoretical concerns associated with using the VR procedure.

In the first test, the assumption that preferences are not strictly opposed is examined. The idea is that if preferences are strictly opposed and participants, although not a unique Nash Equilibrium, behaving truthfully is a partial equilibrium, with the fact that under any equilibrium, the candidates been vetoed should not overlap. However, analysis of the data provided by the New Jersey Public Employment Relations Commission shows that there is a statistically significant amount of overlap in both rankings and vetoes, which supported the assumption that the preferences are not strictly opposed.

In the second test, the assumption that parties must behave strategically is examined. Clippel, Eliaz, and Knight (2014) collected and analyzed, the idea is that given the relative ranking of an arbitrator will not change if does not have direct experience with the arbitrator[2]. Thus, if two arbitrators presented in two different cases, truthful participants will rank the two arbitrators in an exact order relative to each other. However, in the 249 data points, about one-third of the participants reversed his ranking of the two arbitrators, thus suggesting that the participants are behaving untruthfully and strategically.

2.1.2 Violating Criteria of VR

However, the veto-rank mechanism is only attractive as long as participants are truthful, because participants may deviate due to profit. Furthermore, according to Proposition 1, the SCR derived from truth-telling in VR is not Nash implementable. Moreover, Proposition 2 showed that the SCR resulting from truthful reporting or any VR selection is not fully implementable in perfect subgame. In conclusion, the VR mechanism does not entirely satisfy the criteria. Firstly, according to Proposition 1, there are undesirable Nash equilibrium outcomes exist which are not selected by VR mechanism that may lead to Pareto inefficient. Also, Proposition 1 stated that if a pair of (undominated) equilibria existed and two players refuse to coordinate their outcomes in VR mechanism. This behavior will bring about Pareto inefficient and/or MST deviation.

2.1.3 Disadvantage of VR

Apart from violating criteria, VR also has a disadvantage about truthfulness. For instance, truthful reporting is not always an equilibrium under the “veto-rank” procedure. Consider when $n=5$, there are 5 neutral candidates (e.g. $A = \{a, b, c, d, e\}$) in the selection. Suppose for two parties, one has a ranking preference of $a > b > c > d > e$, the other has a ranking preference of $a > b > e > d > c$. Regardless of which party makes the first choice, both parties’ initial remove choice of candidates is the same (e.g. a and b). In the second round, the truthful veto rank of party 1 is $c > d > e$, which means e should be the selected arbitrator. However, the truthful veto rank of party 2 is $e > d > c$, which means c should be the selected arbitrator. Due to the different choosing order, the final selected arbitrator is different, which means there is not always exist a Nash equilibrium. In general, if the candidates are neutral, in spite of the truthful report, two parties’ bias is unclear. Additionally, according to different choosing order, the final selected arbitrator may not be consistent, which means truthful reporting is not always an equilibrium under the “veto-rank” procedure.

2.2 Short-Listing Mechanism(SL)

Owing to these negative effects associated with the VR mechanism, another mechanism---the Short-listing mechanism---was introduced as it is much easier to work with. Proposition 3 stated that under the SL mechanism, one party will first select $(n+1)/2$ candidates as the game begins, and the second party will then selects the arbitrator out of that shortlist. It has been reported by Binmore et al. (2002) that SL satisfies two desiderata[3]. Firstly, the selected arbitrator is a Pareto efficient outcome, which Pareto dominates the procedure satisfies both parties’ minimal satisfaction test. Secondly, the few stages used in the selection, the simpler calculate will be. This paper put the study of Abreu and Sen in the circumstance of choosing an arbitrator[4]. It gives the base and reliable support to the research in this particular condition when two agents have to make their own

decision. Given the two agents' preference, the two SPNE outcomes under the shortlisting procedure are each agent remove $(n-1)/2$ arbitrator and chose one among the remaining arbitrators. Thus, the Subgame-perfect Nash Equilibrium (SPNE) outcome is first mover's top choice among the top $(n+1)/2$ choices of the second mover.

Since no better choice can make one party better off without hurting the other party, these SPNE outcomes are Pareto efficient, as the two parties both ruled out the unwanted ones, the remaining of their choice can be Pareto efficient. In addition to that, it procedure passed the minimal satisfaction test because it dominates both parties' median choice. The number of arbitrators who are ruled out is less than half of the total number, so the median choice must be included in the remaining choices. In conclusion, Short-listing can be generalized to $n > 2$ agents because in the finite set $n \geq 4$ and n is odd, which means at least more than two agents will be selected. When $n > 2$, according to Abreu and Sen's study, the procedure will satisfy Pareto efficiency and minimal satisfaction.

2.3 Judgment of VR and SL

Moreover, through further experimentation, the relative performance of VR and SL has been measured that most VR cases occur untruthful behavior. Furthermore, SL which is not implemented in reality exceeds the general used VR mechanism.

3. Two Main Propositions Addressed for the Current Research Results

After evaluating the two mechanisms, the paper proposed several propositions which supplemented the current research results with the previous research results. In particular, the proof of Proposition 1 was built on Hurwitz and Schmeidler (1978)[5], and the proof of Proposition 2 was built on Abreu and Sen (1990)[6].

3.1 Proposition 1 of Hurwitz and Schmeidler

For instance, Hurwicz and Schmeidler studied the Pareto optimality of Nash Equilibria in the process of making the decision. The question is whether there are non-dictatorial outcome functions can satisfy two requirements. One requirement is that there is a Nash equilibrium in every case. The other is that whether a profile has reached Nash equilibrium also satisfies Pareto optimal. After doing a series of research, Hurwicz and Schmeidler ascertained several results. First, if a society only has two persons, the study indicates that non-dictatorial acceptable outcome functions do not exist. If there are more than two persons in a society, then the results vary according to admissible profiles. If there is no indifference, non-dictatorial acceptable outcome functions will exist. When profiles have indifference, there will be no acceptable outcome functions. It also discovered that if there is weak Pareto optimality instead of Pareto optimality, every function acceptable can be acceptable even when there are indifferences.

Proposition1, which is based on Hurwicz and Schmeidler's study, indicates that SCR with Pareto efficient is dictatorial. When SCR is dictatorial, it cannot meet the requirements of MST. In this study, there is indifference, according to Hurwicz and Schmeidler (1978), the non-dictatorial acceptable outcome functions do not exist. Therefore, the study of Hurwicz and Schmeidler (1978) can prove the proposition 1.

3.2 Proposition 2 of Abreu and Sen

Additionally, Abreu and Sen established a sufficient condition in which social choice correspondence can be implemented in subgame. It is important that the results made by Abreu and Sen can only be suitable for more than three agents and there is no veto power. As for the two-agent case, there should be more discussion. The result reached by Abreu and Sen is more general and less complex than those of M-R.

As for Proposition2, Abreu and Sen's study has back up the proposition and the n equals to 5 when $n > 2$, which can be applied to Abreu and Sen's situation. It gives two examples. One is that a

situation which is not Nash implementation but is subgame perfect implementable. The other is the plurality rule. The example of the selection of arbitrators is similar to these two examples above.

4. Helpfulness of the Paper

Although the content of the paper focuses on the selection of arbitrators, the results, together with the implementation theory can also be helpful when applying to many other scenarios where participants with symmetric information must reach an agreement on a collective decision without monetary transfers. With the knowledge of the paper, people will be able to study participants' behavior in situations like hiring decisions, selection of public leaders, and committee decisions, etc using an implementation-theoretic approach. The first step is to identify several reasonable social choice rules (SCR). Follow by that is to ask if the most commonly used mechanism implemented in theory any of the SCRs identified in step 1 and study whether participants in selected mechanisms tend to behave following the theory. The last step is to search for alternative mechanisms that yield a desirable outcome both theoretically and behaviorally. In this case, Clippel, Eliaz, and Knight identified VR as a prevalent procedure and they use a series of experiments to explore the advantages and disadvantages of the commonly used VR and the alternative SL mechanisms respectively and in the meanwhile, suggesting that the VR procedure is outperformed by SL procedure[7].

5. Limitations of the Paper

However, the paper does have some limitations. The paper assumes that two agents have complete information, but in the real world, information asymmetry may exist in many ways from choosing an arbitrator to select jury members. And Information Asymmetry can be caused by many unpredictable factors.

Another restriction of the paper is that it cannot be extended to more complex scenarios and it only has to choose one person, there are only two groups and the assumption is that every party make truthfully decision. Therefore, in the future, explore mechanisms that can be used in more than two parties is of importance.

6. Conclusion

Thus more considerations and circumstances can be discussed further in the future. For instance, whether the research method can still be efficient when Information Asymmetry occurs and whether the results of this paper can still be reasonable in more complex situations.

References

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