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Voting with endogenous information acquisition: Experimental evidence ☆

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ABSTRACT

The Condorcet jury model with costless but informative signals about the true state of the world predicts that the efficiency of group decision-making increases unambiguously with the group size. However, if signal acquisition is made an endogenous and costly decision, then rational voters have disincentives to purchase information as the group size becomes larger. We investigate the extent to which human subjects recognize this trade-off between better information aggregation and greater incentives to free-ride in a laboratory experiment where we vary the group size, the cost of information acquisition and the precision of signals. We find that the theory predicts well in the case of precise signals. However, when signals are imprecise, free-riding incentives appear to be much weaker as there is a pronounced tendency for subjects to over-acquire information relative to equilibrium predictions. We rationalize the latter finding using a quantal response equilibrium that allows for risk aversion.

1. Introduction

Condorcet's jury theorem (Condorcet, 1785) asserts that if a group of individuals have common preferences over some binary outcome (e.g., convicting the guilty or acquitting the innocent) and are given independent and informative private signals about the true state of the world (e.g., "guilt" or "innocence") then, under majority rule, the correct outcome is more likely to be achieved as the group size of voters is increased. Feddersen and Pesendorfer (1997) have shown that this result is robust to strategic or insincere voting, where voters may rationally vote against their private information; even if voters vote strategically against their signals, they do so in an optimal way so that information aggregation continues to improve as the group size increases. An implication of these results for optimal voting mechanisms is that, under the maintained assumptions, we can always make a voting mechanism better by adding more voters. However, this result assumes that private signals about the true but unknown state of the world are costless and exogenously provided.

In this paper we study the question of endogenous information aggregation in a setting where voters must first independently decide whether to acquire a costly signal about the true state of the world prior to voting as a group whether

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to convict or acquit under majority rule. In particular, we present results from a laboratory experiment designed to explore how the number of players, the cost of information and the informativeness of signals matter for information aggregation by juries or committees. We believe that a laboratory experiment provides the best means of empirically evaluating the theory of voting and information aggregation with endogenous information acquisition as the laboratory allows for firm control over the number of voters, the costs and precision of information that voter receive as well as the incentives that voters face, so that the theory can be properly tested.

The basic set-up of our experiment is the Condorcet jury model in which voters have common preferences and must make a decision as a group about whether to convict or acquit a defendant based on private, informative signals about whether the defendant is guilty or innocent. A main focus of our study is how the size of the group affects the probability that it makes the correct decision (henceforth referred to as informational efficiency). Theory suggests that adding an additional individual (or voter) to the group has two opposing effects. On the one hand, since the additional individual's signal is informative – it is more likely to be correct than incorrect – efficiency will increase. We term this the *information aggregation effect*, and the content of the various versions of the Condorcet Jury Theorem is that when voters are exogenously endowed with private, independent but informative signals about the state of the world, this effect ensures that arbitrarily large groups can reduce the likelihood of error in the group decision without bound, thus improving informational efficiency. However, when the acquisition of information (signals) is a costly choice, then as the group size increases, each individual has a lower incentive to acquire information. This countervailing *free-riding effect* works to reduce informational efficiency. Thus, when information is endogenously chosen and costly, the overall effect of group size on informational efficiency depends on the tradeoff between the information aggregation effect and the free-riding effect. Persico (2004) and Koriyama and Szentes (2009) show the existence of an upper bound on the optimal group size in Condorcet jury environments with costly information acquisition.

These theoretical papers provide us with testable hypotheses that we evaluate in our laboratory experiment. In particular, increases in the group size should result in an increase in informational efficiency when information is informative and freely available. However, if information acquisition is costly, informational efficiency should only increase up to a certain group size before falling off and for large enough group sizes, reaching the minimum efficiency level. Depending on the model parameterization, all voters may have an incentive to acquire information up to a certain group size, but beyond that group size rational voters play a mixed strategy with regard to information acquisition, and for a large enough group size, rational voters should refuse to acquire any information at all. Thus, the theory puts an upper bound on the optimal group size and one purpose of our experiment is to determine whether this upper bound really matters among the laboratory subjects who are asked to make a decision about the purchase of costly information prior to voting. In addition to increasing the group size, we also vary the cost of information acquisition and the precision of the signal process.

To preview our results, we find that if signals are costly and noisy (but informative), the free-riding effect on information acquisition that is predicted to become dominant as the group size increases is actually rather weak, so that the information aggregation effect associated with a larger group size tends to dominate and thus welfare is generally increasing with the group size, counter to theoretical predictions. On the other hand, consistent with theoretical predictions, we find that if signals are costly and perfectly informative, then there is a drop in welfare as the group size increases in line with theoretical predictions. We then consider several explanations for why the group size effect is not as strong in the noisy signal environment as compared with the perfect signal environment.

Specifically, we first consider whether subjects might simply be coordinating on asymmetric equilibria as opposed to the symmetric equilibria that we focus on. We find, however, that these two different types of equilibria are not sufficiently distinct from one another to provide a meaningful explanation. We then consider several different behavioral explanations for our findings including 1) that subjects may approach the game in decision-theoretic rather than game-theoretic terms thereby ignoring free-riding considerations; 2) that behavior reflects noisy best responses so that a quantal response rather than a Nash equilibrium is the appropriate benchmark for analysis and finally, 3) that subjects are risk averse with regard to uncertain money payoffs (rather than risk neutral as the theory presumes), and this risk aversion leads them to over-acquire information in the noisy signal environment. We conclude that a quantal response equilibrium with risk averse preferences provides a compelling explanation for why behavior departs from theoretical predictions in the noisy signal environment.

The rest of the paper is organized as follows. Section 2 discusses related literature. Section 3 presents the theoretical model and equilibrium predictions. Section 4 describes our experimental design and in section 5 we state our research hypotheses with numerical predictions under the parameterizations used in the experiment. Section 6 presents our main experimental findings in comparison with theoretical explanations and we also evaluate the various behavioral explanations for why, in certain treatments, information acquisition departs from theoretical predictions. Finally, section 7 concludes with a summary of our main findings and some suggestions for future research.

2. Related literature

The theory of endogenous information acquisition in the Condorcet jury model begins with Persico (2004) and Martinelli (2006). Persico (2004) observed that if agents must first decide whether to acquire private noisy information that is then aggregated to reach a collective decision, then the information acquisition decision is properly viewed as a free-rider problem with the result that information acquisition will generally be less than the social optimum under a given voting rule. An implication of this observation is that for any given signal precision and voting rule there will exist an optimal committee size,