



Judgment aggregation and agenda manipulation



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ABSTRACT

When individual judgments ('yes' or 'no') on some propositions are aggregated into collective judgments, outcomes may be sensitive to the choice of propositions under consideration (the *agenda*). Such agenda-sensitivity opens the door to manipulation by agenda setters. I define three types of agenda-insensitivity ('basic', 'full', and 'focal') and for each type axiomatically characterize the aggregation procedures satisfying it. Two axioms turn out to be central for agenda-insensitivity: the familiar *independence* axiom, requiring propositionwise aggregation, and the axiom of *implicit consensus preservation*, requiring the respect of any (possibly implicit) consensus. As the paper's second contribution, I prove a new impossibility theorem whereby these two axioms imply dictatorial aggregation for almost all agendas.

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1. Introduction

Imagine that the board of a central bank has to form collective judgments ('yes' or 'no') on some propositions about the economy, such as the proposition that prices will rise. Disagreements on a proposition are resolved by taking a majority vote. The chair of the board knows that a majority believes prices won't rise. Nonetheless he wants the board to form a collective judgment that prices will rise.¹ To achieve this goal, he removes the proposition 'prices will rise' from the agenda, while putting two new propositions on the agenda: 'GDP will grow', and 'growth implies inflation', i.e., 'if GDP will grow, then prices will rise'. Once it comes to voting, the two new propositions are each approved by a (different) majority. The chair is pleased, since the collective beliefs in growth and in growth implying inflation logically entail a belief in inflation. This agenda manipulation has successfully turned an (explicit) 'no inflation' judgment into an (implicit) 'inflation' judgment. Fig. 1 illustrates this reversal in the case of a three-member board.

This example shows that majority voting is vulnerable to agenda manipulation. Which rules (if any) are immune to agenda manipulation? This paper defines different types of agenda sensitivity, and characterizes the aggregation rules immune to each type. Two axioms on the aggregation rule turn out to play key roles in ensuring manipulation-immunity: *independence* (i.e., the analogue for judgment aggregation of Arrow's axiom of *independence of irrelevant alternatives* for preference aggregation), and *implicit consensus preservation* (i.e., the principle of respecting unanimity, in a strengthened version extended to implicit judgments). In a new impossibility theorem, I prove that these two axioms can almost never be sat-

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¹ The reason might be his belief in imminent inflation, or his desire for the bank to raise interest rates (which happens only if the board concludes that there is an inflation risk). In the first case he cares about the truth of collective judgments. In the second case he cares about consequences (actions) resulting from collective judgments. This paper leaves open the motivation of agenda setters.

	initial agenda	manipulated agenda	
	Inflation?	Growth?	Growth implies inflation?
Member 1	Yes	Yes	Yes
Member 2	Yes	No	No
Member 3	No	Yes	No
Majority	No	Yes	Yes

Fig. 1. An agenda manipulation reversing the collective judgment on inflation.

ified by an aggregation rule which is non-dictatorial (as well as having an unrestricted domain and generating rational collective judgments). This impossibility theorem is also of interest in its own right, i.e., independently of the issue of agenda manipulation. Indeed the two axioms need not be motivated by considerations of agenda manipulation. The paper therefore has two main contributions: an analysis of agenda manipulation, and the proof of a new impossibility theorem.

The present analysis of agenda sensitivity fills a gap in the literature on judgment aggregation, in which agenda sensitivity/manipulation is often mentioned informally and was treated in a semi-formal way by Dietrich (2006).² Other types of manipulation have however been much studied. One type is the manipulation of the aggregation rule, more precisely of the order of priority in which a sequential aggregation rule considers the propositions in the agenda (List, 2004; Dietrich and List, 2007c; Nehring et al., 2014). Another type of manipulation is strategic voting, in which voters do not report truthfully their judgments. Strategic voting has been studied using two different approaches. One approach focuses on *opportunities* to manipulate, setting aside the behavioural question of whether voters take these opportunities or vote truthfully (e.g., Dietrich and List, 2007b; Dokow and Falik, 2012). The other approach focuses on *incentives* to manipulate, i.e., on actual voting behaviour (e.g., Dietrich and List, 2007b; Dokow and Falik, 2012; Ahn and Oliveros, 2014; Bozbay et al., 2014; DeClippel and Eliaz, 2015; see also Nehring and Puppe, 2002). The first approach requires only a basic, preference-free judgment-aggregation setup, whereas the second approach requires modelling voters' preferences (and their private information, if any). The present paper studies whether an agenda setter has *opportunities* to manipulate via the choice of agenda. I leave open whether he is himself a voter or an external person, and whether he takes such opportunities or refrains from manipulation. The latter question depends on his preferences, which are not modelled here. Although manipulation behaviour is not addressed explicitly, it is overly clear that manipulation *opportunities* will lead to manipulation *behaviour* under many plausible preferential assumptions.³

The paper's second contribution – a new impossibility theorem – connects to a series of impossibility results in the field; see for instance List and Pettit (2002), Pauly and van Hees (2006), Dietrich (2006), Dietrich and List (2007a), Mongin (2008), Nehring and Puppe (2008), Duddy and Piggins (2013), and papers in the *Symposium on Judgment Aggregation* in Journal of Economic Theory (List and Polak, 2010). Of particular interest to us is a theorem which generalizes Arrow's Theorem from preference to judgment aggregation (Dietrich and List, 2007a and Dokow and Holzman, 2010, both building on Nehring and Puppe, 2010 and strengthening Wilson, 1975). The new theorem shows that if in the generalized Arrow theorem the Pareto-type unanimity condition is extended towards implicit agreements, then, perhaps surprisingly, the dictatorship conclusion now holds for *almost all* agendas, not just agendas of a quite special structure.

I should mention a growing branch of the literature which constructs concrete judgment aggregation rules, and whose attention I hope to draw to agenda manipulation. Many proposals have been made. Our analysis will imply that almost all proposals are vulnerable to agenda manipulation, yet in different ways and to different degrees.⁴

The paper is structured as follows. Section 2 defines the framework. Section 3 states and explains the impossibility theorem on propositionwise and implicit consensus preserving aggregation. Sections 4 and 5 address agenda-sensitivity, stating characterization and impossibility results. Section 6 adds concluding Remarks. Appendix A defines an alternative framework (more typical for judgment-aggregation theory) in which all our results continue to hold. Appendix B contains all proofs.

2. The framework

I now define the judgment-aggregation framework (e.g., List and Pettit, 2002 and Dietrich, 2007, 2014). I define it in a *semantic* version, which takes propositions to be sets of possible worlds ('events') rather than abstract or syntactic objects.

² The limited overlap of the present paper with Dietrich (2006) is explained in Section 4.

³ One such assumption is that the agenda setter holds preferences over outcomes that are totally independent of votes and voters' information, as in our introductory example where the agenda setter simply wants a collective judgment of rising prices.

⁴ The proposals include premise- and conclusion-based rules (e.g., Kornhauser and Sager, 1986; List and Pettit, 2002; Dietrich, 2006; Dietrich and Mongin, 2010), sequential rules (e.g., List, 2004; Dietrich and List, 2007b), distance-based rules (e.g., Konieczny and Pino-Perez, 2002; Pigozzi, 2006; Miller and Osherson, 2009; Eckert and Klamer, 2009; Lang et al., 2011; Duddy and Piggins, 2012), quota rules with well-calibrated acceptance thresholds and various degrees of collective rationality (e.g., Dietrich and List, 2007b; see also Nehring and Puppe, 2010), aggregation rules for restricted domains (Dietrich and List, 2010; Pivato, 2009), relevance-based aggregation rules (Dietrich, 2015), Borda-like and scoring rules (Dietrich, 2014; Duddy et al., 2016), and rules which approximate the majority judgment set when it is inconsistent (Nehring et al., 2014).

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