Testing the single-peakedness of other-regarding preferences

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ABSTRACT

We test an implication that is common to all prominent theories of outcome-based other-regarding preferences: the ordinal preference ranking of an agent over a finite number of alternatives lying on any straight line in the space of material payoffs to oneself and some other agent must be single-peaked or single-plateaued. An incentive compatible mechanism is used to elicit strict preference rankings of subjects over a finite set of alternatives in decision tasks based on dictator and trust games. Violations of single-peakedness range from a low of 19% to a high of 46% across the six main treatments. Other-regarding subjects violate single-peakedness significantly more often than self-regarding subjects. The presence of equal-split in the set of alternatives increases the number of violations. We argue that the violations cannot be explained by appealing to the relative ease of reporting certain rankings or as errors from the theoretical benchmark.

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1. Introduction

An impressive body of laboratory and field experiments has revealed that individuals often behave as if they care about how their actions affect others (Fehr and Schmidt, 2006; Rotemberg, 2006). Several theoretical models have been proposed to account for these findings. In an important class of these models, preferences of an agent (say, Self) are modeled with the help of a binary relation defined over a set whose elements specify the material payoffs for Self and another agent (say, Other). Cox et al. (2008) show that virtually all the prominent models of outcome-based other-regarding preferences assume preferences to be complete, transitive, continuous, (strictly or weakly) convex, and strictly increasing in one's own material payoffs. We shall refer to these five axioms as the *core* preference axioms.

The core preference axioms imply that the ordinal preference ranking of Self over any finite number of alternatives lying on any straight line in the space of material payoffs to Self and Other will be *single-peaked* or *single-plateaued*. Single-peakedness and single-plateauedness are straightforward implications of the core axioms. Testing for them, however, is a powerful way to assess the empirical validity of the overall framework of outcome-based other-regarding preferences because it goes beyond testing a particular model or comparing different models within the framework.

We elicit the strict preference rankings of subjects over a finite set of alternatives in *decision tasks* based on dictator and trust games. Relatively higher ranked alternatives are used to determine payoffs with relative greater probability in order to incentivize truthful reporting. Subjects are classified as self-regarding or other-regarding based on some information in their

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reported rankings (e.g., most-preferred alternatives) and other-regarding subjects are further differentiated as positively and/or negatively other-regarding.

Our *first* question is whether the underlying preferences of subjects indeed accord with the core preference axioms; if not, are the preferences of subjects who are classified as other-regarding as likely to accord with the core axioms as are the preferences of self-regarding subjects. We find that other-regarding subjects are more likely to violate single-peakedness than self-regarding subjects. Further, subjects who are both positively and negatively other-regarding are more likely to violate single-peakedness relative to subjects who are only positively or only negatively other-regarding.

The motivation for our *second* question comes from studies showing that seemingly minor changes to the set of alternatives can significantly alter choices. Such findings are often used to highlight the role of context and question the generality of outcome-based models of other-regarding preferences (Güth et al., 2001; List, 2007; Bardsley, 2008).[1] It is worth stressing that the generality of outcome-based models cannot be questioned simply on the basis of significant differences in *choices* across minor variations of context. The underlying preferences that lead to those choices will differ but may still be consistent with the existing theories across contexts. The generality of the framework can, however, be questioned if minor variations in context lead to significant differences in the extent to which the underlying *preferences* accord with the theoretical framework. We find that the presence of the equal-split alternative leads to a significant increase in the violations of single-peakedness. We assess the robustness of our results and conclude by briefly discussing a potentially useful direction for future work.

2. Theoretical background

Cox et al. (2008) show that preferences of agents as modeled in Fehr and Schmidt (1999), Bolton and Ockenfels (2000), Charness and Rabin (2002), and Cox et al. (2007) satisfy the five core axioms: they are complete, transitive, continuous, convex, and strictly increasing in own payoffs.[2] Suppose that preferences of Self are defined over $\mathbb{R}^2_+$ and satisfy the five core axioms. In view of our experiment, we are interested in identifying what do such preferences imply regarding the structure of ordinal preference rankings over a finite set of alternatives $\mathbb{S} = \{a_i\}^n_{i=1} = \{(g_i, k_i)\}^n_{i=1} \subset \mathbb{R}^2_+$. Let g_i (k_i) denote the material payoff to Other (Self) from alternative $a_i \in \mathbb{S}$ and assume that the alternatives in $\mathbb{S}$ lie on a downward sloping straight line in $\mathbb{R}^2_+$.

Suppose we order the alternatives in $\mathbb{S}$ on a one dimensional horizontal axis in terms of increasing payoffs to Self and denote his ordinal preference ranking over these alternatives on the vertical axis. Then, his ordinal preference ranking over $\mathbb{S}$ is *single-peaked* if (i) the most-preferred alternative is unique and (ii) between any two alternatives that are both on the left (or, both on the right) of the most-preferred alternative, the alternative that is closer to the most-preferred alternative is strictly preferred over the alternative that is farther. *Single-plateaued* preferences refer to a generalization of single-peakedness wherein there is a set of most-preferred alternatives which contains two or more adjacent alternatives (Berga, 1998). The following proposition guides our experimental design. The proof is provided in the Supplement.

Proposition 1. *If preferences over $\mathbb{R}^2_+$ satisfy the five core axioms, then the ordinal preference ranking over the alternatives in $\mathbb{S}$ will be single-peaked or single-plateaued.*

Consider an experiment where subjects are restricted to report *strict* rankings such that a reported ranking will either be single-peaked or non-single-peaked. A single-peaked strict ranking over $\mathbb{S}$ will be consistent with some preference relations defined over $\mathbb{R}^2_+$ which satisfy all the five core axioms. For example, the single-peaked ranking over a set of four alternatives as shown in Panel [A] of Fig. 1 is consistent with both strictly convex preferences (Panels [A.1] and [A.2]) and weakly convex preferences (Panel [A.3]) over $\mathbb{R}^2_+$.

A non-single-peaked strict ranking over $\mathbb{S}$ is not consistent with any strictly convex preference relation over $\mathbb{R}^2_+$ which satisfies the other four core axioms. However, it can be consistent with weakly convex preference relations over $\mathbb{R}^2_+$ which satisfy the other four core axioms as well. Panel [B] in Fig. 1 illustrates that a reported non-single-peaked ranking could either reflect violation of the core axioms (Panel [B.1] where convexity is violated) or indifference between some alternatives (Panel [B.2]).

This last case highlights that restricting subjects to report a strict ranking may lead to spurious violations of single-peakedness. In particular, a subject with a single-plateaued weak ranking over the alternatives in $\mathbb{S}$, which is actually consistent with the theoretical framework, may report any single-peaked or non-single-peaked strict ranking which is payoff-equivalent to his weak ranking. Yet, we restrict subjects to report strict rankings in our six main treatments for several reasons. Almost all existing studies that elicit choices restrict subjects to choose one and only one alternative from a given set and interpret the chosen alternative as the most-preferred alternative. If the study demands categorizing subjects, then the categorization is done with respect to their choices. Restricting subjects to report strict rankings allows us to categorize subjects on the basis of their most-preferred alternatives which parallels the manner in which subjects are

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[1] Context-sensitivity has been demonstrated in other ways. Anonymity between subjects and the experimenter (Hoffman et al., 1994), social distance between subjects (Hoffman et al., 1996), and minimal social cues (Rigdon et al., 2009) affect choices across objectively identical allocation problems.

[2] Some models allow the preferences of Self to be non-increasing in the payoff of Other in some regions of the payoff space to capture the intuitive idea that Self may be willing to sacrifice his own payoff in order to decrease the payoff to Other. Preferences of Self are non-monotonic in the payoff to Other if they are increasing in the payoff to Other in some regions of the payoff space but decreasing in some other regions.