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# Buridanic competition ☆

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ABSTRACT

We analyze a model of two-attribute competition for a decision maker who follows a non-compensatory choice procedure that only responds to ordinal rankings along the two dimensions. The decision maker has an outside option that functions as a default alternative. In the absence of a dominant alternative, the decision maker may stick to the default even if it is dominated – capturing the phenomenon of choice procrastination in the presence of difficult choices. We show that the prevalence of difficult-choice situations in equilibrium is related to the magnitude of the choice procrastination effect. In general, features of the choice procedure that are typically viewed as biases tend to "protect" the decision maker, in the sense that they encourage competitors to offer higher-value alternatives in equilibrium. We discuss the potential implications of this analysis for recent discussions of "default architecture".



## 1. Introduction

One of the biggest distinctions between economists' and psychologists' view of decision processes is the way they regard trade-offs. The standard economic approach assumes that the decision maker (DM henceforth) has well-defined preferences, and in the vast majority of applications these preferences are continuous and locally non-satiable. The economic DM is a "trade-off machine" who effortlessly weighs multiple considerations – Kreps (1988) fondly calls him Totrep ("Trade-Off Talking Rational Economic Person").

A viewpoint more typical of psychologists (Tversky, 1972; Payne et al., 1993; Luce et al., 1999; Anderson, 2003) is that the DM generally tries to *avoid trade-offs* because of the cognitive and emotional difficulty of performing them. This motive is stronger when the DM needs to *justify* his choices to other people, because decision weights are hard to account for. A trade-off avoiding DM will employ so-called "non-compensatory" choice procedures that rely purely on the *ordinal* rankings over alternatives along each dimension. And if the DM has a default option that enables him to "decide not to decide", he may exercise this option and thus "save the mental cost" of actively resolving trade-offs.

This paper explores the possible implications of trade-off avoidance for *competitive interaction* in market or organizational contexts. Does it lead to non-competitive equilibrium outcomes? If so, how large is the departure of from the rational-DM

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competitive benchmark? How often is the DM called to perform trade-offs in equilibrium? What is the role of the default specification for these questions?

To address these questions, we study a simple model in which two agents compete in two-dimensional alternatives for a DM. We refer to these agents as "competitors". The alternative offered by competitor $i$ is a pair $q_i = (q_i^1, q_i^2) \in \mathbb{R}_+^2$, where $q_i^k$ measures the alternative's "true value" along dimension $k$. For instance, $q_i^1$ can represent the alternative's quality whereas $q_i^2$ is a decreasing function of its price. In other applications, both dimensions represent aspects of the alternative's quality – e.g., a car can be characterized by its safety and energy efficiency. A dimension may also correspond to a state of Nature, such that $q_i^k$ describes an investment project's performance in state $k$.

The DM's choice set consists of $q_1$ and $q_2$ – also referred to as the "*market alternatives*" – as well as an exogenous outside option $q_0 = (q_0^1, q_0^2)$. For most of the paper, the outside option is also the DM's *default* alternative – i.e., the one he ends up with if he fails to make an explicit/active decision. Competitor $i$'s payoff is $2 - q_i^1 - q_i^2$ multiplied by the probability it is chosen by the DM. (Note that $q_i^k$ thus quantifies the alternative's value along dimension $k$ in terms of the competitor's cost of providing this value.) We refer to the probability that the DM switches away from the outside option and chooses one of the competitors' alternatives as his "*market participation rate*".

A conventionally rational DM would be endowed with a continuous, strictly increasing function $u(q^1, q^2)$, and he would choose an alternative that maximizes $u$. In this case, our model would collapse into conventional, Bertrand-like competition: in Nash equilibrium, competitors would offer alternatives that maximize $u$ subject to the zero-profit constraint $q^1 + q^2 = 2$ (as long as the outside option has a sufficiently low $u$ value).

In contrast, the DM in our model follows a *non-compensatory* probabilistic choice function, which is based solely (in a monotonically increasing manner) on *ordinal rankings* along the two dimensions. When one alternative dominates all others, we assume the DM chooses it with probability one. In the absence of a dominant alternative, we say that the DM faces a "*difficult choice*". The DM may resist the pressure to perform trade-offs by pretending that it does not exist and neglecting one of the attributes, thus basing his choice entirely on the remaining one. Alternatively, he may procrastinate ("decide not to decide") and thus end up with his default option – even if it is dominated by the other available alternatives.

The latter scenario is reminiscent of the proverbial *Buridan's Ass*: the DM finds it hard to trade-off the relative strengths and weaknesses of the undominated alternatives; his hesitation causes him to procrastinate, and with some probability this procrastination leaves him stuck with the default option in the relevant time frame. "Buridanic" situations of this nature have received considerable attention by researchers who studied empirically choice procrastination in the presence of hard choice problems, in both experimental and "field" settings, notably retirement savings (Iyengar et al., 2004; Madrian and Shea, 2001 and Beshears et al., 2013). At any rate, we assume that the DM never chooses a *dominated non-default* alternative; in this sense, our model captures *default bias*.

In its basic features, our model fits market environments in which firms compete in multi-attribute products. For example, think about weighing a car's safety against its energy efficiency. Even if the consumer has access to precise data about each attribute, it may be hard for him to find the right scale for comparison. The difficulty is not only cognitive but also emotional, because the consumer ultimately needs to trade off the risk of injury or death against lower fuel costs. Similarly, when consumers choose between insurance policies that provide different levels of coverage in different contingencies, they have to perform complex actuarial calculations and imagine unpleasant future events.

A different interpretation holds in organizational settings. For instance, the DM can be a company official who considers several candidates for a construction job with several dimensions (total cost, speed of delivery, quality of materials, etc.). The official needs to justify the selection to his superiors. When the selection is not obvious and requires the exercise of judgment, the official is more vulnerable to criticisms. It may be easier for him to justify his choice to his superiors if he leaves out relevant dimensions, or if he opts for the same constructor that the company has employed before.

Competitors in this model face two conflicting strategic considerations. On one hand, there is a "competitive" motive to offer a dominant alternative in order to win the DM over. On the other hand, domination requires the competitor to offer high value along both dimensions, and this is a costly strategy; a cheaper course of action is to offer a "lopsided" location in $\mathbb{R}_+^2$ – e.g., low $q^1$ and high $q^2$ – such that the chances of being dominated by the opponent are low. The latter is an "obfuscatory" or "anti-competitive" motive. It follows that the question of the competitiveness of the game's outcome is related to the question of how frequently the DM faces market alternatives that dominate one another. In Section 3, we begin our analysis of symmetric Nash equilibria in the game by exploring the latter question.

Suppose that the choice function has the property that the market participation rate increases when one market alternative dominates another. This condition tends to hold in "Buridanic" situations, where domination removes the DM's hesitation and thus overcomes his tendency to adhere to the default/outside option. We show that in this case, domination between market alternatives must occur with positive probability in equilibrium. We also prove a partial converse result. If the choice function satisfies the property that domination between market alternatives never raises the market participation rate, then domination can never occur in equilibrium between two alternatives that belong to same quadrant relative to the outside option. In particular, when the outside option is $(0, 0)$, the DM always faces difficult choices in equilibrium. The collection of results in Section 3 thus relates the possibility of "easy choices" in equilibrium to a simple property of the DM's choice function.

In Section 4, we use the general results of Section 3 to get more detailed characterizations of symmetric Nash equilibria for various natural specifications of the DM's outside option and his choice procedure. We also use the examples to illustrate