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Reference dependent ambiguity

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Abstract

Motivated by experimental and empirical evidence, I study a framework where reference-points – such as a status quo, endowment, or default option – can distort the way an individual responds to ambiguity. I characterize a model of reference-dependent maxmin expected utility, and provide behavioral foundations for comparing reference-dependent ambiguity attitudes. I also illustrate some implications of reference-dependent ambiguity for trade in an asset market, including underdiversification, no-trade, and the potential for a market collapse.

JEL classification: D51; D53; D81

Keywords: Ambiguity; Reference-points; Market collapse

1. Introduction

In his seminal paper on decision-making under uncertainty, Ellsberg (1961) proposes a thought experiment in which individuals are asked to choose among bets on two different urns: urn B contains 50 red and 50 white balls, and urn A contains 100 red and white balls in an unspecified proportion. Ellsberg argues, and many experiments have subsequently confirmed, that individuals will often strictly prefer a bet on urn B over the same bet on urn A, regardless of the high-payoff color. Such choices are inconsistent with subjective expected utility, providing a motivation for models of decision-making under *ambiguity*: uncertainty that is difficult to quantify in terms of a unique probability distribution. Important

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examples include models with multiple or non-additive priors (Gilboa and Schmeidler, 1989; Schmeidler, 1989), ambiguity cost functions (Maccheroni et al., 2006) or ambiguity adjustment factors (Siniscalchi, 2009).

A range of real-world choice environments offer natural testing grounds for theories of decision-making under ambiguity. But a challenge for assessing ambiguity attitudes empirically, or predicting the impact of ambiguity in applications, is that, unlike in the Ellsberg experiment, real-world decisions are made in contexts where behavior can be influenced by *reference-points*: alternatives – such as a status quo, endowment, or default option – that are particularly familiar to the decision-maker, or are otherwise salient in her decision-making process. The endowment effect observed in portfolio choices (Ameriks and Zeldes, 2000; Agnew et al., 2003), the status quo bias observed in mutual fund investments (Patel et al., 1991; Kempf and Ruenzi, 2006), or the effects that default options have on insurance and retirement plans (Johnson et al., 1993; Madrian and Shea, 2001), indicate that reference-points impact behavior in precisely the type of choice environments where ambiguity naturally arises.

Moreover, several studies have found interactions between ambiguity attitudes and reference-dependent behavior. For example, in an experimental setting, Roca et al. (2006) extend the Ellsberg choice problem by endowing subjects with a bet on urn A (framing the ambiguous bet as a reference-point). They find that individuals without an endowment prefer the bet on urn B (in line with Ellsberg's hypothesis), but individuals endowed with a bet on urn A prefer to keep the ambiguous bet. These findings illustrate that reference-points can distort how individuals respond to ambiguity. On the other hand, there is also evidence that ambiguity can contribute to reference-dependent behavior. For example, Dimmock et al. (2016) use Ellsberg's experiment to elicit ambiguity attitudes from respondents in the American Life Panel, which also provides information about investment behavior. They find that ambiguity attitudes contribute significantly to known biases for reference-portfolios, including a bias towards the status quo (the non-participation puzzle), home-portfolio (the equity home-bias), or own-company stock (the own-company stock puzzle).

A large literature in decision-theory has identified various ways in which reference-points can affect behavior. Motivated by the evidence of an interaction between ambiguity and reference-dependent behavior, I contribute to this literature by studying a model of decision-making where reference-points have a specific effect: they can distort how a decision-maker responds to ambiguity. I consider a framework where behavior is allowed to depend on reference-points in general, but then focus on a model where behavior depends on her reference-point only by changing how the decision-maker responds to ambiguity. I therefore abstract from the many other ways in which reference-points can influence decision-making, and focus on a single channel where reference-dependence matters only in the presence of ambiguity.

My starting point is the well-known maxmin expected utility (MEU) model of Gilboa and Schmeidler (1989). Consider a decision-maker (DM) who faces uncertainty about the state of the world $\omega \in \Omega$, and chooses among state-contingent outcomes (acts that map states into a set of consequences X). In the MEU model, the DM's beliefs about states are represented by a set of priors Π (reflecting ambiguity about the probability of states), and the DM evaluates acts according to the "worst-case" expected utility over this set of priors (reflecting an aversion to ambiguity). The reference-dependent MEU model I propose represents similar behavior, but allows reference-points to distort how the DM responds to ambiguity. Specifically, with a reference-point r, the DM evaluates an act $f : \Omega \to X$ using the following decision criterion: