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Risk and rationality: The effects of mood and decision rules on probability weighting☆

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ABSTRACT

Empirical research has shown that people tend to overweight small probabilities and underweight large probabilities when valuing risky prospects, but little is known about factors influencing the shape of the probability weighting curve. Based on a laboratory experiment with monetary incentives, we demonstrate that pre-existing good mood is significantly associated with women's probability weights: Women in a better than normal mood tend to weight probabilities relatively more optimistically. Many men, however, seem to be immunized against effects of incidental mood by applying a mechanical decision criterion such as maximization of expected value.

1. Introduction

In the past decades, abundant experimental evidence has challenged the canonical economic model of decision under risk, expected utility theory. A large number of findings suggest that people systematically violate the axioms of expected utility theory (for a review see Starmer, 2000). In particular, people's choices often exhibit a fourfold pattern: They are risk averse for high-probability gains and low-probability losses, and risk seeking for low-probability gains and high-probability losses. This phenomenon led Kahneman and Tversky (1979) and Tversky and Kahneman (1992) to incorporate an inverse S-shaped probability weighting function as a core component in their prospect theory.

But why would people weight objective probabilities? Kahneman and Tversky justify the shape of the probability weighting function by the psychological principle of diminishing sensitivity, i.e. the psychological impact of a marginal change decreases as one moves further away from a reference point. This principle implies a probability weighting function that is steep near the reference points, naturally taken to be impossibility and certainty, and relatively flat in the middle.[1] However,

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[1] Tversky and Wakker (1995) discuss the properties of the preference order that are necessary and sufficient for an S-shaped probability weighting function. Prelec (1998) as well as Gonzalez and Wu (1999) provide axiomatic foundations for specific functional forms of the weighting function.

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there is vast individual heterogeneity in the specific shape of the probability weighting function. So far, little is known about factors driving the curvature of the probability weighting function, let alone about determinants of individual differences. One exception is the decision maker's gender: On average, women's probability weighting curves depart more strongly from linear weighting than do men's curves (Bruhin et al., 2010).

Several generalizations of expected utility theory offer a rationale for the shape of the probability weighting function by invoking anticipated emotions (Bell, 1982; Loomes and Sugden, 1986; Gul, 1991; Wu, 1999). Recently, for instance, Walther (2003) has shown that an S-shaped transformation of probabilities may result if decision makers anticipate elation or disappointment at the time when uncertainty is resolved. His model of affective utility predicts that higher sensitivity to anticipated emotions leads to greater departures from linear probability weighting.[2]

While anticipated emotions have been integrated into economic models of behavior under risk, this is not the case for incidental emotions, like mood states or emotions carried over from recent experiences, which have no causal link to the decision at hand. In the psychology literature, there is a large body of empirical evidence on the effects of incidental emotions on judgment and decision making (Loewenstein and Lerner, 2003; Pham, 2007). Numerous studies show that incidental mood states generally have mood-congruent effects on perception and object valuation. Risks are perceived to be higher under negative moods than under positive moods (Johnson and Tversky, 1983; Wright and Bower, 1992).[3] In these studies, probabilities are typically not presented as objective numbers but have to be assessed subjectively. Wright and Bower (1992) also detected a susceptibility effect. When judging more frequently occurring events participants exhibit higher susceptibility to mood states than when judging less frequent ones.

It is an open question whether these results on probability assessment carry over to the valuation of risky prospects with stated objective probabilities. If so, risk preferences may be less stable than assumed by economic theory, and subject to factors completely irrelevant to the decision at hand. The experimental literature reports that subjects often choose differently when confronted with the same decision problems at different occasions. The percentage of subjects with preference reversals has been found to be quite substantial (Hey and Orme, 1994). While many authors would attribute this phenomenon to errors, some of this variation could well be due to sensitivity to incidental emotions.

Whereas studying mood and affect has a long tradition in psychology, economists have only recently become interested in this field of research. Examples of experimental work include Capra (2004) and Kirchsteiger et al. (2006), both of which show significant effects of mood state on behavior in games. If incidental mood also influences decisions under risk, the effect could work via two pathways. Mood states could either affect the valuation of monetary outcomes or probability weighting or both. We conjecture that, in the context of financial decision making, the valuation of monetary outcomes is less susceptible to incidental affect than are probability weights. This hypothesis seems particularly plausible in the light of experimental evidence showing that probability weights seem to be the more malleable component of risk taking attitudes (Fehr-Duda et al., 2010; Abdellaoui et al., in press). We therefore hypothesize that people in good moods should weight probabilities more optimistically, i.e. they should put a relatively higher weight on gain probabilities and a relatively lower weight on loss probabilities, than do people in a neutral state.

This paper addresses the question of individual mood effects by estimating the parameters of a sign- and rank-dependent decision model. We elicited certainty equivalents of a large number of lotteries involving real gains and losses, which enabled us to estimate individual probability weighting functions. Mood states were accounted for by a binary variable indicating whether subjects reported to be in a better than usual mood or not.

To our knowledge, this is the first experimental study that sheds light on individual differences in probability weighting.[4] In particular, we show that incidental feelings may have an effect on decision making under risk, rendering risk preferences potentially susceptible to factors irrelevant to the decision at hand. Even though there is no significant gender difference in reported mood states, we find a substantial gender effect in sensitivity to self-reported good mood: Our findings indicate that, in support of our conjecture, women in a better than normal mood tend to weight probabilities more optimistically. No such effect can be detected in average men's behavior. This finding can be explained by two factors: First, contrary to women, a considerable percentage of men use expected values as a guideline to decision making, which seems to immunize them against mood states. Moreover, we show that these men's behavior is indeed consistent with expected value maximization. Hence, the gender difference in decision strategy may also explain why the average male probability weighting curve departs less strongly from linear weighting than does the female one. Second, men who do not apply this decision rule behave congruently with good mood, but to a much lesser degree than do women.

[2] To our knowledge, this theory has not been tested systematically. However, the study by Rottenstreich and Hsee (2001) may be interpreted as preliminary evidence: The authors report that people tend to be less responsive to probabilities when they react to emotion-laden targets, such as a kiss by one's favorite movie star or an electric shock, than they do in the case of comparatively pallid monetary outcomes.

[3] Isen and her colleagues contest the validity of mood-congruent behavior in the context of risk taking, however (Isen and Patrick, 1983; Isen and Labroo, 2003). They argue that people in a good mood stand to lose their affective state as well as their monetary stake, and therefore may behave more cautiously (see also Kliger and Levy, 2003).

[4] A recent paper by Mukherjee (2010) investigates the link between probability weighting and thinking style. His data is based on four choices only and, therefore, not suitable to disentangle utility of outcomes and probability weighting. Kliger and Levy (2008) recover probability weighting functions from *market data* on asset returns and relate them to proxies of mood, such as the degree of cloud coverage.