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An experimental study of precautionary bidding

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ABSTRACT

Auctions often involve goods exhibiting a common-knowledge ex-post risk. In such auctions, precautionary bidding predicts that under expected utility, DARA bidders reduce their bids by more than the appropriate risk premium. Because the degree of riskiness of an auctioned good and bidders' levels of risk aversion are difficult to observe in field settings, we conduct experimental auctions that allow us to identify the precautionary premium directly. We find strong evidence for precautionary bidding. The effect is robust to changes in experimental design features. Our experiment provides the first empirical demonstration of precautionary motives in a strategic setting.

1. Introduction

Consider an auction with pure ex-post risk: the value of the auctioned good is risky, with the risk being independent of private or common value components and signals thereof. The existence of the risk is known ex-ante and is common knowledge among buyers. In the language of decision theory, the auctioned good is a *risky lottery*. Esö and White (2004) study theoretically such auctions with ex-post risk in the affiliated value model by Milgrom and Weber (1982). For the standard first-price auction they show that bidders exhibiting decreasing absolute risk aversion (DARA) unambiguously reduce their bids by more than the appropriate risk premium, an effect they call precautionary bidding.[1] The intuition is that DARA bidders prefer higher income in the case that they win the auction and must bear the ex-post risk involved in the good, and therefore bid more conservatively. This effect is similar to the precautionary saving motive where agents transfer current wealth into future periods with more income uncertainty (Kimball, 1990).

Examples of auctions with ex-post risk are numerous and financially significant. Television rights for Olympic Games are usually auctioned off before the host city is selected from a set of competitors. The winner bears the risk of a more or less attractive host, a risk arising from information unavailable to any bidder at the time the rights are allocated. In procurement auctions, unpredicted events that affect production costs add ex-post risk to the winning bidder's profit. More generally, all goods whose resale value or quality is uncertain ex-ante to all buyers involve some ex-post risk.

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[1] In their article, they provide results for various auction formats. We focus on first-price auctions here.

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Precautionary bidding, if empirically relevant, has several important implications for auction design in general, and more specifically for information revelation by sellers and information acquisition by buyers. For instance, sellers have an incentive to reduce the risk exhibited by the auctioned object as much as possible, and buyers have a strategic incentive to disregard some information. Despite the widespread occurrence of ex-post risk in auctions and its theoretical importance for auction outcomes and designs, no empirical study on precautionary bidding has so far been conducted. Direct measurement of precautionary bidding with field data is not easy, because it requires the independent observation of both the bidders' risk tolerance and the riskiness of the good. In order to provide the first empirical assessment of precautionary bidding, we conduct experimental laboratory auctions, where the controlled setting allows us to identify and quantify the precautionary premium directly.

Our experiment finds strong support for a precautionary bidding effect in first-price auctions. Winning bids are significantly lower when a risky object rather than an equally valued sure object is auctioned. In a control experiment that is discussed in Appendix A, we show that the effect is robust against changing two relevant experimental design features (the mechanism that elicits individual risk preferences and the gain–loss framing of lotteries in the auction). Although our empirical hypothesis is inspired by Esö and White's (2004) theoretical results, the experimental tests that we conduct are in fact model-free, relying only on observable certainty equivalents.

This paper is the first to demonstrate that precautionary bidding is a significant phenomenon in auctions with ex-post risk. But in fact the contribution of this paper is much broader than this, since it provides the first experimental evidence for precautionary motives in any strategic setting. Previous studies on prudence employed experimental measurements in individual preference elicitation tasks (Deck and Schlesinger, 2010; Ebert and Wiesen, 2011, 2014; Noussair et al., 2014). The current paper extends these results to an interactive setting and is thus relevant to many theoretical applications of prudence (Bramoulle and Treich, 2009; Treich, 2010; White, 2008). While our results are fully consistent with precautionary motives, it is conceivable that other mechanisms, for instance loss aversion, contribute to the observed effect. In the experiment we try to control for such mechanisms.

The remainder of the paper is laid out as follows. In the next Section 2 we derive our empirical hypothesis, and in Section 3 we present the experimental design in detail. Section 4 reports the results, which are discussed in Section 5. Section 6 concludes the paper.

2. Predictions

Our empirical test of precautionary bidding is inspired by Esö and White's (2004) analysis of common auction formats within the affiliated value framework of Milgrom and Weber (1982). Esö and White show that under expected utility with DARA utility function, bidders in the first-price auction have unambiguously higher indirect utilities in equilibrium when the prize is risky compared to auctions where the prize is risk-free. That is, when a commonly known ex-post risk is added to the prize, bidders reduce their bids by more than the appropriate individual risk premium related to this risk.

This precautionary effect is caused by the fact that agents' expected marginal utility of money is larger in the presence of ex-post risk, and therefore they bid less aggressively for the risky object than for the risk-free object. In other words, increasing the probability of winning the auction through a higher bid becomes more costly in the presence of ex-post risk. This effect is related to the observation that for DARA utility the prudence premium is larger than the risk premium (Gollier, 2001; Eeckhoudt and Schlesinger, 2006).

Our empirical strategy to identify precautionary bidding is based on the comparison of bids for risky objects and bids for their certainty equivalents, at the individual level. By construction, *both goods are equally valuable*. If bids for risky objects are larger than bids for their certainty equivalents, then bid shading, i.e., the reduction of the bid below the bidder's expected value of the good, would become weaker in the presence of background risk (Eeckhoudt et al., 1996). However, if bids for risky objects are smaller than bids for their certainty equivalents, then a precautionary effect would be observed. Hence, we can formulate our main hypothesis.

Hypothesis 1. *In the affiliated private value first-price auction, buyers' bids for a risky object will be lower than their bids for a risk-free object whose value is equal to their individual certainty equivalent of the risky object.*

As noted before, in most settings in the field the (perceived) riskiness of the good and the degree of bidders' risk aversion cannot easily be measured independently. Moreover, direct comparisons between bids for risky and risk-free goods with an identical certainty equivalent typically cannot be constructed. Our experimental test of precautionary bidding directly compares bids for independently elicited certainty equivalents with bids for the underlying risky objects on the individual level.

Deviating from Esö and White, our definition of precautionary bidding is given in terms of certainty equivalents that can readily be elicited in experiments at the individual level. Because the test is based only on comparisons of bids for risky prospects and their (equally valuable) certainty equivalents, our assessment of precautionary bidding is in fact model-free, and Hypothesis 1 can be interpreted as a behavioral definition of the precautionary effect in first-price auctions. That is, although inspired by Esö and White's results under expected utility, our test remains valid under non-expected utility.