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INTERPRETING PREDICTION MARKET PRICES AS PROBABILITIES

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ABSTRACT

While most empirical analysis of prediction markets treats prices of binary options as predictions of the probability of future events, Manski (2004) has recently argued that there is little existing theory supporting this practice. We provide relevant analytic foundations, describing sufficient conditions under which prediction markets prices correspond with mean beliefs. Beyond these specific sufficient conditions, we show that for a broad class of models prediction market prices are usually close to the mean beliefs of traders. The key parameters driving trading behavior in prediction markets are the degree of risk aversion and the distribution of beliefs, and we provide some novel data on the distribution of beliefs in a couple of interesting contexts. We find that prediction markets prices typically provide useful (albeit sometimes biased) estimates of average beliefs about the probability an event occurs.

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1. Introduction

In a provocative recent paper, Charles Manski (2004) asked "What is the logical basis for interpreting the price of an all-or-nothing futures contract as a market probability that the event will occur?" Moreover, he notes that "recent papers on prediction markets provide no formal analysis showing how such markets aggregate information or opinions." Manski poses an excellent question, and he highlights an important topic for research. As prediction markets have become of more widespread interest, the prices of contracts tied to events as diverse as the re-election of President Bush, the ouster of Saddam Hussein, next month's non-farm payrolls number, or the success of specific products have been interpreted in both academic and popular discussion as though interchangeable with "the market's beliefs".

This paper presents an initial response to Manski's challenge, providing a formal model which provides a plausible microfoundation under which one can treat prediction market prices as probabilities. Further, we explore deviations from our baseline model, and show that for most plausible parameters, prediction market prices at least approximate the central tendency of the distribution of beliefs of traders.[1] The specific model offered by Manski is a special case of our model, and while he emphasizes special assumptions that can lead his model to yield counter-intuitive results, we show that sensible distributions of preferences and beliefs yield more intuitive results.

We proceed as follows. The next section sketches two very simple models in which prediction market prices coincide exactly with the mean of the belief among traders. The following section generalizes the model, showing that prediction market prices can deviate from mean beliefs, but that this deviation is typically small. The extent of the deviation depends crucially on how widely dispersed beliefs are, and so in the final section we present field evidence on this point. To preview, our results suggest that while prediction market prices and mean beliefs may diverge, they are typically very close. We interpret our results as providing a microfoundation for the claim that prediction markets (approximately) efficiently aggregate beliefs.

[1] In concurrent work, Steven Gjerstad (2004) and Ottaviani and Sørensen (2006) derive a number of related results.