

Information transparency in prediction markets



ShengYun Yang*, Ting Li, Eric van Heck

Rotterdam School of Management, Erasmus University, The Netherlands

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ABSTRACT

Prediction markets are designed and conducted for the primary purpose of aggregating information so that market prices forecast future events. In such markets, a group of traders buy and sell contracts and the payoff depends on unknown future events. Information is the key in a prediction market and the success of prediction markets depends on their design. In this paper, we theoretically develop and empirically test the effects of IT-enabled *information transparency* on prediction market performance (information aggregation efficiency and predictive accuracy) through traders' behavior (traders' participation activity and traders' dynamic interactions). We developed twelve prediction markets and empirically tested our hypotheses using a field experiment. The results suggest that improved information transparency (disclosure of different traders' buy and sell orders) can lead to higher levels of traders' dynamic interactions. Increases in traders' participation activity and dynamic interactions lead to higher information aggregation efficiency and greater market predictive accuracy. Interestingly, however, full disclosure of information and complete transparency do not necessarily further improve traders' activities. This paper is one of the first to take an information-based view to study prediction markets and highlights the importance of information transparency in the design of prediction markets. We further discuss the managerial implications, limitations and future research.

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1. Introduction

Forecasting is a fundamental activity of management within a company because it is often required when a decision is made [2,3]. Conventional forecasting methods, however, become less accurate in contemporary environments.¹ When a new product is launched statistical forecasting of demand has no sales data on which to base the demand estimate. Thus, statistical forecasting based on historical data does not perform as well for new products as it does for existing products [3,7]. Likewise, target customers in a survey may not be able to give unbiased purchase intentions without learning from early adopters [36], and opinion variance between experts is limited if they are few in number or if social pressure influences their appraisal [30,68]. Consequently, forecasts based on these methods are less accurate. Over the past decade, some in the business world have come to believe that the best forecasts emerge from neither past behavior patterns nor market analyses created by

far-removed experts who may lack familiarity with front-line work [52]. Rather, the best forecasts come from crowds, particularly front-line employees who work directly with new products and services and interact daily with buyers, sellers and customers in the field, and thus have the most relevant and updated information and knowledge required for forecasting [30,52]. The aggregation of information dispersed in groups is referred to as the wisdom of crowds, collective wisdom or collective intelligence [80]. Companies are recommended to use it to make forecasts and decisions [9,16,51,53,54].

A prediction market is an elegant and well-designed method for capturing collective wisdom and predicting the outcome of a future event [80]. It can be a powerful information-processing mechanism that aggregates the views of multiple market traders to generate a prediction of the future. Since the inception of the first prediction market, the Iowa Electronic Market (IEM), the promising forecasting results of prediction markets have captured much enthusiasm from both academia (such as [30,38,51,62,78]) and the business world (such as HP, Eli Lilly, and Intel).

Our research adopts the information-based view to study prediction markets, as information is the key in a prediction market. Traders in a prediction market use and process different information in their personal estimation of a future event, reflected in their trading activities. Traders learn from the trading activities of others and the market aggregates traders' dispersed information through their trading activities. Therefore, the fundamental element in a prediction market is information and the fundamental activity between traders is information exchange.

* Corresponding author at: Neherkade 1680, 2521 RH The Hague, The Netherlands.

E-mail addresses: annieshengyun@gmail.com (S. Yang), tli@rsm.nl (T. Li), evanheck@rsm.nl (E. van Heck).

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Information transparency, defined as the level of availability and accessibility of market information to its participants [27,88], is a fundamental issue in the design of markets [8]. The success of a prediction market, like any market, depends on its design and implementation [85]. Bloomfield and O'Hara [8] stated that transparency – the real-time, public dissemination of market information – plays a fundamental role in market design, particularly, in the fairness and efficiency of the market. Extant research on prediction market design has focused on market mechanisms [32,61,85], contracts [44,58], traders [1,41,79] and incentives [31,70,73]. Little research has studied the role of market information in prediction market design. Advanced technologies have enabled the distribution of various types and amounts of market information, which allow different levels of information transparency in a market. This paper, therefore, focuses on information transparency.

Research on information transparency has evolved from the early information transparency hypothesis, that open sharing information in electronic markets is beneficial to all traders [45,75], to the recent information transparency strategy [24,81]. The literature on transparency strategy is scarce and scattered across disciplines [27]. Prior research on transparency strategy has addressed information transparency and electronic market design. These studies identified transparency design features related to information disclosure policies throughout the trading process and demonstrated a double-edged effect of information transparency: the effect of information transparency is not always beneficial or equal to different stakeholders in a market [26,77,87]. Previous literature focused on the effects of information transparency on different market positions (buyers, suppliers, and intermediaries) in business-to-consumer (B2C) [26,76,84] and business-to-business (B2B) markets [37,40,42,60,87,88]. This paper focuses on participants in a double auction (i.e., a prediction market), in which a participant is a buyer as well as a seller. Further, it examines the influences of different transparency strategies that go beyond opaque and transparent conditions [25,76,77]. This paper answers the following research question: *How does information transparency influence online prediction market performance?*

Understanding individuals' activities is crucial to enhance the design of online markets [5]. Traders' behavior has captured much attention in research on prediction markets, as it entails information dissemination and has major effects on market performance [7,33,35,67]. Chen et al. [13] identified traders' participation activity and traders' dynamic interactions as two fundamental activities that enable information exchange among traders in a prediction market. The goal of this paper is to examine how information transparency affects prediction market performance by taking into account traders' behavior, namely traders' participation activity and traders' dynamic interactions.

In this paper we propose that while higher information transparency in prediction markets leads to more dynamic interactions between traders, full information transparency does not yield further improvement in traders' participation and interactions. Further, an increased level of traders' participation activity and dynamic interactions improves the market's ability to aggregate information, which subsequently leads to higher market predictive accuracy. To empirically test our hypotheses, we conducted a field experiment in an e-commerce company. We designed and developed an internal online prediction market with four different levels of information transparency: *opaque*, *partially-transparent*, *semi-transparent*, and *fully-transparent*. The traders were the employees of this company and the predicted future events were the outcomes of the company's key performance indicators (KPIs). The field experiment allowed us to investigate the impact of information transparency on traders' behavior and subsequently on prediction market performance in a real business environment.

The results show that in a prediction market the disclosure of different traders' buy and sell orders enhances dynamic interactions between traders, though disclosure does not have an impact on traders'

participation activity. The disclosure of all traders' buy and sell orders, however, impedes dynamic interactions in a market rather than further improving them. Furthermore, increases in traders' participation activity and traders' dynamic interactions in a prediction market enhance the market's ability to aggregate dispersed information (i.e., information aggregation efficiency), and eventually lead to more accurate predictions (i.e., market predictive accuracy).

This paper contributes to the literature on information transparency and prediction markets. With regard to information transparency, this paper differs from prior research in two ways. First, this is the first paper to theoretically develop and empirically test the impact of information transparency in the context of prediction markets where participants are buyers as well as sellers. It extends previous studies on the effect of information transparency on different market positions that focused only on buyers, sellers or intermediaries, respectively, in B2B [37,40,42,60,87,88] or B2C markets [26,84]. Second, this paper examines the effect of different transparency levels that go beyond opaque or transparent information conditions [25,76,77], contributing to the literature on transparency strategy [27]. Unlike prior research on prediction market design that focused on market mechanisms [32,61], contracts [58], traders [1,41,79] and incentives [15,31,70,73], this paper is one of the first to take an information-based view and highlights the importance of information transparency in the design of prediction markets. Second, this paper distinguishes between information aggregation efficiency and market predictive accuracy for the analysis of prediction market performance by defining and developing a measurement of information aggregation efficiency.

This paper is organized as follows: Section 2 provides the theoretical background of the paper and develops the hypotheses related to the effects of information transparency on traders' behavior and prediction market performance. In Section 3, we present our research methods, including the experiment design and the measures of variables. In Section 4, we discuss the results drawn from the field experiment and validate the hypotheses. Section 5 discusses the results and Section 6 concludes with research findings and contributions to research and business practice.

2. Theory and hypothesis development

In this section we review the literature on prediction markets and information transparency, present the conceptual model and develop our hypotheses. Fig. 1 summarizes our conceptual model.

2.1. Prediction market

Prediction markets are designed and run for the primary purpose of mining and aggregating information scattered among traders [34,83]. In such markets, a group of traders buy and sell contracts and the payoff depends on unknown future events. The use of prediction markets is based on the rational expectations hypothesis [11,33], which states that in aggregate, the expected price is an unbiased predictor of the actual price [55]. According to this theory, all information available to

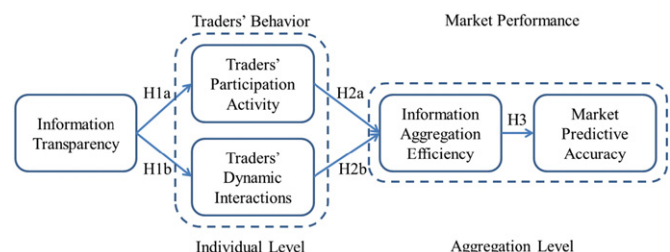


Fig. 1. Conceptual model.

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