PREDICTION MARKETS AS A FORECASTING TOOL

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ABSTRACT

Internal prediction markets draw on the wisdom of crowds, gathering knowledge from a broad range of information sources and embedding that knowledge in the stock price. This chapter examines the use of internal prediction markets as a forecasting tool, including as a stand-alone, and as a supplement to forecasting tools. In addition, this chapter examines internal prediction market applications used in real-world settings and issues associated with the accuracy of internal prediction markets.

INTRODUCTION

Internal prediction markets are different than so-called naturally occurring markets, in that prediction markets are internal markets where generally virtual dollars are used as a basis to try and put prices on particular events or sets of events, for problems of direct relevance to a specific organization. These markets are designed to gather information from a broad range of users in the context of a market, where participants "bet" on the likelihood of potential future events using prices to, ultimately predicting the probability of the outcome of some event.

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Prediction markets provide an information gathering and aggregation mechanism across the population of traders to generate a price on some stock, where that stock being traded typically is a prediction or forecast of some event. For example, a stock may be "the number of flaws in a product will be less than x." Researchers (e.g., Berg, Nelson, & Rietz, 2008; Wolfers & Zitzewitz, 2004) have found that prediction markets provide accurate forecasts, sometimes better than sophisticated statistical tools.

Historically, forecasting the future has been the domain of experts and computer-based forecasting capabilities (e.g., Dalkey, 1969). However, recently, firms have begun to gather opinions from a broader base of employees using prediction markets, in order to use what has been referred to as trying to gather the wisdom of crowds (e.g., Surowiecki, 2004). As an example, recently, a news article (Havenstein, 2008), asked about Google, "What do 80,000 bets say about its future?" That article followed a Blog announcement (Cowgill, 2009) that Google was making use of prediction markets to forecast launch dates, new office openings, and other issues of "strategic" importance to Google. Cowgill (2009) had found that the resulting market prices provided "... informative predictions in the sense that their predictive power increased as time passed and uncertainty was resolved." As with many things in business, if Google is doing them there is interest in how other firms might use them, who used them before Google and how prediction markets are evolving once they have been placed in a corporate environment.

Although this chapter is primarily focused on business applications (e.g., Hemsoth, 2011; Kambit, 2011), a number of other settings also have found that prediction markets can be useful. For example, Polgreen, Nelson, Neumann, and Weinstein (2007) found that prediction markets have been helpful at forecasting infectious diseases. Others have had prediction markets for events such as "Charlie Sheen to be arrested, in rehab or in hospital before midnight ET 30 June, 2011" (which had a 5% chance on June 28, 2011) (http://www.intrade.com/v4/markets/contract/?contractId=747478).

Theoretical Basis

There are different theoretical bases for using prediction markets to forecast. Forsythe, Palfrey, and Plott (1982) suggest multiple theoretical sources including rational expectations and efficient markets. Rational expectations theory specifies a direct relationship between expectations and actual market price behavior (e.g., Harrison & Kreps, 1978). Efficient markets theory has been used as a basis to suggest the rationale for the

accuracy of markets in forecasting events accurately (e.g., Berg, Forsythe, Nelson, & Rietz, 2003). In a path-breaking analysis of efficient markets, Fama (1970) indicates that "prices at any time fully reflect all available information." As a result, theory suggests that we can gather expectations that fully reflect all available information in the form of market prices.

Purpose and Plan of this Chapter

The purpose of this chapter is to review the emerging phenomena of "corporate prediction markets," with a focus on their use as a tool for forecasting and predicting events. In so doing, I review some of the applications of corporate prediction markets that are likely to be used in forecasting the future. Further, I also review issues related to forecast accuracy and whether prediction markets should be stand-alone or in conjunction with other forecasting approaches.

This first section provides an overview of the issues, a brief definition of what prediction markets are, and summary of the purpose of this chapter. The second section provides a number of example markets, and the third section examines some example uses of internal prediction markets. The fourth section investigates forecast accuracy and issues related to that accuracy. The fifth section examines some of the tool capabilities of prediction markets. The sixth section examines whether markets should be used as a stand-alone tool or in conjunction with other tools. The seventh section analyzes some of the concerns of using internal prediction markets for forecasting. The eighth section examines what are some of the characteristics of prediction market problems. Finally, the ninth section briefly summarizes the chapter and examines some extensions.

EXAMPLES OF PREDICTION MARKETS

There are a number of prediction markets, being used in generic and corporate contexts. In what follows, Iowa Electronic Markets (IEM) and Hollywood Stock Exchange (HSX) are examples of open markets, while Google and Microsoft are examples of closed corporate markets. A brief list of some other markets is summarized at the end of the chapter.

Iowa Electronic Markets

Perhaps the longest running prediction market is the IEM (http://www.biz.uiowa.edu/iem/). IEM is an experimental market, operated by the

University of Iowa, developed for teaching and research purposes. Using "real" money virtually anyone can sign up and be a part of the market. Over the years, the markets have been more accurate than polls at predicting the results of elections.

Hollywood Stock Exchange

As another example, the HSX (http://www.hsx.com/) provides markets that trade on movies, and their box office returns. Traders start off with H$ 2,000,000, a virtual currency, and make trades. Ultimately, some of the portfolios are worth hundreds of millions H$. Leading traders are positioned on leader boards so that other traders are aware of what the market capabilities are and to give "publicity" to leading traders.

Google

Google has experimented with prediction markets in order to study information flows (e.g., Coles, Lakhani, & McAfee, 2007). Using "Gobbles" (virtual money), employees bet on a number of different issues, including how much demand there will be for a particular product or even how the company will do during a future time period. A number of findings came out of this research. Google found that betting behavior was related to physical proximity of those around the employee. For example, Cowgill, Wolfers, and Zitzewitz (2008) found that there are strong correlations among the predictions for those that physically sit near each other.

Microsoft

Berg (2007) summarized some of the history of the use of prediction markets at Microsoft. Microsoft apparently began using prediction markets in 2003, with the so-called "Information Forecasting Exchange." Based on information from Todd Proebsting's Microsoft page (http://research.microsoft.com/en-us/um/people/toddpro/), those initial efforts were at most a part time project ("nights and weekends"). Starting in 2006, Microsoft expanded those efforts with what was referred to as "PredictionPoint." Over the years, Microsoft has used a number of prediction markets to attack a number of issues, such as "will the company meet their schedule?" or "how many bugs will be in the software?"

USE OF CORPORATE PREDICTION MARKETS

There have been a number of uses of prediction markets in corporations, including project management, product quality markets, and forecasting events that effect the organization.

Project Management

Remidez and Joslin (2007) found internal markets can be used to facilitate forecasting project management events. In particular, they found that a prediction market correctly predicted 24 of 26 milestones. Further, direct contact with Cisco has indicated that they were planning on using markets to improve the flow of information about projects as part of a project management office effort. In Berg's (2007) analysis of the use of prediction markets at Microsoft, out of projects undertaken at nine product groups, project management schedules were examined at six of them and were the most frequently mentioned use of markets.

Berg (2007) did note some limitations associated with using markets to forecast project schedules, including the following. First, there was some concern that the forecasts could turn into self-fulfilling late forecasts. In particular, there was concern that a person might drag a project into being late in order to generate the right market outcome. Second, the results are visible to all participants, potentially resulting in a difficult situation if management does not have a plan in place to accommodate a forecasted late project. Third, there was some concern about how to use the results. In particular, if the project is on time, there is no interest in the market result, but if it is late, then there may be no time to make an adjustment. Each of these could be the source of further research to determine the extent to which these concerns are likely to actualize themselves.

Product Quality

Another market that has found use in forecasting is the analysis of product quality (http://blog.mercury-rac.com/category/conferences/). Product quality markets can include a range of sources of product quality, including manufactured products and software. King (2006) noted that Microsoft ran markets on the number of bugs that would be found in software over some

period. Cowgill et al. (2008) also indicated that product quality was forecast at Google using prediction markets.

As an example, apparently, EA has used internal prediction markets based on product quality for the games they developed. The markets at EA apparently were well accepted by executives and lower level employees. Executives got the information they needed and lower level employees had a forum where they could provide and use the real information. However, middle management responsible for the processes were the primary source of resistance. EA used "metacritic" scores as the key performance indicators to generate the stocks and markets (http://blog.mercury-rac.com/2007/10/17/notes-from-the-london-prediction-market-conference-part-1/).

Impact of Events

Markets also can be used to forecast the likelihood of key events to the organization and the likely impact of events on corporations or other entities. For example, an organization may be interested in the likelihood that they will lose a particular client by some specific date. In this case, the market would be generated around the probability of the loss or non-loss of the specific client. In addition, they might be interested in the effect of losing that particular client by that date, for example, extent of lost sales. In this second case, the markets would be generated around the estimated loss of sales, contingent on the lost client.

POTENTIAL ISSUES AFFECTING FORECASTING ACCURACY USING PREDICTION MARKETS

There is a substantial literature in prediction markets (e.g., Luckner, 2008). In particular, the literature has examined a number of factors related to forecast accuracy, including the accuracy in the short run and the long run, whether using virtual dollars or real money makes a difference, the impact of trader knowledge and other factors. Our concern is primarily with the set of factors that might impact the accuracy and quality of the market.

Time: Short Run versus Long -Run

There is evidence that prediction markets offer both short-run (e.g., 1-day ahead) and long-run (weeks or months) accuracy. Berg et al. (2003)

examined the short-run accuracy, and Berg et al. (2008) examined the long-run accuracy. Berg et al. (2008) found that markets out performed polls of presidential elections roughly 74% of the time, but 100% of the time in those markets 100 days in advance. Markets appear to have a long-run prediction capability.

Play Money versus Real Money

Servan-Schreiber, Wolfers, Pennock, and Galebach (2004) investigated the relationship between using play money and real money. They found the difference between the average forecasts errors was insignificant. Further, Rosenbloom and Notz (2006) also found no statistical difference between the two forecasts. Accordingly, this suggests that corporate prediction markets can be effective in gathering forecast information using play or virtual money.

Trader Knowledge

An important issue is the impact of trader knowledge on prediction markets. Berg (2007) has suggested that forecasting accuracy of the markets varies in proportion to the trader knowledge. Using established research, O'Leary (1999) and Rodriguez & Watkins (2009) note that a critical point is where traders have a probability greater than .5 of being right in order for the collective to get to the right decision. Of course, this translates into a level of expertise or knowledge of the trader with respect to the specific market.

Underpricing

At least two studies have found underpricing in prediction markets in middle probability events. One study found minor underpricing of stocks in the range of 20%–60% across a 0–100% scale (http://www.consensuspoint.com/prediction-markets-blog/ipredict_accuracy). Similarly, results from Google (Coles et al., 2007) found underpricing of stocks in the range of 15–50% across a 0–100% scale. As a result, there appears to be a bit of an inefficiency or lack of accuracy in prediction markets over a particular range. Future research will need to compare these results to other cases to determine the extent to which these results are systematic or simply an issue in these cases.

Move the Market?

In some settings, a particular issue, stock or proposition, may be particularly important to a specific participant. In that case they may try to "move the market" with their betting activity as a means of influencing the price. For example, in one case a key backer of a political candidate wanted the prediction market to generate a particular outcome, likely under the impression that the outcome would feed back into the real-world outcome (Rhode & Strumpf, 2005). Accordingly, the backer tried to invest enough money to move the market. In an open market the scheme did not work, most investors were rightly convinced that the opposition would more likely win. However, in a closed corporate market with limited liquidity and traders, it is questionable as to whether or not an investor can move the market. If a participant is able to move the market, then clearly the accuracy of the market may be compromised.

TOOL CAPABILITIES OF USING MARKETS FOR FORECASTS

Hewlett-Packard found that markets were more accurate than corporate forecasting tools 75% of the time (Yeh 2008 and others). But this finding begs questions such as, "why would the markets be more accurate than forecasting tools?" It is likely that the tool characteristics or capabilities of markets, such as broad access to other types of information, access to real-time information, trader anonymity, truth telling, and other issues provide prediction markets with the ability to generate highly accurate forecasts.

Broad Information Access

Perhaps the primary benefit deriving from the use of markets for internal purposes compared to other forecasting tools is that firms have access to information sources that they may not have had access prior to implementing the market. Since the markets involve a wide range of participants, information and knowledge is gathered from a broad range of sources, potentially some that are not part of the normal reporting process.

As a result, prediction markets potentially open new communication channels, as new traders join. In addition, they create a new medium for

interacting with those information sources. Since involve a broader base of users, issues such as information asymmetry could be mitigated to a certain extent.

Continuous Feedback and Real-Time Information

Markets can provide continuous feedback about future events. For example, as noted in one market used for forecasting. "If I am leading a project and the stock is, will this thing launch on time, if the stock price goes down I instantly know something has happened." (http://www.dni.gov/nic/NIC_specialproducts.html) As a result, market forecasts gather timely information on a continuing basis, as long as there is new information and as long as the market is continuing. Alternatively, a forecast using a sophisticated approach is likely to have limited data and operate over a limited time horizon.

Anonymity

Most markets are anonymous. As a result, information can be embedded in the price from a range of sources, including sources where the information is supposed to remain secret or at least not directly disclosed. Thus, potentially information not available to those making the forecast, ultimately can be embedded in the price or probability of the event. Further, those providing an official forecast are not anonymous and often the forecast must reflect political realities that limit its effectiveness.

Truth Telling

Because of anonymity, participants can express the truth in their market operations regarding the prediction events. Further, because of the incentives in the market, participants have incentive to trade on what they know as the truth. Accordingly, as noted by Abramowicz and Henderson (2007) "Prediction markets can increase the flow of information, encourage truth telling by internal and external firm monitors, and create incentives for agents to act in the interest of their principals." Thus, the information in the markets may be better than that used in other tools.

Additional Information

Since internal prediction markets gather knowledge distributed throughout the firm, they function in part as "suggestion boxes." As a result, markets potential can gather information that might not normally be gathered as part of the normal management hierarchy, reaching out to those not in the management hierarchy, leading to information potentially beyond those responsible for forecasting, mitigating asymmetries of information.

Involvement

Further, since a broad range of users provide information, potentially there is a higher level of involvement by those in the organization. In many cases "involvement" can lead to improved personal and corporate performance (e.g., Woolridge & Floyd, 1990). The extent that market participants are "involved" can lead to the generation and use of broader bases of information than with other types of forecasting tools.

USE MARKETS AS A STAND-ALONE OR IN CONJUNCTION WITH OTHER FORECASTING TOOLS

If markets have such excellent accuracy, should we see them as stand-alone tools or should they be used in conjunction with other forecasting tools?

Stand-Alone or in Conjunction

If there are sophisticated forecasting tools, then any trader, with access to that information, will be able to embed the forecasting information in the market. Further, those traders will bring the official forecasting information in with any additional information that the trader feels is important. However, if there is no forecasting tool, then no additional information other than the expectations and other knowledge of the traders will be embedded in the price. Accordingly, from an information perspective, more and different information is embedded in the market if there are traders who also have access to forecast information. As a result, we generally would expect better performance when markets are run in conjunction with other sophisticated forecasting tools.

Time Ahead

As noted in a previous section, prediction markets appear to have a long-run forecasting capability. Accordingly, it would appear that using both markets and other forecasting tools would provide the organization a more complete forecast.

SOME CONCERNS OF USING MARKETS FOR FORECASTING

Although prediction markets appear to provide an effective forecasting tool, there are some potential limitations, some of which we list here.

Trade-Off – Cost Benefit of Adding a Market

Although this chapter has argued that markets can provide important and accurate information for forecasting purposes, prediction markets can generate additional costs. For example, not only is there the cost of the market, the software, etc. but there also is the time and effort incurred by employees following and participating in the markets. Clearly, time spent on markets is time that could be spent in other areas. Accordingly, prediction markets must provide additional information or benefits to be cost-effective.

Who Are the Participants in Forecasting Events

One generalization is that participants are likely to be more junior members of the firm (http://www.consensuspoint.com/prediction-markets-blog/prediction-markets-focus-of-mba-thesis-research). If that is the case, then we are likely to see market prices move in response to the information that junior members of the firm have access. Alternatively, junior personnel may be more insulated from political realities of more senior management and thus be more honest. Thus, the organization must ask itself, whose information do they want to gather and disseminate.

Returns to the Participants

Although, since some kind of virtual dollar typically is used, the payoff to participants often is not a direct one to one for the investment, instead it

may result in honors, publicity as a market leader, t-shirts, and the opportunity at lump sum payoffs for being one of the more successful participants. Accordingly, one potential problem is whether or not such returns are of sufficient interest to draw participants into the markets. Further, even if they are drawn into the markets, will they take the market serious enough to make a difference?

Impact on Effort

What would be the impact of markets on "effort?" If the outcomes are not positive, there can be a range of alternative responses. Suppose the prevailing price on whether a project will finish on time is low compared to the price that it will finish on time. Participants affected by the event may work harder to mitigate what they think the market may see. On the other hand, they may think that it is hopeless and give up, particularly, if it is clear to the participants the ultimate demise of the operation is imminent. Alternatively, if the market forecast is positive, then the effort might be reduced as participants feel that the event is destined to happen. As a result, we may see the generation of self-fulfilling prophecies. Accordingly, Berg (2007) and others have suggested that for prediction markets, "betting on failure leads to failure" and "predicting success as an attempt to create a good appearance."

Real Gambling (on the Side)?

Although an issue that might not directly impact the firms involved, conceivably, prediction markets could lead to additional off-line gambling on the market or other related or unrelated issues. Further, some organizations and some potential participants may think that gambling is not appropriate for a workplace or any setting.

WHAT IS A GOOD PREDICTION MARKETS FORECASTING PROBLEM?

There are a number of settings where markets work, but we examine four where markets are more likely to be effective.

Sparse Information

Deloitte (2010) suggests that ''Prediction markets are especially suited to situations where there is sparse data otherwise available that may be used to define a forecasting model.'' In this setting, information is dispersed across the firm. If there is sparse information, a market can act to pull the information together and provide an aggregation function.

Lack of Open and Truthful Information

If the information flows to management are not open, if people are not telling management the ''true'' story, then markets may remove those information asymmetries as seen in a situation where Microsoft used a market to predict when a product would ship (http://www.midasoracle.org/2007/01/23/case-microsofts-internal-prediction-markets/). If a story is not true, then those traders who recognize the lack of truth can trade on that information and make money from the market.

Lack of Organizational Responsibility

Apparently, EA produced around 120 games a year; however, there was limited accountability for the forecasts (http://blog.mercury-rac.com/2007/10/17/notes-from-the-london-prediction-market-conference-part-1/). As a result, the quality of the forecasts was limited. A lack of organizational responsibility can result in a lack of communication of proper information. However, as seen at EA, a prediction market can facilitate and broker that information.

Information Asymmetries

If there are information asymmetries, or information gets stuck at different points in an organization, then prediction markets may work to mitigate those asymmetries. Traders can trade on information asymmetries with the result being the integration of that information in the market price and a loss of asymmetries.

SUMMARY AND EXTENSIONS

This chapter has examined how firms have begun to use internal prediction markets to forecast and predict the future. The chapter examined some of

the kinds of problems that markets are being used to examine. Further, the chapter investigated the potential accuracy of markets as a forecasting tool. In addition, the chapter analyzed some of the unique capabilities of markets as a forecasting tool, and the extent to which markets are a stand-alone-type tool. In addition, this chapter reviewed some of the concerns of using markets as a forecasting tool. Finally, the chapter analyzed some of the characteristics of problems for which markets provide an important tool.

Extensions

There are a number of extensions to this chapter. First, we have focused on two types of problems: project management and product quality. Future research could focus on other types of problems, for example, financial. Second, this chapter has taken markets on their own, and not integrated with other types of technologies, for example, Wikis. Future research could analyze integration issues between the different technologies. Third, this chapter has recognized some of the limitations in prediction markets; however, addition research could focus on biases that might result in limitations of markets, such as the underpricing of the 15–50% mentioned earlier in the chapter. Fourth, prediction markets can be seen as knowledge management efforts. Accordingly, future research could focus on structuring markets as vehicle to evolve tacit knowledge into explicit knowledge.

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Ask Markets – http://www.askmarkets.com/ (Build your own market)
"Bet 2 Give" – https://bet2give.com/b2g/index.html (Real money, winnings go to non-profits organizations
"Bet Fair" – http://corporate.betfair.com/about-us.aspx (Designed to eliminate the need for a book maker)
Consensus Point – http://www.consensuspoint.com/ (Software company)
Crowd Cast – http://www.crowdcast.com/resources/ (Software company)
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