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A COMPARISON OF THE FORECASTING ACCURACY OF PREDICTION MARKETS AND EXPERT PRACTITIONERS (39)

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A comparison of the forecasting accuracy of Prediction Markets and Expert Practitioners

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Abstract

Creating accurate forecasts to inform planning processes and organisational decision making is a perennial organisational challenge and the focus of a substantial body of research in management science, information systems and related disciplines. Prediction markets are a relatively novel Group Decision Support System (GDSS) which can be applied to this problem. This paper presents a study which compares the forecasting performance of a prediction market to a small group of experts.

Keywords: Prediction Markets, Forecasting, Forecasting Accuracy

1.0 Introduction

Creating accurate forecasts to inform planning processes and organisational decision making is a perennial organisational challenge. It has been a pre-eminent theme in management science, with a large and growing body of work focused on understanding how technology in general and information systems in particular can address this challenge. In this context, prediction markets are a form of Group Decision Support System (GDSS) which seek to leverage “the wisdom of crowds” by utilising information technology to aggregate the opinions and knowledge of large numbers of individuals.

This paper compares the forecasting performance of a prediction market comprised of a large number of relatively inexperienced participants to that of a small group of domain experts. In this paper, the extant literature on prediction markets is briefly reviewed and the study is motivated. The results of the data analysis, conclusions and suggestions for further research will be presented at the UKAIS 2016 conference.

2.0 Literature Review

Organisations have always faced the challenge of making decisions based in whole or part on the forecast outcome of large, uncertain and complex systems. There are two macro level paradigms used by organisations to make forecasts in complex problem spaces (Armstrong, 2001). The first approach focuses on using statistical methods to develop quantitative models that can be used derive forecasts.

However, quantitative approaches to modelling large, complex systems face a number of serious limitations. First, the number of interconnected variables that may be required to model a realistically complex system may be computationally prohibitive. Second, the model maker may be unaware of important variables to include in the model. Third, it may be impossible to define the nature of relationships between variables, particular in contexts where those relationships are constantly in flux. Many variables of interest may be inherently inscrutable. For example, it is reasonable to suggest that consumer sentiment will influence customers buying preferences, but it is also evident that sentiment is label attached to a fluid, multi-faceted construct that defies straightforward quantization. All of these factors limit the accuracy that can be achieved with statistical approaches to forecasting.

The second forecasting archetype seeks to identify individuals or groups of experts who can make accurate forecasts. These experts use knowledge, heuristics and experience derived from learning and experience to make forecasts. However, the literature recognises that there are clear limitations on the rationality and information processing capabilities of the human brain (March, 1999; Simon, 1997). Ultimately, intellectual artefacts such as forecasts which are derived from the human mind are subject to the cognitive, psychological and emotional strictures that limit the human brain (Chugh & Bazerman, 2007). There is a clear consensus in the literature that there are fundamental limitations on the ability of individual humans to create accurate forecasts.

In order to overcome these limitations, many approaches seek to leverage groups of experts. Groups of individuals should have access to more information than a solitary individual (Hitt, Black, & Porter, 2005). A group should have access to more resources than individuals, particularly cognitive resources such as attention, as well having access to the pooled skills and knowledge of all of the participants (Ellis & Fisher, 1994). By leavening the effect of psychological and emotional biases, groups often have a particular edge in tasks which call for judgement (Ellis & Fisher, 1994). Groups can leverage the "assembley effect", whereby social interaction can prompt creativity and the generation of novel solutions to problems (Laughlin, Bonner, & Miner, 2002).

However, group forecasting is not a panacea. There are a range of negative second order effects that can adversely affect the performance of groups such as groupthink (Janis, 1972), information cascades (Anderson & Holt, 1997), group polarization (Isenberg, 1986) and escalating commitment (Sprenger, Bolster, & Venkateswaran, 2007). Such effects are caused by the social nature of a group forecasting context. By their nature group forecasting contexts have both task and social dimensions, and in many cases social considerations can dominate task considerations. To minimise these socialisation effects, structured group forecasting approaches such as brainstorming, the Nominal Group Technique and the Delphi method have evolved (Hitt et al., 2005).

Prediction markets are a recently developed tool that can leverage information technology to enable large groups of individuals to collaborate in a structured way to create forecasts and reach decisions. They are based on Hayeks conceptualisation of markets as near perfect transmitters of information (Hayek, 1945). They use a market mechanism to aggregate information held by a diverse population of participants and use that information in the form of market values to make predictions about specific future events (Tziralis & Tatsiopoulos, 2007). By way of example, consider an organisation that wishes to forecast whether a project will meet a particular milestone. To construct a prediction market, a market maker begins by offering for sale a contract on the outcome of the milestone. The contract will pay a holder $1 if the milestone is reached or $0 otherwise. The initial price of the contract would be set to 50 cents and then offered for sale to individuals participating in the project. Under these circumstances, if an individual believes the project milestone will be achieved, they will buy the contract in the expectation of a making a profit in the future. Equally, if a rational participant believes the project will not reach its milestone, then they will sell (or 'short') the contract. This dynamic acts to change the price of the contract, which ultimately moves to reflect the consensus of the group as a whole of the likelihood of the project reaching its milestone. This binary model can be extended to allow a range of disjoint outcomes. Equally, they can be used to allow participants to forecast values rather than select from a particular set of outcomes.

Academic research to date suggests that prediction markets "*can provide accurate forecasting and effective aggregation*" (Hall, 2010, p. 45). Other authors caution against drawing definitive conclusions, but summarise the existing empirical evidence as cautiously optimistic (Ledyard, 2006; Wolfers & Zitzewitz, 2006). However, Graefe and Armstrong (2011) note that "*Available studies are limited and often of a small scale*". Most of the extant studies are laboratory based and suffer from limits to their generalizability (Buckley & O'Brien, 2015). Such studies have limited numbers of participants in the market, are of limited duration and offer stylised contracts for trade. In an applied context, the limitations of laboratory based studies are often a serious impediment to practitioner acceptance (Deck, Lin, & Porter, 2013). Laboratory based studies do not offer reassurance to managers and decision makers who are considering the deployment of prediction markets but are concerned with the generalisability of observed results to real world settings. Slamka et al (2013) call for further research which analyses the performance of prediction markets in real-world settings, while Jian and Sami (2012) echo this concern with a call for field experiments with larger groups.

This research answers that call by presenting data which compares the performance of two forecasting methodologies in a real world context. In both cases, we ask participants to forecast which tax policies will be implemented as part of the national budget. The key distinction between the forecasting populations is experience and applied knowledge. We compare the performance of a prediction market comprised of a large number of relative novices to that of a group of experts. Our research aims to investigate if a large, relatively inexperienced group of participants can outperform a small group of experts.

3.0 Methodology, Results and Conclusions

The results of the data analysis, conclusions and suggestions for further research will be presented at the UKAIS 2016 conference.

References

Anderson, L. R., & Holt, C. A. (1997). Information Cascades in the Laboratory. *American Economic Review*, *87*(5), 847–62.

Armstrong, J. (2001). *Principles of forecasting a handbook for researchers and practitioners* (1st ed.). Boston MA: Kluwer Academic.

Buckley, P., & O'Brien, F. (2015). The effect of malicious manipulations on prediction market accuracy. *Information Systems Frontiers*, 1–13. http://doi.org/10.1007/s10796-015-9617-7

Chugh, D., & Bazerman, M. H. (2007). Bounded awareness: what you fail to see can hurt you. *Mind & Society*, *6*(1), 1–18. http://doi.org/10.1007/s11299-006-0020-4

Deck, C., Lin, S., & Porter, D. (2013). Affecting policy by manipulating prediction markets: Experimental evidence. *Journal of Economic Behavior & Organization*, *85*, 48–62. http://doi.org/10.1016/j.jebo.2012.10.017

Ellis, D. G., & Fisher, B. A. (1994). *Small Group Decision Making: Communication and the Group Process* (4th ed.). New York: McGraw-Hill Book Company.

Graefe, A., & Armstrong, J. S. (2011). Comparing face-to-face meetings, nominal groups, Delphi and prediction markets on an estimation task. *International Journal of Forecasting*, *27*(1), 183–195. http://doi.org/10.1016/j.ijforecast.2010.05.004

Graefe, A., & Weinhardt, C. (2008). Long-Term Forecasting with Prediction Markets A Field Experiment on Applicability and Expert Confidence. *The Journal of Prediction Markets*, *2*(2), 71–91.

Hahn, R. W., & Tetlock, P. C. (2006a). A New Tool for Promoting Economic Development. In R. W. Hahn & P. C. Tetlock (Eds.), *Information Markets: A New Way of Making Decisions* (pp. 170–194). Washington D.C: AEI-Brookings Joint Center for Regulatory Studies.

Hahn, R. W., & Tetlock, P. C. (2006b). Introduction to Information Markets. In *Information Markets: A New Way of Making Decisions* (pp. 1–12). Washington D.C: AEI-Brookings Joint Center for Regulatory Studies.

Hall, C. (2010). Prediction Markets: Issues and Applications. *The Journal of Prediction Markets*, *4*(1), 27–58.

Hayek, F. A. (1945). The Use of Knowledge In Society. *American Economic Review*, *35*(4), 519–530.

Hitt, M., Black, S., & Porter, L. W. (2005). *Management* (2nd Revised US ed). Prentice Hall.

Isenberg, D. J. (1986). Group polarization: A critical review and meta-analysis. *Journal of Personality and Social Psychology*, *50*(6), 1141–1151. http://doi.org/10.1037/0022-3514.50.6.1141

Janis, I. L. (1972). *Victims of Groupthink: A psychological study of foreign-policy decisions and fiascoes*. Houghton Mifflin Company.

Jian, L., & Sami, R. (2012). Aggregation and Manipulation in Prediction Markets: Effects of Trading Mechanism and Information Distribution. *Management Science*, *58*(1), 123–140. http://doi.org/10.1287/mnsc.1110.1404

Laughlin, P. R., Bonner, B. L., & Miner, A. G. (2002). Groups perform better than the best individuals on Letters-to-Numbers problems. *Organizational Behavior and Human Decision Processes*, *88*(2), 605–620. http://doi.org/10.1016/S0749-5978(02)00003-1

Ledyard, J. (2006). Designing Information Markets for Policy Analysis. In *Information Markets: A New Way of Making Decisions* (pp. 37–66). Washington D.C: AEI-Brookings Joint Center for Regulatory Studies.

March, J. G. (1999). *The Pursuit of Organizational Intelligence: Decisions and Learning in Organizations*. Wiley-Blackwell.

Remidez, H., & Joslin, C. (2007). Using Prediction Markets to Support IT Project Management - Research in Progress. In *International Research Workshop on IT Project Management 2007*. Montreal, Quebec, Canada: Association for Information Systems.

Simon, H. A. (1997). *Administrative Behavior, 4th Edition* (4th ed.). Free Press.

Slamka, C., Skiera, B., & Spann, M. (2013). Prediction Market Performance and Market Liquidity: A Comparison of Automated Market Makers. *IEEE Transactions on Engineering Management*, *60*(1), 169 –185. http://doi.org/10.1109/TEM.2012.2191618

Tziralis, G., & Tatsiopoulos, I. (2007). Prediction Markets: An Extended Literature Review. *The Journal of Prediction Markets*, *1*(1), 75–91.

Wolfers, J., & Zitzewitz, E. (2006). Five Open Questions About Prediction Markets. In *Information Markets: A New Way of Making Decisions* (pp. 13–36). Washington D.C: AEI-Brookings Joint Center for Regulatory Studies.