Examiner Report

Essays on Prediction and Betting Markets

Katarina Kálovcová

This thesis undertakes an investigation into the applicability of particular types of prediction and betting markets as information aggregation mechanisms (IAMs). Chapter 1 of the thesis provides an extended introduction of the definition and key characteristics of each market. It also provides an overview of related literature. Chapter 2 examines the Plott-Wit-Yang (2003) (PWY) paradox by focusing on individual-level, rather than aggregate-level, data to show that the observed prices are indeed consistent with individuals learning from observed market odds and not simply reflective of myopic betting. Finally, Chapter 3 considers a (call) prediction market, similar in design to Chen and Plott (2002), to investigate the predictability of PhD enrollments at CERG-EI over the 2009/10 calendar year. Subtle differences between Chen and Plott’s design and the one considered in this study provide useful guidance for future design and implementation in real world settings. Overall this thesis is well written and interesting. It is my overall assessment that the thesis is acceptable and warrants a defence leading to the award of doctoral degree. I will now comment further on my impressions of the dissertation.

The importance and potential usefulness of prediction markets, and more generally IAMs, has a long history in economics. As the author notes in her introduction, Galton’s study provided early scientific evidence on information aggregation, but it wasn’t probably until the work of Hayek (1945) that the market mechanism was explicitly recognised as possessing such qualities. Indeed, it took more time and the birth of experimental economics before these ideas were being scientifically tested in both the laboratory and field. The early seminal study of Smith (1962) provided some of the earliest published results on how the market may coordinate information to reveal the equilibrium competitive price, but it wasn’t until the later studies of Plott and Sunder (1982, 1988) where the explicit objective was to use the market to aggregate information and to focus on how different mechanisms and incentives could achieve such ends.

Plott’s interests in information aggregation led him to investigate other mechanisms which may also serve the role of information aggregation. This work led to the PWY study on the pari-mutuel mechanism which this thesis considers in Chapter 2. The PWY paper examines two broad types of information aggregation problems. The first, when participants have complete information between them; and the second, where information is incomplete leading to a probabilistic information aggregation outcome over outcomes. PWY then investigate a number of behavioural models which may explain their results including 1) private information models (DTPI, CEPI), and 2) models with updated beliefs (CERE, Bayesian). The fact that these authors find the DTPI model best fits the observed behaviour in the more complex probabilistic environment provides basis for their observed ‘paradox’. Kálovcová’s contribution to understanding this paradox in Chapter 2 is impressive. The problem is clearly stated, the intentions are clear, and the methodology is well described. The simple example provided is also useful to understand exactly wherein the paradox may have arisen. The Chapter necessarily requires the reader to have familiarity with PWY (which I fortunately do), but that is not
necessarily to its detriment as its explicit stated objective is to investigate the paradox of that study. The results are presented logically, with the main result (3) well explained.

Of course the ultimate test of any IAM resides in its usefulness for real-world application. Again Plott has been a leader in this area. His (2002) work with Kay-Yut Chen provides strong evidence that a properly designed process can capture disaggregated information to provide meaningful predictions for industry problems, e.g. forecasting sales. As Chen and Plott note, however, implementation in the real world involves considerable difficulties which do not arise in laboratory settings. For example, thin markets, timing, compensation, etc all provide problems which are not encountered in the lab. The Chen and Plott study involved a number of sales forecasting horizons for different products of Hewlett-Packard (HP). The results demonstrated that the mechanism routinely out-performed internal forecasts leading HP to adopt this going forward. Rather than the pari-mutuel betting market considered in PWY, this study employed a set of state contingent Arrow-Debreu securities over different outcomes (i.e. sales levels) and paid one if that event occurred and zero on the other states. This implied that, theoretically, the prices observed could be interpreted as probabilities – although it was frequently observed that prices summed to greater than one and so arbitrage opportunities presented. A novel way in which Kálovcová’s thesis attempted to mitigate this problem was to use the portfolio option as an additional state, meaning participants could at any time buy or sell a market portfolio of one share per event for a price of one. This market-maker feature, at least in theory, presented a useful way in which to ensure that arbitrage opportunities quickly disappeared. However, as reported in the result (3) this was not actually observed. Observation (1) gives some guidance as to why this might have occurred and suggests that player inexperience and price volatility may help explain this occurrence. Moreover, the relative movement in prices as a result of attempting to trade portfolios typically led to negligible arbitrage opportunities in practice.

Although a useful exercise, it is of course difficult to judge the performance of this mechanism over the two markets considered. As well, given the nature of the task, a clearly defined benchmark against which to judge performance is difficult. Ideally, without such a benchmark, the best way to test this mechanism is to employ a test similar to the one described in Chen and Plott (result 2), wherein they use the probability distribution to evaluate whether the observed prices (probabilities) are consistent with observed outcome. Obviously, however, such a test requires a number of data points which are not available in the current study.

In summary, I find the thesis a useful contribution to the applied literature on betting/prediction markets, and IAMs. The problems are well motivated, related literature summarised well, methodology clearly explained, and results reported clearly and honestly. The fact that Kálovcová has already published one chapter of the dissertation demonstrates that she is capable of conducting quality academic research – a universal criteria for a doctoral degree. I also appreciate that conducting laboratory and field experiments of this nature are difficult for a number of reasons related to programming, logistics, ethics, etc. I have myself run similar experiments in both laboratory and field environments and am empathetic to all of these issues. I also applaud Kálovcová for pursuing a topic about which there is still much to learn, which is of paramount importance to academic endeavour.