Optimal use of prediction markets

Background – basic concepts

Crowdsourcing can be defined as "the practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people and especially from the online community rather than from traditional employees or suppliers''. The phenomenon as such was probably first researched by Sir Francis Galton at the beginning of the 20th century. In his seminal paper, published in Nature (1907), he demonstrated that a large group of people, containing only small percentage of experts, usually has sufficient, yet dispersed knowledge to provide correct answer to difficult questions (e.g. to predict outcome of an event).

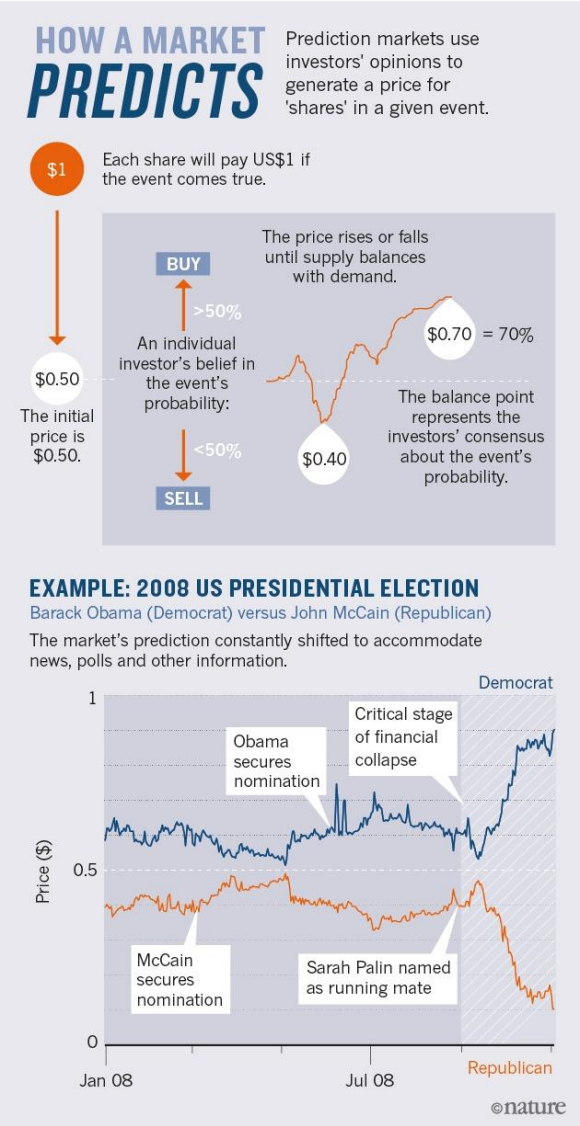
Degrees of the length of Array 0°—100°	Estimates in lbs.	Centiles: Observed deviates from 1207 lbs.	Centiles: Normal p.e =37	Excess of Observed over Normal
5	1074	−133	−90	+43
10	1109	− 98	−70	+28
15	1126	− 81	−57	+24
20	1148	− 59	−46	+13
q_1 25	1162	− 45	−37	+ 8
30	1174	− 33	−29	+ 4
35	1181	− 26	−21	+ 5
40	1188	− 19	−14	+ 5
45	1197	− 10	− 7	+ 3
m 50	1207	0	0	0
55	1214	+ 7	+ 7	0
60	1219	+ 12	+14	− 2
65	1225	+ 18	+21	− 3
70	1230	+ 23	+29	− 6
q_3 75	1236	+ 29	+37	− 8
80	1243	+ 36	+46	−10
85	1254	+ 47	+57	−10
90	1267	+ 52	+70	−18
95	1293	+ 86	+90	− 4

q_1, q_3, the first and third quartiles, stand at 25° and 75° respectively.
m, the median or middlemost value, stands at 50°.
The dressed weight proved to be 1198 lbs.

Figure 1. Distribution of the estimates of the dressed weight of a particular living ox, made by 787 different persons (source: GALTON, F. 1907. Vox Populi. Nature 75, 450-451).

Prediction markets are a specific type of financial markets where wagers (futures contracts) on prospective events are traded. These markets are based on the idea of crowdsourcing and employ the collective intelligence of their users. Prediction markets make use of the Bayesian interpretation of probability, introduced by Thomas Bayes, the 18th century mathematician commonly referred to as "the father of statistics" (for

instance see his seminal paper Bayes et al., 1763). In doing so they use so called "the wisdom of the crowds" or "efficient markets hypothesis" that is also contained in the Latin phrase Vox populi vox dei, meaning "the voice of the people is the voice of God". Participants of such markets give YES or NO answers to certain questions and estimate probabilities of future events in the Bayesian sense. Responses are aggregated into predictions for the areas of interest. In practice, these markets offer predictions at least as accurate as other research methods, allowing non-experts in the field to be



participants of the market.

Figure 2. How a market predicts? (source: nature.com).

The first prediction market, run with modern IT, was the brainchild of professors George R. Neymann, Robert Forsythe and Forrest Nelson who pondered whether market mechanisms could be used to predict the results of presidential elections. This idea came to life in 1988 as Iowa Electronic Markets. At present, apart from elections and entertainment industry, prediction markets are widely utilised in corporate practice,

mainly to monitor the status, stage, and estimated end date of projects. Market potential of innovative products can be estimated using this tool as well. Prediction markets are used by many of US corporations, e.g.: Google, Microsoft, HP, General Electric.

Basic literature:

- GALTON, F. 1907. Vox Populi. Nature 75, 450-451.
- HAYEK, F. A. 1945. The use of knowledge in society. The American Economic Review 35, 519-530.
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- HORN, Ch. F., IVENS, B. S. 2015. Corporate Prediction Markets for Innovation Management: Theoretical Foundations and Practical Examples for Business Use. Adoption of Innovation. Springer, 11-23.
- POLK, C., LEDYARD, J., HANSON, R, ISHIKIDA, T. 2003, The policy analysis market: An electronic commerce application of a combinatorial information market. In Proceedings if the 4th ACM conference on electronic commerce, 272-273.
- https://medium.com/@ianedws/4-crypto-prediction-market-platforms-compared-f1fb187b3ad
- PAGE, L., CLEMEN, R.T. 2013, Do prediction markets produce well-calibrated probability forecasts?, The Economic Journal, 123 (568), 491-513.

Mathematical questions

Key mathematical questions (in order of priority) that might be addressed during the study group include:

- What kind of forecasts can be obtained using prediction markets (long-, medium, short-term)?
- Which areas of the event can be predicted using prediction markets (eg.: sport, politics, financial marekt)?
- What is the advantage of prediction markets over other methods (heuristic method, survey/opinion poll)?