Brexit: what do prediction markets tell us about its likelihood?

1 June 2016

In the run-up to the EU referendum—and all significant political events—the results of opinion polls are closely followed by those seeking to track the likely direction of the vote. However, polls are far from being the only way to estimate the probability of an uncertain event; analysis of bookmakers' odds suggest that there is currently a 23% chance[1] of the UK public voting to leave the EU, suggesting that Brexit is perceived as more likely than Scotland voting for independence was at a comparable moment in the campaign. How can such prediction markets be used to draw inference about how their participants expect these events to unfold.

1   What are prediction markets?

Prediction markets allow the exchange of contracts where the financial return is dependent on the (currently unknown) outcome of future events. They exist in a wide range of forms. Perhaps the best-known examples of pure prediction markets are the election forecasting markets run by the University of Iowa.[2] For instance, using this exchange, an investor can buy an asset for any of the potential US presidential election nominees of the Republican and Democrat parties. Should that potential nominee become the actual nominee, the asset pays out $1; otherwise it pays out nothing.[3]

Such markets are closely linked to other entities such as traditional bookmakers; however, subtle differences exist—prediction markets *match* traders willing to

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[1] As at 1 June 2016.
[2] Wolfers, J. (2006), 'Prediction Markets in Theory and Practice', *NBER Working Papers*.
[3] Iowa Electronic Markets, available online at http://tippie.uiowa.edu/iem/, accessed 22 May 2016.

buy and sell outcome-dependent contracts, whereas a bookmaker *sells* contracts itself (the terms of the contract are the odds the bookmaker offers).

The prevailing prices in these markets can be interpreted as indicating information about the probability of that outcome occurring. For instance, the price of an asset paying $1 if Hillary Clinton becomes the Democrat nominee is approximately $0.84, over eight times the price of an asset conditioned upon Bernie Sanders becoming the nominee,[4] representing her status as the most likely nominee. Similarly, bookmakers offer 'longer' odds (which offer a high pay-off) on events considered highly unlikely to happen; a famous recent example was bookmakers offering odds of 5,000/1 on Leicester City winning the English Premier League.

2   Brexit: what do prediction markets say about it?

One of the main prediction markets for trades dependent on the outcome of the UK's EU membership referendum is the Betfair Exchange, on which approximately £14m has been staked to date.[5] Current trading on this platform indicates that the market believes there is approximately a 23% chance of a vote for Brexit occurring, suggesting that a 'remain' vote is some four times more likely.[6] On the other hand, opinion polls have indicated a potentially close vote: a recent YouGov survey found 44% of voters intend to vote to remain in the EU and 40% plan to vote to leave—the 4% margin being significantly outweighed by the 12% of people who are undecided.[7] The difference is partly explained by the fact that the two methods measure subtlety different concepts. The 23% chance of Brexit referenced above is the chance of the number of votes to leave being higher than the number of votes to remain, regardless of the margin; by contrast, opinion polls attempt to measure the precise levels of support for each option.

To place this figure in context, it is useful to look at historical fluctuations of both this probability and that of outcomes in previous referenda. To do this, we have analysed historical bookmarkers' odds concerning both the current EU referendum and the Scottish independence referendum in September 2014. The figure below plots the implied probabilities of a 'Leave' vote in the EU referendum and a 'Yes' vote to Scottish independence against the number of days to go until the relevant referendum.

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[4] Iowa Electronic Markets, available online at http://tippie.uiowa.edu/iem/, accessed 22 May 2016.
[5] Betfair exchange, available online at https://www.betfair.com/exchange/plus/#/politics/market/1.118739911, accessed 22 May 2016.
[6] Betfair exchange, available online at https://www.betfair.com/exchange/plus/#/politics/market/1.118739911, accessed 22 May 2016.
[7] YouGov (2016), 'EU referendum: Remain lead at four', available online at https://yougov.co.uk/news/2016/05/18/eu-referendum-remain-lead-four/, accessed 24 May 2016.

Implied probability of Brexit vs that of Scottish independence
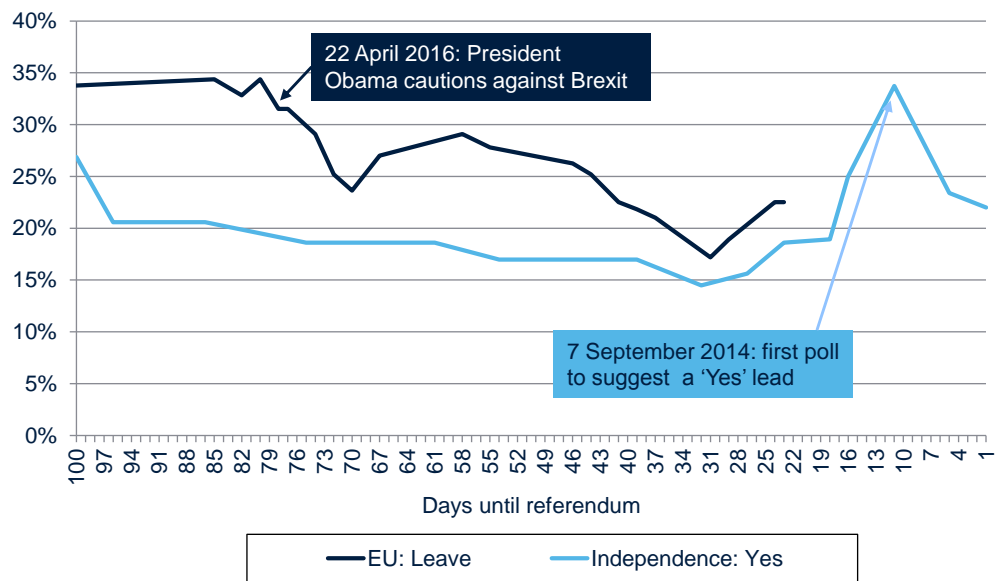
Source: Oxera analysis of bookmakers' odds.

This simple chart reveals some interesting facts—in particular, the implied probability of a Brexit vote is, and has always been, higher than that of a Scottish independence vote at a comparable stage in the campaign.

It is also interesting to observe the relative impact of different events on the implied probability of outcomes. For example, President Obama's April visit to the UK, during which he warned against Brexit, was followed by an immediate reduction in the implied probability of it happening; four days before this, the release of a report by HM Treasury suggesting Brexit would have a negative impact on the UK's economy had caused a negligible impact. In the Scottish case, it is noteworthy that the surge in implied probability of an independence vote peaked approximately ten days before the polls opened, and then rapidly receded following the release of an opinion poll that showed a lead for the 'yes' campaign. By contrast, the pledge of enhanced devolution for Scotland should it choose to remain in the UK by the leaders of the UK's main political parties in the two days before the vote appeared to alter the implied probabilities by relatively little.

3   Should we take prediction markets seriously?

While the information set out above may be of interest to political observers, we must also ask to what extent it can be relied upon. Other methods of drawing inference about the likely outcome of a poll do exist—most notably, opinion polling in advance of the actual ballot.

The accuracy of such polls has recently been cast into doubt by their emphatic failure to predict the Conservative victory in the 2015 General Election, with an inquiry finding the primary cause of this to be inaccurate sampling.[8] In this case, whereas polling firms estimated that the Conservative and Labour parties were

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[8] British Polling Council and Market Research Society (2016), 'Report of the Inquiry into the 2015 British general election opinion polls', March, http://eprints.ncrm.ac.uk/3789/1/Report_final_revised.pdf, accessed 22 May 2016.

set to achieve almost identical vote shares,[9] betting markets indicated that the Conservatives were strong favourites to win the most votes.[10] In this case, the predictions of markets based on the exchange of money were more accurate than conventional polling.

Academic research shows that, depending on conditions,[11] the prices generated by prediction markets will be either equal or very close to the mean beliefs of traders in that market.[12] This implies that the market acts to aggregate and combine the estimates of many individuals of the likelihood of an event occurring, producing one combined value. This ties in with the phenomenon known as the 'wisdom of the crowd', which suggests that when trying to estimate an uncertain variable, the pooled estimate of many people is likely to be more accurate than that of any individual. The aggregation function performed by prediction markets allows us to identify this pooled estimate, and neatly avoids behavioural problems occasionally encountered by pollsters, such as the ability of minor details in the structure of a survey to influence participants' responses.

There are therefore good reasons to regard prediction markets as a valid indicator in the run-up to polls (and, indeed, any uncertain event for which such a market exists). However, much like conventional opinion polls, prediction markets can be volatile and sensitive to developments surrounding the event— one needs only to look at the sudden surge and then decline in estimated probability of a Scottish independence vote in the days prior to the referendum to see that beliefs on one day can be rapidly revised the next as new information becomes available. Finally, it should be remembered that these markets can only offer a barometer of the perceived *probability* of an event by the market participants.

4   Conclusions

Prediction markets allow the exchange of outcome-dependent contracts, and are therefore one way of estimating the outcome of a future uncertain event such as the UK's EU membership referendum. Analysis of the odds provided by bookmakers suggests that the probability of Brexit is currently around 23%. While this means that a 'remain' vote is the strong favourite, this is a significantly higher probability than the estimated likelihood of a vote for Scottish independence at a comparable moment in the campaign. Despite offering an interesting way to quantify and analyse the build-up to a poll, prediction markets can offer only an insight into the perceived probability of an event at a given moment in time, and can fluctuate significantly in response to real-life events; ultimately there is no fail-safe way to predict the future.

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[9] British Polling Council and Market Research Society (2016), 'Report of the Inquiry into the 2015 British general election opinion polls', March, Table 1, available online at http://eprints.ncrm.ac.uk/3789/1/Report_final_revised.pdf, accessed 22 May 2016.

[10] Oddschecker, accessed via the *Internet Archive Wayback Machine*, available online at https://web.archive.org/web/20150506161900/http://www.oddschecker.com/politics/british-politics/next-uk-general-election/most-votes, accessed 22 May 2016.

[11] For instance, that individuals' beliefs around the probability of the event are not correlated with their wealth.

[12] Wolfers, J. (2006), 'Prediction Markets in Theory and Practice', *NBER Working Papers*.