Watch Out for Winners and Losers:

Odd-Implied Brexit Sentiment and FTSE Returns

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1. Introduction

The Bank of England's (BoE) May 2016 *Inflation Report* notes that roughly half of the 9% fall in sterling since November 2015 is due to "perceived risks associated with the referendum on UK membership of the European Union". Yet the BoE does not identify any referendum effects on other UK assets such as bonds and equities. Using changes in Brexit sentiment implied in betting odds, we investigate which companies' stock returns underperform relative to the market following a rise in the perceived likelihood of Brexit (relative "Brexit losers"), and which companies outperform the market (relative "Brexit winners"). We find evidence for such abnormal returns for 103 out of 618 companies in the FTSE All-Share Index. According to our results, 81 companies record negative abnormal returns, marking them out as possible relative Brexit losers; 22 companies record positive abnormal returns, suggesting they are possible relative Brexit winners. Therefore, for every one relative Brexit winner there are four relative Brexit losers.

Using data on the characteristics of listed companies, we show that there appear to be marked differences between the market-perceived Brexit losers and winners. Unsurprisingly, the share of perceived Brexit losers that report Europe as one their most important overseas markets exceeds the share of Brexit winners that do so. By contrast, a somewhat larger portion of the group of Brexit winners report Asia and Africa among their most important overseas markets.

Furthermore, In line with popular perception that large companies stand to benefit from continued EU membership,[1] the size of the median Brexit loser – in terms of both employment and sales – exceeds the size of the median Brexit winner. However, the difference in median sizes is marginal. Moreover, the data indicates a subtler relationship between company size and EU membership gains: in terms of employment and sales, the group of Brexit winners is significantly more heterogeneous than the group of Brexit losers. Both some of the smallest and largest companies displaying abnormal returns belong in the "winner" category.

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Finally, while we find that financial services providers make up the largest share of *both* the losers *and* winners groups, the non-financial companies in the two groups operate in very different sectors. Among relative Brexit losers, two fifths of all companies belong to the construction, hospitality and transportation sectors. Among relative Brexit winners, most non-financial companies belong to the extraction industry.

The next section provides an outline of our empirical methodology. Our findings are reported in Section 3. Section 4 concludes.

2. Data and Methodology, and Empirical estimates

As the Referendum date draws closer, the latest opinion polls suggest a very close race between the "Remain" and "Leave" camps.[2] It is likely that this uncertainty affects the share price of listed companies.

To test the impact of changing sentiment about the likelihood of Brexit on the returns of companies listed in the FTSE All-Share Index, we follow an empirical methodology in the spirit of Knight (2006). Specifically, we calculate abnormal returns and test whether changes in Brexit sentiment – as reflected in changes in the median odds on Brexit offered in betting markets – have a statistically significant (positive or negative) effect on these returns.

We use bookmakers' odds as a measure of Brexit sentiment, rather than polling data, for a number of reasons. First, daily data on the odds offered by a variety of bookmakers are readily available whereas polls are more infrequent.[3] Second, the betting market is very active. There are more than 25 bookmakers active in the Brexit odds market. Betting on the EU referendum has attracted significant amounts of money. By late May, just one of several bookmakers offering Brexit odds, Betfair, had received bets worth £13m, and industry representatives were predicting the Brexit market to surpass all previous UK political events.[4] Third, there is some evidence that betting markets have provided better predictions than the polls in the past, for example, in the case of the 2014 Scottish referendum – as discussed by Bell (2016) – and US elections (see Berg et al., 2001).

Figure 1 plots the evolution of the probability of Brexit implied in the Brexit odds offered by the median bookmaker, and the 25th and 75th percentiles of the distribution of bookmakers' odds. We use the 19 February 2016 as the start date for our analysis because it saw the conclusion of the EU Council summit that paved the way for the formal announcement of the EU referendum on 23 June 2016.[5] The figure highlights that there have been significant changes in Brexit sentiment over time, with the

[1] See YouGov.co.uk, 3 June 2016.
[2] See for instance the *Financial Times*' Brexit poll tracker at https://ig.ft.com/sites/brexit-polling/.
[3] We automatically retrieved odds once per day, at noon, during the period from 19 February 2016 until 13 June 2016 for all bookmakers from the website Oddschecker.com (with kind permission).
[4] See *Financial Times*, 20 May 2016.
[5] The EU Council summit on Friday 19 February resolved lingering uncertainty about the precise date of the EU referendum. Indeed, David Cameron announced the referendum date immediately after on Saturday 20 February 2016 (see BBC, 20 February 2016). Many bookmakers only began to offer EU-referendum bets on or shortly after 19 February.

odds-implied Brexit probability rising as high as 37% in mid-March, and falling as low as 20% in late May. It also shows very little evidence of "disagreement" between bookmakers, lending further credence to the notion of a deep and active betting market.

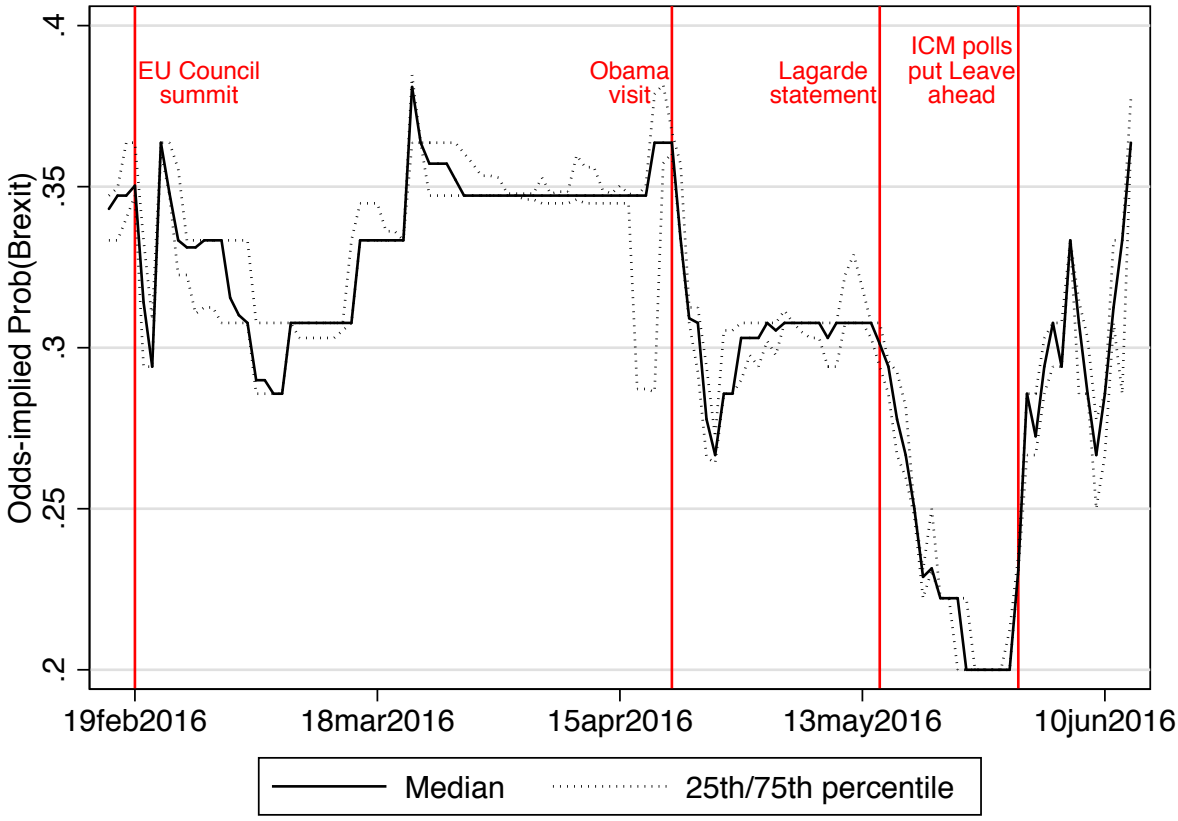


Figure 1: Evolution of odds-implied Brexit probability

Several events seem to have been associated with large changes in betting odds. First, the state visit of US President Barack Obama (which saw the President express unexpectedly forceful support for the UK's continued EU membership) on 21 April, was followed by a fall in the implied probability. Next, the formal statement by IMF Managing Director Christine Lagarde (which lent external support to estimates of the economic costs of Brexit by UK-based economists) on 15 May, was followed by a further fall to below 20%. Finally, on 31 May, when the ICM phone and online polls first documented a lead for "Leave", was followed by a large increase in the implied probability.

Although we focus on the probability of Brexit implied by the betting markets, the polls do tell a similar story. **Figure 2** plots the implied Brexit probability (calculated from the median odds) alongside a rolling two-week average of the difference between the "Leave" and "Remain" votes reported in

polls.[6] While the co-movement is far from perfect,[7] there is evidence that large movements in polls are accompanied by large changes in odds-implied Brexit sentiment.

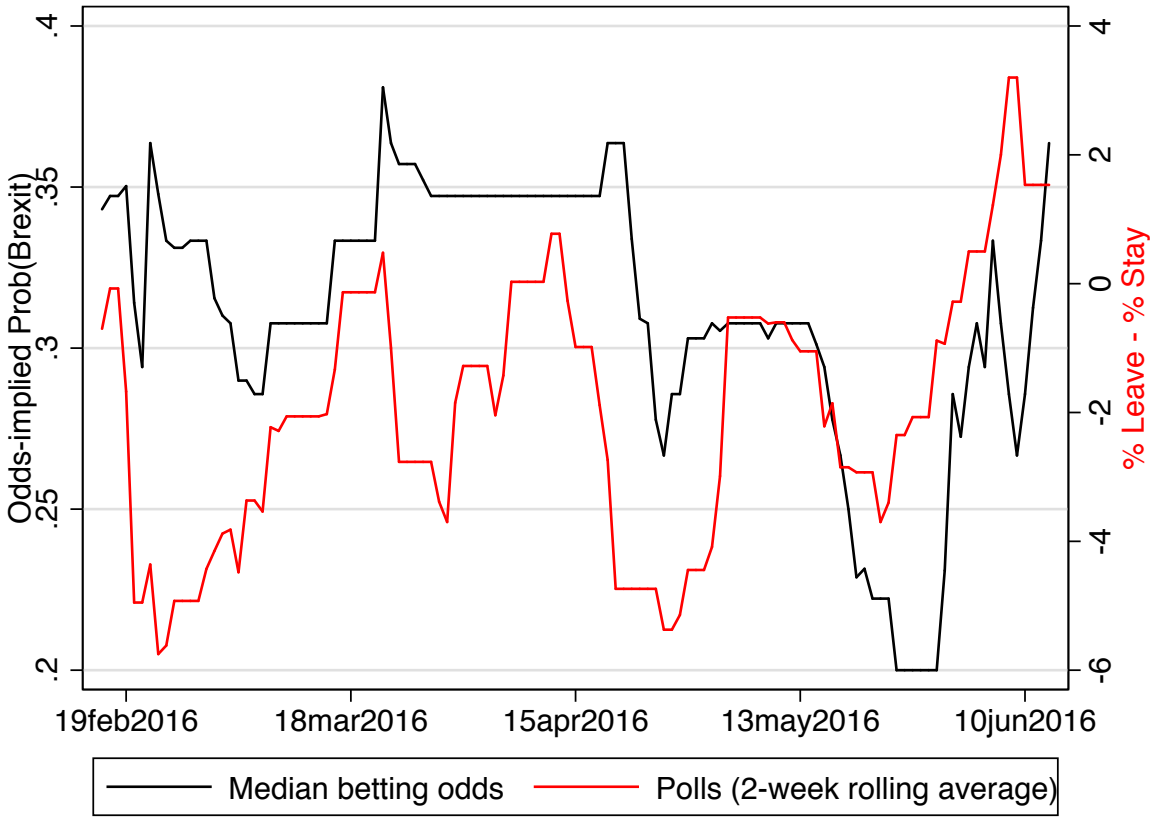


Figure 2: Odds-implied Brexit probability and polling data

To test for the association between companies' abnormal stock returns and changes in Brexit sentiment, we use Bloomberg data on equity prices – adjusted for dividends and stock splits – of UK companies listed in the FTSE All-Share Index. We calculate abnormal returns by estimating the market model

$$R_{it} = \alpha_i + \beta_i R_{Mt} + \varepsilon_{it}, \qquad (1)$$

where R_{it} is the daily return for company *i* on day *t*, R_{Mt} is the daily return on FTSE All-Share Index and ε_{it} is an error term. The model in (1) is estimated using daily data for the one-year period

[6] To construct this rolling average, we use the publication date of the respective polls and the difference between the reported "Leave" and "Remain" vote percentages (unadjusted for the "undecided" category), restricting ourselves to national polls with a sample size in excess of 1,000. Between 6 February and 13 June 2016, there were 57 such polls.

[7] The correlation of changes in the odds-implied Brexit probability with changes in the rolling average of the Leave-Stay margin from polls is .23.

preceding our "referendum start date" on 19 February 2016 (i.e. for 19 February 2015 until 18 February 2016). We then calculate daily abnormal returns in the period from 19 February to 13 June 2016 from the equation

$$R_{it}^{a} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{Mt}), \qquad (2)$$

where $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the ordinary least squares estimates of (1).

The abnormal returns, R_{it}^{a}, are then regressed on the change in the odds-implied Brexit probability:

$$R_{it}^{a} = \gamma_i + \delta_i \Delta \Pr(Brexit_t) + v_{it}, \qquad (3)$$

where $\Delta \Pr(Brexit_t)$ refers to the daily change in the implied probability of Brexit. To mitigate the risk of spurious statistical significance of the coefficients, we estimate regression (3) using heteroscedasticity and autocorrelation consistent (HAC), or robust, standard errors.

The results from regression (3) are reported and discussed in the next section.

3. Findings

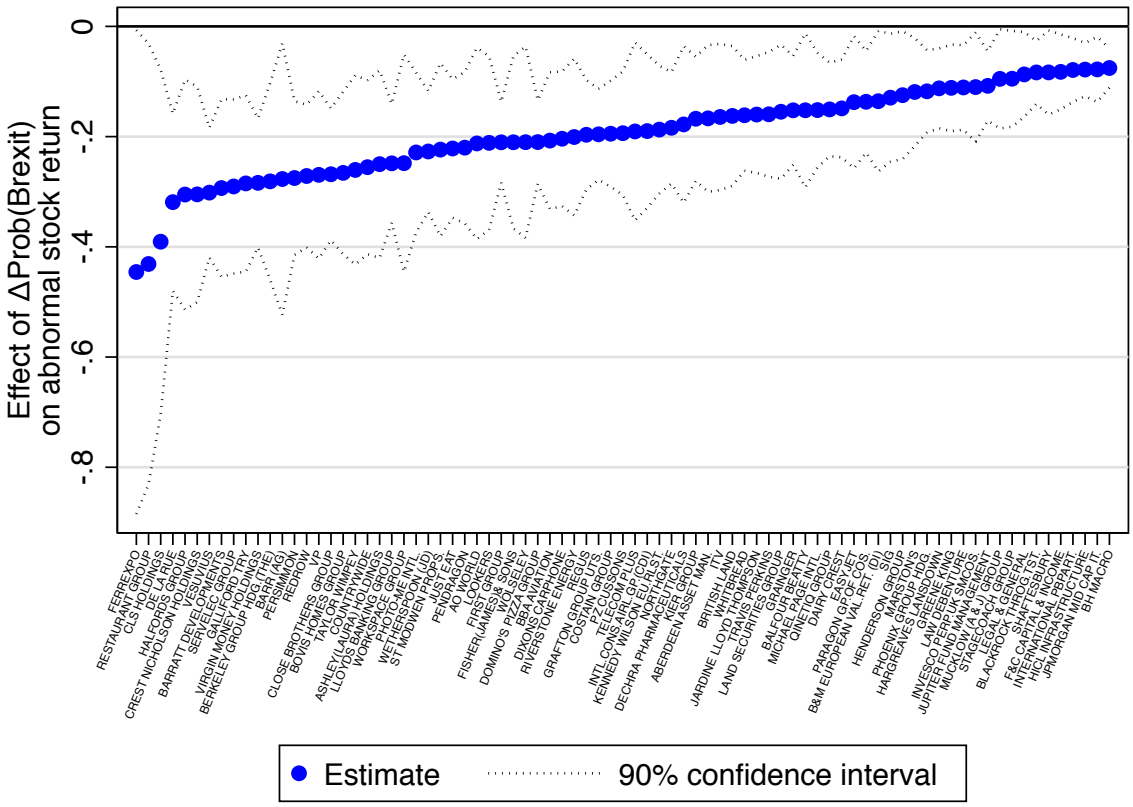
Figure 3 plots the OLS estimate of δ_i in (3), and 90% confidence bands, for companies found to be relative Brexit losers (negative δ_i estimate). We restrict our attention to companies whose abnormal returns display a statistically significant association with Brexit sentiment at the 90% confidence level, and whose δ_i remains statistically significant even if the first and last week of our sample period is dropped.[8] Using these criteria, our analysis puts 81 out of 618 companies from the FTSE All-Shares Index in the Brexit-loser category.[9] Similarly, **Figure 4** plots OLS estimates and 90% confidence bands for the 22 companies found to be relative Brexit winners (positive δ_i estimate) under the same criteria. A coefficient of -0.14 – as in the case of EasyJet – indicates that a percentage point daily increase in the Brexit probability is associated with a .14% decline in abnormal returns.

The figures show that there are nearly four times as many relative Brexit losers as winners.[10] The magnitude of the median δ_i in the losers group is also somewhat larger (at .19) than the magnitude of the median δ_i in the winners group (at .14).

[8] Since there were 77 stock market trading days between 19 February and 13 June 2016, dropping two weeks amounts to a 13% reduction in sample size.

[9] Our company sample is somewhat smaller than the actual constituency of the FTSE All-Share Index at any given point in time – 640 companies – because we only consider constituents that have been in the index continuously between 18 February 2015 and 13 June 2016.

[10] The finding that there significantly more Brexit losers than winners is robust to variations in the choice of confidence level and subsample criterion.



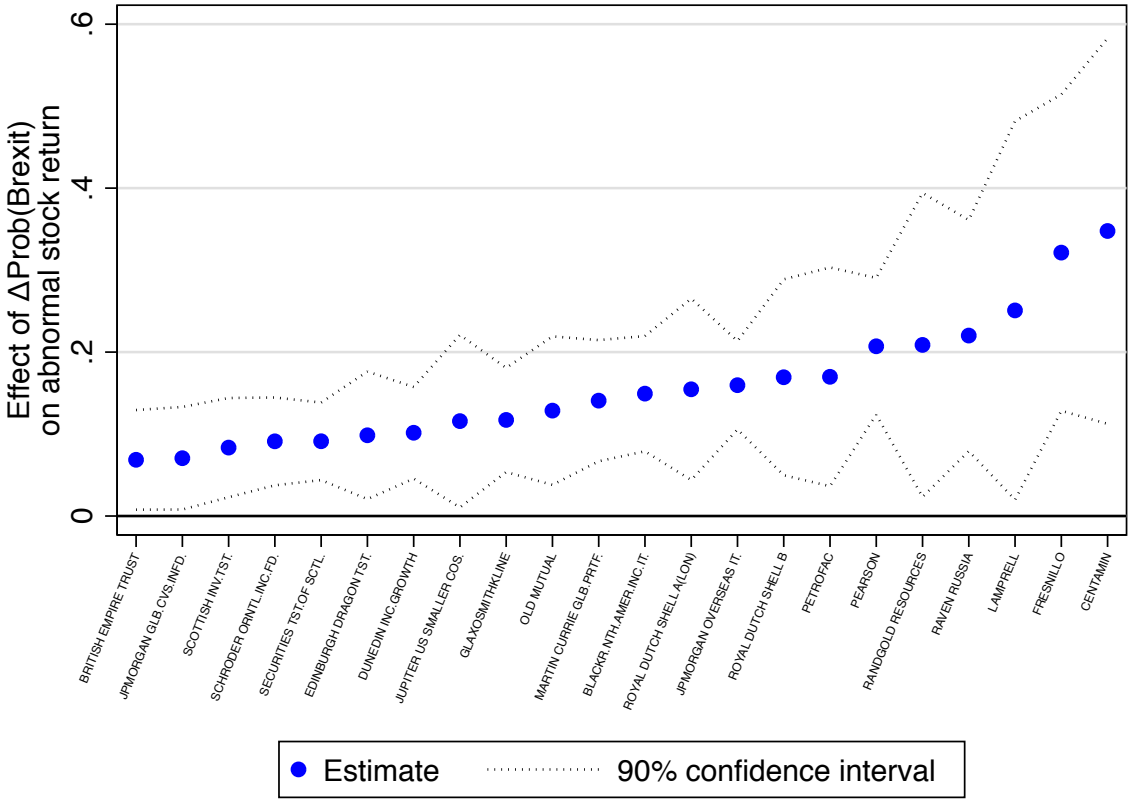


Figure 3 (above): Relative Brexit losers **Figure 4 (below): Relative Brexit winners**

To provide some rationale for the differing stock-market performance of the companies in Figure 3 and Figure 4 in the face of changing Brexit sentiment, we turn to data on company characteristics reported in the FAME database of UK and Irish companies produced by Bureau van Dijk (2016). The FAME database provides self-reported data on value of total sales, employment, primary business activity and major overseas markets for most companies in the FTSE All-Share Index.

Figure 5 documents the share of companies in each group reporting (a country in) each of four major world regions as a key overseas market. As expected, the portion of Brexit losers reporting countries in Europe as important overseas markets (28%) exceeds the portion of Brexit winners doing so (10%) by a factor of almost three. By contrast, a slightly larger share of Brexit winners appear to have major overseas interests in Asia and Africa (14% and 10%, respectively) compared with the group of Brexit losers (12% and 5%, respectively).

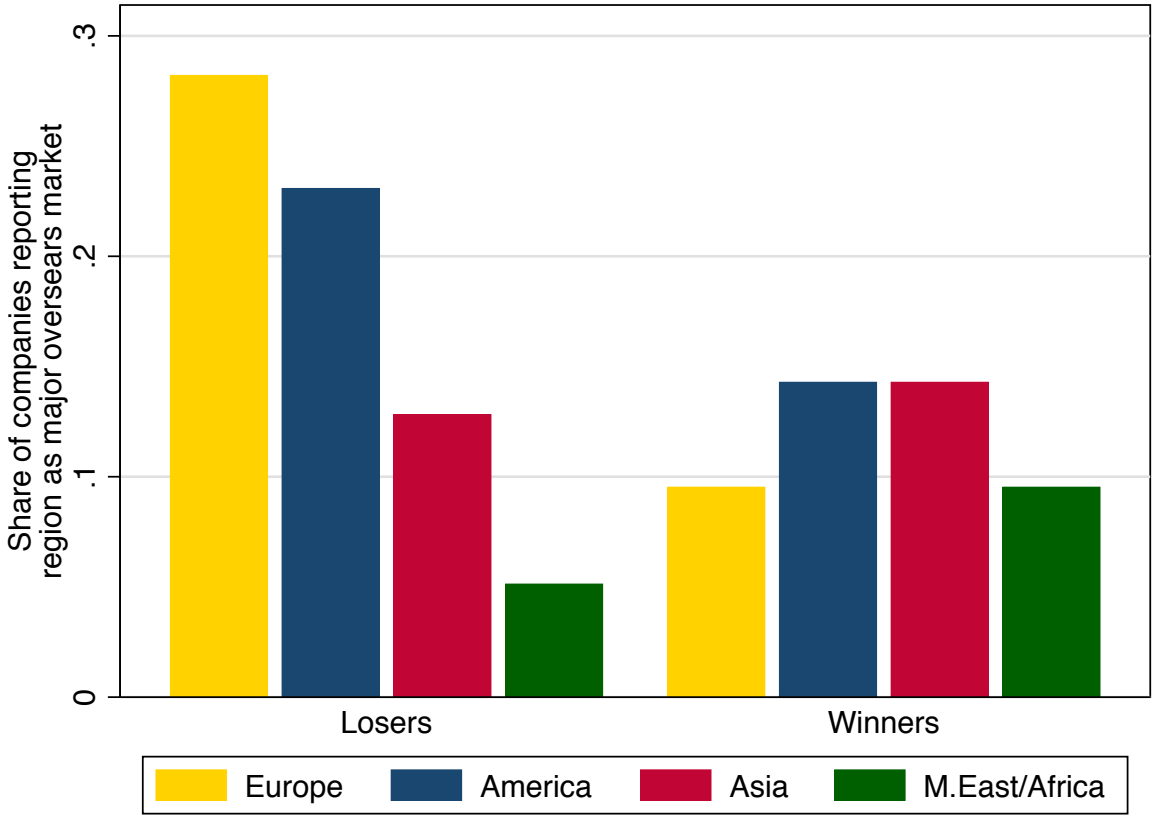


Figure 5: Major overseas markets of Brexit losers and winners

Figure 6 provides box plots of the size distribution of companies in both groups. Size is measured alternatively by the log average values of total sales in the 2011-2015 period, and the log average number of employees in the 2011-15 period. We observe that the median Brexit loser is somewhat larger than the median Brexit winner on either measure of size. However, there is significant

heterogeneity in sizes in the (small) group of relative Brexit winners: indeed, while the smallest Brexit winner is smaller than the smallest Brexit loser, the largest Brexit winner is also no smaller than the largest Brexit loser.

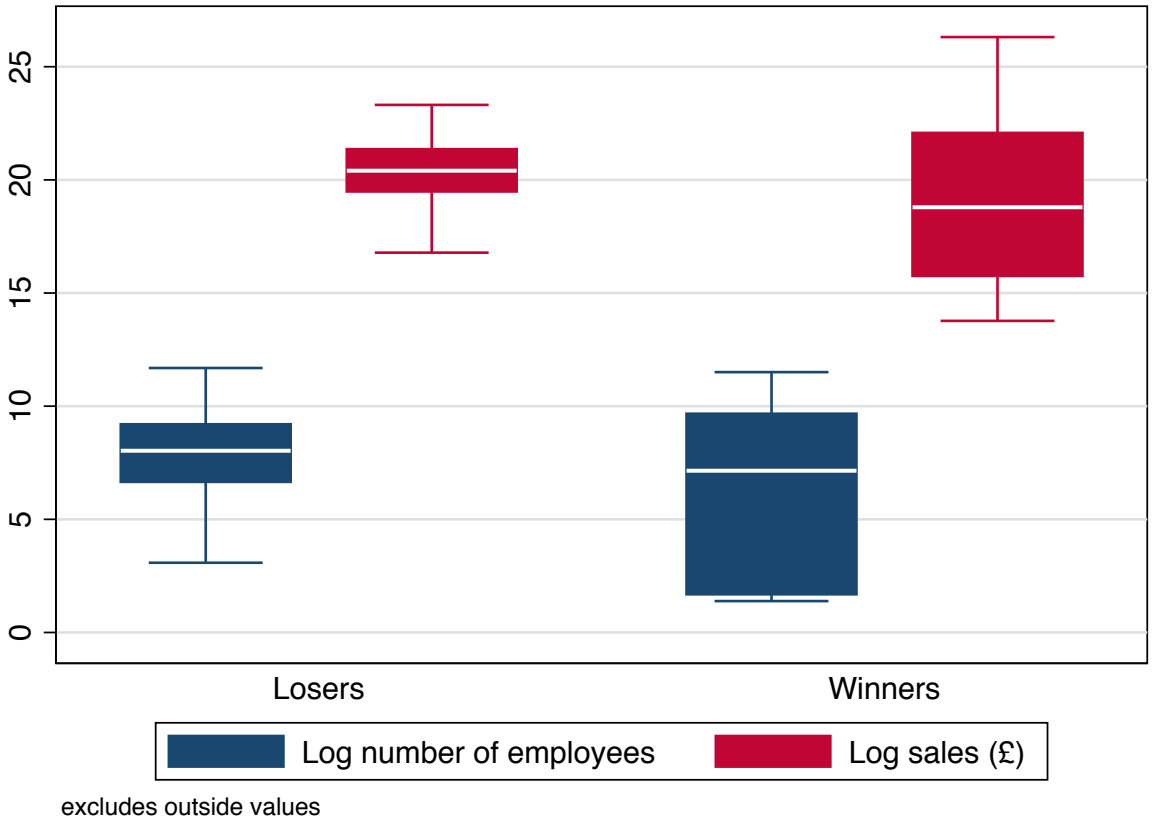


Figure 6: Size distribution of Brexit losers and winners

Figure 7 shows the areas of principal business activity for the Brexit losers and winners we have identified. The largest share of both sets of companies belongs the financial services sector (just over 30% among the relative Brexit losers, and nearly 60% among the relative Brexit winners). Of the 22 Brexit winners, 10 are investment funds that invest predominantly outside Europe (the exception is Dunedin Income Growth). Most of the remaining Brexit winners can be broadly placed in the mining and extraction sector (e.g., Royal Dutch Shell, Fresnillo, Centamin). The majority of the non-financial Brexit losers can be placed in the construction industry (e.g. Taylor Wimpey), hospitality services (e.g. Greene King) and transportation services (e.g. EasyJet).

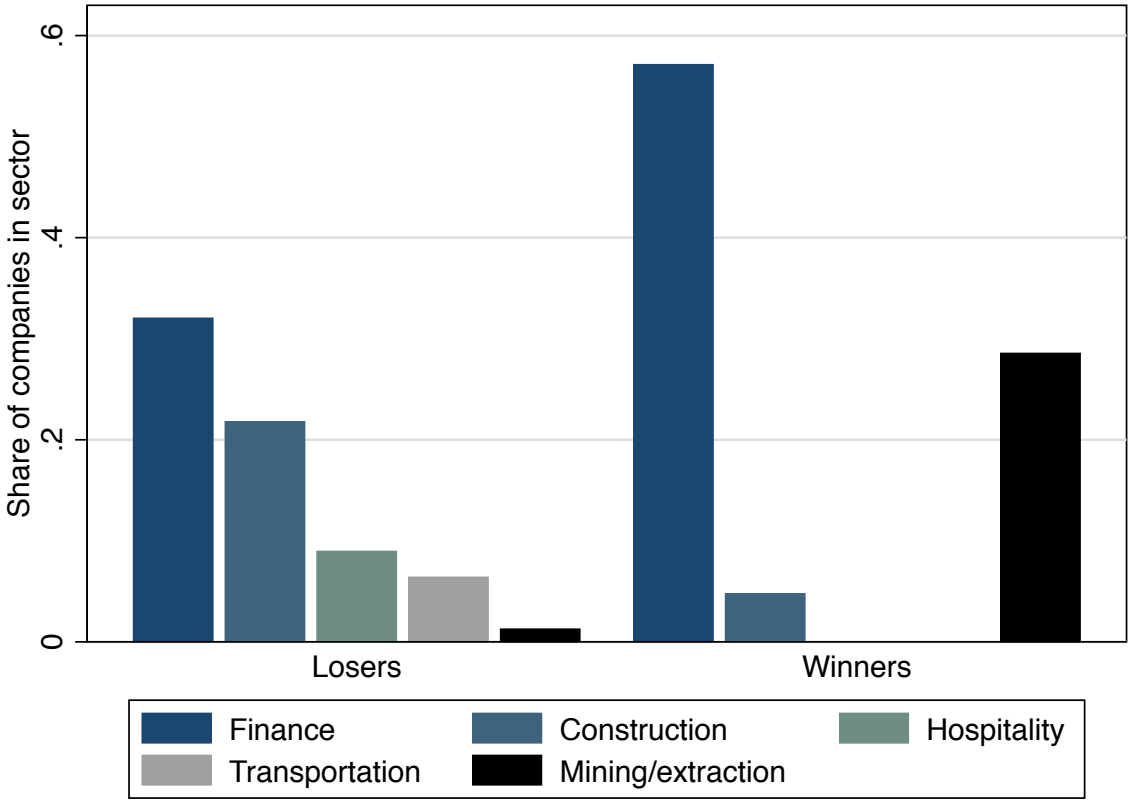


Figure 7: Business activities of Brexit losers and winners

4. Conclusions

There appears to be evidence that perceived increases in the probability of Brexit have a negative impact on the abnormal returns of some companies. In our sample, the abnormal returns of 81 out of 618 companies in the FTSE All-Share Index are negatively affected. As would be expected, a large share of these companies report Europe as an important overseas market, and are active in business areas likely to be adversely affected by the termination of the UK's EU membership (such as hospitality and transportation services).

Although there is some evidence that there are relative winners as well as relative losers from increases in the probability of Brexit, both the statistical evidence – and estimated impact – on the winners is much weaker.

It should be stressed that our focus on abnormal returns only allows us to assess the effect of changes in Brexit sentiment on the performance of companies *relative* to the market as a whole. Whether companies can be classified as Brexit losers or winners in an *absolute* sense depends on the effect of the perceived likelihood of Brexit on the overall stock market, which our methodology does not allow us to predict.

Both the HM Treasury and the IMF have warned that a Brexit vote could have adverse effects on equity prices and increase the equity-price premium in the short run.[11] Although our analysis does not address this question, it does suggest that any impact on stocks will not be uniform and gives an indication of which companies are more likely to be affected. It will be interesting to study the behaviour of returns in the period after the referendum, irrespective of the outcome of the vote.

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[11] See HM Treasury, 23 May 2016 and IMF, 17 June 2016.