

Political Uncertainty on the UK Real Estate market, evidence from the Brexit referendum run-up

Bachelor Thesis in Finance
Stockholm School of Economics



ABSTRACT

Uncertainty on the political front, has in recent years been a major cause to impediment in investment and growth. In contrast to other core asset classes, like equities and bonds, the effects of political risks and uncertainty on the real estate market remain unexplored. This thesis aims to fill this gap, by studying the link between political uncertainty derived from opinion polls on publicly traded real estate firms listed on the London Stock Exchange, in the Brexit referendum run-up. Using cross-sectional regression for polls published between January 2013 and June 2016, we find evidence that the share of leaving votes had a significant relationship with returns on the real estate market, observing large negative abnormal returns relative to the market when the share of leave votes increased in our sample. The results can be used by decision makers to understand the property stock market in connection to political events.

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Keywords

Real Estate Finance, Brexit Referendum, Property stocks, Poll Results, Political Uncertainty.

Date

May 15, 2017

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Introduction

“Ask any finance minister or central banker about leading risks to the global economy and you’ll get one giant worry from everyone: politics.”

Ian Talley in Wall Street Journal (October 10, 2016)

This study will examine the effect of new information about the United Kingdom European Union membership referendum (Brexit referendum) on real estate stock prices, in the referendum run-up. Real estate as an asset class, is often used for diversification by investors due to its low correlation with other core asset classes. International real estate investors value aspects of political stability, regulation, sound financial and economic structure, and the economy’s strength and stability when making investment decisions (Lieser and Groh, 2014). However, the ability to interpret the effects of political information on financial markets is suppressed by the lack of theoretical guidance. Asset pricing models that respond to political news are largely missing from mainstream finance theory. With the help of this study, it might be possible to make predictions of the impact on publicly traded real estate in other countries, with similar political conditions as the UK. Since real estate represents a majority of the real capital stock in the economy, it is relevant both as protection against inflation and as a guarantee for financing. Changes in real estate and rental prices have direct impact on peoples’ wealth and consumer spending, therefore playing an important role for economic stability, making the real estate market relevant to analyze in a political setting. The research questions this thesis aims to answer are:

1. *How was the risk of Brexit priced into real estate stocks compared to the overall stock market?*
2. *Does the pricing of Brexit risk change closer to the referendum?*

Looking back to the times prior to the referendum vote, based on opinion polls, the odds of the UK leaving the European Union were too close to call. During this time, there were huge price swings on the London Stock Exchange (LSE), making it particularly interesting to study if real estate stocks were affected in the same way as the overall stock market. The study examines the market reaction to new information prior to the referendum vote, using poll results published in media. It is fair to assume that the polls were common knowledge, since they were reported by every major news channel within the EU.

Previous literature, Smales (2016), has examined implied volatility on the FTSE100 Index using Brexit poll results, finding positive correlation between implied volatility and the percentage share of leave votes in the opinion polls. Hill *et al.* (2016) have measured the

political uncertainty exposure of individual companies on the LSE by using data on bookmakers' odds for the referendum outcome, finding negative correlation between the stock market and their measure of political uncertainty. Neither of these studies has investigated the impact of pre-referendum uncertainty on the real estate market. This research aims to fill this gap.

The analysis mainly focuses on cross-sectional regression, using FTSE UK EPRA/NAREIT Index as measure for the property market. This is a weighted index of 36 mid- and small cap real estate companies, which incorporates UK-listed Real Estate Investment Trusts (REITs)¹ and Real Estate Holding and Development companies. By using cumulative abnormal return of the reference index, benchmarked against the UK stock market (FTSE All Share Index), we analyze how the real estate sector was affected in comparison to the general market. The definition of political uncertainty in this study is similar to that of Pástor and Veronesi (2012) namely, there is uncertainty about what the government is going to do, as well as what the effect of its action is going to be. This conception of uncertainty fits the UK referendum well since Brexit, in addition to leaving the European Union (EU), was associated with a possible exclusion from the European Economic Area, requiring major policy changes in the years to come. The measure for political uncertainty used is a ratio, calculated as the share of leaving votes divided by the share of remain votes, for each individual poll in the sample. By using this ratio, it is possible to overlook the share of undecided voters, a similar method to Smales (2016). The poll data is retrieved from the Financial Times "Brexit poll tracker", summarizing available information from different data sources for the period between January 2013 until the day prior the voting in June 2016. Polls posted on weekends and holidays are accounted for by affecting the next trading day.

The main finding suggests that there is a highly significant negative correlation between the abnormal returns for real estate stocks and our risk ratio. The negative correlation can be explained by the increase in political uncertainty, arising from an increased probability of a Brexit outcome. This concludes that the uncertainty about the referendum outcome had an evident effect on the publicly traded real estate market, and was priced and accounted for as a

¹ A real estate investment trust is a publicly traded real estate company that owns and may manage investment-grade commercial or residential real estate. REITs provide investors with a liquid and cost efficient way to earn the investment returns typically available from direct real estate investment. To qualify as a REIT, a real estate company must satisfy certain requirements set forth by UK legislation, including the distribution each year to its shareholders of at least 90% of its taxable income. In return for distributing most or all of its taxable income, the company pays no corporate tax on the distributed income. Rather, the tax liability is paid at the individual shareholder level.

risk factor. Our model predicts that the in general very stable real estate sector, is expected to react stronger than the general market to an increased likelihood of a Brexit, due to potentially hazardous changes in demographics that have historically driven the market development. The findings also conclude that the market reacted more strongly to new information about the public opinion of the matter, after the referendum date was set in February 2016. During this time, more polls were published, increasing the awareness about the close call, which raised uncertainty regarding future growth and value projections for the real estate companies, affecting their stock prices.

The structure of the thesis is organized into five parts. First, a review of the existent literature relevant to our work is presented, second, the methodology and data, followed by the empirical model. Further, the results are discussed along with directions for further research, and at last, the paper concludes with a summary of findings and theoretical implications.

Background

Uncertainty on the political front, has in recent years been a major cause to impediment in investment and growth. Opposition towards globalization and radical political parties entering all levels of government in Europe, driving domestically focused agendas has fueled uncertainty in both the real economy and financial markets. Ambiguity to the future of government policy contributes to irresolution in investment decisions. The impact can be either in the growth expectations of future returns or changes in fiscal policy directly impacting the cost of capital.

Brexit

The United Kingdom European Union membership referendum also known as the Brexit referendum took place the 23rd of June 2016, to determine the public opinion for the country, either remaining a member of, or leaving the European Union (EU). The question put to voters was “Should the United Kingdom remain a member of the European Union or leave the European Union?”. The result was 51.9% voting for leaving the EU against 48.1% wanting to remain part of the union; the voter turnout was 72.2% of the 46.5 million registered voters. Interestingly, voter turnout was highly correlated with age, where 64% of registered voters aged 18-24 voted, compared to 80% of voters aged 65-74 (see Table 1)². Other voting trends in the referendum was that older voters were more likely to support leaving the EU, women were

² 'How Britain voted in the 2016 EU Referendum', Ipsos MORI (2016)

more pro EU than males, and voters with a university degree were more likely to vote for remaining than those not holding a degree.³

Table 1. Vote statistics by demographic groups.

Brexit Voting by Group			
Group	Remain %	Leave %	Turnout %
Gender			
Male	45	<u>55</u>	74
Female	<u>51</u>	49	71
Educational level			
No qualification	30	<u>70</u>	70
Other qualification	44	<u>56</u>	71
Degree or higher	<u>68</u>	32	78
Age			
18-24	<u>75</u>	25	64
25-34	<u>60</u>	40	68
35-44	<u>55</u>	45	71
45-54	44	<u>56</u>	73
55-64	39	<u>61</u>	78
65-74	34	<u>66</u>	80
75+	37	<u>63</u>	70

Underlined numbers denote the majority opinion within each demographic group.

Turnout %, describes the share among registered voters that was estimated to vote.

Ipsos MORI "How Britain voted in the 2016 EU Referendum" (Sep 2016)

Immediately after the referendum result was announced, Prime minister David Cameron, having campaigned for the country to remain a member of the EU, announced his resignation. Financial markets reacted strongly the day after the referendum, resulting in a wipeout of \$2 trillion dollars of market equity, making it the worst ever single day loss in absolute terms, beating the previous record from September 2008.⁴ The result sent the pound trembling, hitting a 31-year low against the dollar when the markets opened.⁵ It is also notable that in the time around the referendum the news-based UK economic policy uncertainty index⁶ of Baker *et al.* (2016) spiked, reaching an all-time-high of 1142 points in July 2016, exceeding levels during the 2007-2008 financial crisis and the 2011-2012 Eurozone sovereign debt crisis.

³ Burn-Murdoch, J. 'The demographics that drove Brexit', *Financial Times* (June 2016)

⁴ Javier E. D., 'Brexit cost investors 2 trillion, the worst one day drop ever', *CNBC*, (June 2016)

⁵ McGeever J., Graham P. 'UK markets shudder after Brexit vote, sterling hits 31-year low', *Reuters* (June 2016)

⁶ Baker, S. R., Bloom, N. and Davis, S. J., 'Economic Policy Uncertainty Index'

UK Real estate market

The UK real estate market is the largest in Europe, with characteristics that has made it an attractive investment option. The total value of the market is estimated around £6.25 trillion of which 14% (£871 billion) is classified as commercial properties and 86% (£5.375 billion) is residential properties. Property held as investment accounts for 50% of the commercial property market, where the largest investor groups are listed property companies and collective investment schemes, overseas investors, traditional institutional investors, and private real estate companies respectively holding 31%, 28%, 17% and 12% of investment properties⁷. The value of London's commercial property stock, accounting for 38% of the UK total, has increased quickly, driven to a large extent by the increase in overseas investors that in 2015 had 77% of their UK holdings in London. International investors are attracted to UK due to its political stability, robust legal system, high-quality assets offering good long-term return opportunities, and relatively benign tax environment. Overseas investors dominate the City office market, owning 61% of investment properties, along with 39% of investment property located in West End and Midtown. These markets as well as London hotels, and retail in central London, top the charts for international ownership. Hence, they are potentially the most exposed to any change in foreign investor sentiment, that might arise as consequence of leaving the EU.

The real estate market outlook has been strongly favored by the demographic processes taking place in the UK. Data from the World Bank⁸ shows that the UK has one of the fastest population growths on the continent. In numbers that translates to an annual population growth of more than 500,000 people or 0.8% of the population, highly fueled by immigration. Stably growing demand for housing in combination with a lingering construction supply, has led to high long term profitability of real estate investments. According to a rapport by IPF research⁹, the housing supply has grown by 0.5% per annum while commercial floor space has only increased on average by 0.09% per annum, since 2006.

Political uncertainty from a possible Brexit, resulting in crackdowns on immigration and changes to public policy, could severely impact the underlying demographics that have previously acted in favor of holding UK property. In contrast to other core asset classes like equities and bonds, the effects of political risks and uncertainty on the real estate market remains fairly unexplored. That real estate in the UK is a top investment choice for many investors, making the topic of the thesis relevant and attractive with significant real life implications.

⁷ 'The Size and Structure of the UK Property Market: End-2015 Update', *IPF Research* (2016)

⁸ 'Population Data', *Worldbank Database*

⁹ 'The Size and Structure of the UK Property Market: End-2015 Update', *IPF Research* (2016)

Previous Literature

The relationship between political uncertainty and financial markets has received moderate attention in previous research, (see Tables 2 and 3). The findings are unambiguous in indicating that political uncertainty increases market volatility and reduces growth as well as economic activity.

Few studies have examined cross-sectional variation due to risks related to political uncertainty outside the normal election cycle. This study complements previous research of Hill *et al.* (2016), where the authors have examined the Brexit referendum looking at the probability of a leave vote implied by bookmakers' odds in the referendum run-up and its impact on individual companies. Their study focuses on operational companies excluding certain sectors like, Real Estate Investment and Services, Real Estate Investment Trusts (REITs) and investment companies, while this study mainly focuses on the political uncertainty exposure of REITs and real estate companies. The authors have used cross-sectional regressions and found a negative correlation between the probability of a leave vote and stock prices on the LSE. They also found that large and fast-growing firms were the ones most exposed to political uncertainty, while having a sizeable proportion of foreign sales and foreign assets had a moderating effect. Similarly, Smiles (2016) has by using poll results in the Brexit referendum run-up found evidence of a positive and well defined relationship between political and financial market uncertainty. The implied volatility in UK markets rise as uncertainty about the referendum outcome increases. In contrast, Acker and Duck (2015) examine the impact of the Scottish independence referendum on a broad base of 367 UK stocks, using 26 poll results as well as betting odds, to explore cross-sectional variation in the risk exposure. This study differs from theirs by using a considerably larger sample of 252 polls and a narrower focus on only real estate companies. In addition, limited exposure to Scotland of large and multinational FTSE100 and FTSE250 companies restricts descriptive power of their study.

This research also relates to the work of Pástor and Veronesi (2012), who in their model analyze how changes in government policy affect stock prices. The authors define two categories of uncertainty: political uncertainty, relating to uncertainty about whether the current government policy will change and impact uncertainty, that corresponds to uncertainty about the impact a new government policy will have on private sector profitability. In other words, there is uncertainty about what the government is going to do, as well as uncertainty about what the effect of its action is going to be. The authors find evidence that on average stock prices should fall upon the announcement of changes in policy, and the magnitude should be large if uncertainty about the future is large. This study provides further evidence of this. Pástor and

Veronesi's conception of uncertainty fits the UK referendum well since Brexit in addition to leaving the European Union (EU), was associated with a possible exclusion from the European Economic Area, requiring major policy changes in the years to come. Pástor and Veronesi (2013) show, using the political uncertainty index of Baker *et al.* (2016) that political uncertainty commands a risk premium. They also find that it makes stocks more volatile and correlated, especially when the economy is weak. In the model, investors react to the flow of political news and update their beliefs about the likelihood of the adoption of various government policies in the future.

That shocks in political uncertainty have a negative impact on the real economy, mainly lags in growth and firm activity due to firms temporarily pausing investment and hiring, has been demonstrated by Bloom (2009). Other studies that have focused on the effect of political uncertainty of stocks include Brogaard and Detzel (2015), who have used the news based policy uncertainty index of Baker *et al.* (2016) to measure political risk, and document a negative correlation between market returns in the US and changes in the policy uncertainty index. The findings also suggest that economic policy uncertainty is an independent and priced risk factor.

Belo *et al.* (2013) have linked cross sections of stock returns to government spending exposure of different industries. Their main finding is that during Democratic presidential terms, firms in industries with high government exposure are found to significantly outperform firms in industries with low government exposure but underperform during Republican presidential terms.

Pantazis *et al.* (2000) have investigated the index returns in 33 countries around political elections, finding positive abnormal returns in the two weeks preceding national elections, the positive abnormal returns are found to be strongest when the degree of uncertainty is high, in contrast to the results in this study.

This thesis is also related to empirical studies on market volatility around electoral periods. Białkowski *et al.* (2008) using a sample of 27 countries have found that stock market returns show considerably higher volatility during election periods. Three studies have analyzed volatility around elections by looking at option markets. Kelly *et al.* (2016) have analyzed option markets around national elections and global summits by looking at three option market variables: the implied volatility, the slope of the function relating implied volatility to moneyness, and the variance risk premium. Their model implies that all three variables should be larger, than the same variables calculated for options whose lives do not span a political event. Gemmill (1992) examines the British parliamentary election 1987 and identifies a close relationship between opinion polls and the implied volatility on the FTSE 100 Index in the

weeks before the election. Goodell and Vähämaa (2013) use a sample spanning five US presidential election cycles finding that the implied volatility of the S&P 500 index is related to the outcome of a US presidential election. Further, Anoruo and Murthy (2016) have examined the relationship between the VIX and REIT returns in the US, showing that implied volatility and REIT returns have a significantly negative effect on each other in the low-, medium- and long-term frequencies. Their findings indicate that causality runs from implied volatility to REIT returns in the short- and medium-term frequencies.

Summary of related literature

Table 2. Prior studies using cross-sectional regressions

Study	Proxy for market or sector	Measure of political uncertainty/ other independent variable	Country investigated	Period
Hill. <i>et al.</i> (2016)	Individual listed UK companies	Bookmakers' odds for Brexit	UK	February-June 2016
Smales (2016)	Implied volatility on FTSE100 and DAX	FT Brexit poll tracker	UK	January 2013-June 2016
Kelly <i>et al.</i> (2016)	Option market variables: implied volatility, slope of function relating implied volatility to moneyless, and the variance risk premium	Data on 271 political events like National elections and global summits	20 countries	January 1990-June 2012
Anoruo & Murthy (2016)	REIT returns (all, equity and mortgage)	Implied volatility (the VIX)	US	January 1994-May 2014
Acker & Duck (2015)	367 stocks from several sectors. FTSE 100, FTSE 250 and 17 firms that appear in Marsh and Evans' (2014) Scotsie index.	Bookmakers' odds for Scottish independence	UK	July-September 2014
Pastor & Veronesi (2013)	Realized future excess market returns. (Cumulative return on the value-weighted market portfolio subtracting the cumulative return on the one-month T-bill)	Baker <i>et al.</i> Economic policy uncertainty index (divided by 100).	US	Jan 1985-Dec 2010
Goodell & Vähämaa (2013)	VIX volatility index (Implied volatility of S&P 500 Index)	Monthly data on the IEM presidential contracts (Five US presidential election cycles)	US	Feb 1992-November 2008
Lieser & Groh (2013)	Raw data sample (economic activity, economic size, GDP/capita, real GDP, Inflation, etc.)	Cushman & Wakefield data on the international real estate activity	47 countries	January 2000-January 2009
Brogaard and Detzel (2015)	25 Fama–French portfolios formed on size and momentum returns as test assets.	Baker <i>et al.</i> Economic policy uncertainty index	US	1985-2012

Table 3. Other related studies

Study	Proxy for market or sector	Measure of political uncertainty/ other independent variable	Country investigated	Period	Method used
Baker <i>et al.</i> (2016)	Individual firm data, VIX, macroeconomic data.	Newspaper coverage frequency	12 major economies	1900-Present	Creating an own political uncertainty index
Florin & Magito (2014)	OMX Stockholm	Sold multi-dwelling and commercial buildings and sold manufacturers industries	Sweden	January 1994-December 2013	Engle-Granger 2-step method and Grenger Causality test
Pastor & Veronesi (2012)	Stock prices (simulated)	Impact uncertainty and political uncertainty based on government policy	Theoretical	Randomized	Asset price model
Bloom (2009)	A range of VARs on monthly data like log(S&P500), log(consumer price index), log(employment), etc.	Impact of major uncertainty shocks	US	June 1962-June 2008	Model with a time varying second moment of the driving process
Białkowski <i>et al.</i> (2008)	The US dollar denominate MSCI Country Indices, & MSCI World Index	134 elections	27 OECD countries	January 1980 - November 2004	Volatility event-study
Pantzalis <i>et al.</i> (1999)	Weekly stock return data and economic performance measures for individual country indices using MSCI Index.	Political election dates during the sample period	33 countries	January 1974-January 1995	Event-study
Gemmill (1992)	FTSE 100 Index	Opinion Polls from British parliamentary election 1987	UK	April 1987-June 1987	Binomial option pricing model

Data & Methodology

This section will present the main data used in the study and the reasons for using it. All the data is secondary sourced either from Thomson Reuters Datastream, EPRA or the Financial Times. The FTSE UK EPRA/NAREIT Index is used as a proxy for the UK real estate market. The measure for political uncertainty used is a ratio, calculated as the share of leaving votes divided by the share of remain votes, for each poll in the sample.

The FTSE UK EPRA/NAREIT Index

The UK EPRA/NAREIT Index, launched by FTSE Russell in 2005, is a value-weighted index of 36 UK-listed Real Estate Investment Trusts (REITs) and Real Estate Holding and Development companies. It is a subset of the FTSE EPRA/NAREIT Developed Index, designed to track the performance of real estate companies and REITs listed on the LSE. The European Public Real Estate Association (EPRA) and the National Association of Real Estate Investment Trusts® (NAREIT) are interest groups that aim to promote, develop, and represent the publicly traded real estate sector. The index is based on both real time and end-of-day prices using price and total return methodologies, but only end-of-day prices are used in our model. The index returns are retrieved from the EPRA website¹⁰.

All companies included in the index are classified as mid- or small cap companies, having a low dependence on foreign markets. In total, 91% of the real estate value covered is invested in UK properties. The two largest companies are Land Securities Group and British Land Co, summing to a 24% weight in the total index.

Real estate investments, having a low correlation with other asset returns are used to provide investors with diversification¹¹, which is why we believe our sample might be affected differently compared to other individual companies studied by Hill *et al.* (2016).

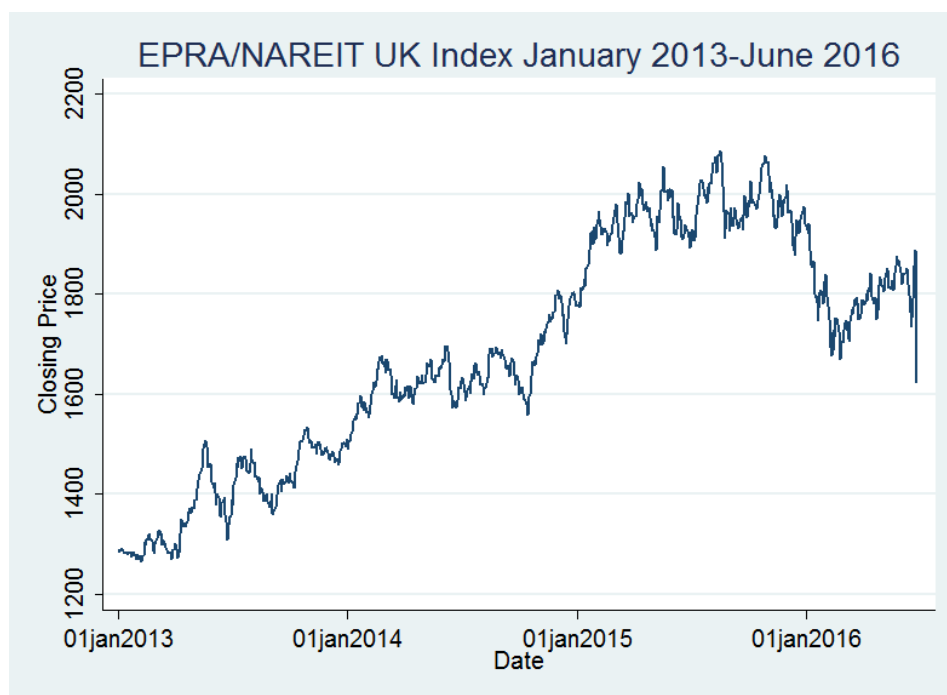
Based on the details above we believe that the index will give us a good proxy for the publicly traded real estate market in the UK. The decision to use only publicly traded real estate in the analysis is due to the fast adaptability to the latest information, in comparison to the private market, where information processing is much slower and prices are affected with considerable lag. Research by Hoesli and Oikarinen (2012) for the UK and US markets, suggest that in the long-run, REIT market performance is better resembled by direct real estate investments than the stock market. Consequently, using publicly traded REITs should offer some indications for the private real estate market as well.

¹⁰ 'Data on FTSE UK EPRA/NAREIT Index', *EPRA's official website*

¹¹ 'Real Estate as an Asset Class', *Credit Suisse* (October 2014).

The property sectors covered include; Health Care, Industrial, Office, Residential, Retail and Self-Storage. Though, the two largest companies have a high weight of 28,57% and might therefore have substantial effect on the results. In order to control for the weight effect, we have created three equally weighted indexes; one with all individual companies included in the index, another with 14 related companies, and the third one with both the individual and the related companies. Additional information about the companies included in the analysis is found in Tables 1A & 2A in Appendix A. Data for each company is collected from Thomson Reuters Datastream.

Graph 1. FTSE UK EPRA/NAREIT Index price over time



Graph 1 gives an overview of the historical development for the FTSE UK EPRA/NAREIT Index during the period of interest. The day after the referendum, the 24th of June 2016, the index dropped -14%, from 1889.06 the 23rd of June to 1623.08 the 24th, which is a huge decrease compared to the FTSE All Share only dropping 3.8%. The one day drop, is the biggest ever observed for the index, which is why it's interesting to analyze whether the Brexit risk was accounted for in the prices of indexed stocks before the referendum.

The poll results

To approximate political uncertainty prior to the UK referendum, this study suggests that opinion poll results are a stronger source than using bookmakers' odds and Bakers Political Uncertainty Index. The decision that a referendum would take place was announced in the beginning of 2013¹², which is the starting period of interest. Opinion polls can be retrieved for a longer period than bookmakers' odds, making it more convenient to use the longer time frame offered by using opinion polls in the analysis. Bakers Political Uncertainty Index is based on newspaper coverage, which in many ways would misguide the analysis, when other events occur during the period of relevance, and the index levels are highest just before and after events occur, not properly picturing the effect of additional information in the run-up to an event.

The data on opinion polls is retrieved from the Financial Times website, based on Financial Times "Brexit poll tracker" containing information from 252 polls between 1st of January 2013 and 22nd of June 2016, from 15 different pollsters compiled by FT Research¹³. The data is collected through both online and telephone polling. Sample sizes range from 500 observations up to 20,058 observations per individual poll, which is why we assume a larger sample poll to have a greater effect on the public opinion and is more likely to get headline attention. Polls published on weekends or holidays are accounted for the next trading day, while polls published on the same day are pooled together, weighted on sample size.

The share of undecided voters is significant throughout the sample, ranging from a highest of 40% in 2013 gradually decreasing closer to the referendum, averaging 15% for the entire sample. For more details about the poll data see Table 3A in Appendix B. To deal with the share of undecided voters in our data we have calculated a ratio based on the percentage of responders supporting leaving the EU, divided by the percentage of respondents wanting to remain members of the EU¹⁴, an estimation method similar to Smales (2016). A ratio of 1.0 indicates that there is an equal share of leave and remain voters. Due to restrictions of the sample it has not been possible to assign weights to demographic groups to account for the actual likeliness of the responders to vote.

¹² 'EU referendum timeline: Countdown to the vote', (20 February 2016) *BBC News UK Politics*

¹³ 'Brexit Poll Tracking', *Financial Times Research*

¹⁴ $L/R = (\%Leave / \%Remain)$

Additional variables

The model controls for a range of macroeconomic factors to take up noise related to construction, political dissatisfaction, and exchange rate. In the main regressions controls for the UK 10-year zero coupon government bond yield, the UK unemployment rate, change in new house building and trade-weighted exchange rate are included. All variables used for control are sourced from Thomson Reuters Datastream.

Since some of the data is only released on a monthly or quarterly basis we assume that that they follow a linear trend. This assumption allows us to smooth out the changes over the intervals between observations. In the main model the variables “Change in house building started” and “Change in unemployment” are smoothened out to daily observations, and the day-to-day change is included in our model. Daily changes for all control variables, besides the 10-year zero coupon bond yield, are calculated by the following formula:

$$\text{Change in } x_t = \frac{x_t}{x_{t-1}} - 1$$

The UK 10-year zero coupon government bond yield is reported daily and is included to proxy the risk-free rate of interest in the economy. A low bond yield implies, cheap debt and a lower cost of capital for investments in fixed assets. A high bond yield makes debt more expensive increasing the cost of capital, having a negative effect on returns. The prediction is therefore that a higher bond yield will have a negative relationship with the property market.

UK unemployment rate is reported monthly and is included to capture political dissatisfaction, driving the leave campaign. The variable is assumed to be negatively correlated with the market as it is closely related to political uncertainty

The amount of UK house building started uses monthly data from the Department for Communities and Local Government, with every new apartment or family house counted as one unit. The variable is used to account for new construction of real estate, increasing the housing supply and thereby decreasing the value of current property, why it is predicted to be negatively correlated with the property market.

The trade-weighted exchange rate is reported monthly by the Bank of England and is the closest equivalent of a real exchange rate, displaying the competitiveness of Sterling nominated assets against foreign assets, weighted on the level of trade between the currencies. The model includes exchange rate fluctuation to account for changes in capital flows motivated by exchange rate changes. International investors are one of the main investor groups, making it an important factor to account for. The assumption is that a high exchange rate will negatively

impact the index returns compared to the overall market, as the real estate market has a comparatively high portion of international investors.

The cumulative abnormal return (CAR)

The variable “CAR” or “Cumulative Abnormal Return on FTSE UK EPRA/NAREIT Index”, described in row 2, Table 4, is based on the difference between the predicted and real return of the index for each day (see Eq. (3)), summing up the previous daily returns with the current date, for each trading day (see Eq. (4)). The reason for using CAR is that it gives a good reference of how the index performs in comparison with the market over time.

The formula for CAR is expressed below in the Eq. (1) - (4):

$$(1) \text{ Real return}_t = \frac{\text{Closing Price}_t}{\text{Closing Price}_{t-1}} - 1$$

$$(2) \text{ Predicted return}_t = \beta_{\text{FTSE EPRA/NAREIT Index}} * \text{Market return}_t + \alpha_{\text{FTSE EPRA/NAREIT Index}}$$

The predicted return is given by the CAPM beta and alpha as expressed in Eq. (2) which is calculated by regressing the FTSE UK EPRA/ NAREIT Index on the market index.¹⁵ As a proxy for the market we have used the FTSE All Share Index, capturing about 96% of the LSE market capitalization.

$$(3) \text{ Abnormal Return}_t = \text{Real return}_t - \text{Predicted return}_t$$

$$(4) \text{ CAR}_t = \text{Abnormal return}_{t_0} + \text{Abnormal return}_{t_0+1} + \dots + \text{Abnormal return}_t$$

The abnormal return at time t , in Eq. (3), is given by the deviation from the expected return at time t , based on the historical trend. The CAR for time t , in Eq. (4), is measured by summing all historical abnormal returns, starting at time t_0 , 1st of January 2013, until time t .

Table 4. Descriptive statistics on main variables

VARIABLES	N	Mean	Sd	Min	Max
Closing Price of FTSE EPRA/NAREIT Index	187.000	1,754.325	203.693	1,270.470	2,083.400
Cumulative Abnormal Return on FTSE Index	187.000	0.099	0.072	-0.081	0.239
L/R (Share of Leave / Share of Remain)	187.000	0.975	0.191	0.333	1.742
10-year zero coupon bond yield	187.000	0.020	0.005	0.012	0.030
Change in trade-weighted exchange rate	187.000	-0.000	0.001	-0.003	0.001
Change in house building started	187.000	0.000	0.003	-0.006	0.008
Change in unemployment	187.000	-0.000	0.001	-0.002	0.001

¹⁵ The CAPM beta, calculated to 0.837562, representing the FTSE EPRA/NAREIT Index correlation with the market, is significant at a 99% confidence level. The CAPM alpha is measured to 0.0002269, describing the Index excess return compared to the market, and is statistically insignificant at conventional confidence levels.

As can be seen in row 4, Table 4, the 10-year zero coupon bond yield ranges between 1.2% to 3.0% over the period. The change in traded weighted exchange rate, row 5 goes between -0.2% to +0.1% per day, change in house building started, row 6, is between -0.2% and +0.3% and the change in unemployment, row 7, range from -0.2% to +0.1%. The mean of the main variable of interest, L/R is slightly below one, meaning that over our sample the remain campaign had a small lead in the polls. However, the score is very close, leaving margin for error and implying that every new poll can turn the tables.

Empirical Model

To examine the relationship between development on the EPRA/NAREIT UK Index in time t and political uncertainty the study implements the following standard OLS regression:

$$(5) \quad CAR_t = \beta_0 + \beta_1 \frac{L}{R_t} + \beta_2 \frac{L}{R_t} * \text{Referendum set} + \beta_3 \text{Macro}_t + \varepsilon_t$$

where CAR_t denotes the CAR of the index on day t and L/R_t is the vote share ratio of leave to remain in polls published on day t , as discussed and defined in the previous section. *Referendum set* is a dummy variable, taking the value 1, for days after the vote date for the referendum was set, the 20th of February 2016, marking the launch for official campaigning. *Macro* _{t} is a set of macroeconomic control variables detailed in the previous section. β_1 and β_2 in Eq. (5) are the main coefficients of interest, measuring the link between the index returns and L/R_t , our measure of political uncertainty, derived from opinion polls.

Hypothesis

Based on previous literature, Hill *et al.* (2016) and Pástor and Veronesi (2013) we believe that an increase in the share of votes for leaving the EU in the Brexit referendum, has a negative impact on the property stock market, assuming that political uncertainty commands an additional risk premium. In other words, we expect a negative correlation between the variable L/R_t and the CAR of the FTSE UK EPRA/NAREIT Index. The negative correlation can be explained by the increase in political uncertainty, which arise with an increased probability of a Brexit outcome. Investors are expected to become more reserved to large investments and the market development should decline. The in general very stable real estate sector is expected to react stronger than the market to an increased likelihood of a Brexit, due to potentially hazardous changes in demographics that have historically driven the market development. Additionally, the negative correlation is believed to be stronger when the referendum date is set

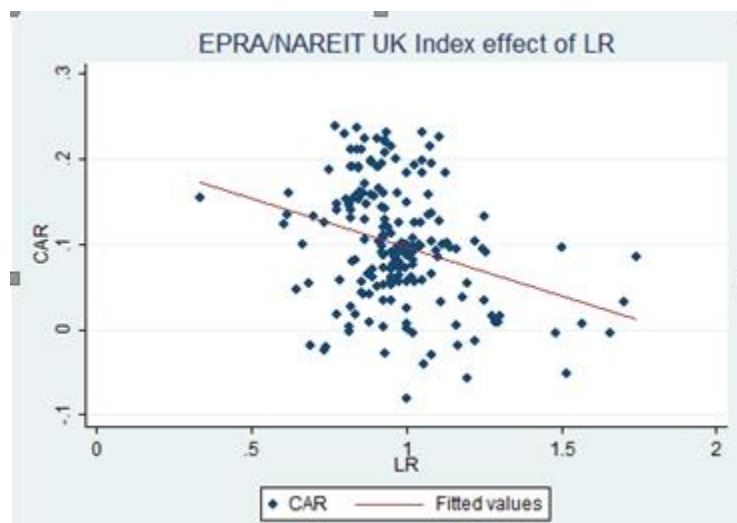
due to Brexit being more time relevant, leading to a higher awareness of the risks associated with the event.

Results

This section will present the main results and findings of this thesis. All results are based on regular OLS regression of the CAR from the FTSE UK EPRA/NAREIT Index on the Leave/Remain ratio (L/R) derived from opinion poll results. A one unit increase in L/R is expected to result in a Brexit outcome, due to the generally low margin of error in similar polls. All results are reported with heteroscedasticity robust standard errors.

Presented in Graph 2, is a plot of the CAR for the FTSE UK EPRA/NAREIT Index to L/R ratio for the entire poll sample. A negative trend line shows that an increase in our measure for political uncertainty, L/R, decreases the CAR on the FTSE UK EPRA/NAREIT Index. This is in line with our predictions that political uncertainty decreases index returns, indicating that the risk was factored into prices of the underlying stocks.

Graph 2. Cumulative Abnormal Return FTSE UK EPRA/NAREIT Index prices effect of L/R



The regression results from the main regression is presented in Table 5. As explained in the Empirical Model section, the main coefficients of interest are β_1 and β_2 , displayed in the first two rows of the following result tables. The result shows a strong negative impact on CAR when the vote share for leaving the EU increases.

Table 5. Main results of regression: CAR on L/R with other control variables included

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
L/R	-0.115*** (0.024)	-0.113*** (0.024)	-0.083*** (0.022)	-0.070*** (0.020)	-0.078*** (0.018)	-0.078*** (0.019)
Political uncertainty after referendum set		-0.013* (0.007)	-0.094*** (0.010)	-0.091*** (0.010)	-0.092*** (0.010)	-0.092*** (0.010)
10-year zero coupon bond yield			-11.705*** (0.892)	-12.204*** (0.920)	-14.073*** (0.997)	-14.046*** (1.053)
Change in house building started				-5.844*** (1.537)	-6.461*** (1.438)	-6.475*** (1.436)
Change in unemployment					-34.227*** (6.002)	-34.483*** (6.092)
Change in trade-weighted exchange rate						-0.659 (5.813)
Observations	187	187	187	187	187	187
R-squared	0.092	0.098	0.456	0.499	0.542	0.542

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The entire sample of 252 polls is used. However, polls published on the same date are weighted and bundled together based on sample size.

As can be seen in Table 5. L/R has a highly significant negative correlation with CAR in all the estimated regressions. The first regression (1) can be interpreted such that, if the share of leaving votes rises from 50% to 66% the FTSE UK EPRA/NAREIT Index should decrease by 11.5% more than the FTSE All Share Index.

Regression (2) adds the dummy variable displaying if the referendum date was set, showing that the real estate index was on average performing worse than the market during the campaign period, February 2016-June 2016. It also shows that the Index performed worse after the referendum date was set, compared to the time prior.

In regression (3), when adding the control for the 10-year zero coupon bond yield, we observe a slight increase in the L/R coefficient. However, the R-squared value increases from 9.8% in regression (2) to 45.6% showing that the interest rate is one of the main drivers of the real estate market, which can be explained by a higher cost of debt in the highly-leveraged sector.

In regression (4) when adding the variable “change in new house building started” to the model, the coefficient of L/R is still significant but slightly higher. The coefficient of change in new housing supply has a negative impact on index prices in line with our expectations, due to a dilution of existing supply.

When adding changes in unemployment in regression (5) the coefficient for L/R decreases implying a connection between unemployment and the leave vote. As stated in the hypothesis this is explained by unemployment driving political dissatisfaction, with unemployed more likely to vote for leaving the EU.

Lastly, in regression (6), adding the change in trade-weighted exchange rate, we see almost no change in the other coefficients, no change in R-squared and an insignificant negative coefficient for the variable itself. Due to the high standard error, we cannot draw any conclusions about the relationship with the CAR, meaning that exchange rates did not seem to have a major impact on capital inflow into listed real estate companies, during the period of interest.

Table 5 shows that the coefficient for variable “Political uncertainty after referendum set” is more negative than the coefficient of L/R for regressions (3), (4), and (5). This implies that the CAR was much more negative after the time the referendum was set, in February 2016 ($\beta_1 + \beta_2$). The reason for not seeing this result in regression (2) is that we haven’t included our main control variable “10-year zero coupon bond yield”, which has a major influence on the index price over time.

In our analysis, we have as well controlled for other variables linked with political uncertainty, exchange rates and construction, but have found the variables included in the main results the most relevant for our sample. Descriptive statistics and results using other control variables are found in Appendix C, Tables 4A & 5A. To control for political uncertainty, we have besides change in unemployment looked at Consumer Confidence (CCI), finding a less stable relationship. Exchange rates controls have been included for both the US Dollar and Euro. Though, using the change in the effective exchange rate, mirroring the foreign exchange effect on trade has not shown any impact on our results. When controlling for construction, we have compared the number of new houses built, with the value of net investments in fixed assets and the change in GDP. Although all variables showed significant and strong results, we choose to present the number of new houses built in our main results due to the strongest direct link to the real estate market. Still it is clear that our main variable L/R was strongly significant in all regressions.

As a further step in our control, we have computed the same regressions on equally weighted indices, consisting of all 36 companies included in the EPRA/NAREIT Index (Reg 7&8). We have also sorted out 14 other related companies, not included in the index, but listed on the LSE, and regressed them both separately (Reg 9&10) and all companies combined (Reg 11&12) weighting all companies equally. Our findings are presented in Table 6 below, and just as before our results for L/R are strongly significant and the coefficient for the index companies is at approximately the same level as in Table 5. Looking at the coefficient of “Political uncertainty after referendum set” while it is not as negative as before, we can draw the same conclusions, that the companies performed worse after the referendum was set. In contrast, the

less negative coefficient, β_2 , displays that the risk for small companies may not have been priced as clearly as for the bigger companies, or that the smaller companies were not affected to the same extent as the larger ones after the referendum set. More details from regressing the equally weighted indices are presented in Tables 6A-9A, in Appendix D.

Table 6. Regression of equally weighted companies based on the mean CAR

VARIABLES	(7)	(8)	(9)	(10)	(11)	(12)
L/R	-0.064*** (0.016)	-0.073*** (0.018)	-0.156*** (0.027)	-0.133*** (0.024)	-0.090*** (0.018)	-0.081*** (0.017)
Political uncertainty after referendum set	-0.063*** (0.007)	-0.075*** (0.008)	-0.093*** (0.011)	-0.090*** (0.010)	-0.071*** (0.008)	-0.070*** (0.007)
10-year zero coupon bond yield	-7.532*** (0.834)	-8.494*** (0.967)	-4.188** (1.755)	-4.407*** (1.482)	-6.596*** (1.062)	-6.330*** (0.963)
Change in house building started	-4.303*** (1.122)	-4.847*** (1.273)	-8.171*** (2.260)	-6.453*** (1.854)	-5.386*** (1.391)	-4.715*** (1.243)
Change in unemployment	-24.647*** (4.798)	-28.176*** (5.573)	-34.324*** (9.635)	-27.150*** (7.979)	-27.357*** (5.959)	-24.507*** (5.411)
Change in trade-weighted exchange rate	1.749 (4.476)	3.079 (5.021)	6.800 (6.869)	9.714 (6.167)	3.163 (5.035)	4.568 (4.652)
Observations	187	187	187	187	187	187
R-squared	0.429	0.435	0.434	0.445	0.416	0.429

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Reg. 7. The dependent variable is an equally weighted mean CAR of all 36 companies listed in the index.

In Reg. 8. The dependent variable is an equally weighted mean CAR of all 30 companies listed in the index, that have no missing observations.

In Reg. 9. The dependent variable is an equally weighted mean CAR of 14 related companies not included in the index.

In Reg. 10. The dependent variable is an equally weighted mean CAR of 11 related companies not included in the index, that have no missing observations.

In Reg. 11. The dependent variable is an equally weighted mean CAR of both 36 companies listed in the index and 14 related companies not included in the index.

In Reg. 12. The dependent variable is an equally weighted mean CAR of both 30 companies listed in the index and 11 related companies not included in the index, that have no missing observations.

As Table 6 shows, the coefficients for all variables are similar to those in Table 5, all being negative and statistically significant, except for the change in trade-weighted exchange rate. The results are robust also when the companies are equally weighted (Reg 7&8), indicating that the result was not driven by the largest companies, showing that the industry in general was affected similarly by changes in the probability of a Brexit.

To increase the power of our analysis we have added 14 other related companies not included in our main index, for a detailed list of the companies see Appendix A, Table 2A. The result (Reg 9&10) for these companies are in line with the main results, even somewhat higher.

Finally, when adding the 36 companies included in the index with the 14 other related companies not included (Reg 11&12), the results stay comparable to those in Table 5, strengthening the robustness of the results.

Discussion

Critique against the study may come from smoothing out the data for a few of the control variables. Though, by smoothing out, the estimation of the variables becomes more accurate for the time when poll results are published. For example, if a poll is published just between two observations of unemployment, it will not be fair to use the last months' figures, as people who are no longer unemployed or people who have now lost their jobs between observations, might have different views.

Further critic towards the study is the use of poll results to estimate political uncertainty. Most notably, not all people tell what they will vote for. For example, most people participating in the polls said that they would vote for remain, but the result tells a different story. This can be due to the Bradley effect, positing that polls are skewed by social desirability bias, voters give inaccurate polling responses fearing that by stating their true preference they open themselves up for criticism. Interviewed people, especially in telephone polls, are more prone to feel pressured to give "politically correct" responses. In the case of the Brexit referendum the subject of social criticism was mainly the racist and anti-immigration motivations driving the leave campaign. Also, the large pool of undecided voters could have been the ones who didn't want to show that they were leaning towards leaving, because it was the less desirable answer. Lastly, the difference in voter turnout between age groups is a major concern when using poll data from a variety of providers, not disclosing the demographic spread of their samples. Thus, the data prevents assigning weights for different voter groups, based on their likeliness to vote which could have increased descriptive power. However, the bias of the data should not have a major impact on financial markets as the opinion polls still where one of the best available sources of information on the current state of public opinion.

Future research could analyze how publicly traded real estate is affected in other economies, in response to similar political events, with frictions between domestic and international agendas. An interesting avenue for future work regarding the UK market, would be how real estate values in different sectors and geographic areas where affected by the Brexit referendum. In broader terms, more work is needed to understand the role of political risk and government policies in asset pricing.

Conclusion

This study has investigated the role of political uncertainty on the UK real estate stock market in the run up to the Brexit referendum, using poll results as a deputation for political uncertainty and FTSE UK EPRA/NAREIT Index as a representation for the UK real estate market. The main findings are that the risk was priced fairly, given the available information on the market, as the index price went down when the proportion of leaving votes increased. This is in line with the assumptions that an increase in political uncertainty due to a possible Brexit, had a distinctly negative impact on the real estate market. Our model predicts that the in general very stable real estate sector was expected to react stronger than the market to an increased likelihood of a Brexit, due to potentially hazardous changes in demographics that have historically driven the market development. The findings also conclude that the market reacted more strongly to new information about the public's opinion of the matter, after the referendum date was set in February 2016. During this time, more polls were published, increasing the awareness about the close call, which raised uncertainty regarding future growth and value projections for the real estate companies, dropping stock prices.

The findings fill in a gap in existing literature, as no earlier studies of which we know of, have investigated the impact of political uncertainty on the real estate market. Nevertheless, Hill, P. *et al*, have investigated the poll effect on individual firms in other sectors, finding comparable results.

Understandings from this study may help investors, companies and government in predicting the effect on the real estate market in case of a similar political event, for example if another country within the EU decides to announce an EU membership referendum like the UK did. Also, it helps people understand how real estate investors, holding illiquid assets, react to political risk.

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Appendix

The appendix is divided into four sections. Section A, displays a list over the companies included in the analysis, both the ones in the index and other related companies, as well as plotting a historical trend for the index companies. Section B, gives more details about the poll data obtained from Financial Times. Third, section C, reports results from regressing CAR on L/R using other control variables than in the main results. At last, section D, displays results from regressing equally weighted indexes, for companies included in the index, for other related companies and for all companies included in the analysis, similar to the main regression.

A. Details for companies included in the equally weighted index, and other related companies.

In Table 1A a total list of all companies included in the FTSE EPRA/NAREIT Index are described by name, index weight and the UK share in the company's portfolio. In the next Table 2A, 14 other related companies that are included in our analysis are shown. Separate regressions with the summed CAR of the index companies, the related companies, and all companies, as the dependent variable are presented in Tables 6A – 9A.

Table 1A. Index constituents included in the analysis.

FTSE EPRA/NAREIT UK companies					
Company name	Weight in Index	Share in UK	Company name	Weight in Index	Share in UK
Land Securities Group Plc	16,15%	100%	NewRiver REIT	1,53%	100%
British Land Company	12,42%	100%	F&C Commercial Property Trust	1,39%	100%
Hammerson Plc	8,75%	57%	Safestore Holdings	1,39%	75%
SEGRO	7,31%	68%	Primary Health Properties	1,23%	100%
Derwent London Plc	5,32%	100%	UK Commercial Property Trust	1,08%	100%
INTU Properties Plc	4,72%	96%	Empiric Student Property*	1,02%	100%
Great Portland Estates Plc	4,43%	100%	Redefine International PLC	0,91%	79%
Capital & CENTS Properties	4,21%	100%	Picton Property Income Limited	0,79%	100%
Shaftesbury Plc	4,18%	100%	Medicx Fund Limited	0,68%	100%
Tritax Big Box REIT*	2,97%	100%	Standard Life Investment	0,63%	100%
Unite Group Plc	2,59%	100%	Daejan Holdings Plc	0,58%	76%
Big Yellow Group Plc	1,88%	100%	Schroder Real Estate Investment Trust	0,57%	100%
Grainger Plc	1,88%	100%	Capital & Regional Plc	0,56%	100%
Kennedy Wilson Europe Real Estate Plc*	1,84%	56%	Helical REIT	0,56%	100%
Assura Plc	1,81%	100%	Target Healthcare REIT Limited*	0,52%	100%
Workspace Group Plc	1,79%	100%	Regional REIT*	0,47%	100%
LondonMetric Property Plc	1,75%	100%	F&C UK Real Estate Investment Trust	0,46%	100%
Hansteen Holding PLC	1,63%	39%	GCP Student Living plc*		100%

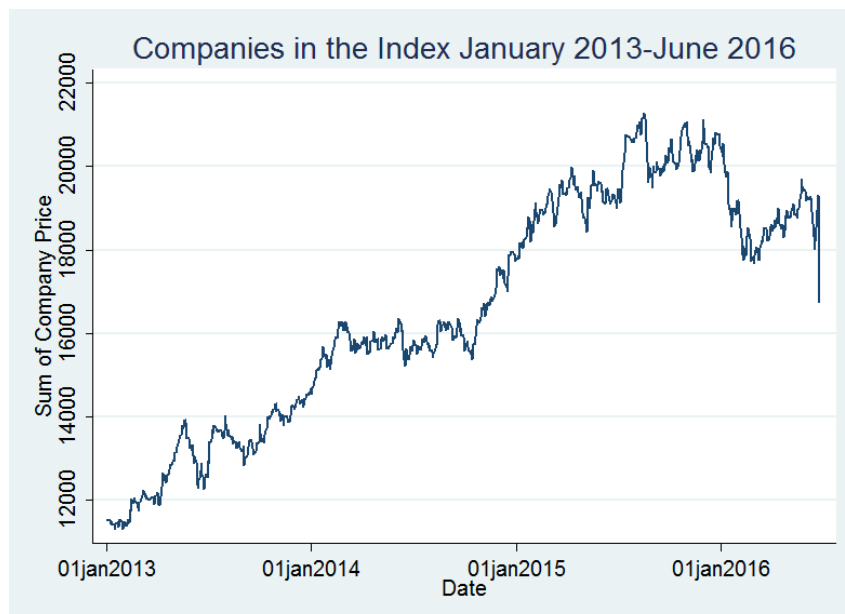
Companies that do not have all observations from January 2013 are marked with (*), and are controlled for in Table 3, 6A and 8A.

Table 2A. Other related companies included in the analysis

Other related companies	
Company name	Share in the UK
St Mowden Props.	100%
Mountview Estates	100%
McKay Securities	100%
Mucklow (A & J) Group	100%
Town Centre Securities	100%
LSL Property Services	100%
Harworth Group	100%
Foxtons Group*	100%
AEW UK Reit*	100%
Ediston Property Inv.Co.*	100%
U and I Group	95,50%
CLS Holdings	60,13%
Urban Civic	No real estate holdings
Savills	No real estate holdings
Average	96%

In Graph 1A the plot for the equally weighted companies included in the FTSE EPRA/NAREIT Index over time (January 2013 – June 2016) is shown. If comparing with Graph 1 in the Data & Methodology section, when plotting the weighted FTSE EPRA/NAREIT Index, we see that the trend is very similar, indicating that not only the 3 biggest companies have affected the historical trend for the index.

Graph 1A. Companies included in the FTSE EPRA/NAREIT Index over time



B. Information about the poll data

In the Table 3A below, summary of the poll data taken from Financial Times is depicted. As can be seen in column 1 and 2 the most frequent pollster publishing 108 poll results is YouGov, followed by ICM publishing 47 poll results. All pollsters have an average sample size of at least 900 observations, displayed in column 3. All results are gathered either by online protocols or telephone interviews, presented in the fourth column for each pollster.

Table 3A. Poll Statistics

POLLSTER	NR OF POLLS	AVERAGE SAMPLE	DATA COLLECTION
BMG Research	8	1464	Online/Telephone Interviews
ComRes	16	1240	Online/Telephone Interviews
Greenberg Quinlan Rosner Research	2	2327	Online
Harris	1	2114	Online
ICM	47	1883	Online/Telephone Interviews
Ipsos MORI	5	913	Telephone Interviews
Lord Ashcroft Polls	1	20 058	Online
Opinium	5	1730	Online
ORB	19	1383	Online/Telephone Interviews
Panelbase	2	1547	Online
Pew Research Center	2	1006	Online
Populus	2	3368	Online/Telephone Interviews
Survation	22	1879	Telephone Interviews
TNS	12	1397	Online
YouGov	108	2238	Online
TOTAL	252	1946	Online/Telephone Interviews

C. Control for other related variables

In this section, regression results for other control variables, similar to the ones included in main results, are presented. Descriptive statistics for the other control variables are presented in Table 4A and the results in Table 5A.

As can be seen in Table 4A, the GBP/USD exchange rate fluctuation is a bit bigger than GBP/EUR exchange rate. This can be due to higher correlation between EUR to GBP on the market.

Changes in net investments in fixed assets and changes in GDP are very small in comparison to changes in the other variables, due to the much larger scale.

The consumer confidence indicator is the most volatile as it is given by people's responses month-by-month which can differ more depending on who you are asking and in what mood the person is.

Table 4A. Descriptive statistics for the other control variables.

VARIABLES	N	Mean	Sd	Min	Max
Change in net investments in fixed assets	187.000	0.000	0.000	-0.000	0.001
Change in GDP	187.000	0.000	0.000	-0.000	0.000
Change in Consumer Confidence	187.000	0.010	0.175	-1.000	1.500
Change in the GBP/USD exchange rate	187.000	0.000	0.005	-0.018	0.022
Change in the GBP/EUR exchange rate	187.000	0.000	0.005	-0.016	0.018

As can be seen in Table 5A, the results are similar to the main results in Table 4. In all of the regressions, controls for Political uncertainty after referendum set and 10-year zero bond yield is included. Then also a control for construction, a control for currency changes and a control for Consumer Confidence is included step by step. Still, there is a significant negative relationship between the CAR of FSTE EPRA/NAREIT Index and the increase in share of leaving votes in all regressions. We can see that as mentioned before in the results section, change in investments in fixed assets and Change in GDP are highly significant. CCI, currency change in EUR/GBP and currency change in USD/GBP are not statistically significant on conventional levels.

Table 5A. Regression of FTSE UK EPRA/NAREIT Index CAR effect of L/R using other control variables that in main regression.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
L/R	-0.078*** (0.024)	-0.077*** (0.024)	-0.076*** (0.024)	-0.086*** (0.021)	-0.086*** (0.021)	-0.086*** (0.022)
Political uncertainty after referendum set	-0.091*** (0.009)	-0.092*** (0.009)	-0.093*** (0.009)	-0.080*** (0.010)	-0.081*** (0.010)	-0.081*** (0.010)
10-year zero coupon bond yield	-10.735*** (0.811)	-10.807*** (0.799)	-10.977*** (0.800)	-10.761*** (0.937)	-10.809*** (0.979)	-10.801*** (0.979)
Change in net investments in fixed assets	-85.107*** (30.518)	-85.794*** (30.467)	-86.859*** (30.784)			
Change in the GBP/USD exchange rate		0.673 (0.614)	0.685 (0.619)			
Change in Consumer Confidence			0.016 (0.014)		0.004 (0.013)	0.004 (0.013)
Change in GDP				-160.936*** (38.708)	-160.384*** (38.799)	-160.848*** (39.108)
Change in the GBP/EUR exchange rate						-0.074 (0.651)
Constant	0.420*** (0.027)	0.420*** (0.027)	0.423*** (0.027)	0.443*** (0.025)	0.443*** (0.026)	0.444*** (0.026)
Observations	187	187	187	187	187	187
R-squared	0.511	0.513	0.515	0.485	0.486	0.486

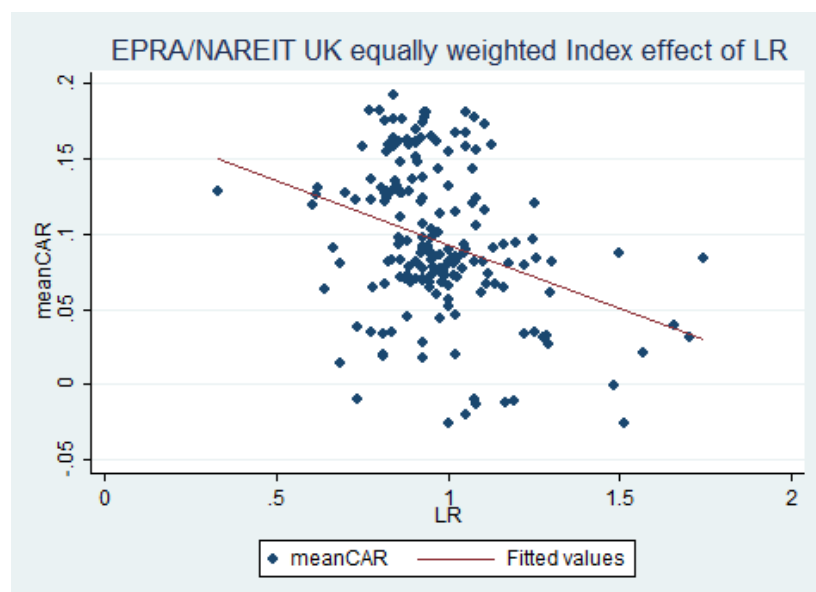
Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

D. Tests for equally weighted indexes

In Graph 3A we have plotted the mean of the CAR for all individual companies included in the FTSE EPRA/NAREIT Index. The graph is very similar to Graph 2 in the Results section with a negative trend.

Graph 3A. Companies included in the FTSE EPRA/NAREIT Index equally weighted over time



In Table 6A and 7A the dependent variable for all regressions shown is the mean of the CAR for all companies included in the index, showing the index as if it was equally weighted. The difference between the tables is that Table 7A excludes companies missing some of the observations within the timeframe. That Table 7A has a more negative L/R coefficient is explained by the exclusion of smaller and less stable companies where the effect of Brexit seems to not be factored into the price as much.

Table 6A. Regression of equally weighted index based on the mean CAR for all 36 companies included.

VARIABLES	(1)	(2)	(3)	(4)	(5)
L/R	-0.085*** (0.017)	-0.083*** (0.017)	-0.068*** (0.017)	-0.060*** (0.016)	-0.065*** (0.015)
Political uncertainty after referendum set		-0.024*** (0.005)	-0.064*** (0.007)	-0.062*** (0.007)	-0.063*** (0.007)
10-year zero coupon bond yield			-5.745*** (0.690)	-6.077*** (0.736)	-7.460*** (0.806)
Change in house building started				-3.884*** (1.149)	-4.341*** (1.135)
Change in unemployment					-25.327*** (4.771)
Constant	0.178*** (0.017)	0.182*** (0.017)	0.292*** (0.020)	0.292*** (0.020)	0.313*** (0.021)
Observations	187	187	187	187	187
R-squared	0.109	0.153	0.338	0.379	0.429

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7A. Regression of equally weighted index based on the mean CAR for the 30 companies included in the index since 2013.

VARIABLES	(1)	(2)	(3)	(4)	(5)
L/R	-0.098*** (0.020)	-0.095*** (0.020)	-0.078*** (0.020)	-0.069*** (0.019)	-0.075*** (0.017)
Political uncertainty after referendum set		-0.032*** (0.006)	-0.077*** (0.008)	-0.075*** (0.008)	-0.075*** (0.008)
10-year zero coupon bond yield			-6.389*** (0.803)	-6.763*** (0.857)	-8.368*** (0.934)
Change in house building started				-4.383*** (1.326)	-4.912*** (1.290)
Change in unemployment					-29.373*** (5.531)
Constant	0.204*** (0.020)	0.209*** (0.020)	0.332*** (0.023)	0.331*** (0.023)	0.356*** (0.024)
Observations	187	187	187	187	187
R-squared	0.109	0.169	0.342	0.382	0.433

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In Table 8A the dependent variable for all regressions shown is the mean of the CAR for all 14 related companies not included in the index. We can see that the result is even stronger than in the previous two tables.

Table 8A. Regression of equally weighted companies based on the mean CAR for 14 related companies not included in the index.

VARIABLES	(1)	(2)	(3)	(4)	(5)
L/R	-0.179*** (0.029)	-0.172*** (0.029)	-0.169*** (0.029)	-0.152*** (0.028)	-0.160*** (0.027)
Political uncertainty after referendum set		-0.088*** (0.008)	-0.097*** (0.012)	-0.093*** (0.011)	-0.094*** (0.011)
10-year zero coupon bond yield			-1.235 (1.356)	-1.889 (1.451)	-3.908** (1.740)
Change in house building started				-7.650*** (2.169)	-8.316*** (2.268)
Change in unemployment					-36.969*** (9.603)
Constant	0.350*** (0.029)	0.364*** (0.029)	0.388*** (0.037)	0.387*** (0.037)	0.418*** (0.041)
Observations	187	187	187	187	187
R-squared	0.155	0.343	0.346	0.397	0.431

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Table 9A the dependent variable for all regressions shown is the mean of the CAR for all companies, both included and not included in the index, that has observations for the whole timeframe. The results are still robust, supporting the main results.

Table 9A. Regression of equally weighted companies based on the mean CAR for both 30 companies in the index and 11 related companies not included in the index.

VARIABLES	(1)	(2)	(3)	(4)	(5)
L/R	-0.102*** (0.018)	-0.099*** (0.019)	-0.087*** (0.019)	-0.078*** (0.018)	-0.084*** (0.017)
Political uncertainty after referendum set		-0.042*** (0.005)	-0.072*** (0.008)	-0.070*** (0.007)	-0.071*** (0.007)
10-year zero coupon bond yield			-4.336*** (0.773)	-4.707*** (0.829)	-6.143*** (0.945)
Change in house building started				-4.338*** (1.265)	-4.812*** (1.262)
Change in unemployment					-26.284*** (5.418)
Constant	0.210*** (0.019)	0.217*** (0.019)	0.300*** (0.022)	0.299*** (0.022)	0.321*** (0.024)
Observations	187	187	187	187	187
R-squared	0.133	0.246	0.336	0.380	0.426

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1