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The sectoral effects of Brexit on the British economy: early evidence from the reaction of the stock market

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ABSTRACT

We investigate the impact of the outcome of the EU referendum (Brexit) on various sectors of the British economy over the period June–July 2016. Using the event study methodology, we assess the effects of Brexit, relative to what had been anticipated, as measured by abnormal returns (ARs). The results show that the banking and travel and leisure sectors were affected negatively, with a cumulative AR of -15.37% for the banking sector. We observe that Brexit has a mixed effect on ARs with apparent sector-by-sector differences.

KEYWORDS

EU referendum; BREXIT; abnormal returns; event study; systematic risk

JEL CLASSIFICATION

G14; G18

I. Introduction

The effects on the British economy of the decision to leave the European Union (Brexit) were debated intensively before the vote and it is still being debated, particularly because it is not clear yet what kind of an exit deal Britain will get – this will be determined by negotiations with the European Union. As a matter of fact, the costs and benefits of Britain's membership of the European Union was a controversial issue even before the decision was taken to hold a referendum. The decision to leave the European Union will bring about costs and benefits, with short-term and long-term ramifications that may differ significantly (good in the short run and bad in the long run, or vice versa). Furthermore, Brexit will have varying effects on different sectors of the economy, both with respect to direction and significance.

It is too early to get a feel of the economic and financial effects of Brexit on the British economy, particularly because the country is still part of the European Union. However, it is possible to envisage the likely costs and benefits of Brexit. The potential costs are (1) possible tariffs on exports to the European Union; (2) the loss of access to the huge EU market; (3) the adverse effect on the City of London, which is typically viewed as a major pillar of the British economy (who needs manufacturing

industry when we have the City) and (4) declining investment in reaction to uncertainty. On the other hand, the potential benefits are (1) avoidance of EU regulation; (2) savings on EU contributions; (3) the ability to strike new trade deals with non-EU countries and (4) the positive effects of skill-based migration policy.

There is no agreement on the relative importance of the potential costs and benefits, and the net effect of these costs and benefits is anybody's guess. However, we may get a feel of the possible effects on various sectors of the British economy by observing how the stock price indices of various sectors reacted following the announcement of the outcome of the referendum on 24 June. For this purpose, we use the event study methodology to calculate abnormal and cumulative abnormal returns (CARs) for various sectors of the British stock market.

II. The potential costs and benefits

A study by Woodford Investment Management (2016) examines the effects of Brexit on trade and manufacturing, financial services, foreign investment and the public sector. The report rejects the 'extreme claims made about the costs and benefits of Brexit for the British economy' as 'lacking in evidential bases'. However, this report itself may be seen as

painting an extremely favourable outlook and lacking in evidential bases. It is all about the ability of Britain to negotiate favourable deals with the European Union, non-EU trade blocs and individual countries. The report does not envisage that any particular region or regions of the country would be more adversely affected by Brexit than the whole country. The authors of the report find support for the notion that Brexit would benefit some sectors more than others and that the range of outcomes for manufacturing industry is probably wider than for services.

As far as trade is concerned, the European Union is currently the destination for about half of all British goods exports, and if we take into account the countries that trade freely with Britain because they have free trade agreements with the European Union, it turns out that 63% of Britain's goods exports are linked to EU membership. The effect of Brexit on trade depends on what kind of deals Britain will strike with the EU and non-EU countries. The report envisages that a favourable trade agreement would be reached after Brexit as there are advantages for both sides in continuing a close commercial arrangement. The report paints a favourable view despite the potential costs associated with tariffs under the 'most-favoured nation' rule and the rules of origin. Optimism with respect to trade is attributed to falling tariffs globally and what the report sees as the 'decline in manufacturing and Europe's diminishing importance'. After Brexit, the argument goes, Britain may find more beneficial trade deals with non-EU countries as has been demonstrated by Switzerland. No matter what the outcome is, different sectors will be affected in different ways. The Woodford report predicts that the financial services sector has more to lose immediately following the exit than most other sectors of the economy, although it suggests that the City's competitive advantage is founded on more than just unfettered access to the single market. As in the case of trade, Britain may be in a position to negotiate deals with emerging markets that could pay off for the financial services sector in the long run. In other words, the effect of Brexit on the financial sector is expected to be negative in the short run and positive in the long run.

The Woodford report is more optimistic about the outlook for foreign direct investment than what is represented by the average view. The less

pessimistic outlook follows from the proposition that access to the single market is not the only reason why firms invest in Britain. Again, the effect is expected to be more negative in the short run as Britain negotiates a new deal with the European Union. If favourable terms emerge out of the negotiations, the outlook for foreign direct investment will be positive.

As for the public sector, the positive effect is that the British government could save about £10 billion per year on its contributions to the EU's budget, which can be used to upgrade the infrastructure. This has implications for growth prospects, on which the report is more optimistic than other studies. However, the report expects that the net impact on growth and job creation will be 'modestly positive', which is 'a strong conclusion when compared with some studies' that show negative impacts of varying degrees. Dhingra, Ottaviano and Sampson (2015) estimate the cost of Brexit to be in the vicinity of 2.2 percentage points in growth in its optimistic scenario, and between 6.3% and 9.5% in its pessimistic one. The Confederation of British Industry (2013) estimates the net benefit to Britain of EU membership to be in the region of 4–5% of GDP – that is between £62 billion and £78 billion per year. The estimates of Pain and Young (2004) indicate that Brexit will reduce the size of the British economy by about 2.25% relative to what it would have been otherwise. These are the studies painting a pessimistic picture.

Other studies paint a more mixed picture. For example, Booth et al. (2015) suggest that the growth of the British economy will depend on what kind of trade policy will be adopted (with respect to the extent of protectionism). The estimates show that if Britain resorted to protectionism post-Brexit, this course of action could cost 2.2% of GDP by 2030. By contrast, if free trade is adopted, Britain could outperform the European Union, as Brexit could add some 1.6% to national income by 2030.

Some studies consider the cost, in terms of lost growth, of EU membership – these are the optimistic studies. For example, Leach (2000) estimated the cost of British membership of the European Union to be 1.75% of GDP, implying that Brexit will eliminate this cost. Minford, Mahabare and Nowell (2005) identified the costs of British membership and additional substantial potential future costs of harmonization, pension sharing and euro membership, estimating

these as equivalent to between 3.2% and 3.7% of GDP. Milne (2004) estimates the recurring annual direct net cost of European Union to be in the range 3–5% of GDP, with a ‘most likely’ figure of 4%. Congdon (2014) puts the cost of Britain’s membership of the European Union at 10%, attributing this cost to regulation and resource misallocation. One has to mention that Congdon’s estimates were prepared for the United Kingdom Independence Party (UKIP), which has a strong anti-Europe stance. This does not mean that other studies do not contain an element of ideological bias – it seems that they all do.

In short, the terms of departure and whether or not Britain negotiates a favourable agreement governing the future relation with the European Union will determine the magnitude and direction of the effects of Brexit. After all, Brexit will change the landscape as Britain will no longer be part of the single market, with free movement of goods, services, people and capital within the EU’s border. Naturally, the new relation with the rest of the world, which may arise out of bilateral agreements, will also play a role.

III. Methodology

Daily returns are calculated as the first natural logarithmic difference of the underlying stock price. We follow Ramiah, Martin, and Moosa (2013) by adjusting daily returns to obtain the ex-post-abnormal returns (ARs) where adjustment is approximated by the CAPM. The ARs are then grouped into industries to obtain the average industry (I) ARs at time t , (AR_{It}). The standard t statistic for an industry’s AR is computed to find out if it is statistically different from zero.

Subsequently, we relax the assumption of efficient market and test for some possible delayed responses. In other words, we allow for the possible overreaction or under-reaction to Brexit whereby markets have a tendency to correct their mistakes in subsequent periods. For this purpose, we estimate the CAR over the following 10 trading days to find out whether or not the market reverts back to its mean process or continues to deviate from the mean price. Once again, we use the t test to determine the statistical significance of cumulative returns.

The event study methodology involves the assumption that the AR of an industry is a function of revenue

minus cost. Zero ARs or CARs may imply any of the following: (1) neither revenue nor cost changes as a result of Brexit; (2) the industry experiences a decline in revenue, which is offset by a decline in cost in the form of government subsidy (or vice versa); (3) it is a protected industry and (4) the industry has the power to pass on the cost to consumers. Otherwise, positive and negative ARs imply favourable and unfavourable effects, respectively.

The event study methodology has been criticized for various reasons including the non-normality of the AR distribution and firm-specific effects, as well as the impact of stock market integration and spillover effects. It is argued that ARs are not normally distributed and have a tendency to exhibit high kurtosis and positive skewness, which may have an undue influence on the parametric t statistics. To address this criticism, we use the Corrado (1989) non-parametric ranking test and the non-parametric conditional distribution approach suggested by Chesney, Reshetar and Karaman (2011). Furthermore, we exclude from the industry portfolio all stocks with firm-specific information 15 days on either side of the announcement day to ensure that the emerging AR is attributed solely to the effect of Brexit. We control for asynchronicity, stock market integration and spillover effects, which requires the augmentation of the CAPM with three market risk premia representing Asia ($\tilde{r}_{mt}^{Asia} - \tilde{r}_{ft}^{Asia}$), Europe ($\tilde{r}_{mt}^{Europe} - \tilde{r}_{ft}^{Europe}$) and the United States ($\tilde{r}_{mt}^{US} - \tilde{r}_{ft}^{US}$).

On 16 June 2016, the Bank of England stated that uncertainty about the EU referendum was the ‘largest immediate risk’ facing global financial markets. These risks can be summarized as economic uncertainty (e.g. domestic gains versus European gambles) and market volatility (downside risks in terms of post-Brexit trading arrangements with foreign countries). To test for the immediate change in systematic risk, we adjust the CAPM by incorporating interaction variables. Our immediate risk model captures the average change in risk as a consequence of the Brexit referendum. A dummy variable (DV), which takes the value of one on the first day of trading after the referendum and zero otherwise, is created to capture immediate changes in systematic risk. This DV is multiplied by the market risk premium to form the first interaction variable. Following Ramiah, Martin and Moosa (2013), the model takes the form

$$\tilde{r}_{it} - \tilde{r}_{ft} = \beta_I^0 + \beta_I^1 [\tilde{r}_{mt} - \tilde{r}_{ft}] + \beta_I^2 [\tilde{r}_{mt} - \tilde{r}_{ft}] * DV_t + \beta_I^3 DV_t + \tilde{\varepsilon}_{it} \quad (1)$$

where \tilde{r}_{it} is industry i 's return at time t , \tilde{r}_{ft} is the risk-free rate at time t , \tilde{r}_{mt} is the market return at time t , DV is a DV that takes the value of one on the first day of trading following the announcement of the results of the referendum is announced and zero otherwise, $\tilde{\varepsilon}_{it}$ is the error term, β_I^0 is the intercept of the regression equation [$E(\beta_I^0) = 0$], β_I^1 is the average short-term systematic risk of the industry, β_I^2 captures the change in the industry risk, and β_I^3 measures the change in the intercept of Equation (1). This equation is estimated to calculate the short-term change in systematic risk of the stock market. As a robustness test, we use other DVs to measure changes in systematic risk from the second up to 10 days of trading.

We conduct a series of econometric tests on all of the regression models. The Chow test is used to detect the presence or otherwise of structural breaks following the referendum, the Wald test is used to check for redundant variables, appropriate AR and MA terms are introduced to control for autocorrelation and GARCH specifications are used to correct for the ARCH effects.¹ More specifically, we use GARCH, TAR, EGARCH and PARMA models in the presence of ARCH effects.

IV. Data and empirical results

Daily data series over the period June 2010–July 2016 were downloaded from Datastream. The series cover individual stock prices, the stock market price index (as a proxy for the market portfolio), sectoral price indices and the bond yield (as a proxy for the risk-free rate). Firm-specific information was downloaded from the website of the stock exchange.

Our findings confirm the propositions that the outcome of the Brexit referendum had a major impact on stock returns. Of the sectors that were affected, the majority displayed negative ARs, but we

also document positive ARs in other sectors. Tables 1 and 2 provide a summary of the estimated ARs for cases of expected and unexpected reactions. It is noticeable that the banking sector and travel and leisure sectors were affected the most. The results of risk analysis (reported in Table 3) produce evidence of changes in short-term systematic risk as predicted by the Bank of England. There appears to be an industry effect whereby the impact of Brexit on industry betas varies across industries. Systematic risk may increase, decrease or remain unchanged.

Our hypotheses are based on discussions pertaining to possible outcomes of Brexit. For instance, a discussion in *Financial Times*² leads us to believe that banks will move out of the United Kingdom if the current arrangements change. We use this argument to formulate the hypothesis that Brexit is bad news for the banking sector, leading to negative ARs and higher risk for this sector. Through various publications³, we gather that (1) it will become more expensive for Britons to buy holidays abroad with a depreciation of the pound (negative reaction to the travel and leisure sector); (2) it is a threat to financial services as Britain will lose its 'passport rights', which allow British-based institutions to sell in the rest of European Union without having a physical location in other countries; (3) it is expected that following Brexit, the United Kingdom will release its own renewable and low carbon energy policy, and for this reason, the alternative energy sector is not expected to be affected; (4) almost 90% of Northern Irish farmers' income comes from Europe, which means that Brexit will have a negative effect on the food industry with the potential barriers to trade and (5) UK's funding from the European Union that goes to scientific research and development will adversely affect the science and technology industry.

The first part of Table 1 reports ARs, CARs (up to 10 days) and their t statistics following the outcome of the referendum. We find that the market reacted in a manner that was originally expected in 11 industries: alternative energy, banking, chemicals,

¹The results of these tests are available upon request from the corresponding author.

²<https://next.ft.com/content/a3a92744-3a52-11e6-9a05-82a9b15a8ee7>.

³<http://www.independent.co.uk/voices/brexit-economy-ftse-value-of-the-pound-is-the-worst-over-think-again-europe-a7120891.html>, <https://woodfordfunds.com/economic-impact-brexit-report/>, <https://www.theguardian.com/business/2016/jul/08/brexit-fallout-the-economic-impact-in-six-key-charts>, http://global.sustain.org/files/Atradius_Economic_Research_Brexit_Top_5_ERU091503en.pdf, <http://www.nortonrosefulbright.com/knowledge/publications/136979/impact-of-a-brexit-on-the-energy-sector>, <http://www.forbes.com/sites/phillemper/2016/06/29/brexit-the-ny-fancy-food-show-the-impact-on-imported-foods/2/#26c9d0502688>, <http://www.wired.co.uk/article/uk-technology-science-eu-brexit> <http://www.aljazeera.com/programmes/countingthecost/2016/07/brexit-fall-out-global-economic-impact-160709061414509.html>.

Table 1. Sectoral reactions in the United Kingdom following Brexit.

Sector	AR	t-Sat	CAR2	t-Stat	CAR5	t-Stat	CAR10	t-Stat
Expected reaction								
Alternative energy	-0.42	-0.27	2.40	1.07	1.56	0.43	-1.53	-0.29
Banks	-4.99	-5.66	-7.81	-5.82	-11.90	-5.09	-15.37	-4.59
Chemicals	0.23	0.36	1.11	1.13	0.60	0.36	-0.59	-0.24
Equity investment instrument	-1.11	-3.48	-0.23	-0.50	-0.91	-1.18	-0.41	-0.34
Financial services	-1.94	-5.62	-2.10	-4.13	-2.85	-3.30	-3.06	-2.39
Food producers	-1.36	-2.09	-1.46	-1.55	-0.90	-0.60	1.38	0.59
Life insurance	-4.20	-5.44	-4.69	-4.31	-5.26	-3.18	-8.18	-3.69
Nonlife insurance	-0.40	-0.52	-0.47	-0.43	0.67	0.40	0.49	0.22
Oil and gas producers	2.71	2.45	5.44	3.26	5.13	1.75	3.55	0.81
Software and computer services	-2.69	-4.82	-3.59	-4.39	-2.98	-2.29	-3.19	-1.81
Travel and leisure	-3.16	-6.97	-3.74	-5.87	-3.72	-3.72	-3.64	-2.69
Unexpected reaction								
Aerospace and defence	2.09	2.77	3.95	3.48	4.30	2.24	7.01	2.70
Beverages	1.16	2.15	2.78	3.48	2.16	1.76	3.86	2.17
Construction and materials	-2.92	-5.31	-6.41	-7.70	-8.11	-5.79	-11.06	-5.21
Electronic and electrical equipment	-2.52	-3.93	-2.06	-2.41	-2.30	-1.78	-2.61	-1.63
Forestry and papers	3.82	3.44	5.23	3.21	5.46	1.90	4.52	1.12
General retailers	-2.86	-5.68	-4.67	-5.82	-8.36	-5.96	-10.62	-5.02
Health-care equipment and services	-1.56	-2.62	-0.09	-0.10	0.73	0.57	-0.08	-0.04
Household goods and home construction	-8.20	-9.93	-10.98	-8.63	-14.04	-6.43	-16.81	-5.22
Media	-1.40	-2.38	-2.34	-2.91	-3.04	-2.55	-2.49	-1.59
Real estate investment and services	-3.65	-5.89	-5.27	-5.97	-5.78	-3.94	-9.55	-4.48
Real estate investment trusts	-6.04	-9.74	-8.01	-8.34	-7.63	-4.94	-12.19	-5.26
Support services	-1.62	-2.65	-3.42	-3.80	-5.39	-3.68	-5.94	-2.77
Tobacco	5.19	4.93	5.32	3.42	9.14	3.56	9.13	2.43

AR: Abnormal return; CAR: cumulative abnormal return.

Table 2. Robustness tests for sectoral reaction in the United Kingdom following Brexit.

Sector	t _{Corrado}	Conditional probability		Excluding firm-specific information		Market integration	
		CP	t-Stat	AR	t-Stat	AR	t-Stat
Expected reaction							
Alternative energy	-1.14	0.02	2.58	0.67	0.27	-0.70	-0.44
Banks	-2.09	0.50	0.00	0.10	0.08	-4.79	-4.68
Chemicals	0.17	0.07	1.80	0.96	0.47	0.02	0.03
Equity investment instrument	-1.13	0.46	0.10	-1.28	-1.57	-1.21	-3.67
Financial services	-3.25	0.49	0.03	-1.59	-2.08	-2.17	-5.81
Food producers	-1.76	0.45	0.13	-0.45	-0.20	-1.38	-2.04
Life insurance	-1.14	0.03	2.57	N/A	N/A	-3.87	-5.29
Nonlife insurance	-0.30	0.11	1.38	N/A	N/A	-0.42	-0.67
Oil and gas producers	1.57	0.07	1.78	-0.46	-0.20	2.22	2.09
Software and computer services	-4.05	0.49	0.03	-2.78	-1.81	-3.03	-5.68
Travel and leisure	-2.70	0.50	0.00	-1.08	-2.10	-1.40	-3.50
Unexpected reaction							
Aerospace and defence	0.60	0.13	1.27	N/A	N/A	2.11	2.79
Beverages	0.42	0.01	3.46	-0.96	-1.81	1.15	2.13
Construction and materials	-2.52	0.49	0.02	-1.51	-1.24	-2.42	-4.35
Electronic and electrical equipment	-1.99	0.49	0.02	-2.48	-2.05	-2.87	-4.50
Forestry and papers	0.74	0.49	0.04	N/A	N/A	3.82	3.42
General retailers	-3.83	0.47	0.07	-3.00	-2.01	-2.73	-5.36
Health-care equipment and services	-2.14	0.20	0.93	-1.33	-0.86	-1.74	-2.88
Household goods and home construction	-3.51	0.04	2.26	-5.26	-3.91	-7.92	-9.59
Media	-2.51	0.48	0.05	-2.30	-1.19	-1.60	-2.64
Real estate investment and services	-2.46	0.50	0.01	-1.81	-3.01	-3.57	-5.61
Real estate investment trusts	-3.23	0.50	0.00	1.29	0.45	-6.35	-9.88
Support services	-3.11	0.02	2.63	-0.76	-0.24	-1.71	-4.76
Tobacco	1.91	0.50	0.01	N/A	N/A	7.10	6.98

AR: Abnormal return; CP: conditional probability.

equity investment instrument, financial services, food producers, life insurance, non-life insurance, oil and gas producers, software and computer services, and travel and leisure. For instance, (1) the banking sector was negatively affected by 15.37% after 10 days; (2) financial services were negatively

affected by 3.06% after 10 days; (3) the alternative energy sector did not record any statistically significant results; (4) food producers were negatively affected by 1.36% on the first day of trading and (5) software and computer services were negatively affected by -3.74% after 2 days. From Table 2, we

Table 3. Changes in short-term systematic risk of the UK sectors following Brexit.

	Beta pre-Brexit	Immediate risk	t-Stat	Beta post-Brexit
Banks	0.94	0.38	10.39	1.32
Construction and materials	0.42	0.70	30.65	1.12
Household goods and home construction	0.58	1.44	69.71	2.02
Mining	0.45	-0.39	-2.79	0.06
Real estate investment and services	0.31	0.38	3.18	0.69
Real estate investment trusts	0.53	0.65	31.28	1.18
Support services	0.45	0.38	27.91	0.83
Tobacco	0.50	-0.52	-7.00	-0.02
Travel and leisure	0.54	0.17	2.20	0.71

find that at least one of the robustness tests confirms these findings.

The second part of Table 1 reports the results of sectors that did not get extensive media coverage in terms of the possible outcome after Brexit, and for this reason, we label the outcomes as unexpected. In that sense, we contribute to the discussion of the impact of the Brexit as we document that 11 industries were affected negatively: household goods and home construction (-8.20%), real estate investment trusts (-6.04%), real estate investment and services (-3.65%), construction and materials (-2.92%), general retailers (-2.86%), electronic and electrical equipment (-2.52%), support services (-1.62%), health-care equipment and services (-1.56%), media (-1.4%), beverages (1.16%), aerospace and defence (2.09%), forestry and papers (3.82%) and tobacco (5.19%). Once again, we find that these results are supported by the robustness test results reported in Table 2.

As envisaged by the Bank of England, Brexit has led to an increase in systematic risk (referred to as immediate risk by the Bank of England), which is confirmed by the results indicating an increase in systematic risk for seven sectors. As shown in Table 3, these sectors are banking, construction and materials, household goods and home construction, real estate investment and services, real estate investment trusts, support services and travel and leisure. Interestingly, we find a decline in systematic risk for the mining and tobacco sectors. It is worth mentioning that the remaining 31 UK sectors did not experience any change in systematic risk. We consider the evidence for no change or a decline in systematic risk to be a surprise.

V. Conclusion

Views on the effects of Brexit on the British economy differ widely and reflect ideological differences, with those in favour of leaving the EU, for whatever reason, anticipating positive effects, and vice versa. While it is too soon to know with certainty what the effects will be, particularly that Britain has not left yet, the reaction of the stock market to Brexit provides early indicators as to what the effects will be.

The results presented in this study, on the basis of the event study methodology, confirm the proposition that Brexit will have varying sectoral effects, although most sectors reacted negatively as indicated by negative ARs. As expected, the banking sector was affected the most while the travel and leisure sector took a big hit. The results also confirm the prediction of the Bank of England on changes in short-term systematic risk.

Disclosure statement

No potential conflict of interest was reported by the authors.

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