

The Impact of the UK's EU Exit on its Attractiveness to FDI and Associated Job Creation Effects

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Abstract

This study examines possible Brexit effects on the UK's attractiveness to greenfield foreign direct investment (FDI) and related job creation. Our results indicate that the UK would be less attractive as a location to FDI and would experience a reduction of FDI-related job creation in any of the considered Brexit outcomes. These effects come about through reduced market potential due to lower market size and reduced access to the EU Single Market. The least damaging post-Brexit outcome would be in the case of the UK's membership in the European Economic Area (EEA) while the most damaging scenario would be the UK leaving the EU without a withdrawal agreement. Our results suggest that to compensate post-Brexit losses in terms of its attractiveness to FDI, the UK's government could consider a more competitive corporate tax rate or spending more on education.

Key words: The location choice of foreign direct investment, Brexit, job creation.

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Table of Contents

Executive Summary	4
1 Introduction.....	6
2 Empirical Methodology.....	7
2.1 Modelling the location choice of greenfield FDI projects.....	8
2.2 Modelling the link between attractiveness to FDI and FDI related job creation.....	9
2.3 Analysis of potential counterfactual Brexit scenarios	10
2.4 Compensatory policy options	10
3 Data.....	10
3.1 The location of new greenfield FDI projects and related job creation.....	10
3.2 Location characteristics.....	10
3.3 Estimates of Brexit outcomes from the existing literature	11
4 Results.....	13
4.1 Baseline estimates on determinants of the location choice of FDI.....	13
4.2 The UK’s attractiveness to FDI	15
4.4 Analysis of counterfactual Brexit outcomes.....	18
4.5 Compensatory policy options	20
5 Summary of Key Findings.....	22
References	24
Appendix.....	26

Executive Summary

This study examines possible effects of Brexit on the attractiveness of the United Kingdom (UK) to greenfield foreign direct investment (FDI)² and related new jobs created. We analyse both static (one-off) and dynamic (linked to foregone trade-related productivity growth) counterfactual outcomes relative to a “No Brexit” scenario in the case of three possible options for the UK-EU trade relationship:

- Membership of the European Economic Area (EEA)
- Free Trade Agreement (FTA) with the EU
- No withdrawal deal with the EU (WTO option)

A separate study examines the possible impact of Brexit on the attractiveness of Northern Ireland to FDI and associated job creation.³ In addition to the three scenarios mentioned above, this latter study analyses counterfactual outcomes for the case of Northern Ireland and the rest of the UK having different trade agreements with the EU.

Taken together, our results indicate that relative to a no Brexit scenario, the UK would be less attractive in the medium to long run as a location for FDI and would experience a reduction of FDI-related job creation in any of the three considered options for the UK-EU trade relationship. These effects come about through reduced market potential due to lower market size and reduced access to the EU Single Market. Given the uncertainty related to the UK’s EU exit and other changes in the UK’s attractiveness to FDI linked to other channels not captured by this analysis, these effects should be interpreted as being indicative of lower-bound effects.

The least damaging post-Brexit outcome would be in the case of membership in the EEA with a reduction in the medium to long run by 0.5% per annum of the number of FDI projects going to the UK. The corresponding reduction of the FDI-related new jobs would be 0.5% per annum. The implied cumulated reduction of greenfield FDI inflows from 2019 until 2030 would be 1.4 billion GBP relative to No Brexit. The largest cumulated reduction would be for FDI in services by non-EU investors, 0.5 billion GBP. The largest reduction in the number of FDI projects would be for FDI in services by non-EU investors while the largest reduction of FDI-related new jobs would be for FDI in manufacturing by non-EU investors.

The most damaging post-Brexit outcome would be in the case of the UK leaving the EU without an agreed withdrawal deal. The number of FDI projects going to the UK would be lower in the medium to long run by 1.7% per annum if only one-off effects are counted and by 3.4 % per annum if additional

² New greenfield FDI projects are new operations established by foreign companies at a new site. The foreign company may or may not already be present in the country, but the FDI project is in a new location within the country. It can also include relocation from one country to another.

³ “The Impact of the UK’s EU Exit on the Attractiveness of Northern Ireland to FDI and Associated Job Creation Effects”, by Iulia Siedschlag and Manuel Tong Koecklin, March 2019, Department for the Economy, Belfast, Northern Ireland, available at <https://www.economy-ni.gov.uk/sites/default/files/publications/economy/Impact-of-UK-EU-Exit-on-the-Attractiveness-of-Northern-Ireland-to-FDI-and-Associated-Job-Creation-Effects.pdf>

dynamic effects associated with foregone trade-related productivity growth are taken into account. The largest losses would be in the case of FDI in manufacturing by EU investors: the number of FDI projects would be lower in the medium to long run by 1.8% (one-off effects) and 3.6% (dynamic effects) per annum, respectively. The implied cumulated loss of greenfield FDI inflows over 2019-2030 would be 4.8 billion GBP (static effects) and 9.8 billion GBP (dynamic effects), respectively. The largest cumulated loss over 2019-2030 would be for FDI in services by non-EU investors: 1.2 billion GBP (static effects) and 2.4 billion GBP (dynamic effects), respectively. The corresponding reduction in the FDI related new jobs would be 1.6% and 3.3% per annum, respectively with the largest reductions in the case of FDI in manufacturing by non-EU investors, by 2.0% and 4.2% per annum respectively.

Relative to a no deal Brexit scenario, the UK's FDI attractiveness losses would be lower in the case of a free trade agreement with the EU. The number of FDI projects going to the UK would be lower in the medium to long run by 1.2% per annum if only one-off effects are counted and by 2.0% per annum if additional dynamic effects are taken into account. The largest loss would be for FDI in manufacturing by EU investors: the number of FDI projects would be lower in the medium to long run by 1.2% (one off effects) and 2.1% (dynamic effects) per annum, respectively. The implied cumulated loss of greenfield FDI inflows over 2019-2030 would be 3.3 billion GBP (static effects) and 5.7 billion GBP (dynamic effects) respectively. The largest cumulated losses would be for FDI inflows in services by non-EU investors: 0.8 billion GBP (static effects) and 1.4 billion GBP (dynamic effects), respectively. The number of FDI-related new jobs would be lower by 1.1% (static effects) and 1.9% (dynamic effects) per annum, respectively. The largest losses would be for FDI in manufacturing by non-EU investors, 1.4% and 2.5% per annum respectively.

While the UK would be less attractive to FDI in any of the post-Brexit scenarios considered, a number of EU countries would be worse off and others would be better off than the UK. Focusing on the worst case scenario of leaving the EU without an agreed withdrawal deal, the UK's losses in terms of its probability to be chosen as location for FDI projects in the case of one-off effects only would be relatively smaller than those of a number of small open economies including Luxembourg, Estonia, Croatia, and Ireland. However, when additional dynamic effects are taken into account, the UK would be worse off than any of the other EU countries with the exception of Luxembourg. A number of other EU countries would become more attractive to FDI post-Brexit relative to their attractiveness before Brexit including large countries (notably, Spain, and Poland) as well as small countries (notably, Cyprus, Denmark, Sweden and Portugal). The UK's attractiveness loss would be larger than for any other EU country in the case of FDI in manufacturing by EU investors when both static and dynamic effects are counted.

To compensate post-Brexit losses in terms of its attractiveness to FDI, policy options available to the UK's government could be a lower corporate tax rate or spending more on education. Our results suggests that the largest losses (dynamic effects) in the worst case scenario (leaving the EU without a deal) could be compensated in the medium to long run by lowering the corporate tax rate to 13.1% or increasing the government expenditures on education to 13.5% of total government expenditure.

This Report is complemented by a set of presentation slides available online at <https://www.economy-ni.gov.uk/sites/default/files/publications/economy/Impact-of-Uk-EU-Exit-on-its-Attractiveness-to-FDI-and-Associated-Job-Creation-Effects-Slide-Pack.pdf>.

1 Introduction

A large international evidence has established that foreign direct investment (FDI) is associated with new technologies and management know-how which contribute to higher productivity and job creation in host countries.⁴ The United Kingdom (UK) is the leading destination for FDI in the EU and the second largest in the world after the US.⁵ Existing international evidence shows that EU membership has been an important factor in attracting FDI to the UK. Bruno et al. (2016) have estimated that the EU membership has increased FDI inflows into the UK on average by 28% over the period 1985-2013 and predict that leaving the EU would reduce FDI inflows into the UK by 22% in the medium to long run. Campos and Coricelli (2015) estimate that over the period 1986 -2014, the net inflows into UK would have been lower on average by 25% to 30%, had the UK not been in the EU.

Recent evidence provided by Davies, Siedschlag and Studnicka (2018) on the location choice of FDI in EU countries over the period 2002-2013 finds that investors consider a range of factors for the location choice of new greenfield foreign affiliates and the relative importance of these factors differs for intra-EU investors and investors from outside the EU. The evidence indicates that investors from non-EU countries are mainly motivated by getting access to the EU Single Market while investors from other EU countries tend to choose low-cost locations. Furthermore, the evidence shows that the relative importance of location choice determinants varies also across manufacturing and services sectors. This evidence suggests that a reduced access to the EU Single Market post-Brexit is likely to affect the UK's attractiveness to new greenfield FDI projects.

Against this background, this study examines and quantifies the possible impact of Brexit on the attractiveness of the UK to greenfield FDI and associated job creation effects. The analysis builds on and extends previous analysis by Siedschlag et al. (2013a, 2013b) and Davies, Siedschlag, and Studnicka (2018).

We examine the attractiveness of the UK and the other EU countries to all FDI projects and in addition we distinguish between FDI projects in manufacturing and in services; FDI projects by EU and non-EU investors as well as combinations of these different types of FDI projects: FDI projects in manufacturing by EU and non-EU investors; FDI projects in services by EU and non-EU investors.

The post-Brexit counterfactual outcomes we consider include the following possible models of the UK-EU trade relationship:

- Membership of the European Economic Area (EEA)
- Free Trade Agreement (FTA) with the EU
- No withdrawal deal with the EU (WTO option)

We estimate counterfactual Brexit outcomes on the UK's attractiveness to FDI using our estimates on the location choice of FDI in EU countries combined with existing estimates on static and dynamic

⁴ Recent international evidence is discussed among others by Schiffbauer et al. (2017).

⁵ For the importance of the UK in the EU and global FDI see among others Barrett et al. (2015). Recent evidence on the importance of FDI in the UK's economy is provided by Dhingra et al. (2017).

effects of alternative Brexit scenarios on the GDPs of the UK and other EU countries.⁶ Further, we estimate counterfactual Brexit outcomes with respect to FDI related job creation. Finally, we analyse policy options to compensate negative Brexit effects including corporate taxation policy and government spending on education.

To the best of our knowledge this evidence is novel in comparison to other recent studies on economic effects of Brexit in a number of ways: (i) we identify the UK's attractiveness to greenfield FDI by using a multi-country econometric set up; (ii) we estimate counterfactual Brexit static and dynamic effects on the UK's attractiveness to FDI; (iii) we estimate counterfactual Brexit outcomes for FDI-related job creation; (iv) we identify and quantify policy options to compensate possible Brexit negative effects.

The rest of this paper is structured as follows. Section 2 discusses the empirical methodology. Next, section 3 describes the data used for the analysis and section 4 presents the empirical findings. Finally, section 5 summarises the key findings and concludes.

2 Empirical Methodology

To address the questions described above, we use multivariate econometric models to obtain insights on the relationships between access to the EU Single Market, attractiveness to FDI and FDI-related job creation. On the basis of these results and using existing estimates on the effects of alternative Brexit scenarios on the GDPs of the UK and other EU countries, we examine possible impacts of Brexit on the attractiveness of the UK to FDI and associated FDI-related job creation effects.

The empirical strategy we use consists of the following four stages:

- Modelling the importance of access to the EU Single Market and of other factors on the attractiveness of the UK and other EU countries to FDI;
- Modelling the link between the attractiveness of EU countries to FDI and FDI - related job creation;
- Predicting alternative Brexit outcomes for the UK's attractiveness to FDI and FDI-related job creation;
- Examining policy options to compensate the negative Brexit effects on the UK's attractiveness to FDI.

⁶ Static effects are one-off losses due to lower trade while dynamic effects include additional losses over time due to forgone productivity gains associated with trade. See Rojas-Romagosa (2016) for a detailed discussion on modelling post-Brexit static and dynamic income outcomes.

2.1 Modelling the location choice of greenfield FDI projects

We examine the role of access to the EU Single Market and other factors which influence the location choice of FDI projects by using a random utility maximization modelling framework following McFadden (1974).⁷ In this modelling set up, the foreign investor considers the set of all possible locations (the UK and the other EU countries), and chooses the location with the highest profitability among competing alternatives. Each location's profitability is a function of the location's characteristics such as demand (market size and market access) and supply factors (production costs, skills availability, innovation capacity, corporate tax rate). It is assumed that locational characteristics affect the profitability of all investors symmetrically.

The baseline model specification we estimate is as follows:

$$y_{ijt} = \begin{cases} 1 & \text{if } \pi_{ijt} > \pi_{ikt}, \forall j \neq k \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

The dependent variable y_{ijt} is a binary variable equal to 1 if a new FDI project i was established in location j in year t . π_{ijt} is the expected profit for the FDI project i in location j in year t . Location j is chosen if π_{ijt} is larger than in any other alternative location k . Since π_{ijt} is not known *ex-ante* by the foreign investor, the probability that region j is chosen for the location of foreign affiliate/FDI project i depends on the likelihood that its profit will be maximized in location j depending on its characteristics. The expected profit, π_{ijt} is a function of observed locational characteristics X_{jt} , and a random term of unobserved profit μ_{ijt} :

$$\pi_{ijt} = \beta X_{jt-1} + \mu_{ijt} \quad (2)$$

β is a vector of coefficients related to the corresponding vector of observable location characteristics X_{jt-1} . The location characteristics are lagged by one year with respect to the location choice decision for each project to alleviate possible reverse causality. The description of the variables used in the econometric analysis and their data sources is given in Table A1 in the Appendix.

Following McFadden (1974), if, and only if, μ_{ijt} follows an extreme-value type 1 distribution and is independent and identically distributed across all investors i and alternative locations j , the probability that location j is chosen by firm i at time t is given by:

$$P_{jt} = \frac{e^{\beta X_{jt}}}{\sum_j e^{\beta X_{jt}}} \quad (3)$$

where $\sum_j P_{jt} = 1$

Given the assumption that location characteristics affect all investors symmetrically, the location probability P_{jt} quantifies the share of firms choosing to invest in location j in year t . The assumption about the distribution of stochastic terms μ_{ij} implies a statistical property known as independence of

⁷ Recent reviews of this modelling framework include among others Schmidheiny and Brühlhart (2011), Siedschlag et al. (2013a, 2013b), and Lawless et al. (2014).

irrelevant alternatives (IIA). Under this assumption, the parameters β can be estimated by a conditional logit model (CLM). The IIA property implies that the total number of investments is fixed and that changes in the location characteristics affect only the distribution of investments across all location alternatives. This means that if a location becomes more attractive and attracts one additional investment, this will be at the expense of another location.⁸

Using the estimates obtained above, we predict the attractiveness of a given location i (UK and the other EU countries) to FDI in each year t , FDI_Prob_{it} .

2.2 Modelling the link between attractiveness to FDI and FDI related job creation

We examine the link between attractiveness to FDI and FDI related job creation by estimating the following model:

$$\ln FDI_Jobs_{it} = \alpha_0 + \alpha_1 \ln FDI_Prob_{it} + \sum_{i=1}^7 \beta_i X_{it-1} + \gamma_t + \varepsilon_{it} \quad (4)$$

The dependent variable taken in logs is the number of FDI related jobs created in a given country i and year t . The explanatory variables include the predicted attractiveness to FDI of a given country i and year t (retrieved from the previous modelling stage) and a vector of time variant country-specific characteristics which have been found to impact on job creation/employment:⁹ real wage per employee, real wage per employee growth, real GDP growth, financial development (private credit as % of GDP), capital stock (total fixed assets as % of GDP), tertiary educational attainment (the share of the of population with tertiary education in the population aged 30-34), R&D intensity (R&D expenditures as % of GDP). These variables are lagged by one year with respect to the dependent variable to avoid possible simultaneity concerns. The model also includes time-specific effects (γ_t) to control for common macroeconomic shocks. More detailed descriptions of variables and data sources are given in Table A1 in the Appendix.

The parameter of interest is α_1 which captures the elasticity of FDI-related job creation with respect to countries' attractiveness to FDI – the per cent change in FDI-related job creation following a one per cent change in the predicted country's attractiveness to FDI.

⁸ This econometric framework has been used widely to model the location choice of foreign direct investment. Recent reviews of this literature include among others Barrios et al. (2012), Siedschlag et al. (2013a, 2013b), Lawless et al. (2014) and Davies, Siedschlag and Studnicka (2016).

⁹ See for example Nickell and Nicolitsas (1999).

2.3 Analysis of potential counterfactual Brexit scenarios

To examine possible Brexit effects on the UK's attractiveness to FDI, we estimate counterfactual outcomes corresponding to the possible alternative models of the UK-EU relationship described above and compare these with the "No Brexit" baseline estimates obtained in the first stage of this analysis. More specifically, we use estimated reductions in GDP obtained by previous studies under alternative Brexit scenarios (Aichele and Felbermayr 2015; Rojas-Romagosa 2016) and compute the corresponding reduced access to the EU Single Market for the UK and the other EU countries. On this basis, we obtain counterfactual outcomes for the attractiveness of the UK to FDI. Using the elasticities of FDI-related job creation with respect to countries' attractiveness to FDI and the changes in the UK's attractiveness to FDI, we compute the corresponding changes in FDI related job creation under alternative Brexit scenarios.

2.4 Compensatory policy options

Having quantified the post-Brexit outcomes on the UK's attractiveness to FDI under the three considered scenarios, we simulate policy options to compensate the negative effects. To this purpose, we consider changes in two policy areas:

- the corporate tax rate
- government expenditure on education

The policy simulations are based on the estimated changes in the UK's probability to be chosen as location to FDI with respect to changes in its corporate tax rate and government expenditure on education.

3 Data

We combine data from several sources including the following: (i) information on the location and number of new greenfield FDI projects, invested capital, and FDI-related job creation in the UK and the EU countries; (ii) data on location characteristics; (iii) existing estimates on possible effects of alternative Brexit scenarios on the GDP of the UK and the other EU countries. The key features of the data are described in the next sections below.

3.1 The location of new greenfield FDI projects and related job creation

We analyse over 65,000 new greenfield FDI projects established in the UK and the other EU countries over the period 2003-2017. The information on the location and number of FDI projects, invested capital and related new jobs has been extracted from the fDi Markets data base. To net out any anticipated Brexit effects on the location choice of new greenfield FDI projects and associated employment effects, we base our analysis on new FDI projects and FDI-related job creation over the period 2003-2015.

3.2 Location characteristics

We use annual data on location characteristics (provided by the Eurostat, the World Bank and KPMG) including: GDP (in constant 2010 prices), GDP per capita (in constant 2010 prices), domestic credit to

the private sector as % of GDP; trade openness (trade as % of GDP), government expenditure on education, (% of total government expenditure), R&D expenditures (% of GDP), statutory corporate tax rates, wage per employee (in constant 2010 prices), capital stocks, and tertiary educational attainment. Detailed descriptions of variables and data sources are given in Table A1 in the Appendix.

The key variable in our analysis is access to the EU Single Market ($EU MP_i$) which is defined for a given EU country i and year t as follows:¹⁰

$$EU MP_{it} = GDP_{it} + \sum_j \frac{GDP_{jt}}{d_{ij}} \quad (5)$$

with $j \neq i$, for all other possible locations j relative to the host country i .

d_{ij} denotes the distance between countries i and j ¹¹ to account for the fact that market access declines with transport cost.

The UK's access to the EU Single Market is obtained as a sum of its economic size (GDP) and the sum of the economic size of all other EU countries to which the UK has access discounted by the bilateral distance between the UK and all other countries.

3.3 Estimates of Brexit outcomes from the existing literature

To generate counterfactual Brexit outcomes, we combine our estimates on the location choice of FDI projects across EU countries with estimates of the effect of possible Brexit scenarios on the UK's and the other EU countries' GDP taken from Aichele and Felbermayr (2015) and Rojas-Romagosa (2016).¹² A description of the main features of these Brexit scenarios is provided in Box 1. The estimated GDPs reductions for the UK and the rest of EU countries are shown in Table A2 in the Appendix.

As shown in Table A2, the UK's GDP in the medium to long run would be lower in any of the considered Brexit scenarios relative to the baseline *No Brexit* scenario. The least damaging Brexit option for the UK would be membership in the EEA with a reduction in GDP by 0.6%. The most damaging option would be the no-deal (WTO) option with a drop in GDP by 4.1% if only static effects are considered and by 8.7% if dynamic effects related to foregone trade-related innovation and productivity growth are taken into account. The corresponding GDP reductions in the case of a FTA scenario would be 3.4% (static effects only) and 5.9% (both static and dynamic effects), respectively. These Brexit negative effects on the UK's GDP would be the largest among all EU countries. The next most sizeable effects would be on Ireland's GDP: in the worst case of a no deal scenario, Ireland's GDP would be lower relative to what it would be under no Brexit by 3.7% if only static effects are considered and by 5.8% if additional dynamic effects are taken into account. Belgium and Luxembourg would also see large

¹⁰ This measure has been first proposed by Harris (1954) and has been used widely in the literature on the location choice of foreign direct investment. See for example, Head and Mayer (2004), Crozet, Mayer, and Mucchielli (2004), Barrios et al. (2012), Siedschlag et al. (2013a, 2013b).

¹¹ The distance between two countries is the average distance in km between the biggest cities of those two countries, weighted by the share of the city in the overall country's population. The information is taken from the CEPII data base available from http://www.cepii.fr/CEPII/en/bdd_modele/download.asp?id=8. Further details are provided by Mayer and Zignago (2011).

¹² We thank Hugo Rojas-Romagosa for sharing with us his estimates of dynamic effects of Brexit on the GDP of EU countries.

reductions in their GDPs while the Brexit impact on the GDPs of the rest of the other EU countries would be less important.

Box 1: Brexit Scenarios

Static effects

EEA scenario: The United Kingdom exits the EU, but receives a status similar to that of Norway or Switzerland, meaning that the EU and UK retain a deep trade agreement. The increased cost of trade results from reversing the trade cost reductions from joining the EU that were previously observed.

FTA scenario: Free trade agreement with the EU after 10 years. From 2019 until 2029 the WTO's most favoured nation (MFN) tariffs will be applied reciprocally for the UK's trade with WTO members including the EU. In 2029 the tariffs will return to zero. In the case of the UK's leaving the EU, non-tariff barriers (NTB) are assumed to be higher with the equivalent of the intra-EU NTB ad-valorem savings due to the EU Single Market estimated by Egger et al. (2015). Once the FTA will be in place, NTB costs are assumed half of the non-EU NTB levels.

WTO scenario: Tariffs will increase to the WTO's MFN level. NTB costs will increase to the non-EU NTB levels applied before the EU Single Market.

Dynamic effects

Larger losses are likely due to foregone trade due to dynamic income gains over time associated with productivity growth linked to trade-induced innovation. These dynamic trade effects in the context of Brexit have been discussed recently (for example by HM Treasury 2016; Dhingra et al. 2016; Kierzenkowski et al. 2016) following recent work by Keller (2002) and Melitz and Trefler (2012). This is not a standard approach of modelling trade policy. Above baseline trade volumes are obtained by creating an exogenous link between trade volumes and above-baseline total factor productivity increases. A conservative value for the elasticity of trade to productivity is used, 0.1. Given the lack of conclusive empirical evidence on the precise mechanisms and estimates for the trade-productivity elasticity, these results should be considered as indicative only.

The scenarios described above are based on assumptions regarding the trade costs under different possible trade agreements between the EU and the UK. These assumptions do not include possible trade agreements between the UK and non-EU countries. Further, it is assumed that post-Brexit, the UK will retain its WTO membership and it will also continue to benefit from the preferential terms within the current free trade agreements (FTAs) negotiated by the EU with non-EU countries.

Sources: Aichele and Felbermayr (2015), Rojas-Romagosa (2016).

4 Results

4.1 Baseline estimates on determinants of the location choice of FDI

Tables 1 and 2 show the estimates for the importance of access to the EU Single Market and of other factors for the attractiveness of EU countries to all FDI projects and the different types of FDI considered. The results indicate that a larger EU market potential (a larger access to the EU Single Market) increases a country's probability to be chosen as location for FDI projects. The importance of this factor appears to be greater in the case of investments from non-EU countries in comparison to intra-EU investments. While in the case of intra-EU investments, access to the EU Single Market is more important for the location choice of FDI in services, in the case of FDI by non-EU investors it is more important for the location choice of FDI in manufacturing. Other factors which are found to increase the attractiveness of EU countries to FDI are a higher intensity of government spending on education (more important for FDI from non-EU countries than for intra-EU investments and for FDI in services in comparison to FDI in manufacturing); real GDP per capita (more important for intra-EU investments and for FDI in manufacturing); lower corporate tax rate (more important for FDI from non-EU countries).

Table 1: Determinants of the location choice of FDI projects in EU countries, 2003-2015, All FDI and by EU and non-EU investors

Location characteristics	All FDI	EU FDI	Non EU FDI
EU market potential	1.131*** (0.008)	0.903*** (0.009)	1.458*** (0.013)
Real GDP per capita	-1.157*** (0.019)	-1.136*** (0.023)	-1.134*** (0.032)
Corporate tax rate	-0.734*** (0.029)	-0.584*** (0.037)	-0.893*** (0.047)
Financial development	0.136*** (0.015)	0.031* (0.018)	0.285*** (0.026)
R&D expenditure	0.167*** (0.016)	0.219*** (0.021)	0.081*** (0.027)
Trade openness	0.493*** (0.022)	0.179*** (0.028)	0.980*** (0.034)
Government expenditure on education	1.504*** (0.036)	0.980*** (0.044)	2.126*** (0.060)
Number of observations	1,420,000	797,000	620,000
Pseudo R ²	0.151	0.108	0.234

Notes: Estimates obtained with a conditional logit model (CLM).

Source: Own estimates based on FDI data from the fDi Markets, OECD and the Eurostat.

Table 2: Determinants of the location choice of FDI projects in EU countries, 2003-2015, Manufacturing and Services FDI and by EU and non-EU investors

Location characteristics	EU FDI Man	EU FDI Services	Non EU FDI Man	Non EU FDI Services
EU market potential	0.885*** (0.012)	0.926*** (0.014)	1.492*** (0.019)	1.434*** (0.017)
Real GDP per capita	-1.195*** (0.029)	-1.051*** (0.036)	-1.422*** (0.047)	-0.879*** (0.046)
Corporate tax rate	-0.690*** (0.050)	-0.473*** (0.056)	-0.743*** (0.070)	-0.976*** (0.065)
Financial development	0.012 (0.023)	0.056* (0.029)	0.156*** (0.037)	0.412*** (0.037)
R&D expenditure	0.223*** (0.028)	0.222*** (0.032)	0.296*** (0.040)	-0.085** (0.039)
Trade openness	0.038 (0.037)	0.340*** (0.042)	1.185*** (0.050)	0.836*** (0.049)
Government expenditure on education	0.775*** (0.058)	1.227*** (0.069)	1.688*** (0.086)	2.422*** (0.086)
Number of observations	435,000	349,000	280,000	331,000
Pseudo R ²	0.109	0.111	0.222	0.257

Notes: Estimates obtained with a conditional logit model (CLM).

Source: Own estimates based on FDI data from the fDi Markets, OECD and the Eurostat.

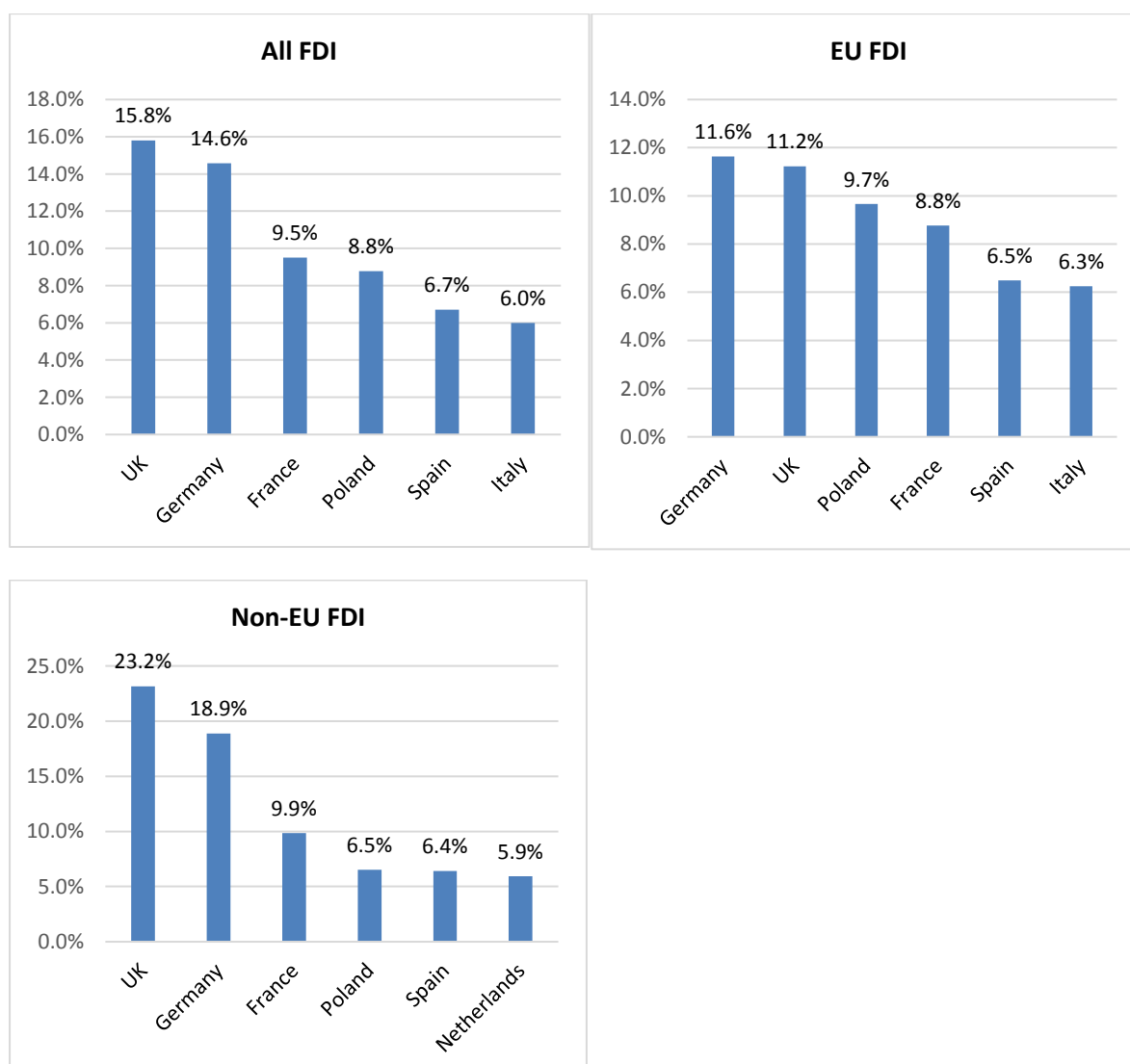
Looking at the main determinants for the location choice of FDI, the results indicate that FDI projects from non-EU countries tend to locate in countries with a high intensity of government spending on education and a higher EU market potential, while intra-EU investments appear to seek locations with lower production costs (countries with lower GDP per capita). Government spending on education appears to be the main attractiveness factor for FDI by non-EU investors in manufacturing and services and for intra-EU FDI in services while intra-EU FDI in manufacturing is most sensitive to countries' EU market potential.

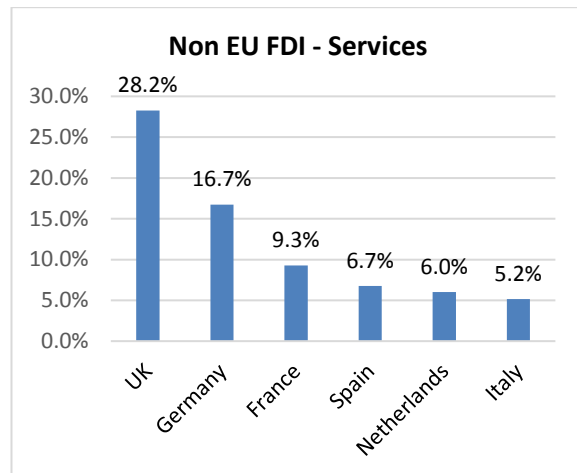
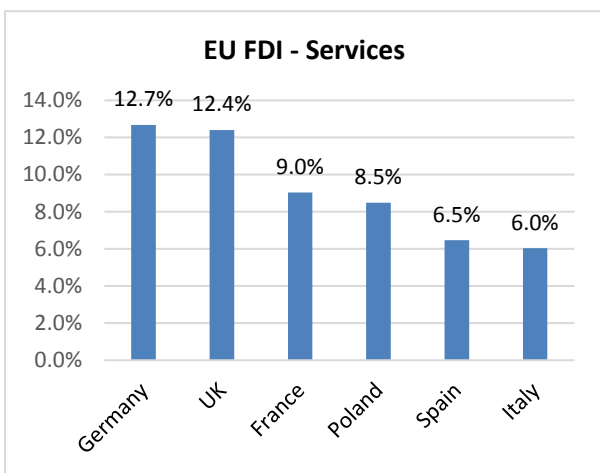
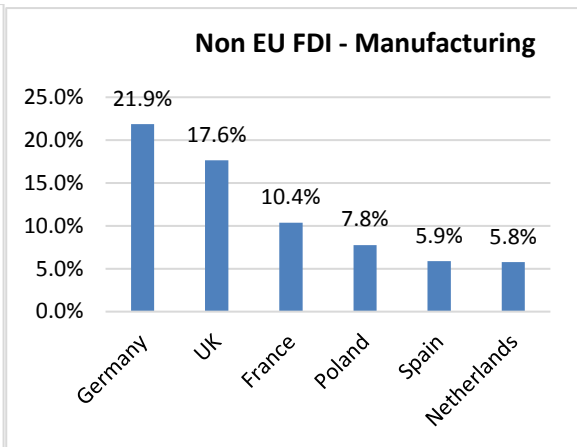
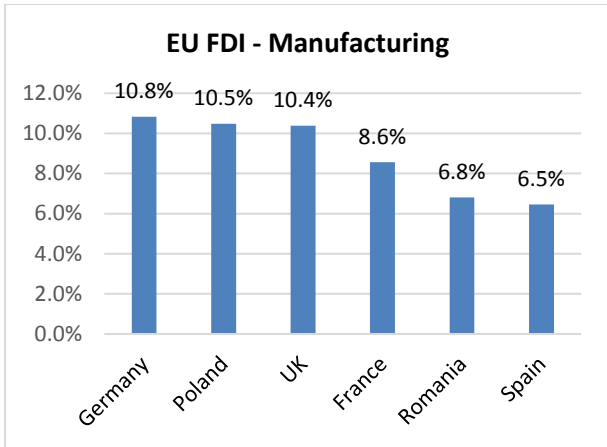
4.2 The UK's attractiveness to FDI

On the basis of the results shown in Tables 1 and 2, Figure 1 compares the UK's attractiveness to FDI with the other five most attractive EU countries. The numbers shown are estimated average location probabilities conditional on locational characteristics over the period 2003-2015.

The UK is the leading destination when all FDI projects going to the EU are considered as well as for FDI by non-EU investors and for FDI in services by non-EU investors. The UK is the second most attractive location (behind but close to Germany) for intra-EU FDI projects for FDI in manufacturing by non-EU investors and for intra-EU FDI. Germany and Poland are slightly ahead of the UK as locations for intra-EU FDI in manufacturing.

Figure 1: The attractiveness to FDI by type of FDI: the UK and other top EU locations, average conditional probabilities, 2003-2015 – No Brexit





Source: Own estimates based on FDI data from the fDi Markets, OECD and the Eurostat.

4.3 The attractiveness of EU countries to FDI and FDI related job creation

Table 3 shows the estimated elasticity of FDI related new jobs with respect to changes in the conditional location probabilities of EU countries. The results indicate that on average, a 1% increase in the average location probability would increase the corresponding average number of FDI-related new jobs by nearly 1%. The highest elasticity is for FDI in manufacturing by non-EU investors, 1.2%. The results are symmetric in the case of a reduction of countries' attractiveness to FDI.

These estimates will be combined with the estimated counterfactual Brexit outcomes for the UK's attractiveness to FDI to obtain corresponding counterfactual outcomes for FDI-related job creation.

Table 3: Average elasticities of FDI related jobs created with respect to changes in the conditional location probabilities of EU countries

FDI projects	Elasticity with respect to location probability
All FDI projects	0.970***
EU FDI	1.097***
EU FDI - Manufacturing	1.076***
EU FDI – Services	1.163***
Non-EU FDI	1.024***
Non EU FDI - Manufacturing	1.218***
Non EU FDI - Services	1.138***

Notes: Estimates obtained with the model described by Equation (4) in Section 2.2.

Source: Own estimates based on FDI data from the fDi Markets, OECD and the Eurostat.

4.4 Analysis of counterfactual Brexit outcomes

Tables 4-6 summarise the results for the counterfactual Brexit outcomes estimated as discussed in Section 2.3.

Table 4 shows the estimated counterfactual outcomes for the UK's attractiveness to FDI. On the basis of these results and data on invested capital (from fDi Markets), Table 5 reports the implied reductions of greenfield FDI inflows over 2019-2030 relative to no Brexit. These results indicate that post-Brexit the UK would be less attractive to FDI relative to the baseline No Brexit scenario in any of the three options for the UK-EU trade relationship considered. The least damaging post-Brexit outcome would be in the case of the UK's membership in the EEA with a reduction of the number of FDI projects going to the UK by 0.5% per annum in the medium to long term relative to what the number of projects would be in the case of no Brexit. On the basis of the reported invested capital over the period 2003-2015, this result implies that new greenfield FDI flows into the UK over 2019-2030 would be lower by 1.4 billion GBP. The largest loss in terms of number of projects and invested capital in the case of the UK's EEA membership would be for FDI in services by non-EU investors.

The most damaging scenario would be in the case where the UK would leave the EU without a deal (with WTO most favoured nation tariffs applying): the number of FDI projects going to the UK would be lower by 1.7% per annum in the medium to long term if only one-off effects are counted and by 3.4% if additional effects associated with foregone trade-related productivity growth are taken into account. The implied reduction of FDI inflows over 2019-2030 would be 4.8 billion GBP (static effects) and 9.8 billion GBP (dynamic effects), respectively. The largest loss in terms of number of projects would be in the case of FDI in manufacturing by EU investors: 1.8% per annum if only static effects are counted and 3.6% per annum with additional dynamic effects taken into account. This outcome could be linked to the UK's lower attractiveness to this type of FDI relative to other EU countries (Germany and Poland) as shown in Fig. 1. In terms of invested capital, the largest cumulated loss over 2019-2030 would be for FDI in services by non-EU investors: 1.2 billion GBP (static effects) and 2.4 billion GBP (dynamic effects), respectively.

Relative to the no deal scenario, the UK's FDI attractiveness losses would be lower in the case of a free trade agreement with the EU: the number of FDI projects would be lower by 1.2% per annum if only static effects are counted and by 2% with additional dynamic effects taken into account. The implied cumulated loss of FDI inflows over 2019-2030 would be 3.3 billion GBP (static effects) and 5.7 billion GBP (dynamic effects), respectively. The largest losses would be for FDI inflows in services by non-EU investors: 0.8 billion GBP (static effects) and 1.4 billion GBP (dynamic effects), respectively.

Table 4 Counterfactual Brexit impacts – Estimated losses in the UK’s probability to be chosen as location for FDI, % average annual changes relative to No Brexit

	Static EEA	Static FTA	Static WTO	Dynamic FTA	Dynamic WTO
All FDI	-0.48	-1.15	-1.65	-1.99	-3.38
EU FDI	-0.36	-1.18	-1.71	-2.05	-3.46
EU FDI - Manufacturing	-0.37	-1.24	-1.78	-2.13	-3.59
EU FDI - Services	-0.34	-1.10	-1.61	-1.91	-3.26
Non EU FDI	-0.51	-0.94	-1.35	-1.64	-2.80
Non EU FDI - Manufacturing	-0.49	-1.18	-1.67	-2.05	-3.48
Non EU FDI – Services	-0.52	-0.78	-1.14	-1.37	-2.34

Source: Own estimates based on data from the fDi Markets, Eurostat, KPMG, the World Bank, Aichele and Felbermayr (2015) and Rojas-Romagosa (2016).

Table 5: Counterfactual Brexit impacts – Estimated cumulated reduction in invested capital in new greenfield FDI in the UK relative to No Brexit, 2019-2030, billions GBP

	Static EEA	Static FTA	Static WTO	Dynamic FTA	Dynamic WTO
All FDI	-1.39	-3.32	-4.77	-5.75	-9.76
EU FDI	-0.46	-1.50	-2.18	-2.61	-4.40
EU FDI - Manufacturing	-0.24	-0.79	-1.14	-1.36	-2.30
EU FDI - Services	-0.11	-0.36	-0.52	-0.62	-1.06
Non EU FDI	-0.82	-1.52	-2.18	-2.65	-4.53
Non EU FDI - Manufacturing	-0.16	-0.39	-0.56	-0.68	-1.16
Non EU FDI – Services	-0.53	-0.80	-1.16	-1.40	-2.39

Source: Own estimates based on data from the fDi Markets, Eurostat, KPMG, the World Bank, Aichele and Felbermayr (2015) and Rojas-Romagosa (2016).

Table 6 shows the estimated counterfactual outcomes for FDI related new jobs. A similar pattern with the one for FDI projects emerges. Relative to no Brexit, the number of FDI related new jobs would be lower by 0.5% per annum in the case of the UK’s EEA membership. The number of FDI related new jobs in the case of the UK’s EU exit without a deal would be lower by 1.6% per annum if only static effects are counted and by 3.3% per annum with additional dynamic effects. The largest reduction would be for FDI in manufacturing by non- EU investors, by 2% and 4.2% per annum, respectively. This result is in line with the estimated elasticities of FDI-related new jobs with respect to changes in location probabilities: the number of new jobs created by FDI in manufacturing by non-EU investors appears to be the most sensitive to changes in attractiveness to FDI. In the case of a free trade agreement with the EU, the number of FDI related new jobs would be lower by 1.1% and 1.9% per annum respectively. The largest losses would be for FDI in manufacturing by non-EU investors, 1.4% and 2.5% per annum respectively.

Table 6 Counterfactual Brexit impacts – Estimated reductions in the UK’s FDI related new jobs, % average annual changes relative to No Brexit

	Static EEA	Static FTA	Static WTO	Dynamic FTA	Dynamic WTO
All FDI	-0.47	-1.12	-1.60	-1.93	-3.28
EU FDI	-0.39	-1.29	-1.88	-2.25	-3.80
EU FDI - Manufacturing	-0.40	-1.33	-1.92	-2.29	-3.86
EU FDI - Services	-0.40	-1.28	-1.87	-2.22	-3.79
Non EU FDI	-0.52	-0.96	-1.38	-1.68	-2.87
Non EU FDI - Manufacturing	-0.60	-1.44	-2.03	-2.50	-4.24
Non EU FDI - Services	-0.59	-0.89	-1.30	-1.56	-2.66

Source: Own estimates based on data from the fDi Markets, Eurostat, KPMG, the World Bank, Aichele and Felbermayr (2015) and Rojas-Romagosa (2016).

Taken together, these results indicate that the UK would be less attractive to FDI in any of the post-Brexit scenarios considered. While the losses discussed above would come about through the reduced EU market potential, there might be additional losses coming through other channels. These estimates should be therefore interpreted as being indicative of lower-bound effects. Given the importance of the UK as a trade partner for the other EU countries, Brexit would also affect the market potential and the attractiveness to FDI of the other EU countries.

Tables A3-A6 in the Appendix show the counterfactual outcomes for all EU countries in the case of a no deal Brexit scenario. The static counterfactual effects for all FDI projects shown in Table A3 indicate that while the UK’s attractiveness losses would be larger than in many other EU countries, a number of small open economies would be worse off than the UK, including Luxembourg, Estonia, Croatia and Ireland. When dynamic effects are taken into account, the UK would be worse off than any of the other EU countries with the exception of Luxembourg. A number of countries would become more attractive to FDI including large countries and small countries. The three countries with the largest attractiveness gains would be Cyprus, Denmark and Sweden. The counterfactual effects by the origin of investors shown in Table A4 indicate that the UK’s attractiveness losses would be larger than in most of the other EU countries for FDI by EU investors while in the case of FDI by non-EU investors a larger number of small countries would be worse off than the UK. The UK’s losses appear to be larger than for any other EU country in the case of FDI in manufacturing by EU investors when both one-off and dynamic effects are taken into account (Table A5).

4.5 Compensatory policy options

Having estimated potential post-Brexit losses for the UK’s attractiveness to FDI, the next question we examine is what policy changes could help to compensate these. We focus on two policies which are directly influenced by government policy choices and have been found to influence greatly the location choice of FDI projects (see Tables 1 and 2): the corporate tax rate and government spending on education.

Table 7 shows the estimated policy options available to the UK to compensate the post-Brexit losses of its attractiveness to FDI in two of the analysed scenarios with sizeable effects: (i) a free trade agreement with the EU (FTA) and (ii) no deal (WTO).

Table 7. Policy options to compensate the losses of the UK's attractiveness to FDI

Post-Brexit outcomes	Compensatory Corporate tax rate %	Compensatory government expenditure on education % of total expenditure
All FDI		
FTA static effects	17.7	12.2
FTA dynamic effects	15.9	12.6
WTO static effects	16.6	12.4
WTO dynamic effects	13.1	13.5
EU FDI		
FTA static effects	15.9	12.9
FTA dynamic effects	12.9	13.9
WTO static effects	14.1	13.5
WTO dynamic effects	8.1	15.6
Non EU FDI		
FTA static effects	18.8	11.8
FTA dynamic effects	17.9	12.0
WTO static effects	18.3	11.9
WTO dynamic effects	16.5	12.4

Source: Own estimates.

Taking all FDI projects into account, in the worst case scenario (leaving the EU without a deal) the UK's corporate tax rate would need to be 13.1% in the medium to long term to compensate the largest attractiveness loss (one-off and dynamic effects). In the case the UK would agree a free trade agreement with the EU, the corresponding attractiveness losses could be compensated with a corporate tax rate at 15.9%. Given the more sizeable losses for the UK's attractiveness to FDI by EU investors, to maintain its pre-Brexit attractiveness to these FDI projects, in the worst case scenario, the UK's corporate tax rate would need to be 8.1%. To put these figures into context, in 2015 the UK's corporate tax rate was 20% (26.9% on average over 2003-2015).

In the case of the alternative compensatory policy option considered, increasing the government spending on education to 13.5% of total government expenditure in the medium to long term would compensate the largest losses in the UK's attractiveness to all FDI in the worst case scenario. The corresponding figure in the case of a free trade agreement with the EU would be 12.6%. The largest losses in the case of FDI by EU investors could be compensated with a higher government expenditure on education of 15.6%. In comparison to these counterfactuals, government expenditure on education was 11.5% of total government expenditure in 2015 (13% on average over 2003-2015).

5 Summary of Key Findings

This study examines possible post-Brexit consequences on the attractiveness of the UK to greenfield foreign direct investment (FDI) and related job creation. We analyse both static (one-off) and dynamic counterfactual outcomes of alternative models for the UK-EU relationship relative to a “No Brexit scenario”. Further, we examine policy options to compensate the potential Brexit negative effects. To this purpose, we analyse over 65,000 new greenfield FDI projects established in the UK and the other EU countries over the period 2003-2015. In addition, we further distinguish and examine different types of FDI projects: FDI by EU and by non-EU investors; FDI in manufacturing by EU and non-EU investors; FDI in services by EU and non-EU investors.

Taken together, our results indicate that relative to a no Brexit outcome, the UK would be less attractive as a location to FDI and would experience a reduction of FDI-related job creation in any of the considered post-Brexit options for the UK-EU relationship.

The least damaging post-Brexit outcome would be in the case of membership in the EEA with a reduction in the medium to long run by 0.5% per annum of the number of FDI projects going to the UK. On the basis of the reported greenfield FDI flows into the UK over 2003-2015, the cumulated loss of invested capital in greenfield FDI from 2019 until 2030 would amount to 1.4 billion GBP. The corresponding reduction of the FDI-related new jobs would be 0.5% per annum. The largest loss for the number of FDI projects would be for FDI in services by non-EU investors while the largest reduction in FDI related new jobs would be for FDI in manufacturing by non-EU investors.

The most damaging post-Brexit outcome would be in the case of the UK leaving the EU without an agreed withdrawal deal. The number of FDI projects going to the UK would be lower in the medium to long run by 1.7% per annum if only one-off effects are counted and by 3.4 % per annum if additional dynamic effects associated with foregone trade-related productivity growth are taken into account. The implied cumulated loss of invested capital in greenfield FDI over 2019-2030 would be 4.8 billion GBP (static effects) and 9.8 billion GBP (dynamic effects), respectively. The corresponding reduction in the FDI-related new jobs would be 1.6% and 3.3% per annum, respectively. The largest losses in terms of number of projects would be in the case of FDI in manufacturing by EU investors: the number of FDI projects would be lower in the medium to long run by 1.8% (one-off effects) and 3.6% (dynamic effects) per annum, respectively. In terms of the number of FDI related new jobs, the largest reductions would be for FDI in manufacturing by non-EU investors, by 2.0% per annum and 4.2% per annum respectively. In terms of invested capital, the largest cumulated loss over 2019-2030 would be for FDI in services by non-EU investors: 1.2 billion GBP (static effects) and 2.4 billion GBP (dynamic effects), respectively.

Relative to a no deal Brexit scenario, the UK's FDI attractiveness losses would be lower in the case of a free agreement with the EU: the number of FDI projects going to the UK would be lower in the medium to long run by 1.2% per annum if only one-off effects are counted and by 2.0% per annum if additional dynamic effects are taken into account. The implied cumulated loss of FDI inflows over 2019-2030 would be 3.3 billion GBP (static effects) and 5.7 billion GBP (dynamic effects) respectively. The largest cumulated loss would be for FDI in services by non-EU investors: 0.8 billion GBP (static effects) and 1.4 billion GBP (dynamic effects), respectively. The largest losses with respect to the number of projects would be for FDI in manufacturing by EU investors: the number of FDI projects would be lower in the

medium to long run by 1.2% (one off effects) and 2.1% (dynamic effects) respectively. The number of FDI-related new jobs would be lower by 1.1% (static effects) and 1.9% (dynamic effects) per annum, respectively with the largest reductions for FDI in manufacturing by non-EU investors, 1.4% (one-off effects) and 2.5% (dynamic effects) per annum, respectively.

While the UK would be less attractive to FDI in any of the post-Brexit scenarios considered, a number of EU countries would be worse off and others would be better off than the UK. Focusing on the worst case scenario of leaving the EU without an agreed withdrawal deal, the UK's losses in terms of its probability to be chosen as location for FDI projects in the case of one-off effects only would be relatively smaller than those of a number of small open economies including Luxembourg, Estonia, Croatia, and Ireland. However, when additional dynamic effects are taken into account, the UK would be worse off than any of the other EU countries with the exception of Luxembourg. A number of other EU countries would become more attractive to FDI post-Brexit relative to their attractiveness before Brexit including large countries (notably, Spain, and Poland) as well as small countries (notably, Cyprus, Denmark, Sweden and Portugal). The UK's attractiveness loss would be larger than for any other EU country in the case of FDI in manufacturing by EU investors when both static and dynamic effects are counted.

To compensate post-Brexit losses in terms of its attractiveness to FDI, policy options available to the UK's government could be a lower corporate tax rate or spending more on education. Our results suggests that the largest losses (one off and dynamic effects) in the worst case scenario (leaving the EU without a deal) could be compensated in the medium to long run by lowering the corporate tax rate to 13.1% or increasing the government expenditures on education to 13.5% of total expenditure.

References

- Aichele, Rahel, and Gabriel Felbermayr (2015). "Costs and benefits of a United Kingdom exit from the European Union", Guetersloh: Bertelsmann Stiftung.
- Barrett, A., A. Bergin, J. FitzGerald, D. Lambert, D. McCoy, E. Morgenroth, I. Siedschlag, Z. Studnicka (2015). Scoping the Possible Economic Implications of BREXIT on Ireland, ESRI Research Series No. 48, Economic and Social Research Institute, Dublin.
- Barrios, S., Huizinga, H., Laeven, L., and Nicodeme, G. (2012). "International taxation and multinational firm location decisions", *Journal of Public Economics*, 96(11): 946-958.
- Crozet, M., T. Mayer, and J. L. Mucchielli (2004). "How do firms agglomerate? A study of FDI in France", *Regional Science and Urban Economics*, 34(1): 27-54.
- Bruno, R., N. Campos, S. Estrin, M. Tian (2016). Foreign Direct Investment and the Relationship Between the United Kingdom and the European Union, CEP Discussion Paper No. 1453, Centre for Economic Performance, London.
- Campos, N. and F. Coricelli (2015). Some Unpleasant Brexit Econometrics, VoxEU.org
- Davies, R. B., I. Siedschlag, Z. Studnicka (2016). "The Impact of Taxes on the Intensive and Extensive Margins of FDI", ESRI Working Paper No. 537, Economic and Social Research Institute, Dublin.
- Davies, R. B., I. Siedschlag, Z. Studnicka (2018). Corporate Taxation and the Location Choice of Foreign Direct Investment in EU Countries, ESRI Working Paper No. 591, Economic and Social Research Institute, Dublin.
- Dhingra, Swati, Gianmarco Ottaviano, Thomas Sampson, and John Van Reenen (2016). "The Consequences of Brexit for UK Trade and Living Standards", Paper Brexit 02, Centre for Economic Performance (CEP), London School of Economics.
- Dhingra, S., G. Ottaviano, V. Rappoport, T. Sampson, C. Thomas (2017). UK Trade and FDI: A Post-Brexit Perspective, *Papers in Regional Science*, 97: 9-24.
- Ebell, M., J. Warren (2016). The Long-Term Economic Impact of Leaving the EU, *National Institute Economic Review*, 236: 121-138.
- Emerson, M., M. Busse, M. Di salvo, D. Gros, J. Pelkmans (2017). An Assessment of the Economic Impact of Brexit on the EU 27, Study prepared for the European Parliament, Directorate General Internal Policies.
- Egger, Peter, Joseph Francois, Miriam Manchin, Doug Nelson (2015). "Non-Tariff Barriers, Integration, and the Transatlantic Economy, *Economic Policy*, 30(83): 539-584.
- Head, K. and T. Mayer (2004). "Market potential and the location of Japanese investment in the European Union, *Review of Economics and Statistics*, 86(2): 959-972.
- HM Treasury (2016). "HM Treasury Analysis: The long-term economic impact of EU membership and the alternatives", Technical Report, HM Government.
- Kierzenkowski, R., N. Pain, E. Rusticelli, and S. Zwart (2016). "The Economic Consequences of Brexit: A Taxing Decision," OECD Economic Policy Paper 16, OECD.

- Keller, Wolfgang (2002). "Trade and the transmission of technology", *Journal of Economic Growth*, 7(1): 5-24.
- Lawless, M., D. McCoy, E. Morgenroth, C. O'Toole (2014). "The Importance of Corporation Tax Policy in the Location Choices of Multinational Firms", Department of Finance, Dublin.
- Mayer, Thierry, and Soledad Zignago (2011). "Notes on CEPII's distances measures: the *GeoDist* database", CEPII Working Paper, No 25, December 2011.
- Melitz, Marc, and Daniel Trefler (2012). "Gains from trade when firms matter", *Journal of Economic Perspectives*, 26(2): 91-118.
- Nickell, S. and Nicolitsas, D. (1999), 'How Does Financial Pressure Affect Firms?', *European Economic Review*, 43(1), pp. 1435-1456.
- Rojas-Romagosa, Hugo (2016). "Trade effects of Brexit for the Netherlands", CPB Background Document, June 2016.
- Schiffbauer, M., I. Siedschlag, F. Ruane (2017). Do Foreign Mergers and Acquisitions Boost Firm Productivity?, *International Business Review*, 26(6): 1124-1140, published online 5 May 2017.
- Siedschlag, I., D. Smith, C. Turcu, X. Zhang (2013a). What Determines the Location Choice of R&D Activities by Multinational Firms?, *Research Policy*, vol. 42(8): 1420-1430.
- Siedschlag, I., D. Smith, X. Zhang (2013b). What Determines the Location Choice of Multinational Firms in the ICT Sector, *Economics of Innovation and New Technology*, vol. 22 (5-6): 581-600.

Appendix

Table A1 **Variables Definitions and Data Sources**

Variable	Definition	Data source
Location choice	Binary variable equal to 1 if a FDI project was established in host country, 0 otherwise	fDi Markets
Number of FDI-related new jobs	Number of new jobs created by new FDI projects	fDi Markets
Invested capital	Investment in new greenfield FDI projects, million GBP	fDi Markets
EU market potential	The sum of GDP in the host country and the inverse distance-weighted GDP of all alternative locations in the European Union other than the host country.	The World Bank, Economy & Growth Indicators, Eurostat and CEPII
Bilateral distance	Average distance in km between the biggest cities of those two countries, weighted by the share of the city in the overall country's population.	CEPII, http://www.cepii.fr/
Real GDP per capita	GDP in 2010 prices over midyear population in host country	Eurostat
Real GDP	GDP in constant 2010 prices	Eurostat
Real GDP growth	Annual change in real GDP	Own calculations based on data from the Eurostat
Corporate tax rate	Statutory corporate tax rate	KPMG, https://home.kpmg/kh/en/home/services/tax
Financial development	Domestic credit to the private sector, % of GDP	The World Bank, Economy & Growth Indicators
R&D expenditure intensity	Public and private R&D expenditure, % of GDP	The World Bank, Science & Technology Indicators and Eurostat
Trade openness	Exports plus imports, % of GDP	Eurostat
Government expenditure on education	% of total government expenditure on education	Eurostat
Real wage per employee	Real wage per employee (euros)	Eurostat
Real wage per employee growth	Annual change in the real wage per employee (Euros)	Own calculations based on data from the Eurostat
Capital stock	Total fixed assets, % of GDP	Eurostat
Tertiary educational attainment	The share of the population with tertiary education in the population in the age group 30-34	Eurostat

Table A2 The impact of Brexit on GDP in EU countries - % change in 2030 relative to No Brexit

EU Countries	IfO Estimates	CPB Estimates		CPB Estimates	
		Static effects		Dynamic effects	
	EEA	FTA	WTO	FTA	WTO
AT-Austria	-0.05	-0.3	-0.4	-0.5	-0.7
BE-Belgium	-0.23	-1.5	-2.1	-2.15	-2.98
BG-Bulgaria	-0.08	-0.5	-0.6	-0.64	-0.77
CY-Cyprus	-0.38	-0.7	-0.8	-1.00	-1.27
CZ-Czech Republic	-0.12	-0.5	-0.6	-0.82	-1.26
DK-Denmark	-0.13	-0.7	-0.8	-1.14	-1.45
ES-Spain	-0.09	-0.7	-0.9	-1.37	-1.91
EE-Estonia	-0.10	-0.3	-0.4	-0.53	-0.66
FI-Finland	-0.10	-0.4	-0.4	-0.77	-0.97
FR-France	-0.07	-0.50	-0.60	-0.97	-1.38
DE-Germany	-0.09	-0.50	-0.60	-0.89	-1.23
GR-Greece	-0.05	-0.40	-0.60	-0.68	-0.93
HU-Hungary	-0.09	-0.70	-0.80	-1.08	-1.36
IE-Ireland	-0.85	-3.40	-3.70	-4.86	-5.79
IT-Italy	-0.07	-0.40	-0.50	-0.81	-1.08
LT-Lithuania	-0.09	-0.30	-0.40	-0.53	-0.66
LU-Luxembourg	-0.49	-1.50	-2.10	-2.15	-2.98
LV-Latvia	-0.06	-0.30	-0.40	-0.53	-0.66
MT-Malta	-0.46	-0.70	-0.80	-1.00	-1.27
NL-Netherlands	-0.12	-0.90	-1.20	-1.50	-2.00
PL-Poland	-0.07	-0.40	-0.60	-0.81	-1.10
PT-Portugal	-0.08	-0.70	-0.90	-1.11	-1.59
RO-Romania	-0.05	-0.30	-0.30	-0.52	-0.66
SK-Slovakia	-0.09	-0.50	-0.60	-0.72	-0.97
SI-Slovenia	-0.06	-0.30	-0.30	-0.38	-0.48
SE-Sweden	-0.13	-0.60	-0.70	-1.13	-1.49
UK-United Kingdom	-0.64	-3.40	-4.10	-5.90	-8.70
EU27	-0.10	-0.60	-0.80	-1.10	-1.50

Sources: Estimates of GDP changes for various options of the UK-EU relationship by Rojas-Romagosa (2016) for CPB and Aichele and Felbermayr (2015) for IfO.

Table A3 Counterfactuals for the other EU countries - no deal (WTO), all FDI

All FDI	Static % change	All FDI	Dynamic % change
Luxembourg	-3.90	Luxembourg	-4.85
Estonia	-2.74	UK	-3.38
Croatia	-2.04	Czech Republic	-3.06
Ireland	-1.79	Croatia	-2.99
UK	-1.65	Estonia	-2.80
Czech Republic	-1.14	Slovakia	-2.19
Malta	-1.10	Ireland	-1.80
Belgium	-1.04	Belgium	-1.78
Slovenia	-1.00	Hungary	-1.53
Latvia	-0.99	Slovenia	-1.42
Slovakia	-0.99	Malta	-1.02
Lithuania	-0.78	Romania	-0.53
Bulgaria	-0.28	Bulgaria	-0.22
Hungary	-0.24	Lithuania	-0.08
Germany	-0.09	Germany	0.25
Romania	-0.07	Latvia	0.59
France	0.10	France	0.65
Italy	0.16	Italy	0.75
Greece	0.56	Greece	0.83
Poland	1.01	Austria	1.24
Austria	1.07	Poland	1.49
Netherlands	1.30	Finland	1.67
Finland	1.36	Netherlands	1.84
Spain	1.43	Portugal	2.45
Portugal	1.65	Spain	2.49
Sweden	2.17	Sweden	3.24
Denmark	3.19	Denmark	5.21
Cyprus	4.83	Cyprus	8.99

Source: Own estimates based on data from the fDI Markets, Eurostat, KPMG, the World Bank, Aichele and Felbermayr (2015) and Rojas-Romagosa (2016).

Table A4 Counterfactuals for the other EU countries - no deal (WTO), by the origin of investor

EU FDI	Static % change	EU FDI	Dynamic % change	Non EU FDI	Static % change	Non EU FDI	Dynamic % change
Luxembourg	-2.96	Luxembourg	-3.55	Luxembourg	-5.52	Luxembourg	-7.33
Ireland	-1.83	UK	-3.46	Estonia	-4.70	Czech Republic	-5.37
Estonia	-1.82	Croatia	-2.13	Croatia	-3.26	Estonia	-5.04
UK	-1.71	Ireland	-2.02	Malta	-2.54	Croatia	-4.93
Croatia	-1.47	Estonia	-1.84	Czech Republic	-2.11	Slovakia	-4.00
Latvia	-0.85	Czech Republic	-1.79	Belgium	-2.00	Belgium	-3.42
Slovenia	-0.74	Slovakia	-1.17	Slovenia	-1.96	Hungary	-3.10
Czech Republic	-0.61	Slovenia	-1.03	Slovakia	-1.89	Slovenia	-2.91
Belgium	-0.58	Belgium	-0.97	Lithuania	-1.57	UK	-2.80
Malta	-0.55	Hungary	-0.67	Ireland	-1.44	Malta	-2.43
Slovakia	-0.48	Malta	-0.52	Latvia	-1.42	Ireland	-1.14
Lithuania	-0.48	Bulgaria	-0.31	UK	-1.35	Romania	-0.86
Bulgaria	-0.32	Romania	-0.25	Hungary	-0.86	Lithuania	-0.73
Germany	-0.03	Lithuania	0.01	Romania	-0.19	Bulgaria	0.11
France	0.00	Latvia	0.13	Bulgaria	-0.12	Germany	0.13
Italy	0.01	Germany	0.36	Germany	-0.11	Austria	0.81
Romania	0.05	France	0.43	France	0.21	Greece	0.82
Hungary	0.07	Italy	0.45	Italy	0.41	France	0.87
Greece	0.36	Greece	0.51	Greece	0.67	Latvia	1.03
Poland	0.83	Austria	1.12	Austria	1.03	Italy	1.13
Austria	0.89	Finland	1.24	Poland	1.28	Finland	1.36
Spain	1.03	Poland	1.24	Finland	1.34	Poland	1.93
Finland	1.04	Netherlands	1.53	Netherlands	1.61	Netherlands	2.26
Netherlands	1.06	Spain	1.69	Portugal	1.90	Portugal	3.12
Portugal	1.26	Portugal	1.72	Spain	1.96	Spain	3.70
Sweden	1.61	Sweden	2.30	Sweden	2.71	Sweden	4.17
Denmark	2.38	Denmark	3.68	Denmark	4.02	Denmark	7.02
Cyprus	3.21	Cyprus	5.71	Cyprus	7.20	Cyprus	14.05

Source: Own estimates based on data from the fDi Markets, Eurostat, KPMG, the World Bank, Aichele and Felbermayr (2015) and Rojas-Romagosa (2016).

Table A5 Counterfactuals for the other EU countries - no deal (WTO), FDI in manufacturing

Man EU FDI	Static % change	Man EU FDI	Dynamic % change	Man Non-EU FDI	Static % change	Man Non EU FDI	Dynamic % change
Luxembourg	-2.95	UK	-3.59	Luxembourg	-5.50	Luxembourg	-6.83
Ireland	-1.96	Luxembourg	-3.48	Estonia	-4.20	Czech Republic	-4.81
UK	-1.78	Ireland	-2.24	Croatia	-3.17	Croatia	-4.60
Estonia	-1.60	Croatia	-1.87	Czech Republic	-1.88	Estonia	-4.11
Croatia	-1.32	Czech Republic	-1.60	Malta	-1.84	UK	-3.48
Latvia	-0.83	Estonia	-1.53	Ireland	-1.82	Slovakia	-3.29
Slovenia	-0.61	Slovakia	-1.11	Slovenia	-1.74	Belgium	-2.87
Belgium	-0.56	Belgium	-0.91	Belgium	-1.70	Slovenia	-2.45
Malta	-0.55	Slovenia	-0.81	UK	-1.67	Hungary	-2.39
Czech Republic	-0.52	Hungary	-0.58	Slovakia	-1.66	Ireland	-1.43
Slovakia	-0.47	Malta	-0.50	Latvia	-1.39	Malta	-1.16
Lithuania	-0.41	Bulgaria	-0.29	Lithuania	-1.21	Romania	-1.07
Bulgaria	-0.30	Romania	-0.20	Hungary	-0.55	Lithuania	0.01
Germany	-0.05	Lithuania	0.10	Romania	-0.37	Bulgaria	0.15
Italy	-0.04	Latvia	0.13	Bulgaria	-0.29	Germany	0.15
France	0.00	Germany	0.33	Germany	-0.09	France	0.75
Romania	0.06	Italy	0.38	France	0.18	Greece	0.93
Hungary	0.10	France	0.42	Italy	0.29	Italy	0.94
Greece	0.38	Greece	0.57	Greece	0.65	Austria	1.22
Poland	0.77	Poland	1.14	Austria	1.23	Latvia	1.28
Austria	0.95	Austria	1.23	Poland	1.35	Finland	1.61
Netherlands	0.98	Netherlands	1.41	Finland	1.52	Poland	2.07
Spain	1.00	Finland	1.46	Netherlands	1.78	Netherlands	2.64
Finland	1.17	Spain	1.62	Spain	2.04	Portugal	3.45
Portugal	1.33	Portugal	1.80	Portugal	2.11	Spain	3.74
Sweden	1.65	Sweden	2.36	Sweden	2.79	Sweden	4.19
Denmark	2.40	Denmark	3.68	Denmark	4.28	Denmark	7.37
Cyprus	3.03	Cyprus	5.36	Cyprus	7.07	Cyprus	14.09

Source: Own estimates based on data from the fDi Markets, Eurostat, KPMG, the World Bank, Aichele and Felbermayr (2015) and Rojas-Romagosa (2016)

Table A6 Counterfactuals for the other EU countries - no deal (WTO), FDI in services

Services EU FDI	Static % change	Services EU FDI	Dynamic % change	Services Non-EU FDI	Static % change	Services Non-EU FDI	Dynamic % change
Luxembourg	-3.00	Luxembourg	-3.71	Luxembourg	-5.66	Luxembourg	-7.91
Estonia	-2.16	UK	-3.26	Estonia	-5.22	Estonia	-6.00
Croatia	-1.70	Croatia	-2.53	Croatia	-3.47	Czech Republic	-5.82
Ireland	-1.64	Estonia	-2.33	Malta	-3.26	Croatia	-5.43
UK	-1.61	Czech Republic	-2.08	Slovenia	-2.35	Slovakia	-4.58
Slovenia	-0.94	Ireland	-1.72	Czech Republic	-2.29	Belgium	-3.87
Latvia	-0.92	Slovenia	-1.40	Belgium	-2.25	Hungary	-3.72
Czech Republic	-0.73	Slovakia	-1.27	Slovakia	-2.08	Malta	-3.66
Belgium	-0.63	Belgium	-1.08	Lithuania	-1.96	Slovenia	-3.62
Malta	-0.62	Hungary	-0.80	Latvia	-1.56	UK	-2.34
Lithuania	-0.60	Malta	-0.63	Ireland	-1.26	Lithuania	-1.52
Slovakia	-0.50	Bulgaria	-0.32	Hungary	-1.14	Ireland	-1.13
Bulgaria	-0.35	Romania	-0.31	UK	-1.14	Romania	-0.66
Germany	0.00	Lithuania	-0.14	Bulgaria	-0.09	Bulgaria	-0.08
France	0.00	Latvia	0.10	Germany	-0.06	Germany	0.21
Hungary	0.02	Greece	0.37	Romania	-0.01	Austria	0.29
Romania	0.03	Germany	0.43	France	0.25	Greece	0.51
Italy	0.09	France	0.43	Italy	0.51	Latvia	0.60
Greece	0.32	Italy	0.54	Greece	0.58	Finland	0.86
Austria	0.80	Finland	0.85	Austria	0.78	France	0.96
Finland	0.83	Austria	0.91	Finland	1.03	Italy	1.26
Poland	0.93	Poland	1.40	Poland	1.28	Poland	1.90
Spain	1.06	Portugal	1.57	Netherlands	1.45	Netherlands	1.93
Portugal	1.16	Netherlands	1.70	Portugal	1.57	Portugal	2.57
Netherlands	1.17	Spain	1.79	Spain	1.86	Spain	3.59
Sweden	1.52	Sweden	2.16	Sweden	2.53	Sweden	3.96
Denmark	2.32	Denmark	3.63	Denmark	3.63	Denmark	6.44
Cyprus	3.43	Cyprus	6.15	Cyprus	6.98	Cyprus	13.45

Source: Own estimates based on data from the fDi Markets, Eurostat, KPMG, the World Bank, Aichele and Felbermayr (2015) and Rojas-Romagosa (2016)