Economics Bulletin

Volume 44, Issue 1

An empirical study of the immediate effect of the brexit referendum on greenfield foreign direct investment in the uk

Daniel Bembennek
WHU - Otto Beisheim School of Management

Michael Frenkel
WHU - Otto Beisheim School of Management

Abstract

We investigate the impact of the Brexit referendum on greenfield foreign direct investment (GFDI) inflows to the UK in the years before an agreement with the EU was reached. The study is motivated by the question of whether the signal of the policy change was already strong enough to influence long-term investment decisions. We find robust evidence of a negative impact on greenfield investment inflows to the UK from 2016 to 2019.

We thank the Dr. Hans Riegel Foundation for its support.
Citation: Daniel Bembennek and Michael Frenkel, (2024) "An empirical study of the immediate effect of the brexit referendum on greenfield foreign direct investment in the uk", *Economics Bulletin*, Volume 44, Issue 1, pages 57-63
Contact: Daniel Bembennek - daniel.bembennek@whu.edu, Michael Frenkel - michael.frenkel@whu.edu.
Submitted: July 01, 2023. **Published:** March 30, 2024.

1. Introduction

The Brexit referendum on June 23, 2016, with its narrow outcome in favour of “Leave” signalled to investors that the UK would begin a process of separation from the European Single Market. This membership had provided firms in the UK a "one business passport" that allowed them to operate easily in the other 27 member countries through trade and investment.

This paper examines the referendum's impact on greenfield foreign direct investments (GFDI). As it took time to finalise negotiations on the details of the Brexit agreement, there was a considerable period of uncertainty for investors. Likewise, such uncertainty was already created by the decision to hold the referendum. We are therefore interested in the referendum's impact on FDI in the UK between the announcement of the referendum and the conclusion of the Brexit agreement. We focus on GFDI because this type of FDI reflects investments with typically longer-term effects on the economy (Nguyen et al. (2021), Global Investment Competitiveness Report (2020)). We use a gravity model approach to study the direct effect of the Brexit referendum.

The paper is structured as follows: The second section briefly reviews the relevant literature. The third section describes the data and the methodology used. The fourth section presents the estimation results. The fifth section offers some conclusions.

2. Literature Review

Several studies examined the impact of the Brexit referendum and Brexit on FDI inflows to the UK. For example, Welfens and Baier (2018) use a gravity model with OECD data for FDI inflows from 1985 to 2012 to examine the impact of EU membership. They find that a country's EU membership increases FDI flows and project these results to the UK's exit from the EU. Serwicka and Tamberi (2018) analyse the impact of the Brexit referendum on GFDI inflows to the UK. They use data through mid-2018, creating a "synthetic" UK and applying a weighted basket of comparable countries to estimate the difference from the actual UK at the time. Also based on the fDi.markets database, Frenkel and Stefan (2023) find that the number of GFDI projects announced in the UK decreased during the years after the Brexit referendum. Our paper extends the literature on the effects of the Brexit referendum on GFDI by using a comprehensive dataset on GFDI and focusing on invested capital and a comprehensive set of explanatory variables.

3. Data and Methodology

We use GFDI data for the UK from the Financial Times Group's fDI.markets database. This dataset can be considered the most comprehensive database for announced Greenfield Direct Investments. More specifically, we use annual data for the period 2010-2019 and create a variable using the sum of the announced value of projects aggregated by country and year (scaled to single US dollars). We only consider GFDI observations if data for all explanatory variables are available. As a result, the study comprises 540 observations.

We also use data from the "Gravity Dataset" of the CEPII Economic Institute based on Conte et al. (2022) for the explanatory variables. This dataset is a compendium of data from various sources and thus provides a one-stop shop for gravity estimations.

We employ a gravity model estimation approach for GFDI inflows to the UK and apply panel data from 2010 until 2019. Following the recent literature, we use a Poisson Pseudo Maximum Likelihood (PPML) estimation technique based on Santos Silva and Tenreyro (2006, 2011). The advantages of the PPML approach are its robustness against heteroskedasticity and its usability when the dependent variable has zero values to avoid undefined numbers, we add a value of one to the variable's value before taking logs. As GFDI represents a long-term investment that typically requires a long planning period, all explanatory variables are included with a lag of two years. The assumption behind the two-year lag is an early-stage decision for a country to invest before researching the concrete location in the country. Therefore, we assume a more extended time lag between the decision for a country and the final announcement.

Our FDI gravity model uses gravity arguments similar to those of Yotov et al. (2016) in their study of trade flows. Specifically, based on this study, our estimation model takes the following form:

$$GFDI_{j,t} = exp\big[\,\beta_1 * \ln DIST_{j,t-2} + \beta_2 * \ln GDP\ PER\ CAP_{j,t-2} + \beta_3 * \ln POP_{j,t-2} + \beta_4 * \ln TRADE_{j,t-2} + \beta_5 * RTA_{j,t-2} + \beta_6 * EEA_{j,t-2} + \beta_7 * LANGUAGE_{j,t-2} + \beta_8 * RELIG_{j,t-2} + (\beta_9 * Yearly_{Dummies_t}) + (\beta_{10} * BREXIT) + \rho_{j,t} + \vartheta_{i,j}\big] * \epsilon_{ij,t}$$

The dependent variable $GFDI_{j,t}$ represents the value of UK GFDI inflows in US dollars from country *j* in year *t*. For countries with no GFDI in a given year, the value of GFDI inflows for these countries is set to zero. It allows us to include countries with a low ability to invest capital and to paint a complete picture of investment effects.

The variable DIST describes the distance in kilometres between London as the largest city in the UK and the largest city in the country of origin *j*. The binary variable LANGUAGE is set to one if English is the common official or predominant language with country *j*. Both variables are based on the CEPII GeoDist database by Mayer and Zignago (2011). The variables GDP PER CAP and POP denote GDP per capita and population of the source country, respectively (based on the World Bank Development Indicators, WDI). The variable TRADE represents the value of imports (in thousand US dollars) of the UK from source country of origin *j*, based on the BACI database of CEPII. The trade values in the BACI database are standardised, for example, in terms of only using FOB Incoterm for import and export values (Gaulier and Zignago (2010)). The EEA variable contains all members of the European Union and the EFTA countries Liechtenstein, Norway and Iceland. Together, they form the European Economic Area with exclusive access to the common market. The binary variable RTA uses WTO data to describe the existence of a bilateral trade agreement between the UK and country *j* without the countries in the European Economic Area. The RELIG variable explains the similarity of the proportions of major monotheistic religions between the UK and country *j* based on Diesdier and Mayer (2007). It has a value between zero and one, where one represents perfect similarity. The BREXIT variable is a binary variable with a value of one from 2016 until 2019 and zero otherwise. We include the whole of 2016 in the Brexit variable as we believe the uncertainty

did not start with the Brexit referendum result, but with actual planning and announcement of the referendum. The date was announced on February 20, 2016.

Following Yotov et al. (2016), factor variables are used for the estimation. To account for unobserved facts, we include $\rho_{j,t}$ for investor-time fixed effects. We also include pair fixed effects to mitigate endogeneity problems. The standard errors are clustered by the investor-ID variable.

Since our study focuses on the impact of the Brexit referendum on Greenfield Direct Investments into the UK, we test the impact using two strategies. Firstly, we test the effect using the BREXIT variable and secondly by using year dummies. Among others, Baltagi et al. (2008) and Chala and Lee (2015) show ambiguous RTA and EU membership. Therefore, we test robustness by using the explanatory variables EEA and RTA independently in the estimations.

We hypothesise that the Brexit referendum led to uncertainty about the UK's economic future and thus to a lower flow of long-term investments into the UK. We base our definition of uncertainty and the corresponding effects of uncertainty on Bloom et al. (2018), who characterise the Brexit referendum as a source of a "large and persistent uncertainty shock".

4. Estimation Results

The correlation matrix in Table 1 generally does not show a high correlation between the explanatory variables, with correlation values mostly below 0.5. The exceptions are the correlations between EEA and RTA on the one hand and between DIST and both EEA and RTA on the other hand. We take this into account when selecting the specifications of the estimation models.

Table 1
Correlation Matrix for Variables (2010-2019) - incl. logs taken

	GFI	DIST	GDP PER CAP	POP	TRADE	RTA	EEA	LANGUAGE	RELIG	BREXIT
GFI	1.000									
DIST	-0.0542	1.000								
GDP PER CAP	0.2085	-0.4132	1.000							
POP	0.2946	0.2532	-0.4595	1.000						
TRADE	0.3742	-0.3110	0.3164	0.5485	1.000					
RTA	-0.1128	-0.6151	0.3714	-0.4093	0.0812	1.000				
EEA	-0.0019	-0.8102	0.3849	-0.3510	0.2250	0.6455	1.000			
LANGUAGE	0.1302	0.3824	-0.0422	-0.0256	-0.0940	-0.1356	-0.3645	1.000		
RELIG	0.1263	-0.4837	0.4173	-0.2420	0.1741	0.4657	0.5242	-0.0279	1.000	
BREXIT	-0.0587	0.0158	0.0014	-0.0001	-0.0211	0.0549	0.0069	-0.0122	0.0320	1.000

Table 2 shows the PPML estimation results for seven models. Based on the Correlation Matrix, we perform in Models (1) - (6) three groups of estimations, including DIST, RTA and EEA, separately. So, Models (1) and (2) include DIST, Models (3) and (4) include RTA, and EEA is implemented in Models (5) and (6). We use this approach to check the robustness and biases due to high correlation between the variables DIST, RTA and EEA. Every group of estimations includes the variable BREXIT or yearly dummies from 2016 until 2019.

Table 2: Effects on the Annual Value of Greenfield Investments (2010-2019)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
DIST	-0.219**	-0.220**	-	-	-	-	-
GDP PER CAP	0.927***	0.930***	0.783***	0.786***	0.965***	0.969***	0.846***
POP	0.602***	0.604***	0.464***	0.467***	0.615***	0.617***	0.514***
TRADE	0.201	0.198	0.370**	0.367**	0.219	0.216	0.327**
RTA	-	-	-0.0762	-0.0730	-	-	-
EEA	-	-	-	-	0.638*	0.643*	-
LANGUAGE	0.605***	0.604***	0.421*	0.419*	0.706***	0.706***	0.480**
RELIG	-1.133	-1.127	1.250	1.272	-1.590	-1.590	0.548
BREXIT	-0.237*	-	-0.232*	-	-0.237*	-	-
Dummy_2016	-	-0.322**	-	-0.317**	-	-0.324**	-
Dummy_2017	-	-0.334**	-	-0.331**	-	-0.331**	-
Dummy_2018	-	-0.0621	-	-0.0646	-	-0.0592	-
Dummy_2019	-	-0.254*	-	-0.240*	-	-0.254*	-
Pre_BREXIT_RoW	-	-	-	-	-	-	0.200**
Post_BREXIT_RoW	-	-	-	-	-	-	-0.474**
Pre_BREXIT_EEA	-	-	-	-	-	-	0.148
Post_BREXIT_EEA	-	-	-	-	-	-	-0.114
CONSTANT	9.495***	9.523***	6.871***	6.876***	6.911***	6.919***	6.820***
Observations	540	540	540	540	540	540	540
R-square	0.652	0.654	0.653	0.655	0.657	0.659	0.654

Note: ***, **, and * indicate significance levels of 1%, 5% and 10%, respectively.
All variables are lagged by two years, except yearly dummies and BREXIT.
Variables DIST, GDP PER CAP, POP, TRADE are log taken.

For Models (1) – (6), we find a significant negative impact of the Brexit referendum on GFDI inflows. More specifically, the BREXIT variable is significant at a 10% level in Models 1, 3 and 5, and the annual dummies for 2016 and 2017 are significant at a 5-percent level in Models 2, 4 and 6. This supports the hypothesis that the Brexit referendum led to greater uncertainty, which in turn had a negative impact on GFDI inflows to the UK.

Furthermore, we find a negative relationship between distance and the value of greenfield investments for the first two models. This result could be due to the relatively lower distance of the UK to the EU countries in contrast to the most countries worldwide. The UK and the other 27 members of the EU formed the European Single Market with reciprocal and exclusive access to the markets. The variables GDP PER CAP and POP influence the value of GFDI in all estimates with a significance level of 1%. The variable LANGUAGE has a significant positive effect on GFDI in all Models. It indicates that the common language reduces the efforts and barriers to establishing new foreign investments. We find no evidence that religion influence GFDI in the UK. For EEA, we find a positive impact on a 10%-significance level, indicating the positive influence of the open common market in the European Economic Area. The TRADE variable only shows a positive impact on GFDI in 2 out of the first 6 Models at a 5%-significance level. For RTA and RELIG, no influence on GFDI can be found.

To examine the differences in the impact of the Brexit referendum on GFDI from EEA countries and the rest of the world (RoW), we extend our analysis by one more specification. More specifically, we introduce in Model 7 a different set of dummy variables. We include two dummy variables for GFDI from EEA countries for the time before and after the Brexit referendum (Pre_BREXIT_EEA and Post_BREXIT_EEA), and two other dummy variables for GFDI from countries in the rest of the world (RoW) before and after the Brexit referendum (Pre_BREXIT_RoW and Post_BREXIT_RoW). These dummy variables replace the dummy

variables in Model (1) to (6). We find a significant positive effect for GFDI from RoW countries to the UK before the Brexit referendum and an even higher significant negative effect thereafter. As we do not find such an effect for GFDI from EEA countries, this suggests that the negative GFDI effects in the UK primarily reflect the effects from RoW countries. This could be related to the fact that companies from the RoW countries would lose access to the European Common Market through Brexit.

5. Conclusion

This study examines the immediate impact of the Brexit referendum outcome on greenfield foreign direct investments (GFDI). We find a significant negative impact on GFDI inflows to the UK. More specifically, the negative impact of the Brexit referendum on GFDI was primarily caused by a decline in GFDI from countries outside the European Economic Area. This result could be due to the uncertainty about future economic developments created by the Brexit referendum. We find no empirical evidence of the importance of Regional Trade Agreements for GFDI inflows to the UK. In addition, there is evidence that the common language of the investing country and the UK positively affects GFDI inflows into the UK.

The analysis is not without limitations. First, the study does not identify specific sectoral effects of the Brexit referendum. If they could be identified, this would suggest that the impact of uncertainty is not area wide. Second, the period of the data does not allow us to examine whether there is a long-term effect on GFDI that persists after the Brexit agreement takes effect. This is left to future research. Third, while the fDI.markets database contains the most detailed data on greenfield investment projects, it is not an official database and could be criticized.

References

Baltagi, B. H., Egger, P., & Pfaffermayr, M. (2008). Estimating regional trade agreement effects on FDI in an interdependent world. *Journal of Econometrics*, *145*(1-2), 194–208. https://doi.org/10.1016/j.jeconom.2008.05.017

Bloom, N., Bunn, P., Chen, S., Mizen, P., Smietanka, P., Thwaites, G., & Young, G. (2018). Brexit and Uncertainty: Insights from the Decision Maker Panel. Fiscal Studies, 39(4), 555–580. https://doi.org/10.1111/1475-5890.12179

Chala, B. W., & Lee, H.-H. (2015). Do Regional Trade Agreements Increase Bilateral Greenfield Investment? *Journal of Economic Integration*, *30*(4), 680–707. https://doi.org/10.11130/jei.2015.30.4.680

Conte, M., Cotterlaz, P., & Mayer, T. (2022). The CEPII Gravity Database. *Working Paper CEPII*(No. 2022-05 - July) , dataset "Gravity Dataset" V202211.

Disdier, A.-C., & Mayer, T. (2007). Je t'aime, moi non plus: Bilateral opinions and international trade. *European Journal of Political Economy*, *23*(4), 1140–1159. https://econpapers.repec.org/article/eeepoleco/v_3a23_3ay_3a2007_3ai_3a4_3ap_3a1140-1159.htm

fDi Markets from Financial Times (online database)
- https://www.fdimarkets.com/

Frenkel, M., & Stefan, H. (2023). The impact of the brexit referendum on greenfield foreign direct investments from countries within and outside the European single market. *Applied Economics Letters*, 1–4. https://doi.org/10.1080/13504851.2023.2176437

Gaulier, G., & Zignago, S. (2010). BACI: International Trade Database at the Product-Level. The 1994-2007 Version. *Working Papers*. https://ideas.repec.org/p/cii/cepidt/2010-23.html

Global Investment Competitiveness Report 2019/2020: Rebuilding Investor Confidence in Times of Uncertainty. (2020). Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-1536-2

Mayer, T., & Zignago, S. (2011). Notes on CEPII's distances measures: The *GeoDist* database. *CEPII Working Paper*(25).

Nguyen, H. T., Luu, H. N., & Do, N. H. (2021). The dynamic relationship between greenfield investments, cross-border M&As, domestic investment and economic growth in Vietnam. *Economic Change and Restructuring*, *54*(4), 1065–1089. https://doi.org/10.1007/s10644-020-09292-7

Santos Silva, J. M. C., & Tenreyro, S. (2006). The Log of Gravity. *The Review of Economics and Statistics*, *88*(4), 641–658. https://doi.org/10.1162/rest.88.4.641

Santos Silva, J. M. C., & Tenreyro, S. (2011). Poisson: Some Convergence Issues. *The Stata Journal: Promoting Communications on Statistics and Stata*, *11*(2), 207–212. https://doi.org/10.1177/1536867X1101100203

Serwicka, I., & Tamberi, N. (2018). Not Backing Britain - FDI Inflows since the Brexit Referendum - UK Trade Policy Observatory - Serwicka - Tamberi - 2018(Briefing Paper 23).

Welfens, P., & Baier, F. (2018). BREXIT and Foreign Direct Investment: Key Issues and New Empirical Findings. *International Journal of Financial Studies*, *6*(2), 46. https://doi.org/10.3390/ijfs6020046

Yotov, Y., Piermartini, R., Monteiro, J.-A., & Larch, M. (2016). *An advanced guide to trade policy analysis: The structural gravity model*. World Trade Organization. https://doi.org/10.30875/abc0167e-en