Not Backing Britain: FDI Inflows Since the Brexit Referendum

Appendix

Data

fDi Markets database has four measures of FDI:

a) number of projects announcements (projects),
b) total capital expenditure (capex),
c) number of jobs created through investments (jobs),
d) number of firms investing (firms).

fDi Markets tracks all cross-border project-based greenfield investment that results in new capacity (i.e. new jobs being created and capital being invested), distinguishing between new projects and expansions, but excludes mergers and acquisitions. Expansions can be sub-divided further into expansions of existing functions at a location and co-locations of new functions at a location.

fDi Markets tracks these greenfield investments in real-time, with projects tracked for all industries and all countries worldwide at a monthly frequency. Since January 2003, the fDi Markets database has tracked over US$ 9 trillion of investments globally from over 60,000 companies.

Within this database, 'Date' variable refers to investment project announcement date rather than point in time when investment commenced. When a project is identified, the project is validated with company sources, which allows further company information to be captured, including decision making contacts, and is entered into fDi Markets.

fDi Markets tracks the jobs and capital investment of every project, but owing to commercial confidentiality these data are not available for all investment projects recorded in the database. Missing data on job creation and capital expenditure are, however, imputed based on algorithms that calculate estimated jobs and investment based on projects of a similar scope when the actual figures are not released by the company.[1]

Taxonomy of sub-sectors in the fDi Markets database

fDi Markets database records information on investment across all industries, and these are categorised into sectors (aligned to Standard International Classification, SIC, codes) and sub-sectors (aligned to the

[1] Data providers claim that the typical accuracy of these estimates is over 80% when the sample includes at least 20 projects, and for random testing of 1,000 projects near 100% accuracy is achieved.

North American Standard Industrial Classification, NAICS). Overall, fDi Markets distinguishes between 38 sectors and some 270 sub-sectors.

In this briefing paper we introduced a bespoke taxonomy of sectors (see Table 1 below for detail) to answer the research questions that we formulated as part of the main analysis. The categorisation makes use of the 'sub-sector' variable of the fDi Markets, the most disaggregated industrial breakdown available in this database. As such this taxonomy distinguishes between:

a) manufacturing and services sectors,
b) supply chain industries versus those business-to-consumer (B2C) industries:
    - this is based on an industry categorisation in Delgado and Mills (2017); Appendix B to this paper categorises the 6-digit NAICS 2012 industries into those that are supply chains and those that are B2C; this categorisation is based on the 2002 Benchmark Input-Output (IO) Accounts of the United States of the Bureau of the Economic Analysis;
    - Delgado and Mills (2017) classify industries into supply chain and B2C depending on the percent of value of sold for final use by households (i.e. share sold to Personal Consumption Expenditure, PCE);
    - supply chain industries are considered those that sell most of their goods and services to other businesses and government, with one-third or less of their output to PCE (PCE ≤ 33.3%);
    - B2C industries are those that sell most of their output to consumers (PCE > 33.3%);

Table 1: Categorisation of fDi Markets sub-sectors into the bespoke taxonomy of industries

	fDi Markets: Industry Sub-sector	Supply chain or B2C industries	Manufacturing or Services
1.	Accommodation	B2C	Services
2.	Accounting, tax preparation, bookkeeping, & payroll services	Supply Chain	Services
3.	Advertising, PR, & related	Supply Chain	Services
4.	Agriculture, construction, & mining machinery	Supply Chain	Manufacturing
5.	Air transportation	B2C	Services
6.	Aircraft	Supply Chain	Manufacturing
7.	Aircraft engines, other parts & auxiliary equipment	Supply Chain	Manufacturing
8.	All other electrical equipment & components	Supply Chain	Manufacturing
9.	All other food	B2C	Manufacturing
10.	All other industrial machinery	Supply Chain	Manufacturing
11.	All other information services	B2C	Services
12.	All other transportation (Automotive OEM)	B2C	Manufacturing
13.	All other transportation (Non-Automotive OEM)	B2C	Manufacturing
14.	Alumina & aluminium production and processing	Supply Chain	Manufacturing
15.	Amusement & theme parks	B2C	Services
16.	Animal food	B2C	Manufacturing
17.	Animal production	B2C	Services
18.	Animal slaughtering & processing	B2C	Manufacturing

19.	Apparel accessories & other apparel	B2C	Manufacturing
20.	Apparel knitting	B2C	Manufacturing
21.	Architectural & structured metals	Supply Chain	Manufacturing
22.	Architectural, engineering, & related services	Supply Chain	Services
23.	Artificial & synthetic fibres	Supply Chain	Manufacturing
24.	Asphalt paving, roofing, & saturated materials	Supply Chain	Manufacturing
25.	Audio & video equipment	B2C	Manufacturing
26.	Automobiles	B2C	Manufacturing
27.	Bakeries & tortillas	B2C	Manufacturing
28.	Basic chemicals	Supply Chain	Manufacturing
29.	Batteries	Supply Chain	Manufacturing
30.	Biological products (except diagnostic)	Supply Chain	Manufacturing
31.	Biomass power	B2C	Services
32.	Boiler, tank, & shipping container	Supply Chain	Manufacturing
33.	Breweries & distilleries	B2C	Manufacturing
34.	Building material & garden equipment & supplies dealers	B2C	Services
35.	Business schools, computer & management training	B2C	Services
36.	Business support services	Supply Chain	Services
37.	Cable & other subscription programming	Supply Chain	Services
38.	Cement & concrete products	Supply Chain	Manufacturing
39.	Clay product & refractory	Supply Chain	Manufacturing
40.	Clothing & clothing accessories	B2C	Services
41.	Coal mining	Supply Chain	Services
42.	Coating, engraving, heat treating, & allied activities	Supply Chain	Manufacturing
43.	Coffee & tea	B2C	Manufacturing
44.	Commercial & institutional building construction	Supply Chain	Services
45.	Commercial & service industry machinery	Supply Chain	Manufacturing
46.	Communication & energy wires & cables	Supply Chain	Manufacturing
47.	Communications equipment	Supply Chain	Manufacturing
48.	Computer & peripheral equipment	Supply Chain	Manufacturing
49.	Computer facilities management services	Supply Chain	Services
50.	Computer systems design services	Supply Chain	Services
51.	Converted paper products	Supply Chain	Manufacturing
52.	Copper, nickel, lead, & zinc mining	Supply Chain	Services
53.	Corporate & investment banking	Supply Chain	Services
54.	Cosmetics, perfume, personal care & household products	B2C	Manufacturing
55.	Couriers & messengers	Supply Chain	Services
56.	Crop production	B2C	Services
57.	Custom computer programming services	Supply Chain	Services

58.	Cut & sew apparel	B2C	Manufacturing
59.	Cutlery & handtools	B2C	Manufacturing
60.	Dairy products	B2C	Manufacturing
61.	Data processing, hosting, & related services	Supply Chain	Services
62.	Dolls, toy, & games	B2C	Manufacturing
63.	Educational support services	B2C	Services
64.	Electric lighting equipment	Supply Chain	Manufacturing
65.	Electrical equipment	Supply Chain	Manufacturing
66.	Electromedical and Electrotherapeutic Apparatus	Supply Chain	Manufacturing
67.	Electronics & appliances stores	B2C	Services
68.	Employment services	Supply Chain	Services
69.	Engines & Turbines	Supply Chain	Manufacturing
70.	Environmental consulting services	Supply Chain	Services
71.	Fishing, hunting & trapping	Supply Chain	Services
72.	Food & Beverage Stores (Beverages)	B2C	Services
73.	Food & Beverage Stores (Food & Tobacco)	B2C	Services
74.	Food product machinery	Supply Chain	Manufacturing
75.	Food services	B2C	Services
76.	Footwear	B2C	Manufacturing
77.	Forestry & logging	Supply Chain	Services
78.	Forging & stamping	Supply Chain	Manufacturing
79.	Fossil fuel electric power	B2C	Services
80.	Foundries	Supply Chain	Manufacturing
81.	Freight/Distribution Services	Supply Chain	Services
82.	Fruits & vegetables & specialist foods	B2C	Manufacturing
83.	Furniture, homeware & related products (Consumer Products)	B2C	Manufacturing
84.	Furniture, homeware & related products (Textiles)	B2C	Manufacturing
85.	Furniture, homeware & related products (Wood Products)	B2C	Manufacturing
86.	Gambling industries	B2C	Services
87.	Gasoline stations	B2C	Services
88.	General medical & surgical hospitals	B2C	Services
89.	General merchandise stores	B2C	Services
90.	General purpose machinery	Supply Chain	Manufacturing
91.	Geothermal electric power	B2C	Services
92.	Glass & glass products	Supply Chain	Manufacturing
93.	Gold ore & silver ore mining	Supply Chain	Services
94.	Grains & oilseed	Supply Chain	Manufacturing
95.	Guided missile & space vehicles	Supply Chain	Manufacturing
96.	Hardware	Supply Chain	Manufacturing

97.	Health & personal care stores	B2C	Services
98.	Heavy & civil engineering	Supply Chain	Services
99.	Heavy duty trucks	Supply Chain	Manufacturing
100.	Home healthcare & all other ambulatory health care services	B2C	Services
101.	Household appliances	B2C	Manufacturing
102.	Hydroelectric power	B2C	Services
103.	Industrial building construction	Supply Chain	Services
104.	Insurance	Supply Chain	Services
105.	Internet publishing & broadcasting & web search	B2C	Services
106.	Investment management	Supply Chain	Services
107.	In-Vitro diagnostic substances	Supply Chain	Manufacturing
108.	Iron & steel mills & ferroalloy	Supply Chain	Manufacturing
109.	Iron ore mining	Supply Chain	Services
110.	Jewellery & silverware	B2C	Manufacturing
111.	Laminated plastics plates, sheets & shapes	Supply Chain	Manufacturing
112.	Leather & hide tanning and finishing	Supply Chain	Manufacturing
113.	Legal services	B2C	Services
114.	Light trucks & utility vehicles	B2C	Manufacturing
115.	Lime & gypsum products	Supply Chain	Manufacturing
116.	Machine shops, turned products, screws, nuts & bolts	Supply Chain	Manufacturing
117.	Magnetic & optical media	Supply Chain	Manufacturing
118.	Management consulting services	Supply Chain	Services
119.	Marine electric power	B2C	Services
120.	Measuring & control instruments	Supply Chain	Manufacturing
121.	Medical equipment & supplies	Supply Chain	Manufacturing
122.	Medicinal & botanical	Supply Chain	Manufacturing
123.	Metalworking machinery	Supply Chain	Manufacturing
124.	Military armoured vehicle, tank, & components	Supply Chain	Manufacturing
125.	Miscellaneous store retailers	B2C	Services
126.	Motion picture & sound recording industries	B2C	Services
127.	Motor vehicle & parts dealers (Automotive Components)	B2C	Services
128.	Motor vehicle & parts dealers (Automotive OEM)	B2C	Services
129.	Motor vehicle body & trailers	Supply Chain	Manufacturing
130.	Motor vehicle brake systems	Supply Chain	Manufacturing
131.	Motor vehicle electrical & electronic equipment	Supply Chain	Manufacturing
132.	Motor vehicle gasoline engines & engine parts	Supply Chain	Manufacturing
133.	Motor vehicle seating & interior trim	Supply Chain	Manufacturing
134.	Motor vehicle stamping	Supply Chain	Manufacturing
135.	Motor vehicle steering & suspension components	Supply Chain	Manufacturing

136.	Motor vehicle transmission & power train parts	Supply Chain	Manufacturing
137.	Motorcycle, bicycle, & parts	B2C	Manufacturing
138.	Museums, historical sites, & similar	B2C	Services
139.	Natural, liquefied and compressed gas	B2C	Services
140.	Navigational instruments	Supply Chain	Manufacturing
141.	Newspaper, periodical, book, & directory publishers	B2C	Services
142.	Nonferrous metal production & processing	Supply Chain	Manufacturing
143.	Nonmetallic mineral mining & quarrying	Supply Chain	Services
144.	Nonstore retailers	B2C	Services
145.	Nuclear electric power generation	B2C	Services
146.	Nursing & residential care facilities	B2C	Services
147.	Office supplies	B2C	Manufacturing
148.	Offices of physicians, dentists, & other healthcare practitioners	B2C	Services
149.	Oil & gas extraction	Supply Chain	Services
150.	Other (Aerospace)	Supply Chain	Manufacturing
151.	Other (Beverages)	B2C	Manufacturing
152.	Other (Biotechnology)	Supply Chain	Manufacturing
153.	Other (Building & Construction Materials)	Supply Chain	Manufacturing
154.	Other (Business Machines & Equipment)	Supply Chain	Manufacturing
155.	Other (Ceramics & Glass)	B2C	Manufacturing
156.	Other (Consumer Electronics)	Supply Chain	Manufacturing
157.	Other (Consumer Products)	Supply Chain	Manufacturing
158.	Other (Engines & Turbines)	Supply Chain	Manufacturing
159.	Other (Financial Services)	Supply Chain	Services
160.	Other (Healthcare)	B2C	Services
161.	Other (Hotels & Tourism)	B2C	Services
162.	Other (Medical Devices)	Supply Chain	Manufacturing
163.	Other (Metals)	Supply Chain	Manufacturing
164.	Other (Minerals)	Supply Chain	Manufacturing
165.	Other (Paper, Printing & Packaging)	Supply Chain	Manufacturing
166.	Other (Pharmaceuticals)	Supply Chain	Manufacturing
167.	Other (Real Estate)	B2C	Services
168.	Other (Semiconductors)	Supply Chain	Manufacturing
169.	Other (Software & IT services)	Supply Chain	Services
170.	Other (Space & Defence)	Supply Chain	Manufacturing
171.	Other (Textiles)	Supply Chain	Manufacturing
172.	Other (Transportation)	B2C	Services
173.	Other (Warehousing & Storage)	B2C	Services
174.	Other (Wood Products)	Supply Chain	Manufacturing

175.	Other amusement & recreation industries	B2C	Services
176.	Other chemical products & preparation	Supply Chain	Manufacturing
177.	Other computer related services	Supply Chain	Services
178.	Other electric power generation (Alternative/Renewable Energy)	B2C	Services
179.	Other electric power generation (Coal, Oil and Natural Gas)	B2C	Services
180.	Other fabricated metal products	Supply Chain	Manufacturing
181.	Other leather & allied products	B2C	Manufacturing
182.	Other metal ore mining	Supply Chain	Services
183.	Other motor vehicle parts	Supply Chain	Manufacturing
184.	Other non-metallic mineral products	Supply Chain	Manufacturing
185.	Other petroleum & coal products	Supply Chain	Manufacturing
186.	Other pipeline transportation	Supply Chain	Services
187.	Other plastics products	Supply Chain	Manufacturing
188.	Other rubber products	Supply Chain	Manufacturing
189.	Other support services	Supply Chain	Services
190.	Other telecommunications	B2C	Services
191.	Outpatient care centres & medical & diagnostic laboratories	B2C	Services
192.	Paints, coatings, additives & adhesives	Supply Chain	Manufacturing
193.	Paper industry machinery	Supply Chain	Manufacturing
194.	Performing arts, spectator sports, & related	B2C	Services
195.	Pesticide, fertilisers & other agricultural chemicals	Supply Chain	Manufacturing
196.	Petroleum bulk stations & terminals	B2C	Services
197.	Petroleum refineries	Supply Chain	Manufacturing
198.	Pharmaceutical preparations	B2C	Manufacturing
199.	Pipeline transportation of crude oil	Supply Chain	Services
200.	Pipeline transportation of natural gas	Supply Chain	Services
201.	Plastic bottles	Supply Chain	Manufacturing
202.	Plastic pipes, pipe fitting & unlaminated profile shapes	Supply Chain	Manufacturing
203.	Plastics & rubber industry machinery	Supply Chain	Manufacturing
204.	Plastics packaging materials & unlaminated film & sheets	Supply Chain	Manufacturing
205.	Polystyrene foam products	Supply Chain	Manufacturing
206.	Postal service	Supply Chain	Services
207.	Power transmission equipment	Supply Chain	Manufacturing
208.	Printing & related activities	Supply Chain	Manufacturing
209.	Printing machinery & equipment	Supply Chain	Manufacturing
210.	Professional, scientific & technical services	Supply Chain	Services
211.	Psychiatric & speciality hospitals	B2C	Services
212.	Pulp, paper, & paperboard	Supply Chain	Manufacturing
213.	Radio & TV broadcasting	Supply Chain	Services

214.	Rail transportation	B2C	Services
215.	Railroad rolling stock	Supply Chain	Manufacturing
216.	Real estate services	Supply Chain	Services
217.	Rental & leasing services	B2C	Services
218.	Residential building construction	Supply Chain	Services
219.	Resin & artificial synthetic fibres & filaments	Supply Chain	Manufacturing
220.	Retail banking	Supply Chain	Services
221.	Rubber hoses & belting	Supply Chain	Manufacturing
222.	Satellite telecommunications	B2C	Services
223.	Sawmill & woodworking machinery	Supply Chain	Manufacturing
224.	Scenic & sightseeing transport	Supply Chain	Services
225.	Schools, colleges, universities, & professional schools	B2C	Services
226.	Seafood products	B2C	Manufacturing
227.	Seasoning & dressing	B2C	Manufacturing
228.	Semiconductor machinery	Supply Chain	Manufacturing
229.	Semiconductors & other electronic components	Supply Chain	Manufacturing
230.	Ships & boats	Supply Chain	Manufacturing
231.	Sign manufacturing	Supply Chain	Manufacturing
232.	Snack food	B2C	Manufacturing
233.	Soap, cleaning compounds, & toilet preparation	B2C	Manufacturing
234.	Social assistance	B2C	Services
235.	Soft drinks & ice	B2C	Manufacturing
236.	Software publishers, except video games	Supply Chain	Services
237.	Solar electric power	B2C	Services
238.	Specialised design services	Supply Chain	Services
239.	Speciality trade contractors	Supply Chain	Services
240.	Sporting goods, hobby, books & music	B2C	Services
241.	Spring & wire products	Supply Chain	Manufacturing
242.	Steel products	Supply Chain	Manufacturing
243.	Sugar & confectionary products	Supply Chain	Manufacturing
244.	Support Activities for Mining	Supply Chain	Services
245.	Support activities for mining & energy	Supply Chain	Services
246.	Support activities for transportation	Supply Chain	Services
247.	Technical, trade & other schools	B2C	Services
248.	Textile machinery	Supply Chain	Manufacturing
249.	Textiles & Textile Mills	Supply Chain	Manufacturing
250.	Tobacco	B2C	Manufacturing
251.	Transit & ground passenger transportation	B2C	Services
252.	Travel arrangement & reservation services	Supply Chain	Services

253.	Truck transportation	Supply Chain	Services
254.	Tyres	B2C	Manufacturing
255.	Unspecified	unspecified	unspecified
256.	Urethane, foam products & other compounds	Supply Chain	Manufacturing
257.	Ventilation, heating, air conditioning, and commercial refrigeration equipment manufacturing	Supply Chain	Manufacturing
258.	Video games, applications and digital content	Supply Chain	Services
259.	Warehousing & storage	Supply Chain	Services
260.	Waste management & remediation services	Supply Chain	Services
261.	Water transportation	Supply Chain	Services
262.	Water, sewage & other systems	B2C	Services
263.	Wholesale Trade (Consumer Goods)	B2C	Services
264.	Wholesale Trade (Food & Tobacco)	B2C	Services
265.	Wind electric power	B2C	Services
266.	Wineries	B2C	Manufacturing
267.	Wired telecommunication carriers	B2C	Services
268.	Wireless telecommunication carriers	B2C	Services
269.	Wiring devices	Supply Chain	Manufacturing
270.	Wood products	Supply Chain	Manufacturing

FDI to the UK: top ten sub-sectors

In the briefing paper we discussed what was the industrial profile of inward investment to the UK, focussing on the most common sectors and sub-sectors (where fDi Markets distinguishes 39 sectors and 270 sub-sectors). We mentioned that at the most disaggregated industrial breakdown – sub-sectors – the most common type of inward FDI to the UK was in the 'software publishers (except video games) sub-sector, followed by 'internet publishing, broadcasting and web search'.

Owing to the space constraints of the main paper we chose to report data table with information on the top ten FDI sub-sectors in this online appendix (see: **Table 2** below).

Table 2: Inward FDI to the UK: top ten sub-sectors by number of investment projects announced

Top ten sub-sectors (projects): 2003-2014			Top ten sub-sectors (projects): 2015			Top ten sub-sectors (projects): 2016			Top ten sub-sectors (projects): 2017		
	count	(%)		count	(%)		count	(%)		count	(%)
Software publishers, except video games	1,327	14.7	Software publishers, except video games	185	16.2	Software publishers, except video games	155	14.9	Software publishers, except video games	144	15.3
Internet publishing & broadcasting & web search	344	3.8	Internet publishing & broadcasting & web search	58	5.1	Internet publishing & broadcasting & web search	44	4.2	Internet publishing & broadcasting & web search	41	4.4
Corporate & investment banking	320	3.6	Corporate & investment banking	34	3.0	Custom computer programming services	38	3.7	Corporate & investment banking	36	3.8
Retail banking	318	3.5	Custom computer programming services	30	2.6	Professional, scientific & technical services	32	3.1	Rental & leasing services	35	3.7
Custom computer programming services	309	3.4	Advertising, PR, & related	30	2.6	Retail banking	27	2.6	Professional, scientific & technical services	24	2.5
Accommodation	224	2.5	Professional, scientific & technical services	30	2.6	Freight/Distribution Services	25	2.4	Advertising, PR, & related	23	2.4
Advertising, PR, & related	215	2.4	Business support services	26	2.3	Corporate & investment banking	22	2.1	Custom computer programming services	22	2.3
Professional, scientific & technical services	198	2.2	Data processing, hosting, & related services	25	2.2	Investment management	21	2.0	Freight/Distribution Services	19	2.0
Investment management	174	1.9	Rental & leasing services	24	2.1	Advertising, PR, & related	20	1.9	Legal services	17	1.8
Insurance	152	1.7	Freight/Distribution Services	23	2.0	Pharmaceutical preparations	20	1.9	Pharmaceutical preparations	16	1.7
						Rental & leasing services	20	1.9			
						Architectural, engineering, & related services	20	1.9			
Total	**9,006**	**100.0**	**Total**	**1,139**	**100.0**	**Total**	**1,041**	**100.0**	**Total**	**942**	**100.0**

Details on SCM

The synthetic control method (SCM) is an instrument designed for policy evaluation in comparative case studies. In the absence of an explicit counterfactual, the SCM proposes an alternative to the difference in difference estimator. The argument is the following: we want to measure the effect of a policy intervention, but we do not have treated and non-treated units as in a lab experiment. The control group could be represented by similar units and we could use their average as comparison for the treated unit. However, as the literature on matching argues, there can be a control that better represents the treated unit than the simple average of the control units. By looking at pre-treatment characteristics of treated and control units, we can construct the counterfactual as a weighted average of the units in the control group, such that control units that are more similar to the treated one will receive a larger weight and hence have a greater influence on the resulting counterfactual. The synthetic control method is all about finding these weights.

Consider $j \in (1, J+1)$ units over the time periods $t \in (1, T)$. The unit $j = 1$ receives the treatment at time $t = T_0$. It follows that units $j \in (2, J+1)$ represent the control group, the period $t \in (1, T_0 - 1)$ is the pre-intervention period and $t \in (T_0, T)$ is the post-intervention period. For each unit, we observe a variable of interest (or outcome variable) Y_{jt} and a set of other variables $k \in (1, K)$ contained in the matrices X_{jt}. The variables in the X matrices must be 'good predictors' of Y, and these can also be linear combinations of the outcome variable Y (e.g., the average of Y over the pre-treatment period). The objective is to find the vector of weights W that will be used to compute the weighted average in order better represent the treated unit in the pre-treatment period. Let X_1 be the matrix of predictors for the treated unit and X_0 the one for the control group. The SCM chooses W that minimizes the distance between X_1 and X_0 in the pre-intervention period. This is the Euclidean distance weighted by V:

$$\sqrt{(X_1 - X_0 W)' \, V \, (X_1 - X_0 W)} \quad (1)$$

To avoid extrapolation, we must impose some constraints: the sum of all the weights in W must add up to 1, and each weight w_j must lie in the interval (0, 1). We can express the problem as:

$$\min_W \sqrt{(X_1 - X_0 W)' \, \mathrm{V} \, (X_1 - X_0 W)}$$

subject to:

$$i'W = 1 \quad \text{and} \quad w_j \in (0, 1)$$

where i is a vector of 1 of length J (sum vector) so that $i'W$ is the sum of all the w_j elements of W. There are some different options over the choice of V, which could be defined by the researcher arbitrarily or can using some data-driven procedure based on the minimisation of the distance between the outcome variable of the resulting synthetic control and the treated unit:

$$\sqrt{(Y_1 - Y_0 \mathrm{W})' \, (Y_1 - Y_0 \mathrm{W})} \qquad (2)$$

Here we choose *V* following the data driven procedure proposed by Abadie et al. (2010, 2015).

As stressed by Ferman et al. (2016), the researcher has some discretion over the choice of the linear combinations of *Y* to use as predictor in the matching procedure[2]. We therefore test different specifications of the model that vary in the linear combination of the outcome variable used as predictor. The specifications that we tested are the same considered by Jardón et al. (2018) (specifications 1-5) and additional four:

1. The average of all pre-treatment periods
2. The last pre-treatment period
3. The first and last pre-treatment period
4. The first, middle and last pre-treatment period
5. The first, middle and last pre-treatment period
6. The average for each month
7. The average for each month for the second half of the pre-intervention period
8. The average for each month and the final pre-intervention period
9. The average for each month for the first and second half of the pre-intervention period separately

For each specification, we calculated the root mean squared prediction error (RMSPE) defined as:

$$RMSPE = \sqrt[2]{\frac{1}{T_0}\sum_{t=1}^{T_0}\left(Y_{jt} - \widehat{Y_{jt}}\right)^2}$$

where $t \in (1, T)$ indicates the period of observation and T_0 is the last month before Brexit (i.e., May 2016), Y_{jt} is inward FDI in country *j* at time *t* and $\widehat{Y_{jt}}$ is the estimated synthetic control. Ferman et al. (2016) suggested that, since countries in the control group did not receive the treatment, the ideal specification *s* is the one that minimises the RMSPE in the post-Brexit period for all the countries in the control group:

$$\min_{s \in S}\left[\frac{1}{(T - T_0) * J}\sum_{j=2}^{J+1}\sum_{t=T_0+1}^{T}\left(Y_{j,t} - \widehat{Y_{J,t}^{s}}\right)^2\right]$$

We do this for each specification both using and not using a validation period for the computation of the V matrix.

The goodness of fit, or R^2, is computed as 1 minus the sum of squared deviation of *Y* from the synthetic control results over the sum of squared deviation of *Y* from its mean:

[2] The problem arises for the other *k* variables in *X* as well. However, the predictive power of linear combinations of *Y* is generally much higher than the one of other variables, and this makes the problem much more important.

$$R^2 = 1 - \frac{MSE}{\sigma_1^2} = 1 - \frac{\sum_{t=1}^{T_0}\left(Y_{1t} - \widehat{Y_{1t}}\right)^2}{\sum_{t=1}^{T_0}(Y_{1t} - \bar{Y}_1)^2}$$

After this, we run in-space placebo tests as suggested by Abadie et al. (2015). We re-assign the treatment to each country in the donor pool and then see whether the treatment effect of the control unit is larger than the one of the treated unit. We then compute a ratio of post to pre-treatment RMSPE:

$$ratio_i = \frac{\sqrt{\frac{1}{T - T_0}\sum_{t=T_0+1}^{T}\left(Y_{it} - \sum_{j \neq i} \widehat{w_i^j} Y_{jt}\right)^2}}{\sqrt{\frac{1}{T_0}\sum_{t=1}^{T_0}\left(Y_{it} - \sum_{j \neq i} \widehat{w_i^j} Y_{jt}\right)^2}}$$

From the ratios, we can compute a pseudo p-value as:

$$p - \text{value} = \frac{1}{J+1}\sum_{i=1}^{J+1} I\left(\widehat{\beta_{iT}^{SC}} - \widehat{\beta_{1T}^{SC}}\right)$$

Tables Table A3 and

Table A*4* below we report in column 1 the mean squared prediction errors (MSPE) for all the nine specification. For the best four specifications (i.e., four with the lowest MSPE), compute the R-squared for the treated unit (column 2) and the p-values (column 3). Column 4 shows the rank of the specification in terms of MSPE. Table A3 reports the estimation for the nested optimization, while

Table A*4* reports those for the nested optimization where the V-matrix is computed on a validation period.

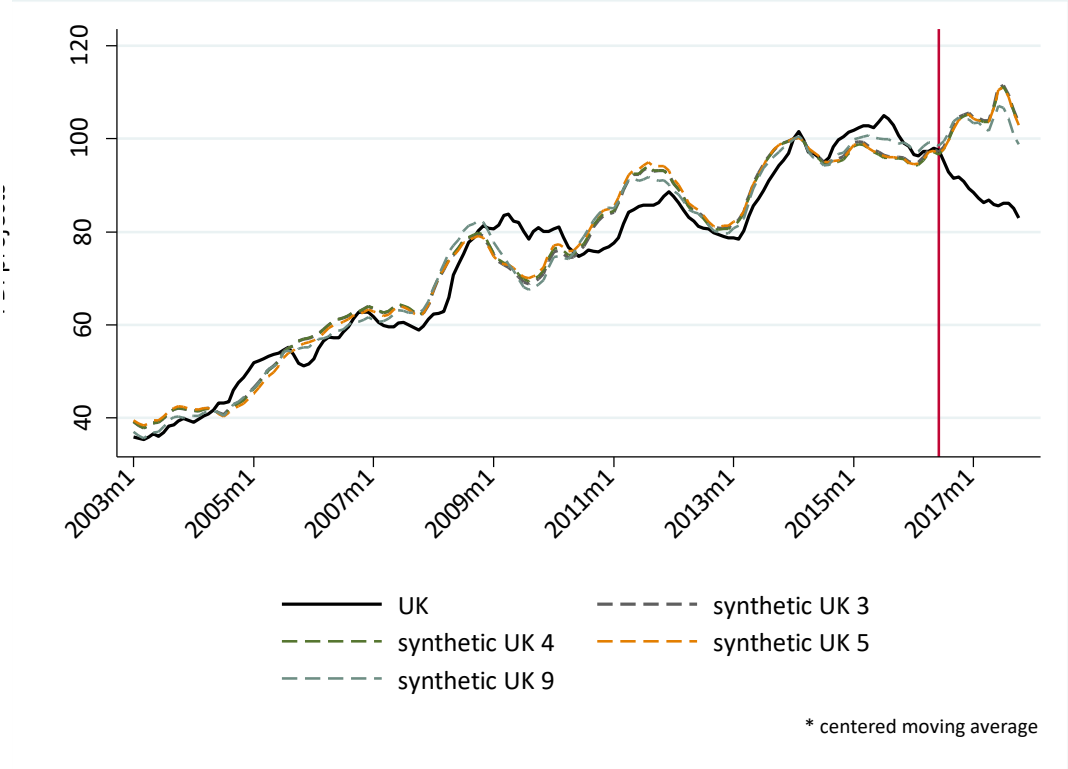
We consider the best four specifications as robustness test to see whether our results differ across specifications. For each of the four best specifications, independently on optimization method, the synthetic counterfactual matches well the actual UK series – the R-squared is over 0.90 for all of them. Furthermore, p-values of zero for each specification make us confident on the robustness of results.

Table A3: Results for nested optimization

Specification	MSPE	R2	p-value	Rank
1	711			8
2	740			9
3	576	0.94	0	4
4	555	0.94	0	2
5	516	0.94	0	1
6	629			6
7	656			7
8	609			5
9	565	0.95	0	3

Figure 1 and Figure 2 below plot the synthetic counterfactuals for the four best specifications using nested optimization and considering a validation period, respectively.

Figure 1: Best four specification, nested optimization

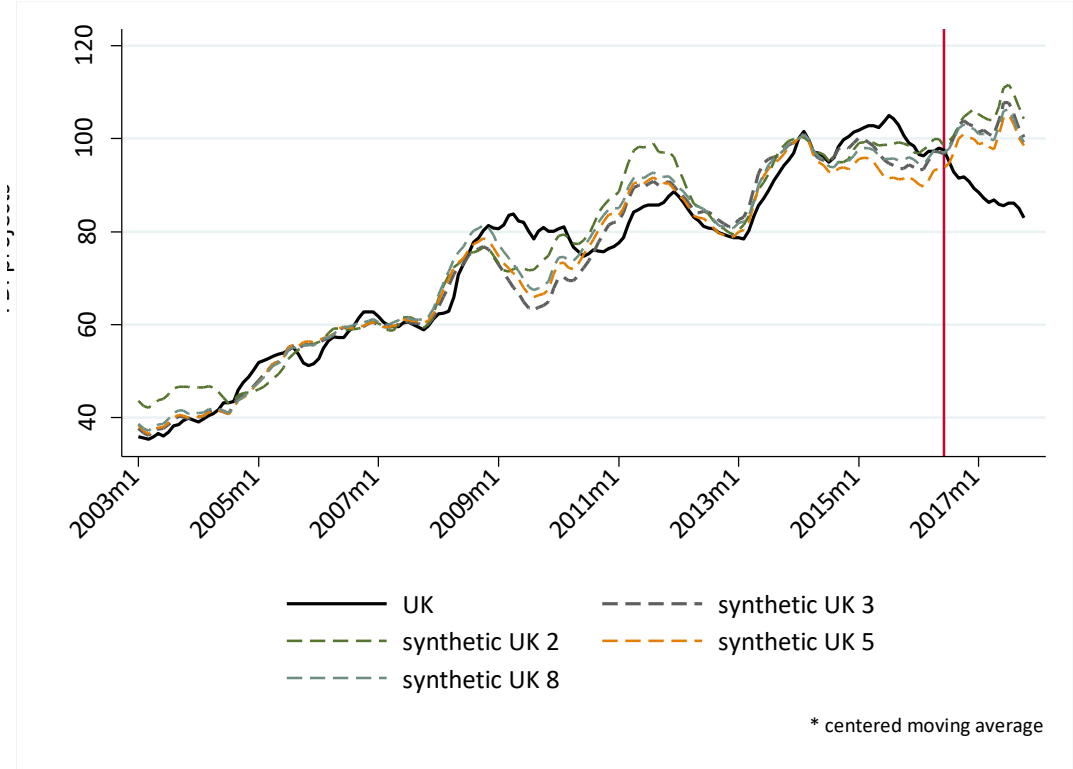


The solid line shows the actual UK series while the dashed lines are synthetic counterfactual for different specifications.

Table A4: Results for nested optimization with validation period

Specification	MSPE	R2	p-value	Rank
1	1034			9
2	807	0.92	0	4
3	725	0.93	0	3
4	816			
5	547	0.93	0	1
6	1013			8
7	884			7
8	676	0.94	0	2
9	824			6

Figure 2: Best four specification, nested optimization with validation period



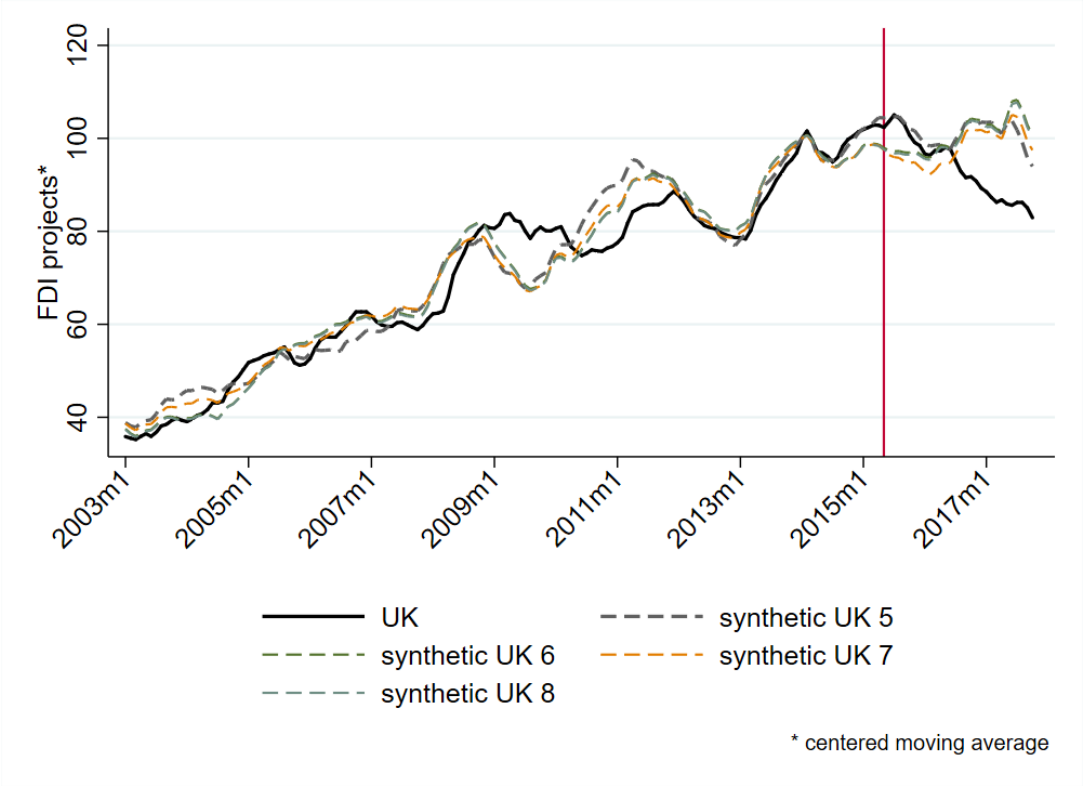
The solid line shows the actual UK series while the dashed lines are synthetic counterfactual for different specifications.

As mentioned footnote 12 in the briefing paper, we tested whether different 'treatment date'. We consider May 2015 as breaking point, the month when David Cameron won general election. As above, we test the nine different specifications.

Results for the SCM at with breaking point in May 2015 are plotted in

Figure *3* below. As for Figure 1 and Figure 2, we show the four best specifications in terms of MSPE. The SCM predicts that UK inward FDI has been lower than what they could have been only after the referendum results, but not beforehand. This reinforces our previous results showing that UK started to perform worse than the control units only after the referendum.

Figure 3: Best four specifications, break date May 2015, nested optimization



References

Abadie, A., Diamond, A. and Hainmueller, J. (2010) 'Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program', *Journal of the American Statistical Association*, 105(490):493-505.

Abadie, A., Diamond, A. and Hainmueller, J. (2015) 'Comparative Politics and the Synthetic Control Method', *American Journal of Political Science*, 59(2):495-510.

Delgado, M. and Mills, K.G. (2017) 'A New Categorization of the U.S. Economy: The Role of Supply Chain Industries in Innovation and Economic Performance', MIT Sloan School Working Paper 5241-16, MIT Sloan School of Management.

Ferman, B., Campos de Xavier Pinto, C., Possebom, V.A. (2016) 'Cherry Picking with Synthetic Controls', Textos para discussão 420, FGV/EESP - Escola de Economia de São Paulo, Getulio Vargas Foundation (Brazil).

Financial Times fDi Markets database. Available at: https://www.fdimarkets.com/.

Jardón, A., Kuik, O. and Tol, R.S.J. (2018) 'Causal Effects of PetroCaribe on Sustainable Development: A Synthetic Control Analysis', University of Sussex Working Paper, No. 09-2018.