Unravelling Deep Integration

Local Labour Market Effects of the Brexit Vote

Beata Javorcik [1] Ben Kett [1] Katherine Stapleton [1] Layla O'Kane [2]

[1]University of Oxford
[2]Burning Glass Technologies

September 2020

Introduction

- The Brexit referendum introduced prospect of 'unravelling' of decades-long deep integration with the EU
- It created a threat of substantial and complex future barriers to trade in goods and services, and movement of labour
- Unique opportunity to examine the labour market consequences of deep integration being reversed
- Study the real time labour demand response by focusing on online job adverts
- Focus on 21st century trade barriers: the UK is a services dominant economy
- Important implications for the post-COVID19 world where threat of trade barriers looms large

This paper

Question: How did the threat of future barriers to UK exports to the EU affect labour demand?

- Use 'near universe' of UK online job postings from 2015-2019 (BGT)
- Develop measures of local labour market exposure to prospective barriers
- Explore their impact on local labour demand
- Consider trade in services and in goods
- Consider other key channels: exchange rate depreciation, immigration policy uncertainty
- Develop time-varying measures of public concern over Brexit-induced trade barriers based on newspaper coverage and Google searches

Preview of results

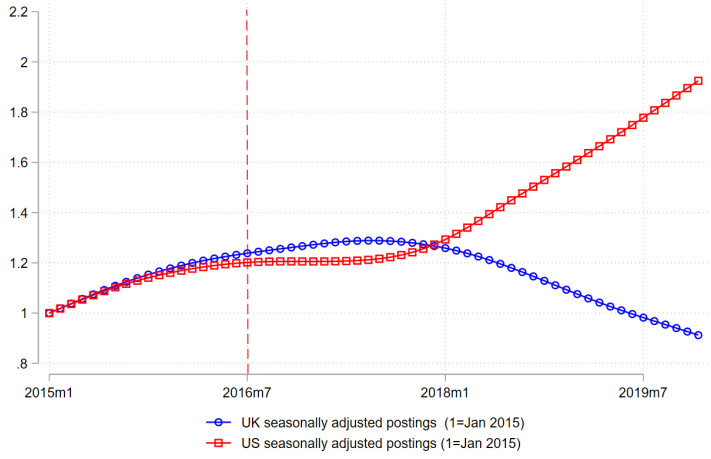
- Areas more exposed to future trade barriers on professional services reduced hiring after the referendum relative to less exposed areas
- Particularly strong impact on financial services
- Reduction in hiring after the vote concentrated in months with greater newspaper coverage and Google searches relating to future trade policy
- Robust to controlling for global trends in the industry and distinct from the impact of the exchange rate depreciation, immigration & goods trade
- Relative decline in hiring concentrated in higher skilled & professional jobs

Related literature

- Labour market effects of trade *integration*
  - **Negative effects of import competition**: Autor et al. (2013), Edmonds et al. (2010), Topalova (2010), Pierce and Schott (2016)
- Brexit
  - **Tariff uncertainty matters**: Crowley et al. (2018), Graziano et al. (2018), Bloom et al. (2018)
  - **Sterling devaluation decreased wages/worker training**: Costa et al. (2019)
  - **Cost of trade disintegration**: Mayer et al. (2019), Dhingra et al. (2017), Sampson (2017), Van Reenen (2016)
- Protectionism
  - **Effects of the US-China Trade war:** Fajgelbaum et al. (2019) Amiti et al. (2019), Blanchard et al. (2019), Cavallo et al. (2019), Handley et al. (2020)
- Online job postings
  - **Used to study demand for skills & tasks:** Hershbein & Kahn (2018) Deming & Noray (2018), Deming & Kahn (2017)

Online job adverts after Brexit

- The total number of job adverts posted online in the UK in 2019 was 10% lower than in 2015, compared to 64% higher in the US



Threat of future barriers to services exports

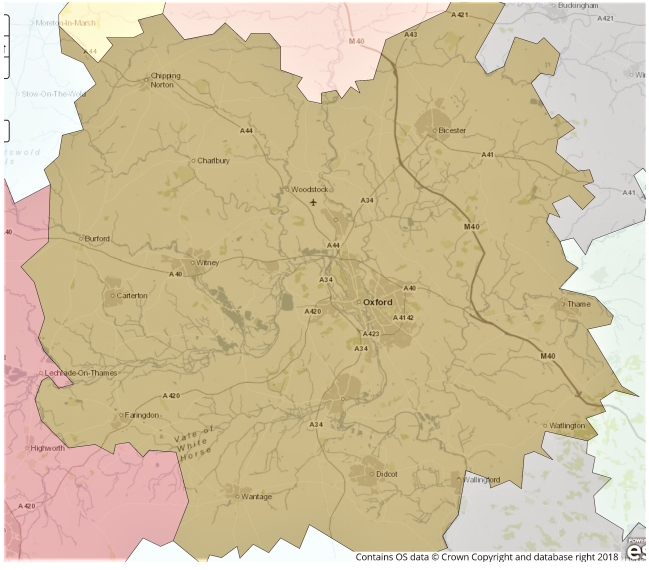
- The referendum result was unexpected: sudden jump in probability of trade barriers
- Services account for 80% of UK economic output and 46% of exports
- Financial services made up 6.9% of the UK's total output in 2018 and contributed £29 billion in tax in 2017/18
- If the UK leaves the single market without a services trade agreement, UK will become a 'third country' to the EU for services trade, trade reverts to the GATS terms & UK faces rules set by individual member states
- Major shift in policy for many service sectors: EU single market is the most integrated area for trade in services in the world

Focus on local labour markets

Analysis at unit of UK Travel to Work Areas (TTWAs)

- The UK has 218 travel to work areas (excluding Northern Ireland)
- Def: at least 75% of the area's resident workforce work in the area and at least 75% of the people who work in the area also live in the area
- The area must also have an economically active population of at least 3,500
- Range in population size from 6,800 to 8.4 million.

Example TTWA: Oxford



Data sources

1. Employment composition: Business Register and Employment Survey (BRES)
   - Employment shares by TTWA and SIC4 code in 2015
   - Surveys approximately 85,000 businesses, includes 28.5 million employees (est. 91% of the total UK labour force)
   - Employment: employees plus the number of working owners who receive earnings or share of profits
2. EU immigration: Annual Population Survey (APS)
3. Services trade: ONS & OECD STRI
4. Goods tariffs and trade data: WITS

Measuring barriers to service exports

- Evaluate the 'gap' between services trade restrictions placed on countries within the EEA and the Most-favoured Nation (MFN) services trade restrictions on third countries
- Use the 2014 OECD Services Trade Restrictiveness Index (STRI): quantifies services trade restrictiveness in each EEA country & sector at the MFN level and intra-EEA level
- Index includes restrictions on foreign entry and movement of people, barriers to competition, regulatory transparency and other discriminatory measures that impact the ease of doing business
  - **Some examples:** limiting foreign equity shares in local businesses, restricting cross-border mergers, product level regulations
- We focus on professional services: finance, insurance, legal, accounting, ICT, telecoms, engineering and architecture

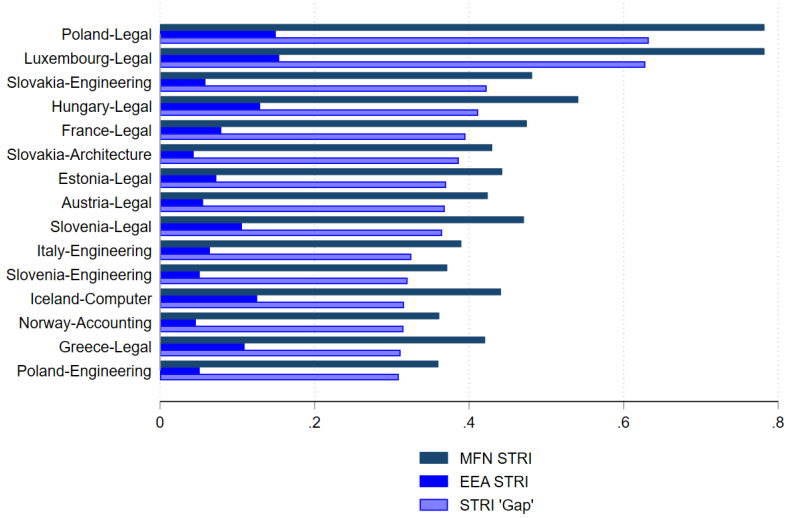
Professional services trade barrier exposure

$$prof_services_exposure_r = \sum_j employment_share_{rj,2015} \times prof_services_exposure_j \quad (1)$$

$$prof_services_exposure_j = \frac{Exports_{j,2015}}{L_{j,2015}} \times avg_STRI_gap_{j,2014} \quad (2)$$

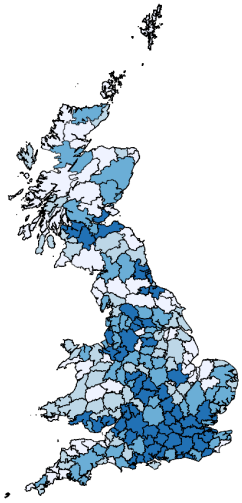
- Avg STRI $gap_{j,2014}$: difference between the 2014 MFN STRI and intra-EEA STRI for industry j in EEA country c, weighted by UK exports to EEA country c in sector j in 2015
- $Exports_{j,2015}$: UK exports from industry j to the EEA in 2015
- $L_{j,2015}$: national employment in sector j in 2015
- $employment_share_{rj,2015}$: industry j shar of TTWA r employment (BRES)

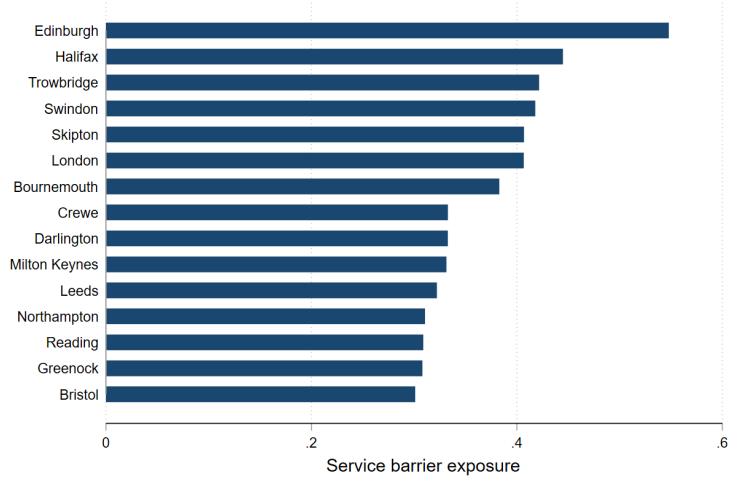
OECD STRI country-sector pairs with highest EEA vs MFN barrier 'gap'



Notes: Raw OECD STRI scores from 2014

Professional services exposure by UK region





Trade in goods: tariff 'threat'

- If no trade deal negotiated, UK trade with EU reverts to MFN levels
- At HS6 level: 37% are >5%, 11% are >10%, and 2% are >15%
- Firms differentially affected by tariff uncertainty after vote depending on pre-referendum composition of products
- Focus on export tariff 'threat' but also look at intermediate import tariff 'threat' and prospective import protection
- Local labour markets differentially affected depending on pre-referendum composition of employment

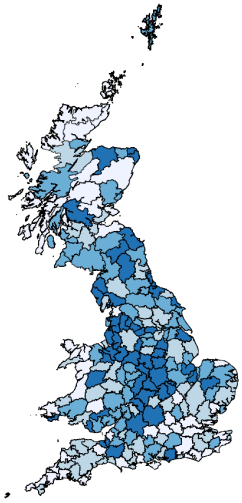
Export tariff exposure

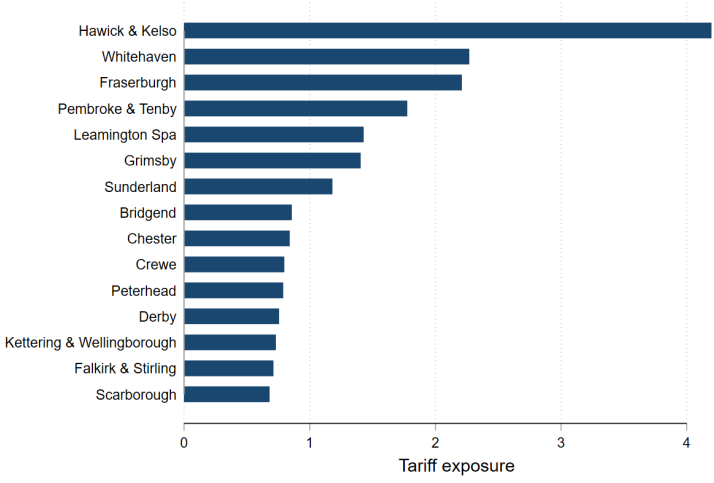
$$tariff_exposure_r = \sum_{j \in r} employment_share_{rj,2015} \times tariff_exposure_{j,2014} \tag{3}$$

$$tariff_exposure_{j,2014} = \frac{Exports_{j,2014}}{L_{j,2015}} \times avg_MFN_tariff_{j,2014} \tag{4}$$

- $employment_share_{rj,2015}$: industry j share of TTWA r employment (BRES)
- $avg_MFN_tariff_{j,2014}$: export-weighted average EU MFN ad valorem tariff across all HS6 products mapped to sector j
- $L_{j,2015}$: national employment (4-digit SIC sector j)
- $Exports_{j,2014}$: UK exports to the EU in 2014

Export tariff exposure by UK TTWA



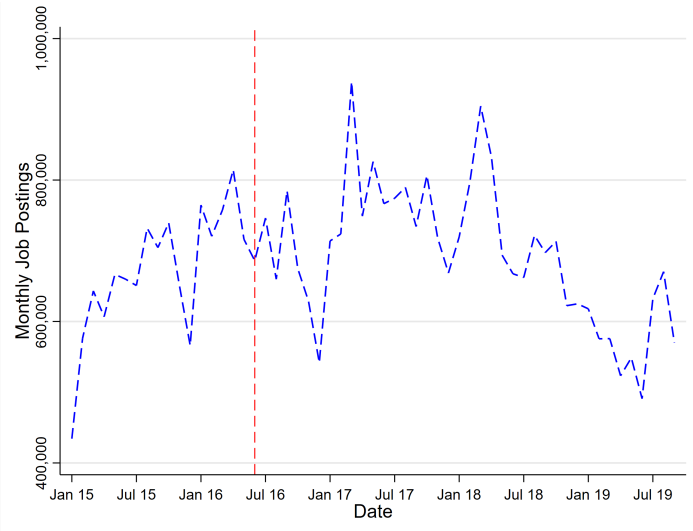


Job Postings Data

Burning Glass Technologies (BGT):

- scrape 'universe' of online job postings on a daily basis
- sourced from >40,000 online job boards and company websites
- Almost 30 million UK job adverts from Jan 2015- Dec 2019
- Classify posts by 225 TTWAs
- Over our time period BGT covers on average 86% of the total vacancies reported in the UK Vacancy Survey

Job Postings Data



Baseline specification

$$log(job_postings_{rt}) = \beta_0 + \beta_1 trade_barrier_exposure_r \times post_vote_t + \mathbf{X}_{rt} + \gamma_t + \gamma_r + \epsilon_{rt} \quad (5)$$

- Period: Jan 2015 - Dec 2019
- $job_postings_{rt}$: count of postings by TTWA r & month t
- $post_vote_t$: dummy for the post referendum period
- $\mathbf{X}_{rt}$: region-specific time-varying controls
- Fixed effects: year-month t and TTWA r
- Clustering: year-month t and TTWA r

Other channels: Exchange rate

- Large overnight depreciation of the pound with respect to the dollar and euro after the referendum
- Firms affected through higher cost of imported inputs and increased competitiveness of export products
- Different depreciation for different currencies: pound-dollar fell 8%, pound-euro fell 6%
- Following Costa et al. (2019), use a weighted sum of exposure to the exchange rate depreciation depending on sector-specific trade with different countries
- Two measures: one for exports and one for imported inputs

Other channels: EU immigration

- Employment share of EU and Eastern EU nationals before the vote x *post_vote*
- Use data from the Annual Population Survey (APS) in 2015: a continuous household survey
- Provides breakdown of the share of employment of EU and Eastern EU nationals in each UK region and SIC1 industry (11 regions excluding Northern Ireland)
- Use data on the SIC1 (k) employment composition of each TTWA in a given region to construct the employment share measures

$$EU_national_share_r = \sum_k employment_share_{kr} \times \frac{EUworkers_{k,reg}}{Totalworkers_{k,reg}} \quad (6)$$

Baseline results

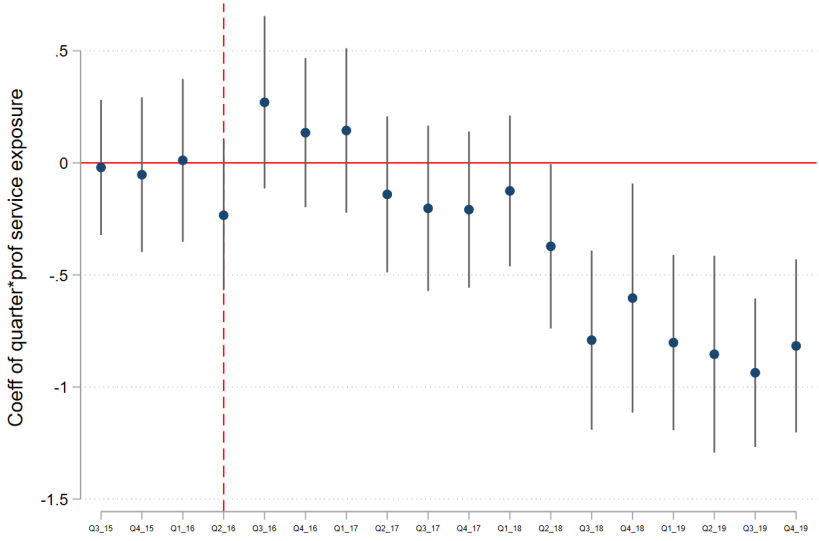
Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * prof service exposure	**-0.538*** **	**-0.540*** **	**-0.351*** **	**-0.346*** **	**-0.344*** **
	(0.132)	(0.132)	(0.124)	(0.124)	(0.128)
post vote * tariff exposure		-0.008	0.001	0.003	0.001
		(0.033)	(0.035)	(0.035)	(0.035)
post vote * xrate impact via imports			-74.18	-81.09	-76.97
			(52.49)	(50.31)	(50.49)
post vote * xrate impact via exports			7.888*	9.084**	8.587**
			(4.194)	(4.065)	(4.277)
post vote * EU national share				0.639	
				(0.797)	
post vote * EU8 national share					0.556
					(1.341)
Observations	12,780	12,780	12,780	12,780	12,780
Adjusted R-squared	0.984	0.984	0.984	0.984	0.984
TTWA FE	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Baseline results magnitude

- Prof services exposure:
  - 1 sd increase in exposure (0.09) reduces postings by 3.1% (based on col 4)
  - Average number of monthly postings is 2,409 $\rightarrow$ a decline of 74 postings per month
  - Aggregate effect: if all TTWAs had the 10th percentile exposure score, there would have been cumulatively 1.5 million more postings over post vote period
- Exchange rate (exports): 1 sd increase in the TTWA's export exposure to the post-referendum sterling depreciation (0.003) $\rightarrow$ 3.1% increase in postings

Professional services impact by quarter



Note: Quarters 1 & 2 of 2015 excluded. 95% confidence intervals displayed.

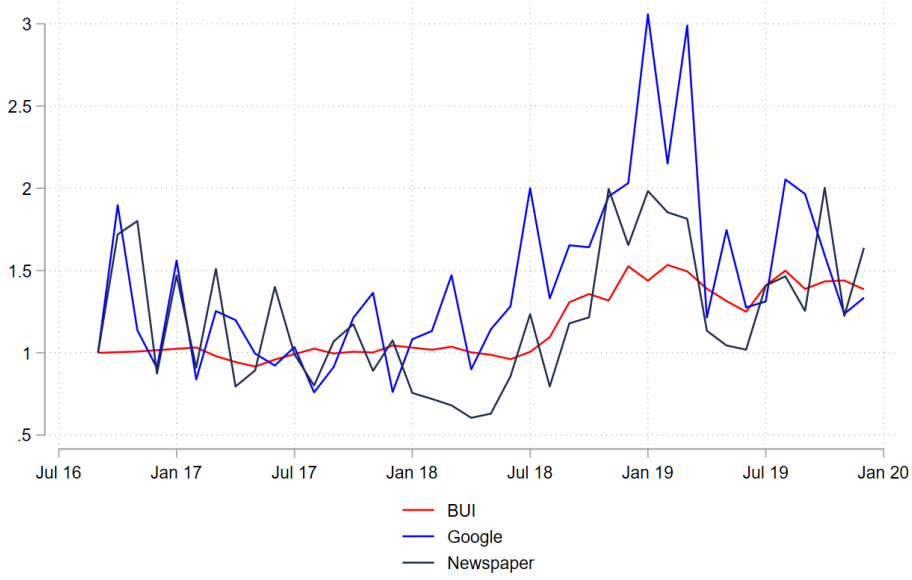
Time-varying perceptions about future trade policy

- 3 1/2 years passed between the referendum and the UK leaving the EU
- How did different decisions and political signals affect hiring within this period?
- Construct measure of time-varying interest in Brexit-related trade policy using newspaper articles and Google search data
- Also for comparison use the Brexit Uncertainty Index (BUI) collected from the Decision Makers Panel: monthly firm survey asking if Brexit was one of the three highest drivers of uncertainty for their business

Time-varying newspaper & google search coverage

- Build on method of Baker et al. (2016)'s Economic Policy Uncertainty (EPU) Index and Ahir et al. (2018)'s World Trade Uncertainty (WTU) Index
  - List of 8 trade related terms: 'trade', 'tariffs', 'passporting', 'wto', 'world trade organisation', 'trade policy', 'trade agreement', 'services agreement'
  - Additionally search must include 'Brexit', 'leave EU', 'EU' or 'no deal'
- Google trends provides index of relative search intensity for these terms
- Look at top 10 UK newspapers by circulation using Factiva
- Construct monthly indices based on newspaper coverage and google searches

Monthly measures



Post-vote period time-varying results

Dep variable: log postings	(1)	(2)	(3)	(4)	(5)	(6)
	Google		Newspaper		BUI	
measure*prof service exposure	**-0.231*** **	**-0.268*** **	**-0.066***	**-0.083***	**-0.034*** **	**-0.039*** **
	(0.08)	(0.060)	(0.039)	(0.042)	(0.007)	(0.007)
measure *tariff exposure	-0.007	-0.001	0.008	0.011**	-0.000	0.000
	(0.011)	(0.011)	(0.005)	(0.005)	(0.002)	(0.001)
measure*EU national share	-1.907***		-0.826***		-0.264***	
	(0.349)		(0.239)		(0.042)	
measure*EU8 national share		-2.900***		-1.249***		-0.413***
		(0.524)		(0.398)		(0.062)
Observations	8,520	8,520	8,520	8,520	8,520	8,520
Adjusted R-squared	0.987	0.987	0.987	0.987	0.987	0.987
TTWA FE	YES	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Post-vote period time-varying results

Taking col (1):

- For mean prof service exposure (0.127) moving from the 25th percentile of uncertainty (1.57) to the 75th percentile (2.53) decreases postings by 2.8%
- Equivalent for EU national share decreases postings by 8.5%, or 8.3% for EU8 national share

Was this a global pattern? Placebo using US data

- Ask: what would have happened if the UK had followed US sectoral trends? Create a placebo using US postings data
- Map the US 6-digit North American Industry Classification System (NAICS) code to the UK 4 digit SIC codes
- Use same TTWA pre-sample sectoral employment shares as for the tariff threat measure as weights for the US sectoral job postings

$$US_postings_{r,t} = \sum_{j} Employment_share_{j,r} \times US_postings_{j,t}$$

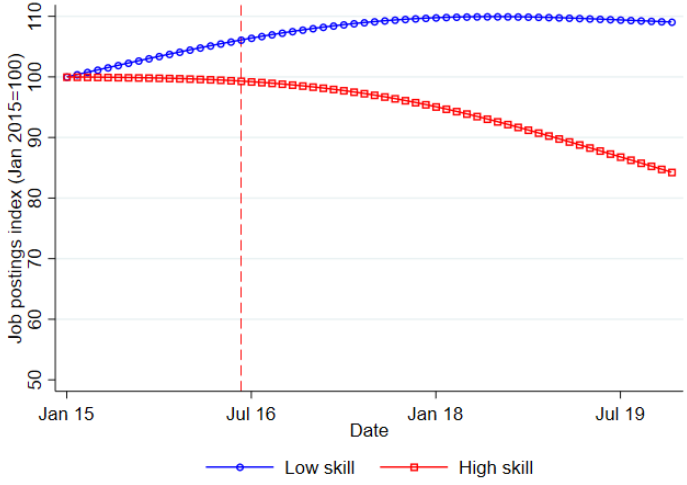
- Assume any impact of Brexit in the US would be far more muted than in the UK

US placebo results

Dep variable: **log US postings**	(1)	(2)	(3)	(4)	(5)	(6)
	Google		Newspaper		BUI	
measure*service barrier exposure	0.002	0.002	-0.001	-0.001	-0.000	-0.000
	(0.017)	(0.016)	(0.007)	(0.007)	(0.002)	(0.002)
measure *tariff exposure	-0.001	-0.001	-0.000*	-0.000*	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
measure*EU national share	-0.037		0.002		-0.011*	
	(0.052)		(0.033)		(0.007)	
measure*EU8 national share		-0.058		-0.006		-0.019*
		(0.078)		(0.048)		(0.011)
Observations	8,520	8,520	8,520	8,520	8,520	8,520
Adjusted R-squared	0.994	0.994	0.994	0.994	0.994	0.994
TTWA FE	YES	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Skill breakdown & impact across occupations



Services impact mainly concentrated in higher skilled occupations

Dep variable: log postings	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Panel (a) High skill					Panel (b) Low skill				
post vote * prof service exposure	**-0.637*** **	**-0.635*** **	**-0.433*** **	**-0.428*** **	**-0.429*** **	**-0.280** **	**-0.283** **	-0.180	-0.173	-0.164
	(0.132)	(0.132)	(0.137)	(0.138)	(0.141)	(0.127)	(0.127)	(0.119)	(0.117)	(0.121)
post vote * tariff exposure		0.009	0.018	0.020	0.018		-0.017	-0.008	-0.004	-0.007
		(0.032)	(0.034)	(0.034)	(0.034)		(0.037)	(0.039)	(0.038)	(0.039)
post vote * xrate impact via imports			-81.38*	-88.19*	-82.67*			-32.19	-41.68	-37.99
			(47.58)	(46.30)	(46.23)			(53.76)	(51.41)	(51.55)
post vote * xrate impact via exports			7.753*	8.936**	8.077*			7.478	9.123*	8.933*
			(4.108)	(3.968)	(4.230)			(4.746)	(4.651)	(4.823)
post vote * EU national share				0.632					0.875	
				(0.811)					(0.764)	
post vote * EU8 national share					0.258					1.152
					(1.379)					(1.321)
Observations	12,766	12,766	12,766	12,766	12,766	12,766	12,766	12,766	12,766	12,766
Adjusted R-squared	0.976	0.976	0.976	0.976	0.976	0.976	0.976	0.976	0.976	0.976
TTWA FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Impact on high skill postings

Coefficient on professional services exposure increases in magnitude from baseline (-0.346 $\rightarrow$ -0.428).

A 1 sd increase in prof services decreases high skill postings by 3.8%.

In 2015, the average number of monthly high skilled postings was 1,613 $\rightarrow$ a reduction of 61 job ads per month.

Worst affected sectors are finance, engineering, info services & legal

Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * finance barrier exposure	**-0.499*** **	**-0.492*** **	**-0.461*** **	**-0.454*** **	**-0.471*** **
	(0.142)	(0.142)	(0.149)	(0.152)	(0.153)
post vote * engineering barrier exposure	**-6.284*** **	**-6.208*** **	**-5.731** **	**-5.501** **	**-6.068** **
	(2.238)	(2.256)	(2.490)	(2.636)	(2.722)
post vote * info services barrier exposure	**-3.815** **	**-3.858** **	**-3.740** **	**-3.804** **	**-3.696** **
	(1.778)	(1.772)	(1.785)	(1.775)	(1.759)
post vote * legal barrier exposure	-3.544	-3.630	**-4.154***	**-4.157***	**-4.221***
	(2.231)	(2.231)	(2.248)	(2.242)	(2.308)
post vote * insurance barrier exposure	1.136*	1.138*	1.040	1.032	1.046
	(0.589)	(0.588)	(0.651)	(0.655)	(0.651)
post vote * telecoms barrier exposure	-0.468	-0.545	-0.589	-0.544	-0.668
	(0.942)	(0.931)	(0.863)	(0.865)	(0.868)
post vote * computer barrier exposure	-0.800	-0.788	-0.065	-0.098	-0.038
	(0.783)	(0.780)	(0.890)	(0.894)	(0.884)
post vote * accounting barrier exposure	-1.904	-1.965	-1.774	-1.825	-1.740
	(2.794)	(2.811)	(2.970)	(2.969)	(2.963)
post vote * architecture barrier exposure	-5.654	-9.794	1.665	2.906	-1.725
	(57.43)	(58.78)	(56.38)	(56.63)	(57.87)
	...	...	...	...	...
Observations	12,780	12,780	12,780	12,780	12,780
Adjusted R-squared	0.984	0.984	0.984	0.984	0.984
TTWA FE	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES

Note: Also includes post vote exchange rate and EU share controls. Standard errors two-way clustered at TTWA & month-year level

Zooming in on Financial Services

- Within the group of services considered, Financial Services (FS) alone account for 42% of exports to the EEA
- FS are heavily reliant on 'passporting': within the Single Market, financial businesses authorised in any Member State operate freely across the EEA
- Passporting was a major part of the Brexit discussions and the loss of passporting was considered one of the greatest potential consequences of Brexit
- Not just London: two thirds of FS jobs are based outside the capital
- Also look solely at FS and exploit additional geographic variation in EU export intensity of FS

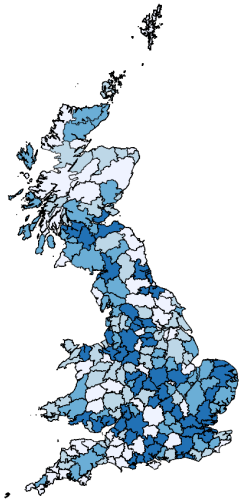
Regional Financial Services EU export exposure

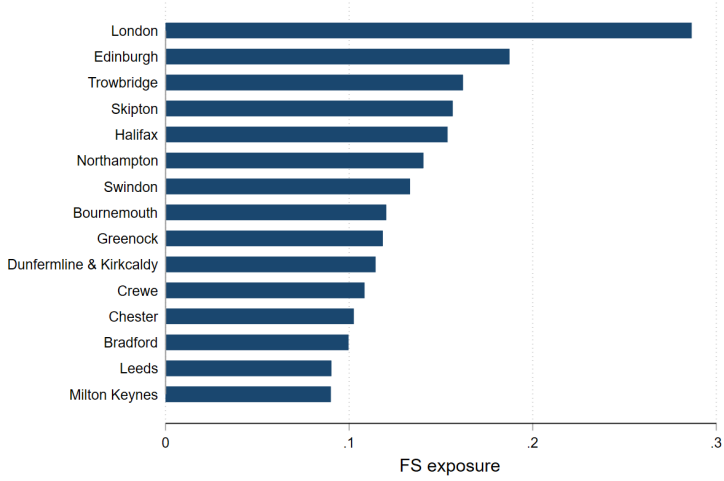
$$\text{FS exposure}_{r,NUTS1} = \text{FS employment share}_{r,2015} \times \text{Regional FS exposure}_{NUTS1} \quad (7)$$

$$\text{Regional FS exposure}_{\text{NUTS1}} = \frac{\text{Regional FS Exports to EEA}_{\text{NUTS1,2015}}}{\text{L}_{\text{FS,NUTS1,2015}}} \times \text{avg STRI gap}_{\text{FS,2014}} \quad (8)$$

- FS employment share$_{r,2015}$: FS share of TTWA r employment in 2015 (BRES)
- Regional FS Exports to EEA$_{\text{NUTS1,2015}}$: FS exports of UK NUTS1 region to the EEA
- L$_{\text{FS,NUTS1,2015}}$: FS employment in UK NUTS1 region
- avg_STRI_gap: as above

UK Financial Service export exposure





Financial services results

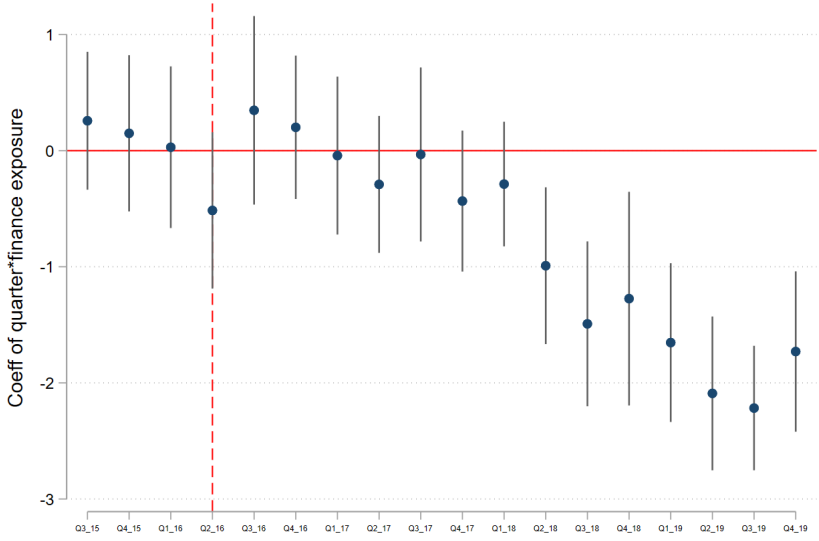
Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * financial services exposure	**-1.201*** **	**-1.201*** **	**-0.817*** **	**-0.868*** **	**-0.826*** **
	(0.296)	(0.295)	(0.279)	(0.254)	(0.269)
post vote * tariff exposure		-0.003	0.004	0.007	0.004
		(0.033)	(0.035)	(0.035)	(0.036)
post vote * xrate impact via imports			-98.19*	-105.3**	-100.6**
			(50.48)	(48.40)	(49.15)
post vote * xrate impact via exports			8.203*	9.857**	9.344**
			(4.238)	(4.070)	(4.260)
post vote * EU national share				0.914	
				(0.804)	
post vote * EU8 national share					0.940
					(1.310)
Observations	12,780	12,780	12,780	12,780	12,780
Adjusted R-squared	0.984	0.984	0.984	0.984	0.984
TTWA FE	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Financial services results magnitudes

- Financial services exposure:
  - 1 sd increase in FS exposure (0.0346) $\rightarrow$ decrease in postings of 3%
- Exchange rate imports:
  - 1 sd increase in imported input exposure to sterling depreciation $\rightarrow$ 3.4% decrease in postings
- Exchange rate exports:
  - 1 sd increase in export exposure to the depreciation $\rightarrow$ 3.4% increase in postings

Financial services impact by quarter



Note: Quarters 1 & 2 of 2015 excluded. 95% confidence intervals displayed.

For FS, lower skilled job ads were also negatively affected

Dep variable: log postings	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Panel (a) High skill					Panel (b) Low skill				
post vote * FS exposure	**-1.414*** **	**-1.414*** **	**-0.989*** **	**-1.043*** **	**-0.996*** **	**-0.662** **	**-0.662** **	**-0.455***	**-0.512** **	**-0.468***
	(0.322)	(0.323)	(0.317)	(0.286)	(0.308)	(0.275)	(0.274)	(0.262)	(0.237)	(0.249)
post vote * tariff exposure		0.015	0.021	0.025	0.021		-0.014	-0.006	-0.002	-0.006
		(0.032)	(0.034)	(0.035)	(0.035)		(0.037)	(0.039)	(0.038)	(0.039)
post vote * xrate impact via imports			-111.6**	-119.0***	-113.5**			-43.27	-51.25	-46.79
			(44.88)	(43.29)	(43.78)			(51.63)	(49.68)	(50.31)
post vote * xrate impact via exports			8.154*	9.900**	9.046**			7.613	9.489**	9.251*
			(4.159)	(3.979)	(4.213)			(4.750)	(4.618)	(4.775)
post vote * EU national share				0.964					1.032	
				(0.822)					(0.775)	
post vote * EU8 national share					0.734					1.345
					(1.346)					(1.300)
Observations	12,773	12,773	12,773	12,773	12,773	12,766	12,766	12,766	12,766	12,766
Adjusted R-squared	0.982	0.982	0.982	0.982	0.982	0.976	0.976	0.976	0.976	0.976
TTWA FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Impact of FS exposure on different occupations

Dep var: log SOC postings	1. Managers, Directors and Senior Officials	2. Professional Occupations	3. Associate Professional and Technical Occupations	5. Skilled Trades Occupations	7. Sales and Customer Service Occupations
post vote * FS exposure	**-1.105*** **	**-1.030*** **	**-0.878*** **	**-1.004*** **	**-0.630** **
	(0.327)	(0.305)	(0.326)	(0.313)	(0.291)
post vote * tariff exposure	-0.018	0.059	0.006	0.009	-0.034
	(0.031)	(0.047)	(0.038)	(0.023)	(0.024)
post vote * EU national share	-90.90*	-180.1***	-105.4**	47.36	-43.75
	(49.14)	(47.15)	(52.70)	(61.94)	(52.67)
post vote * xrate impact via imports	1.741	13.64***	11.22**	2.340	2.284
	(4.354)	(4.158)	(5.558)	(4.652)	(4.399)
post vote * xrate impact via exports	1.133	0.559	1.309	2.526**	1.176
	(0.880)	(0.833)	(0.957)	(0.969)	(0.918)

	4. Administrative and Secretarial Occupations	6. Caring, Leisure and Other Service Occupations	8. Process, Plant and Machine Operatives	9. Elementary Occupations
post vote * FS exposure	-0.365	-0.0556	**-0.612***	-0.474
	(0.292)	(0.277)	(0.327)	(0.318)
post vote * tariff exposure	0.0089	0.035	-0.036	0.035
	(0.034)	(0.034)	(0.036)	(0.058)
post vote * EU national share	56.40	-68.27	51.62	23.61
	(56.14)	(51.68)	(61.31)	(59.99)
post vote * xrate impact via imports	9.635*	18.98***	4.639	5.929
	(4.875)	(4.274)	(6.313)	(5.315)
post vote * xrate impact via exports	1.309	0.332	2.395**	1.051
	(0.951)	(0.840)	(0.987)	(0.945)
Observations	12,780	12,780	12,780	12,780
TTWA FE	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES

Notes: 98.% of postings are assigned an SOC code.Standard errors two-way clustered at TTWA & month-year level

Impact of financial services exposure on different occupations

- Reduction in postings for 5 out of 9 major occupation groupings
- Worst affected occupations: *Managers, directors and senior officials*; and *Professional Occupations*
- Magnitudes range from -5.7% (Sales and customer services occupations) to -10% (Managers, directors and senior officials) for an 1 sd change in financial services exposure

Robustness

- Excluding London Table
- Share controls Table
- Alternative tariff measures Table
- Intermediate import & import competing tariffs Table
- NTBs on goods Table

Conclusions

- UK areas more exposed to prospective trade barriers on services exports to the EU experienced a substantial reduction in the posting of online job adverts after the referendum, relative to less exposed regions
- This reduction was concentrated in the months after the vote when there was greater search interest in future trade policy with the EU & greater reported uncertainty caused by Brexit
- Robust to controlling for ER depreciation & immigration policy; this impact was not a common trend experienced in the US, was felt not only in London & the impact was greatest for higher skilled & professional occupations
- The impact for Financial Services was particularly acute
- The threat of goods tariffs, on the other hand, does not appear to have had much effect on online job adverts

Appendix: Baseline excluding London

Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * prof service exposure	-0.539***	-0.541***	-0.355***	-0.340**	-0.346**
	(0.135)	(0.135)	(0.125)	(0.130)	(0.132)
post vote * tariff exposure		-0.008	0.001	0.003	0.001
		(0.033)	(0.035)	(0.035)	(0.035)
post vote * xrate impact via imports			-74.38	-81.50	-76.98
			(52.61)	(49.95)	(50.52)
post vote * xrate impact via exports			7.904*	9.181**	8.574*
			(4.191)	(4.114)	(4.296)
post vote * EU national share				0.703	
				(0.953)	
post vote * EU8 national share					0.540
					(1.399)
Observations	12,780	12,780	12,780	12,780	12,780
Adjusted R-squared	0.984	0.984	0.984	0.984	0.984
TTWA FE	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Robustness

Appendix: Including shares

Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * prof service exposure	-4.287**	-4.216**	-3.285*	-3.432*	-3.299*
	(1.972)	(1.974)	(1.764)	(1.755)	(1.750)
post vote * prof services emp sh * exp_emp ratio	0.544*	0.534*	0.419	0.441*	0.422*
	(0.284)	(0.285)	(0.251)	(0.250)	(0.249)
post vote * tariff exposure		-0.032	-0.021	-0.020	-0.021
		(0.060)	(0.060)	(0.060)	(0.061)
post vote * manu emp sh * exp_emp ratio		0.001	0.001	0.001	0.001
		(0.002)	(0.002)	(0.002)	(0.002)
post vote * xrate impact via imports			-50.49	-57.74	-53.42
			(54.59)	(52.82)	(52.97)
post vote * xrate impact via exports			7.284*	8.727**	8.051*
			(4.193)	(4.081)	(4.300)
post vote * EU national share				0.788	
				(0.788)	
post vote * EU8 national share					0.614
					(1.331)
Observations	12,780	12,780	12,780	12,780	12,780
Adjusted R-squared	0.984	0.984	0.984	0.984	0.984
TTWA FE	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Appendix: Alt. tariff specifications and NTBs

Other specifications for robustness:

- Output weighted: replace sectoral employment by sectoral output
- Export weighted: remove employment weighting, leaving trade weighting
- Logged tariffs: replace τ by $ln(1+\tau)$ before weighting
- Regional export weighted: replace 4-digit national exports by regional 2-digit exports
- Non-tariff barriers: replace tariff by average number of non-tariff barriers (WITS)

Appendix: Alt. tariff specifications

	Output weighted		Export weighted		Logged tariffs		Regional export weighted	
Dep variable: log postings	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
post vote * prof service exposure		-0.338***		-0.345***		-0.337***		-0.325**
		(0.124)		(0.128)		(0.124)		(0.124)
post vote * tariff exposure	9.830	12.66	4.416	0.498	10.34	13.47	0.000	0.000*
	(18.09)	(19.21)	(7.898)	(9.710)	(19.11)	(20.18)	(0.000)	(0.000)
post vote * xrate impact via imports		-81.68		-80.78		-81.75		-82.25
		(49.71)		(53.22)		(49.68)		(49.56)
post vote * xrate impact via exports		9.458**		9.067**		9.462**		10.04**
		(4.024)		(4.232)		(4.024)		(3.893)
post vote * EU national share		0.655		0.630		0.655		0.667
		(0.797)		(0.802)		(0.797)		(0.791)
Observations	12,780	12,780	12,780	12,780	12,780	12,780	12,780	12,780
Adjusted R-squared	0.984	0.984	0.984	0.984	0.984	0.984	0.984	0.984
TTWA FE	YES	YES	YES	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Robustness

Appendix: Goods NTBs

Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * prof service exposure	-0.538***	-0.531***	-0.339***	-0.336**	-0.335**
	(0.132)	(0.139)	(0.126)	(0.126)	(0.129)
post vote * tariff exposure		-0.017	-0.013	-0.010	-0.012
		(0.036)	(0.036)	(0.035)	(0.036)
post vote * goods NTBs		0.069	0.117	0.104	0.108
		(0.166)	(0.175)	(0.172)	(0.173)
post vote * xrate impact via imports			-71.45	-77.93	-73.39
			(53.59)	(51.49)	(51.71)
post vote * xrate impact via exports			8.467*	9.477**	8.862**
			(4.269)	(4.178)	(4.324)
post vote * EU national share				0.573	
				(0.770)	
post vote * EU8 national share					0.348
					(1.303)
Observations	12,780	12,780	12,780	12,780	12,780
Adjusted R-squared	0.984	0.984	0.984	0.984	0.984
TTWA FE	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Robustness

Appendix: Import tariff protection

$$imp_protection_r = \sum_{j \in r} employment_share_{rj,2015} \times imp_protection_{j,2014} \tag{9}$$

$$imp_protection_{j,2014} = \frac{Imports_{j,2014}}{L_{j,2014}} \times avg_MFN_tariff_{j,2014} \tag{10}$$

- $employment_share_{rj,2015}$: industry j share of TTWA r employment (BRES)
- $avg_MFN_tariff_{p,2014}$: imports-weighted average EU MFN ad valorem tariff across all products mapped to sector j
- $L_{j,2014}$: national employment (4-digit ISIC, j)
- $Imports_{j,2014}$: UK imports from the EU in 2014

Appendix: Intermediate input tariff threat

$$intinputs_threat_r = \sum_{k \in r} employment_share_{rk,2015} \times intinputs_threat_{k,2014} \tag{11}$$

$$intinputs_threat_{k,2014} = \frac{1}{L_k} \sum_j S_{j,k} \sum_{p \in j} imports_p \times MFN_tariff_{p,2014} \tag{12}$$

- k: output sector
- j: input sector
- $S_{j,k}$: EU imported inputs from j as a share of total EU imported inputs in k

Appendix: Results with import protection and intermediate input tariffs

Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * prof service exposure				-0.337***	-0.333**
				(0.125)	(0.129)
post vote * intermediate import tariff exposure	-0.024		0.082	0.105	0.093
	(0.124)		(0.216)	(0.206)	(0.201)
post vote * import protection tariff exposure		-0.008	-0.054	-0.047	-0.045
		(0.017)	(0.035)	(0.034)	(0.034)
post vote * export tariff exposure			0.072	0.063	0.059
			(0.062)	(0.062)	(0.062)
post vote * xrate impact via imports				-82.73	-78.34
				(49.81)	(50.21)
post vote * xrate impact via exports				9.183**	8.693**
				(4.112)	(4.300)
post vote * EU national share				0.726	
				(0.790)	
post vote * EU8 national share					0.701
					(1.285)
Observations	12,780	12,780	12,780	12,780	12,780
Adjusted R-squared	0.984	0.984	0.984	0.984	0.984
TTWA FE	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Robustness

Appendix: US placebo for FS

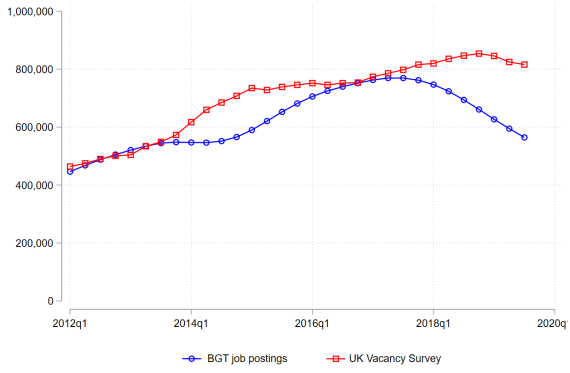
Dep variable: log US postings	(1)	(2)	(3)	(4)	(5)	(6)
	Google		Newspaper		BUI	
measure* FS exposure	-0.010	-0.012	-0.011	-0.010	-0.003	-0.004
	(0.036)	(0.034)	(0.016)	(0.015)	(0.004)	(0.004)
measure *tariff exposure	-0.001	-0.001	-0.000*	-0.000**	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
measure*EU national share	-0.032		0.005		-0.010	
	(0.055)		(0.034)		(0.007)	
measure*EU8 national share		-0.054		-0.003		-0.018
		(0.083)		(0.050)		(0.011)
Observations	8,520	8,520	8,520	8,520	8,520	8,520
Adjusted R-squared	0.994	0.994	0.994	0.994	0.994	0.994
TTWA FE	YES	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES	YES

Notes: Standard errors two-way clustered at TTWA & month-year level

Robustness

Appendix: What proportion of jobs are posted online? Comparison with UK vacancy survey (VS)

- UK vacancy survey: statutory, monthly survey of around 6000 businesses asking them how many job vacancies they have
- ONS uses this to construct total estimates for UK vacancies
- Over the period of 2012-2019 the BGT total number of postings is 86% of the UKVS total



Appendix: How do online job ads relate to the total number of jobs? Comparison with UK Workforce Jobs (WFJ) estimates

- ONS WFJ provides a quarterly measure of the total number of jobs in the UK.
- Over 2012-2019 the median number of workforce jobs was 34 million.
- Average ratio of monthly job postings from BGT to the total number of workforce jobs was 1.8%.

