

Unravelling Deep Integration

Local Labour Market Effects of the Brexit Vote

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Introduction

- ▶ The Brexit referendum introduced prospect of 'unravelling' of decades-long deep integration with the EU
- ▶ It created a threat of substantial and complex barriers to trade in services and (to a lesser extent) in goods
- ▶ Unique opportunity to examine the labour market consequences of deep integration being reversed

This paper

Question: How did the threat of future barriers to UK exports to the EU affect online job postings?

- ▶ Use 'near universe' of UK online job postings from 2015-2019 ([BGT](#))
- ▶ Develop measures of local labour market exposure to prospective barriers
- ▶ Consider trade in services and in goods
- ▶ Consider other key channels: exchange rate depreciation, immigration policy

Preview of results

- ▶ Areas more exposed to future barriers on professional services exports reduced hiring after the referendum relative to less exposed areas
- ▶ Decline in hiring concentrated in high skill & professional jobs
- ▶ Reduction in hiring after the vote concentrated in months with greater uncertainty about future trade policy

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)
- ▶ Impacts of 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)

Brexit timeline

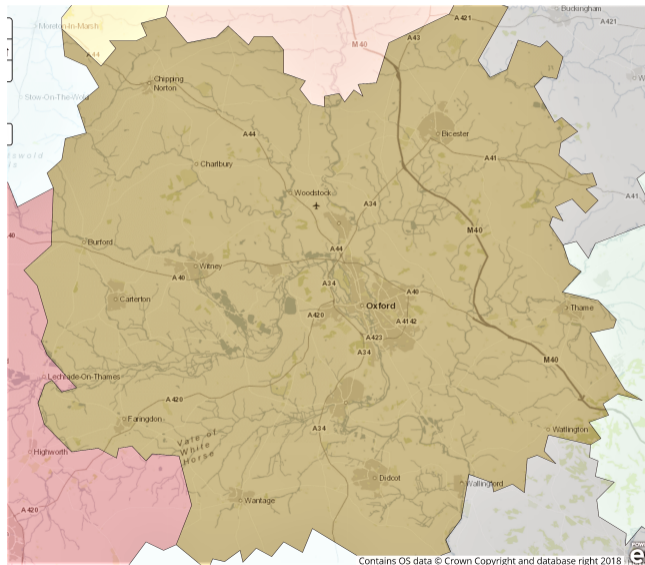
- ▶ 23rd Jan 2013: David Cameron declares he is in favour of an EU referendum
- ▶ **23rd Jun 2016: Referendum**
- ▶ **29th Mar 2017: Invocation of Article 50**
- ▶ **12th Jul 2018: UK Government publishes its White Paper**
- ▶ 14th Nov 2018: The Withdrawal Agreement is agreed and published
- ▶ 31st Jan 2020: UK leaves the EU, entering transition period until the end of 2020
- ▶ 24th Dec 2020: Brexit trade deal agreed
- ▶ 1st Jan 2021: Transition period ended

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



Job Postings Data

Burning Glass Technologies (BGT):

- ▶ Scrape 'near-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

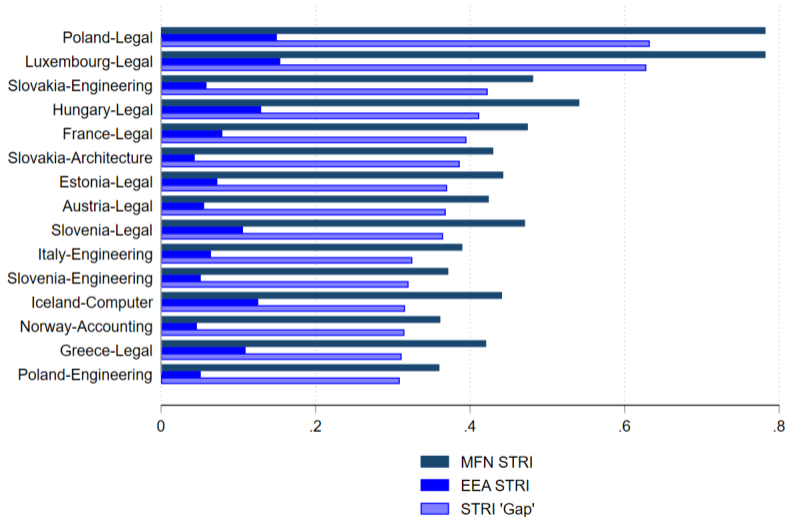
Other Data Sources

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

OECD Services Trade Restrictiveness Index (STRI) for 2014

- ▶ Available at country-industry level
- ▶ Quantifies restrictions on services provision by (i) EEA countries, (ii) non-EEA WTO members
- ▶ Covers restrictions on foreign entry and movement of people, barriers to competition, regulatory transparency and other discriminatory measures
 - ▶ Examples: limits on foreign equity shares in local businesses, restrictions on cross-border mergers, product level regulations
- ▶ Calculate **the 'gap' between STRI within-EEA and STRI for third countries**
- ▶ Focus on professional services:
 - ▶ finance, insurance, legal, accounting, ICT, telecoms, engineering and architecture

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



Notes: Raw OECD STRI scores from 2014

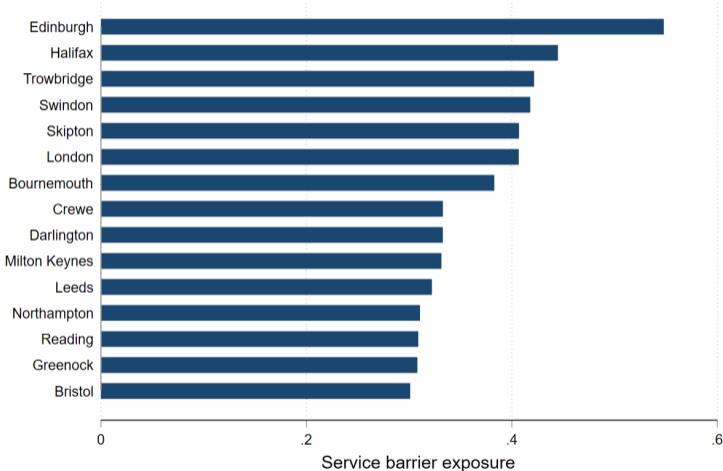
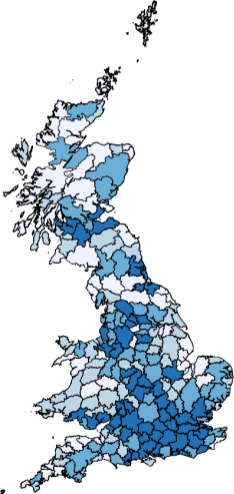
Professional services trade barrier exposure

$$\text{prof_services_exposure}_{j^{serv}} = \frac{\text{Exports}_{j^{serv},2015}}{L_{j^{serv},2015}} \times \text{avg_STRI_gap}_{j^{serv},2014} \quad (1)$$

$$\text{prof_services_exposure}_r = \sum_{j^{serv} \in r} \text{empl_share}_{j^{serv},r,2015} \times \text{prof_services_exposure}_{j^{serv}} \quad (2)$$

- ▶ $\text{avg_STRI_gap}_{j^{serv},2014}$: difference between the 2014 MFN STRI and intra-EEA STRI for industry j^{serv} in EEA country c , weighted by UK exports to EEA country c in sector j^{serv} in 2015
- ▶ $\text{Exports}_{j^{serv},2015}$: UK exports from industry j^{serv} to the EEA in 2015
- ▶ $L_{j^{serv},2015}$: national employment in sector j^{serv} in 2015
- ▶ $\text{empl_share}_{rj^{serv},2015}$: industry j^{serv} share of TTWA r employment (**BRES**)

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

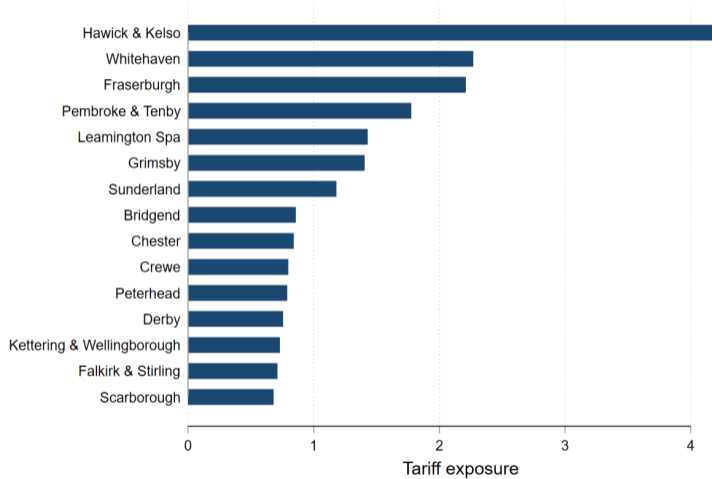
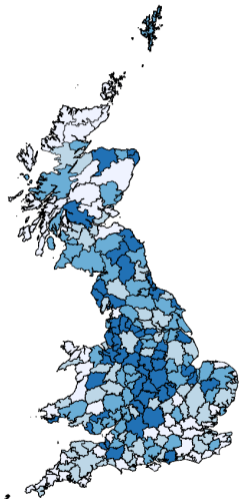
Export tariff exposure

$$\text{tariff_exposure}_{j^{manu},2014} = \frac{\text{Exports}_{j^{manu},2014}}{L_{j^{manu},2015}} \times \text{avg_MFN_tariff}_{j^{manu},2014} \quad (3)$$

$$\text{tariff_exposure}_r = \sum_{j^{manu} \in r} \text{empl_share}_{rj^{manu},2015} \times \text{tariff_exposure}_{j^{manu},2014} \quad (4)$$

- ▶ $\text{avg_MFN_tariff}_{j^{manu},2014}$: export-weighted average EU MFN ad valorem tariff across all HS6 products mapped to sector j^{manu}
- ▶ $\text{empl_share}_{rj^{manu},2015}$: industry j^{manu} share of TTWA r employment
- ▶ $L_{j^{manu},2015}$: national employment (4-digit SIC sector j^{manu})
- ▶ $\text{Exports}_{j^{manu},2014}$: UK exports to the EU in 2014

Export tariff exposure by UK TTWA



Baseline specification

$$\log(\text{job_postings}_{rt}) = \beta_0 + \beta_1 \text{trade_barrier_exposure}_{rt} \times \text{post_vote}_t + \mathbf{X}_r + \gamma_t + \gamma_r + \epsilon_{rt} \quad (5)$$

- ▶ 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}_r : 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
- ▶ Construct an exchange rate control based on the real effective exchange rate (REER):

$$E_{rt}^X \equiv \sum_j \text{empl_sh}_{jr,2015} \times \frac{\text{Exports}_{j,2014}}{L_{j,2015}} \times REER_t \quad (6)$$

Other channels: EU immigration

- ▶ Employment share of EU and Eastern EU nationals before the vote \times *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

$$EU_national_share_r = \sum_{k \in r} empl_sh_{kr,2015} \times \frac{EUworkers_{k,reg}}{Totalworkers_{k,reg}} \quad (7)$$

Baseline results

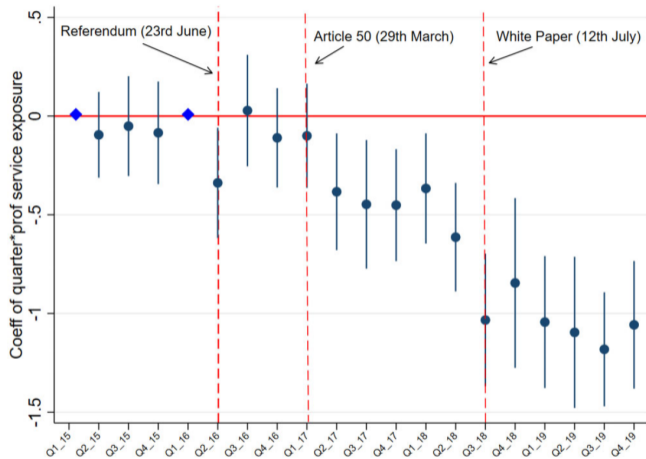
Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * service barrier exposure	-0.538*** (0.132)	-0.540*** (0.132)	-0.559*** (0.134)	-0.553*** (0.127)	-0.557*** (0.133)
post vote * tariff exposure		-0.008 (0.033)	-0.029 (0.055)	-0.029 (0.055)	-0.029 (0.054)
export REER			-0.135 (0.146)	-0.136 (0.146)	-0.141 (0.146)
post vote * EU national share				-0.267 (0.861)	
post vote * EU8 national share					-0.885 (1.377)
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

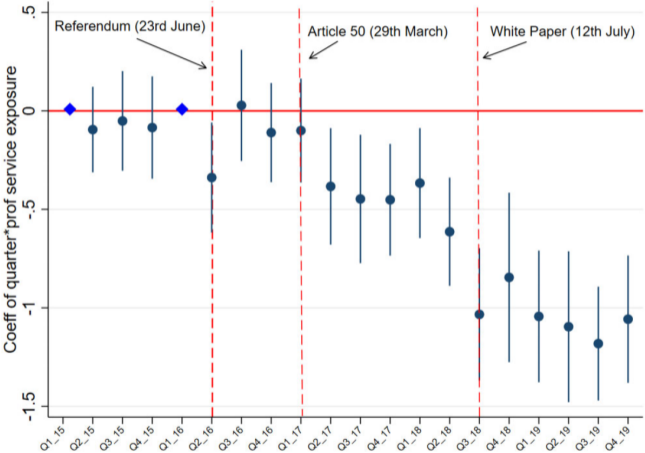
- ▶ Prof services exposure:
 - ▶ 1 sd increase in exposure (0.09) reduces postings by 3.82% (based on col 4)
 - ▶ Average number of monthly postings per TTWA is 2,442 → a decline of 93 postings per month

Timing of the effects: 29th Mar 2017 Invocation of Article 50



Note: Quarters 1 of 2015 & 2016 excluded. 90% confidence intervals displayed.

12th July 2018 UK Gov't publishes its White Paper ruling out mutual recognition as preferred option for financial services sector



Note: Quarters 1 of 2015 & 2016 excluded. 90% confidence intervals displayed.

fastFT Brexit

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‘A real blow’: City group lashes out at Brexit white paper

TheCityUK also describes white paper as ‘frustrating’

Katie Martin JULY 12 2018

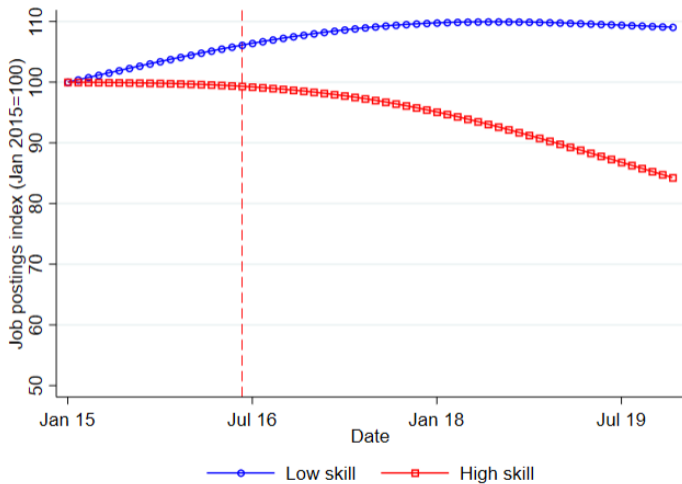


The UK government’s [preferred path forward](#) with the EU is “a real blow for the UK’s financial and related professional services sector”, the City of London Corporation said on Thursday.

White paper

- ▶ July 2018 publication of a white paper fleshing out Theresa May's proposal for Britain's future relationship with the EU
- ▶ The White paper "confirms that Britain would seek a "free trade area" for goods (...). But it also sets out plans for a **looser relationship on services**, which represent 80 per cent of the British economy, **including financial services**; the white paper says Britain would seek the 'freedom to chart its own path'."
- ▶ Quote from [FT article from 12th July 2018](#)

Skill breakdown & impact across occupations



Impact on high vs low skill 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 * service barrier exposure	-0.637*** (0.132)	-0.635*** (0.132)	-0.649*** (0.133)	-0.642*** (0.127)	-0.647*** (0.132)	-0.280** (0.127)	-0.283** (0.127)	-0.297** (0.128)	-0.298** (0.122)	-0.296** (0.127)
post vote * tariff exposure		0.009 (0.032)	-0.006 (0.050)	-0.006 (0.050)	-0.006 (0.050)		-0.017 (0.037)	-0.032 (0.056)	-0.031 (0.056)	-0.032 (0.056)
export REER			-0.097 (0.134)	-0.098 (0.134)	-0.105 (0.133)			-0.094 (0.140)	-0.094 (0.140)	-0.095 (0.140)
post vote * EU national share				-0.280 (0.861)					0.079 (0.844)	
post vote * EU8 national share					-1.119 (1.382)					-0.180 (1.375)
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
Clustering	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM

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 (-0.557 \rightarrow -0.647).

A 1 sd increase in prof services decreases high skill postings by 5.76%.

In 2015, the average number of monthly high skilled postings was 1,613 \rightarrow a reduction of 90 job ads per month.

Impact on postings for different occupations

Dep var: log SOC postings	1. Managers, Directors and Senior Officials	2. Professional Occupations	3. Associate Professional and Technical Occupations
post vote * prof services exposure	-0.551*** (0.130)	-0.798*** (0.146)	-0.532*** (0.149)
post vote * tariff exposure	-0.048 (0.046)	0.052 (0.053)	-0.032 (0.051)
	4. Administrative and Secretarial Occupations	5. Skilled Trades Occupations	6. Caring, Leisure and Other Service Occupations
post vote * prof services exposure	-0.017 (0.134)	-0.220 (0.153)	-0.173 (0.121)
post vote * tariff exposure	-0.049 (0.030)	-0.042 (0.035)	0.020 (0.038)
	7. Sales and Customer Service Occupations	8. Process, Plant and Machine Operatives	9. Elementary Occupations
post vote * prof services exposure	-0.243 (0.151)	-0.175 (0.157)	-0.173 (0.172)
post vote * tariff exposure	-0.050 (0.032)	-0.082** (0.040)	0.037 (0.075)
Observations	12,780	12,780	12,780
TTWA FE	YES	YES	YES
Month-Year FE	YES	YES	YES

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

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Impact on different occupations

- ▶ Reduction in postings for 3 out of 9 major occupation groupings
- ▶ Worst affected occupations: Managers, directors and senior officials; and Professional Occupations, and Associate Professional and Technical Occupations
- ▶ Magnitudes range from -3.7% (Associate Professional and Technical Occupations) to -5.0% (Professional occupations) for a 1 sd change in professional services exposure
- ▶ One sd change in tariff exposure implies -3.5% change in postings for Plant and Machine Operators

Extensions and Robustness

- ▶ Zoom in on financial services using more detailed data on regional exports
- ▶ Zoom in on periods of increased threat of barriers & greater uncertainty
- ▶ 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 future EU barriers on services exports experienced a substantial decline in online job adverts after the Brexit referendum relative to less exposed regions
- ▶ The impact was particularly acute for Financial services, skilled jobs, and professional occupations
- ▶ Threat of goods tariffs does not appear to have had much effect on online job adverts
- ▶ Robust to controlling for exchange rate depreciation and migrant presence

EXTENSION 1: ZOOMING IN ON FINANCIAL SERVICES

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

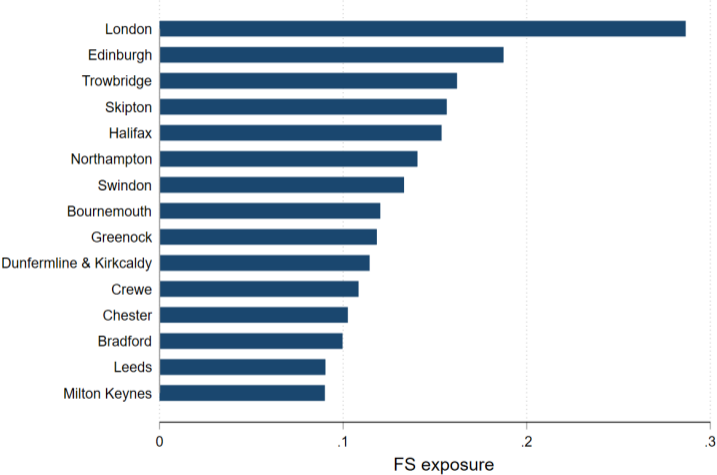
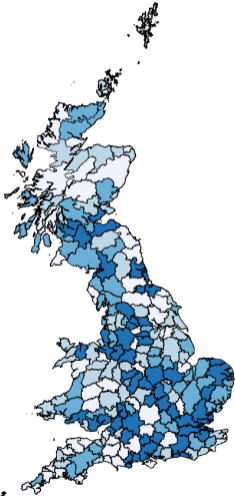
Regional Financial Services EU export exposure

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

$$\text{FS exposure}_{r,NUTS1} = \text{FS employment share}_{r,2015} \times \text{Regional FS exposure}_{NUTS1} \quad (9)$$

- ▶ FS employment share $_{r,2015}$: FS share of TTWA r employment in 2015 (BRES)
- ▶ Regional FS Exports to EEA $_{NUTS1,2015}$: FS exports of UK NUTS1 region to the EEA
- ▶ $L_{FS,NUTS1,2015}$: FS employment in UK NUTS1 region
- ▶ avg STRI gap: as above

UK Financial Service export exposure



Financial services results

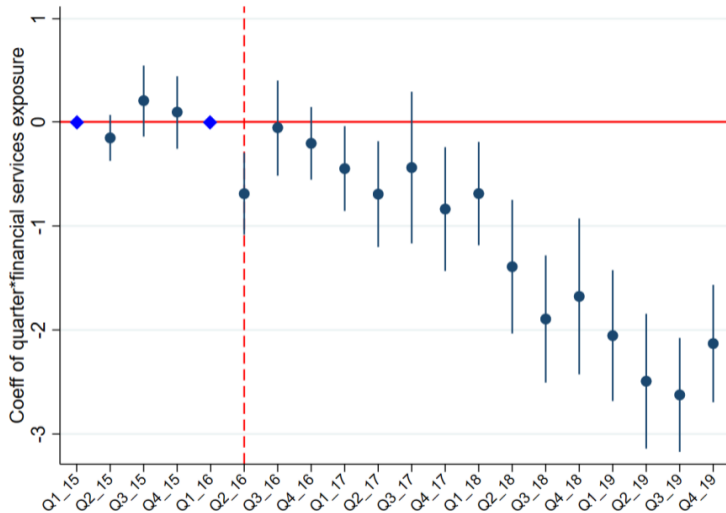
Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * financial services exposure	-1.201*** (0.296)	-1.201*** (0.295)	-1.225*** (0.302)	-1.211*** (0.293)	-1.208*** (0.300)
post vote * tariff exposure		-0.003 (0.033)	-0.018 (0.052)	-0.018 (0.052)	-0.017 (0.052)
export REER			-0.098 (0.142)	-0.099 (0.142)	-0.102 (0.142)
post vote * EU national share				-0.139 (0.926)	
post vote * EU8 national share					-0.589 (1.403)
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 (0.0345) → decrease in postings of 2.4%

Financial services impact by quarter



Note: Quarters 1 of 2015 & 2016 excluded. 90% confidence intervals displayed.

The impact for FS was also greater for higher skilled postings

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***	-1.427***	-1.414***	-1.405***	-0.662**	-0.662**	-0.681**	-0.697**	-0.680**
	(0.322)	(0.323)	(0.327)	(0.319)	(0.329)	(0.275)	(0.274)	(0.278)	(0.264)	(0.270)
post vote * tariff exposure		0.015	0.007	0.007	0.008		-0.014	-0.026	-0.025	-0.026
		(0.032)	(0.048)	(0.048)	(0.048)		(0.037)	(0.054)	(0.054)	(0.054)
export REER			-0.054	-0.054	-0.059			-0.075	-0.075	-0.076
			(0.130)	(0.130)	(0.130)			(0.139)	(0.139)	(0.139)
post vote * EU national share				-0.128					0.165	
				(0.938)					(0.885)	
post vote * EU8 national share					-0.773					-0.010
					(1.424)					(1.383)
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
Clustering	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM

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

EXTENSION 2: ZOOMING IN ON THE POST-REFERENDUM PERIOD

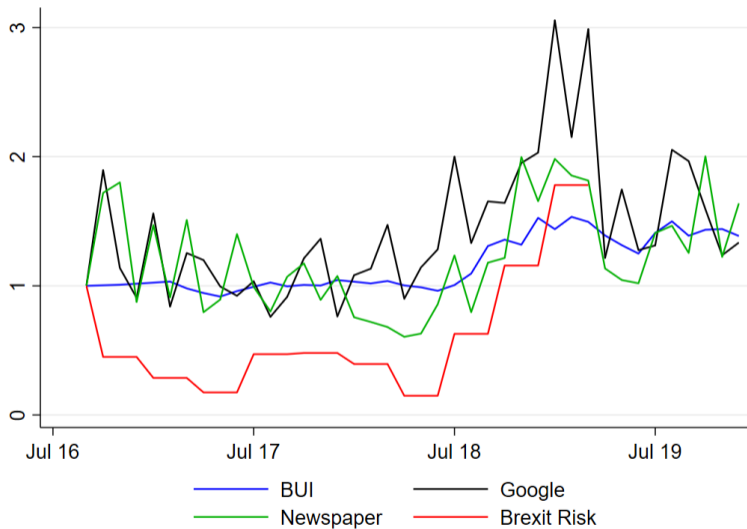
Time-varying perceptions about future trade policy

- ▶ 3 1/2 years passed between the referendum and the UK leaving the EU
- ▶ How did different decisions and political signals affect labour demand within this period?
- ▶ Use two existing measures of Brexit-related uncertainty over time:
 1. **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
 2. **Brexit 'Risk' Index** from Hassan et al. (2019): measures prevalence of uncertainty & risk synonyms in discussion of Brexit in quarterly earnings call transcripts
- ▶ Also construct two new measures of trade policy-specific Brexit uncertainty using newspaper articles and Google search data

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)	(7)	(8)
	BUI		Brexit Risk		Google		Newspaper	
measure*service barrier exposure	-0.034*** (0.007)	-0.039*** (0.007)	-0.141*** (0.050)	-0.172*** (0.051)	-0.232*** (0.058)	-0.269*** (0.060)	-0.066* (0.039)	-0.082* (0.042)
measure *tariff exposure	-0.001 (0.002)	0.000 (0.002)	0.005 (0.010)	0.011 (0.010)	-0.007 (0.011)	-0.001 (0.011)	0.009 (0.006)	0.012* (0.006)
measure*EU national share	-0.264*** (0.042)		-1.585*** (0.281)		-1.907*** (0.349)		-0.826*** (0.239)	
measure*EU8 national share		-0.414*** (0.062)		-2.394*** (0.414)		-2.901*** (0.523)		-1.246*** (0.399)
export REER	0.390 (0.369)	0.410 (0.376)	0.124 (0.404)	0.148 (0.411)	0.342 (0.394)	0.346 (0.398)	0.367 (0.413)	0.356 (0.415)
Observations	8,520	8,520	6,603	6,603	8,520	8,520	8,520	8,520
Adjusted R-squared	0.987	0.987	0.988	0.988	0.987	0.987	0.987	0.987
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

Post-vote period time-varying results

Taking col (1):

- ▶ For mean prof service exposure (0.127) moving from the 25th percentile of uncertainty (1.13) to the 75th percentile (2.25) decreases postings by 3.3%
- ▶ Now also find negative results for EU national share and EU8 national share

ROBUSTNESS CHECKS

Robustness

- ▶ Excluding London [Table](#)
- ▶ Share controls [Table](#)
- ▶ Alternative tariff measures [Table](#)
- ▶ Intermediate import & import competing tariffs [Table](#)
- ▶ NTBs on goods [Table](#)

Appendix: Baseline excluding London

Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * service barrier exposure	-0.539*** (0.135)	-0.541*** (0.135)	-0.560*** (0.137)	-0.558*** (0.134)	-0.563*** (0.139)
post vote * tariff exposure		-0.008 (0.033)	-0.029 (0.055)	-0.029 (0.055)	-0.029 (0.054)
export REER			-0.136 (0.146)	-0.137 (0.146)	-0.143 (0.146)
post vote * EU national share				-0.327 (1.002)	
post vote * EU8 national share					-0.929 (1.426)
Observations	12,720	12,720	12,720	12,720	12,720
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
Clustering	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM

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 * service barrier exposure	-4.287** (1.972)	-4.216** (1.974)	-4.246** (1.988)	-4.247** (1.959)	-4.162** (1.933)
post vote * services emp sh * EU export sh	0.544* (0.284)	0.534* (0.285)	0.535* (0.286)	0.536* (0.283)	0.523* (0.279)
post vote * tariff exposure		-0.032 (0.060)	-0.031 (0.062)	-0.031 (0.062)	-0.030 (0.062)
post vote * manu emp sh * EU export sh		0.001 (0.002)	0.000 (0.004)	0.000 (0.004)	0.000 (0.004)
export REER			-0.108 (0.233)	-0.108 (0.234)	-0.117 (0.235)
post vote * EU national share				0.004 (0.857)	
post vote * EU8 national share					-0.622 (1.352)
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
Clustering	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM

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

Robustness

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

Dep variable: log postings	Output weighted		Export weighted		Logged tariffs		Regional export weighted	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
post vote * service barrier exposure		-0.539*** (0.127)		-0.554*** (0.135)		-0.539*** (0.127)		-0.525*** (0.125)
post vote * tariff exposure	9.830 (18.093)	1.122 (21.268)	4.416 (7.898)	-2.999 (8.413)	10.343 (19.105)	1.237 (22.412)	0.000 (0.000)	0.000 (0.000)
export REER		-0.069 (0.084)		-0.082 (0.081)		-0.068 (0.084)		-0.032 (0.075)
post vote * EU national share		-0.248 (0.866)		-0.220 (0.871)		-0.248 (0.866)		-0.277 (0.865)
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
Clustering	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM

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 * service barrier exposure	-0.538*** (0.132)	-0.531*** (0.139)	-0.550*** (0.141)	-0.541*** (0.134)	-0.544*** (0.138)
post vote * tariff exposure		-0.017 (0.035)	-0.038 (0.055)	-0.040 (0.054)	-0.042 (0.054)
post vote * goods NTMs		0.069 (0.166)	0.069 (0.165)	0.080 (0.162)	0.104 (0.166)
export REER			-0.135 (0.144)	-0.136 (0.144)	-0.143 (0.143)
post vote * EU national share				-0.333 (0.840)	
post vote * EU8 national share					-1.109 (1.360)
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
Clustering	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM	TTWA-YM

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

Robustness

Appendix: Import tariff protection

$$\text{imp protection}_r = \sum_{j^{manu} \in r} \text{empl share}_{j^{manu} r, 2015} \times \text{imp protection}_{j^{manu}, 2014} \quad (10)$$

$$\text{imp protection}_{j^{manu}, 2014} = \frac{\text{Imports}_{j^{manu}, 2014}}{L_{j^{manu}, 2015}} \times \text{avg MFN tariff}_{j^{manu}, 2014}^{(Imp)} \quad (11)$$

- ▶ $\text{empl share}_{j^{manu} r, 2015}$: industry j^{manu} share of TTWA r employment (BRES)
- ▶ $\text{avg MFN tariff}_{j^{manu}, 2014}^{(Imp)}$: imports-weighted average EU MFN ad valorem tariff across all products mapped to sector j^{manu}
- ▶ $L_{j^{manu}, 2014}$: national employment (4-digit ISIC, j^{manu})
- ▶ $\text{Imports}_{j^{manu}, 2014}$: UK imports from the EU in 2014

Appendix: Intermediate input tariff threat

$$\text{intinputs threat}_r = \sum_{k \in r} \text{empl share}_{rk,2015} \times \text{intinputs threat}_{k,2014} \quad (12)$$

$$\text{intinputs threat}_{k,2014} = \frac{1}{L_k} \sum_{j^{manu}} S_{k,j^{manu}} \sum_{p \in j^{manu}} \text{Imports}_p \times \text{MFN tariff}_{p,2014} \quad (13)$$

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

Appendix: Results with import protection and intermediate input tariffs

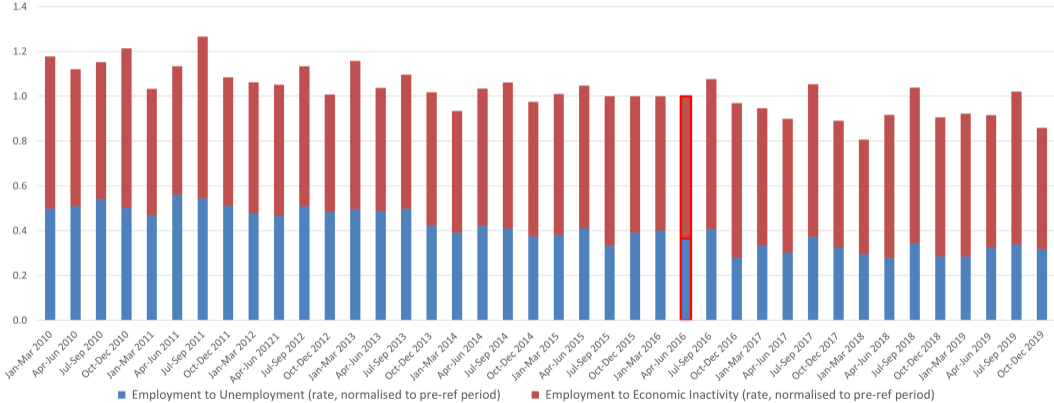
Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * import protection tariff exposure	-0.008 (0.017)		-0.027 (0.041)		
post vote * intermediate import tariff exposure		-0.024 (0.124)	-0.010 (0.256)		
post vote * service import barrier exposure				-2.252*** (0.562)	-1.389** (0.579)
post vote * service barrier exposure			-0.553*** (0.139)		-0.271* (0.157)
post vote * export tariff exposure			0.017 (0.085)		-0.033 (0.056)
export REER			-0.142 (0.180)		-0.141 (0.146)
post vote * EU8 national share			-0.733 (1.325)		-0.703 (1.361)
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: Job flows

Movement out of employment as a percentage of employment, normalised relative to pre-referendum period (C)



Appendix: Job flows

Job-to-job moves by reason for move as a percentage of employment, normalised to pre-referendum period (C)



Appendix: Job flows

Gross and net employment inflows and outflows as a percentage of employment (A)

