Unravelling Deep Integration

Local Labour Market Effects of the Brexit Vote

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Research 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 uncertainty

Brexit timeline

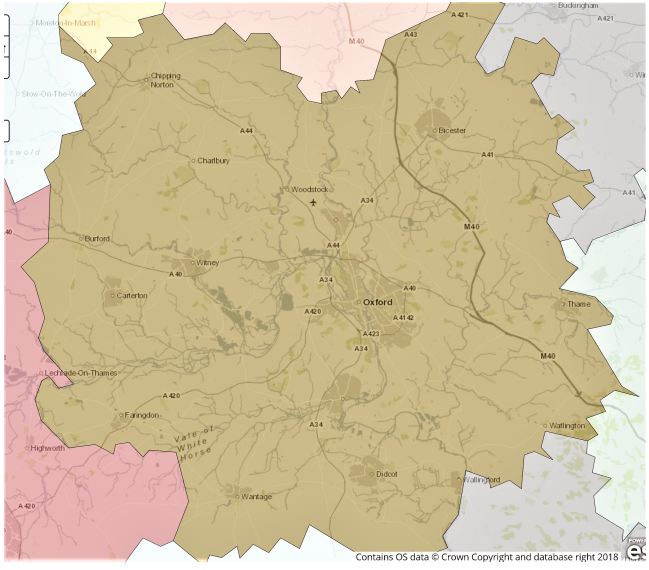
- 23rd Jan 2013: David Cameron declares he is in favour of an EU referendum
- **23rd Jun 2016: Brexit referendum**
- **29th Mar 2017: Invocation of Article 50**
- **12th July 2018: UK Government publishes its White Paper**
- 14th Nov 2018: The Withdrawal Agreement is agreed and published
- 31st Jan 2020: UK leaves the EU and enters transition period
- 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

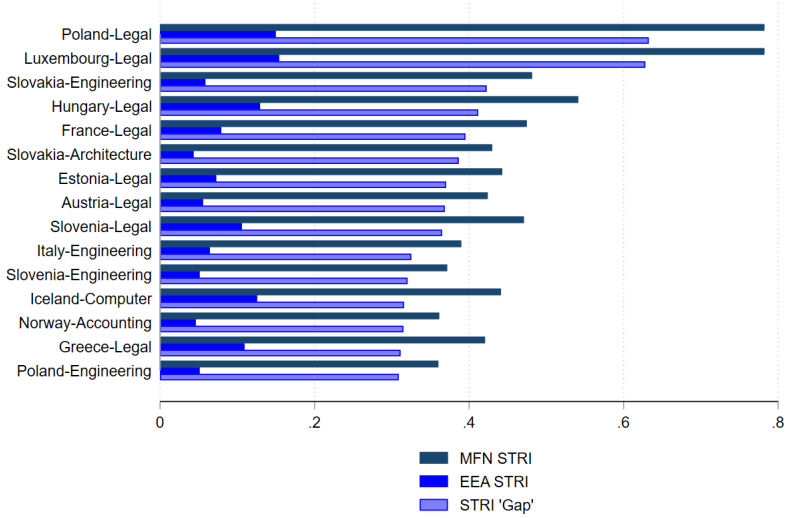
Burning Glass Technologies (BGT):

- Scrape '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

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

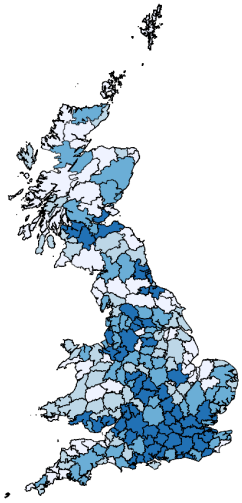
Professional services trade barrier exposure

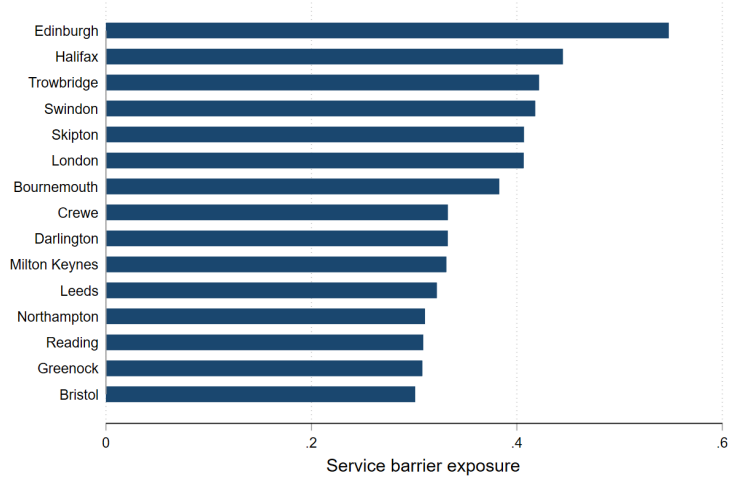
$$prof\_services\_exposure_{j^{serv}} = \frac{Exports_{j^{serv},2015}}{L_{j^{serv},2015}} \times avg\_STRI\_gap_{j^{serv},2014} \quad (1)$$

$$prof\_services\_exposure_{r} = \sum_{j^{serv}} empl\_share_{rj^{serv},2015} \times prof\_services\_exposure_{j^{serv}} \quad (2)$$

- 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
- $Exports_{j^{serv},2015}$: UK exports from industry j^{serv} to the EEA in 2015
- $L_{j^{serv},2015}$: national employment in sector j^{serv} in 2015
- $empl\_share_{rj^{serv},2015}$: industry j^{serv} share of TTWA r employment (BRES)

Professional services exposure by UK region

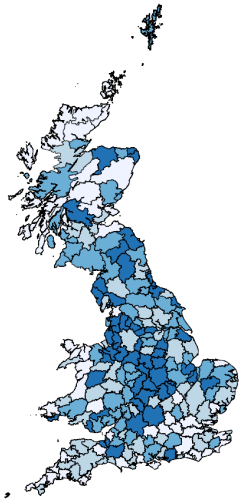


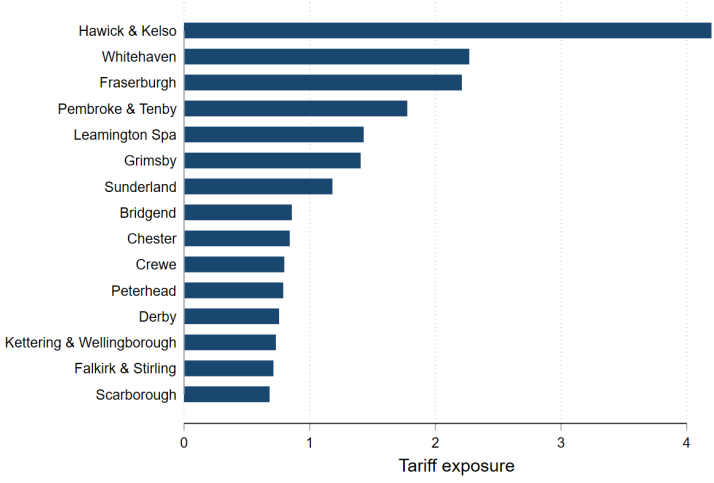


Trade in goods: tariff 'threat'

- Threat of no deal and hence UK trade with EU reverting to the WTO terms
- At HS6 level: 37% are >5%, 11% are >10%, and 2% are >15%
- Focus on export tariff 'threat', but also consider intermediate import tariff 'threat' and possible import protection in robustness checks
- Local labour markets differentially affected depending on pre-referendum composition of employment

Export tariff exposure by UK TTWA





Baseline specification

$$log(job\_postings_{rt}) = \beta_0 + \beta_1 trade\_barrier\_exposure_r \times post\_vote_t + \mathbf{X}_{rt} + \gamma_t + \gamma_r + \epsilon_{rt} \quad (3)$$

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

$$E_{rt}^{X} \equiv \sum_{j} \text{empl\_sh}_{jr,2015} \times \frac{\text{Exports}_{j,2014}}{L_{j,2015}} \times REER_{t} \tag{4}$$

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

$$EU\_national\_share_r = \sum_k empl\_share_{kr} \times \frac{EUworkers_{k,reg}}{Totalworkers_{k,reg}} \tag{5}$$

Baseline results

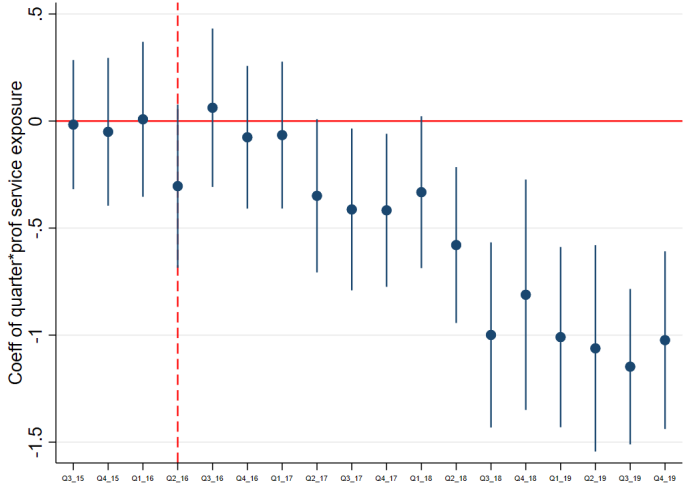
Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * service barrier exposure	**-0.538*** **	**-0.540*** **	**-0.559*** **	**-0.553*** **	**-0.557*** **
	(0.132)	(0.132)	(0.134)	(0.127)	(0.133)
post vote * tariff exposure		-0.008	-0.029	-0.029	-0.029
		(0.033)	(0.055)	(0.055)	(0.054)
export REER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

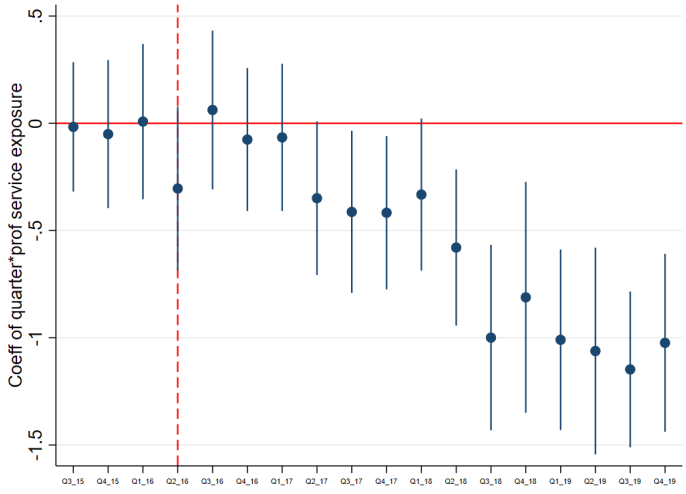
- Service barrier exposure:
  - 1 sd increase in exposure (0.09) reduces postings by 4.95% (based on col 4)
  - Average number of monthly postings is 2,409 $\rightarrow$ a decline of 120 postings per month per TTWA
  - Aggregate effect: if all TTWAs had the 10th percentile exposure score, there would have been cumulatively approx. 1.5 million more postings over post vote period

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



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

fastFT Brexit + Add to myFT

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

TheCityUK also describes white paper as ‘frustrating’

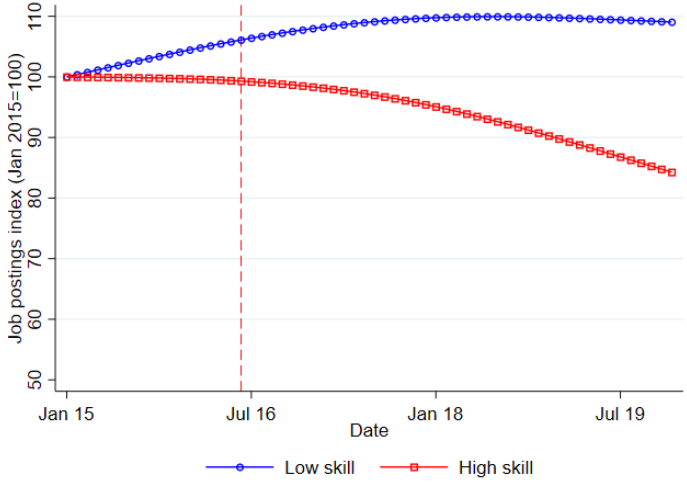
Katie Martin JULY 12 2018

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*** **	**-0.635*** **	**-0.649*** **	**-0.642*** **	**-0.647*** **	**-0.280** **	**-0.283** **	**-0.297** **	**-0.298** **	**-0.296** **
	(0.132)	(0.132)	(0.133)	(0.127)	(0.132)	-0.127	-0.127	-0.128	-0.122	-0.127
post vote * tariff exposure		0.00904	-0.00585	-0.00638	-0.00558		-0.0172	-0.0316	-0.0315	-0.0316
		(0.0322)	(0.0504)	(0.0503)	(0.0497)		-0.0373	-0.0557	-0.0555	-0.0557
export REER			-0.0972	-0.0981	-0.105			-0.0942	-0.0939	-0.0955
			(0.134)	(0.134)	(0.133)			-0.14	-0.14	-0.14
post vote * EU national share				-0.280					0.0788	
				(0.861)					-0.844	
post vote * EU8 national share					-1.119					-0.18
					(1.382)					-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 service barrier exposure increases in magnitude relative to 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 per TTWA.

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**	4. Administrative and Secretarial Occupations	5. Skilled Trades Occupations
post vote * prof services exposure	**-0.546***** (0.133)	**-0.792***** (0.147)	**-0.542***** (0.149)	-0.022 (0.133)	-0.239 (0.153)
post vote * tariff exposure	-0.042 (0.048)	0.058 (0.053)	-0.043 (0.057)	-0.055* (0.033)	-0.063 (0.043)
export REER	0.019 (0.029)	-0.018 (0.022)	0.030 (0.025)	0.044** (0.018)	0.060* (0.030)
post vote * EU national share	0.531 (0.850)	-1.077 (0.889)	0.002 (0.976)	0.625 (0.921)	2.231** (0.958)
	6. Caring, Leisure and Other Service Occupations	7. Sales and Customer Service Occupations	8. Process, Plant and Machine Operatives	9. Elementary Occupations	
post vote * prof services exposure	-0.170 (0.121)	-0.241 (0.151)	-0.182 (0.157)	-0.172 (0.174)	
post vote * tariff exposure	0.023 (0.040)	-0.048 (0.034)	-0.090** (0.041)	0.038 (0.078)	
export REER	-0.014 (0.017)	0.009 (0.023)	0.041 (0.025)	-0.014 (0.031)	
post vote * EU national share	-1.281 (0.938)	0.724 (0.932)	2.081** (0.906)	0.635 (0.984)	
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 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	4. Administrative and Secretarial Occupations	5. Skilled Trades Occupations
post vote * prof services exposure	**-0.546*** **	**-0.792*** **	**-0.542*** **	-0.022	-0.239
	(0.133)	(0.147)	(0.149)	(0.133)	(0.153)
post vote * tariff exposure	-0.042	0.058	-0.043	-0.055*	-0.063
	(0.048)	(0.053)	(0.057)	(0.033)	(0.043)
export REER	0.019	-0.018	0.030	0.044**	0.060*
	(0.029)	(0.022)	(0.025)	(0.018)	(0.030)
post vote * EU national share	0.531	-1.077	0.002	0.625	2.231**
	(0.850)	(0.889)	(0.976)	(0.921)	(0.958)

	6. Caring, Leisure and Other Service Occupations	7. Sales and Customer Service Occupations	**8. Process, Plant and Machine Operatives**	9. Elementary Occupations
post vote * prof services exposure	-0.170	-0.241	-0.182	-0.172
	(0.121)	(0.151)	(0.157)	(0.174)
post vote * tariff exposure	0.023	-0.048	**-0.090** **	0.038
	(0.040)	(0.034)	(0.041)	(0.078)
export REER	-0.014	0.009	0.041	-0.014
	(0.017)	(0.023)	(0.025)	(0.031)
post vote * EU national share	-1.281	0.724	2.081**	0.635
	(0.938)	(0.932)	(0.906)	(0.984)
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 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
- Magnitudes range from -4.9% (Associate Professional and Technical Occupations) to -7.1% (Professional occupations) for a one sd change in service barrier exposure

- One sd change in tariff exposure implies -3.64% change in postings for Plant, 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 reduction 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
- The 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 were 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

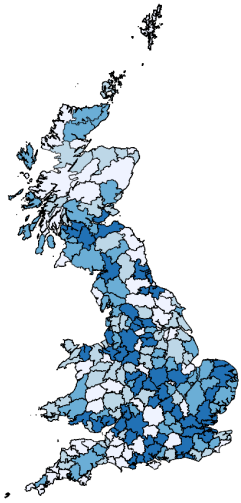
Regional Financial Services EU export exposure

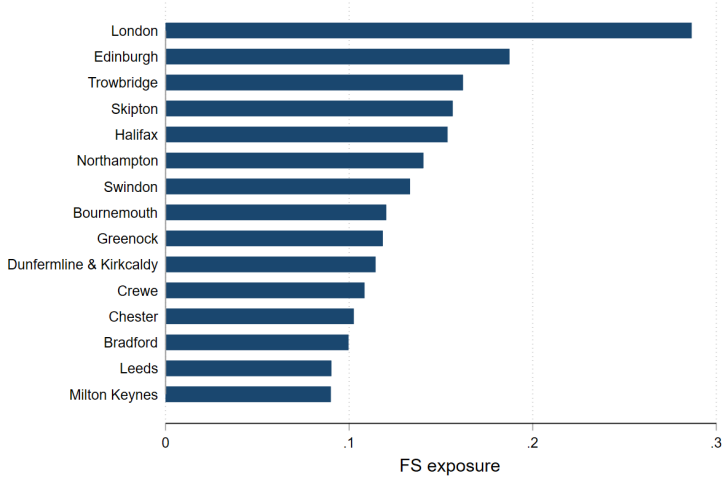
$$\text{Regional FS exposure}_{NUTS1} = \frac{\text{Regional FS Exports to EEA}_{NUTS1,2015}}{\text{L}_{FS,NUTS1,2015}} \times \text{avg STRI gap}_{FS,2014} \quad (6)$$

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

- 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

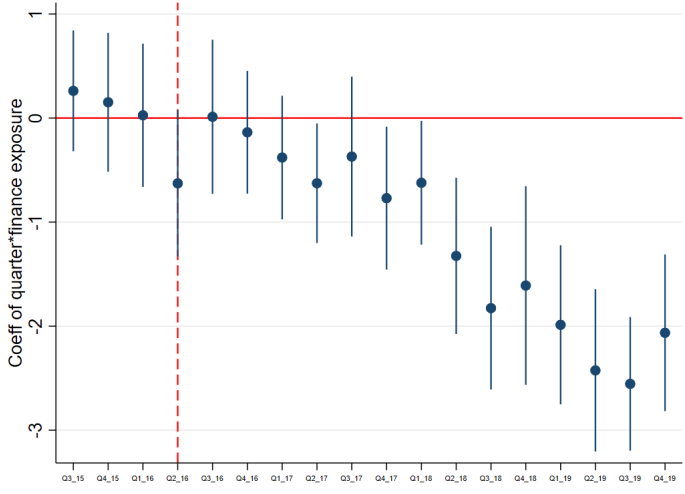
Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * financial services exposure	**-1.201*** **	**-1.201*** **	**-1.225*** **	**-1.211*** **	**-1.208*** **
	(0.296)	(0.295)	(0.302)	(0.293)	(0.300)
post vote * tariff exposure		-0.003	-0.018	-0.018	-0.017
		(0.033)	(0.053)	(0.052)	(0.052)
export REER			-0.098	-0.099	-0.102
			(0.142)	(0.142)	(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) $\rightarrow$ decrease in postings of 4.2%

Financial services impact by quarter



Note: Quarters 1 & 2 of 2015 excluded. 95% 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	-0.026	-0.026
		(0.032)	(0.048)	(0.048)	(0.048)		(0.037)	(0.054)	(0.054)	(0.055)
export REER			-0.054	-0.054	-0.059			-0.076	-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

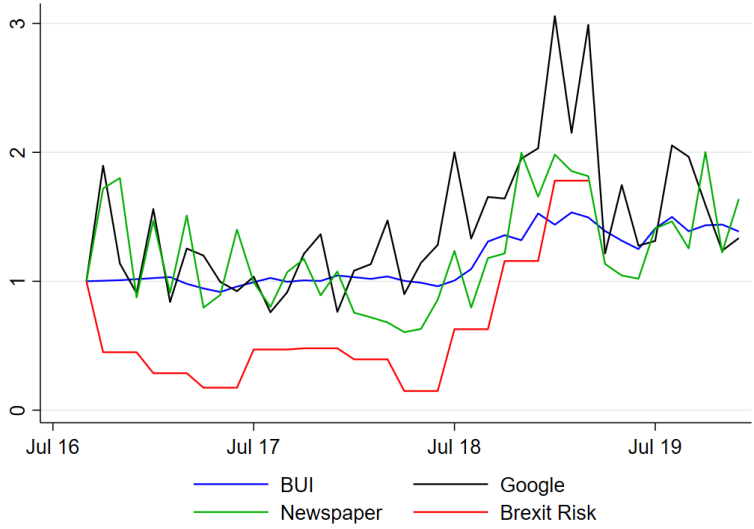
Time-varying perceptions about future trade policy

- 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*** **	**-0.040*** **	**-0.141*** **	**-0.172*** **	**-0.232*** **	**-0.269*** **	**-0.066***	**-0.082***
	(0.007)	(0.007)	(0.050)	(0.051)	(0.058)	(0.060)	(0.039)	(0.042)
measure *tariff exposure	-0.001	0.000	0.005	0.011	-0.007	-0.001	0.009	0.012*
	(0.002)	(0.002)	(0.010)	(0.010)	(0.011)	(0.011)	(0.006)	(0.006)
measure*EU national share	**-0.264*** **		**-1.585*** **		**-1.907*** **		**-0.826*** **	
	(0.042)		(0.281)		(0.349)		(0.239)	
measure*EU8 national share		**-0.414*** **		**-2.394*** **		**-2.901*** **		**-1.246*** **
		(0.062)		(0.414)		(0.523)		(0.399)
export REER	0.390	0.410	0.124	0.148	0.342	0.346	0.367	0.356
	(0.369)	(0.376)	(0.404)	(0.411)	(0.394)	(0.398)	(0.413)	(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***	-0.541***	-0.560***	-0.558***	-0.563***
	(0.135)	(0.135)	(0.137)	(0.134)	(0.139)
post vote * tariff exposure		-0.008	-0.029	-0.029	-0.029
		(0.033)	(0.055)	(0.055)	(0.054)
export REER			-0.136	-0.137	-0.143
			(0.146)	(0.146)	(0.146)
post vote * EU national share				-0.327	
				(1.002)	
post vote * EU8 national share					-0.929
					(1.426)
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: Including shares

Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * service barrier exposure	-4.287**	-4.216**	-4.246**	-4.247**	-4.162**
	(1.972)	(1.974)	(1.988)	(1.959)	(1.933)
post vote * services emp sh * EU export sh	0.544*	0.534*	0.535*	0.536*	0.523*
	(0.284)	(0.285)	(0.286)	(0.283)	(0.279)
post vote * tariff exposure		-0.032	-0.031	-0.031	-0.030
		(0.060)	(0.062)	(0.062)	(0.062)
post vote * manu emp sh * EU export sh		0.001	0.000	0.000	0.000
		(0.002)	(0.004)	(0.004)	(0.004)
export REER			-0.108	-0.108	-0.117
			(0.233)	(0.234)	(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

	Output weighted		Export weighted		Logged tariffs		Regional export weighted	
Dep variable: log postings	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
post vote * service barrier exposure		-0.539***		-0.554***		-0.539***		-0.525***
		(0.127)		(0.135)		(0.127)		(0.125)
post vote * tariff exposure	9.830	1.122	4.416	-2.999	10.340	1.237	0.000	0.000
	(18.090)	(21.270)	(7.898)	(8.413)	(19.110)	(22.410)	(0.000)	(0.000)
export REER		-0.069		-0.082		-0.068		-0.032
		(0.084)		(0.081)		(0.084)		(0.075)
post vote * EU national share		-0.248		-0.220		-0.248		-0.277
		(0.866)		(0.871)		(0.866)		(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***	-0.531***	-0.550***	-0.541***	-0.544***
	(0.132)	(0.139)	(0.141)	(0.134)	(0.138)
post vote * tariff exposure		-0.017	-0.038	-0.040	-0.042
		(0.036)	(0.055)	(0.054)	(0.054)
post vote * goods NTMs		0.069	0.069	0.080	0.104
		(0.166)	(0.165)	(0.162)	(0.166)
export REER			-0.135	-0.136	-0.143
			(0.144)	(0.144)	(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

$$imp\_protection_r = \sum_{j^{manu} \in r} employment\_share_{rj^{manu},2015} \times imp\_protection_{j^{manu},2014} \quad (8)$$

$$imp\_protection_{j^{manu},2014} = \frac{Imports_{j^{manu},2014}}{L_{j^{manu},2014}} \times avg\_MFN\_tariff_{j^{manu},2014} \quad (9)$$

- $employment\_share_{rj^{manu},2015}$: industry j^{manu} 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^{manu}
- $L_{j^{manu},2014}$: national employment (4-digit ISIC, j^{manu})
- $Imports_{j^{manu},2014}$: UK imports from the EU in 2014

Appendix: Intermediate input tariff threat

$$intinputs\_threat_r = \sum_{k \in r} employment\_share_{rk,2015} \times intinputs\_threat_{k,2014} \tag{10}$$

$$intinputs\_threat_{k,2014} = \frac{1}{L_k} \sum_{j^{manu}} S_{k,j^{manu}} \sum_{p \in j^{manu}} imports_p \times MFN\_tariff_{p,2014} \tag{11}$$

- 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 * service barrier exposure				-0.549***	-0.553***
				(0.133)	(0.139)
post vote * intermediate import tariff exposure	-0.024		0.082	-0.019	-0.010
	(0.124)		(0.216)	(0.262)	(0.256)
post vote * import protection tariff exposure		-0.008	-0.054	-0.029	-0.027
		(0.017)	(0.035)	(0.041)	(0.041)
post vote * export tariff exposure			0.072	0.021	0.017
			(0.062)	(0.084)	(0.085)
export REER				-0.140	-0.142
				(0.179)	(0.180)
post vote * EU national share				-0.198	
				(0.849)	
post vote * EU8 national share					-0.733
					(1.325)
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

ADDITIONAL INFORMATION

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

Export tariff exposure

$$tariff\_exposure_{j^{manu},2014} = \frac{Exports_{j^{manu},2014}}{L_{j^{manu},2015}} \times avg\_MFN\_tariff_{j^{manu},2014} \tag{12}$$

$$tariff\_exposure_{r} = \sum_{j^{manu} \in r} empl\_share_{rj^{manu},2015} \times tariff\_exposure_{j^{manu},2014} \tag{13}$$

- $avg\_MFN\_tariff_{j^{manu},2014}$: export-weighted average EU MFN ad valorem tariff across all HS6 products mapped to sector j^{manu}

- $empl\_share_{rj^{manu},2015}$: industry j^{manu} share of TTWA r employment
- $L_{j^{manu},2015}$: national employment (4-digit SIC sector j^{manu})
- $Exports_{j^{manu},2014}$: UK exports to the EU in 2014