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 goods and services and movement of labour
- Unique opportunity to examine the labour market consequences of deep integration being reversed
- 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 barriers on professional services exports reduced hiring after the referendum relative to less exposed areas
- Particularly strong impact on financial services
- Decline in hiring concentrated in higher skilled & professional jobs
- Reduction in hiring after the vote concentrated in months with greater newspaper coverage and Google searches relating to future trade policy

Related literature

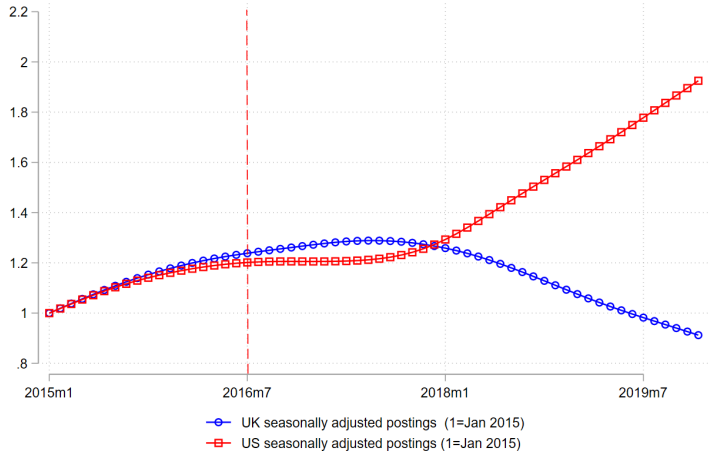
- Labour market effects of trade *integration*
  - **Negative effects of import competition**: Autor et al. (2013), Edmonds et al. (2010), Topalova (2010), Pierce and Schott (2016)
- Brexit
  - **Tariff uncertainty matters**: Crowley et al. (2018), Graziano et al. (2018), Bloom et al. (2018)
  - **Sterling 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)
- 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
- 12th Jul 2018: UK Government publishes its White Paper
- 14th Nov 2018: The Withdrawal Agreement is agreed and published
- 15th Jan 2019: First failed vote on withdrawal deal in UK Parliament
- 12th Mar 2019: Second failed vote
- 29th Mar 2019: Third failed vote and originally planned leaving date
- 31st Jan 2020: UK leaves the EU, entering transition period until the end of 2020
- 1st Jan 2021: ???

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

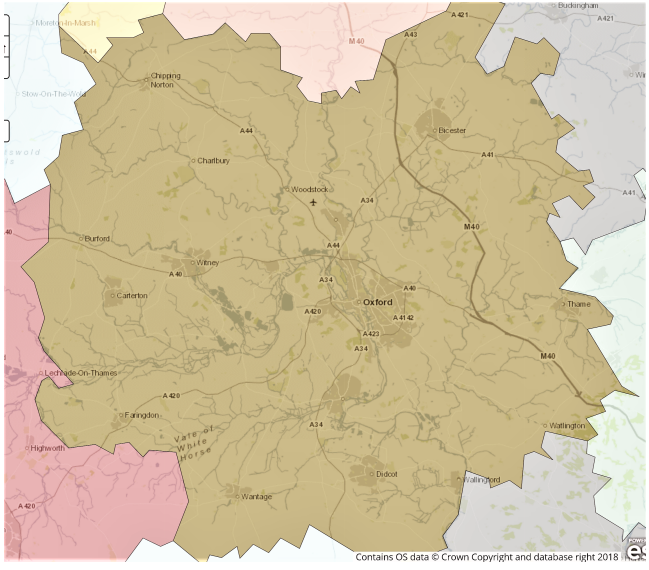
- The referendum result was unexpected: sudden jump in probability of trade barriers
- Services account for 80% of UK economic output and 46% of exports
- Financial services made up 6.9% of the UK's total output in 2018 and contributed £29 billion in tax in 2017/18
- If the UK leaves the single market 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

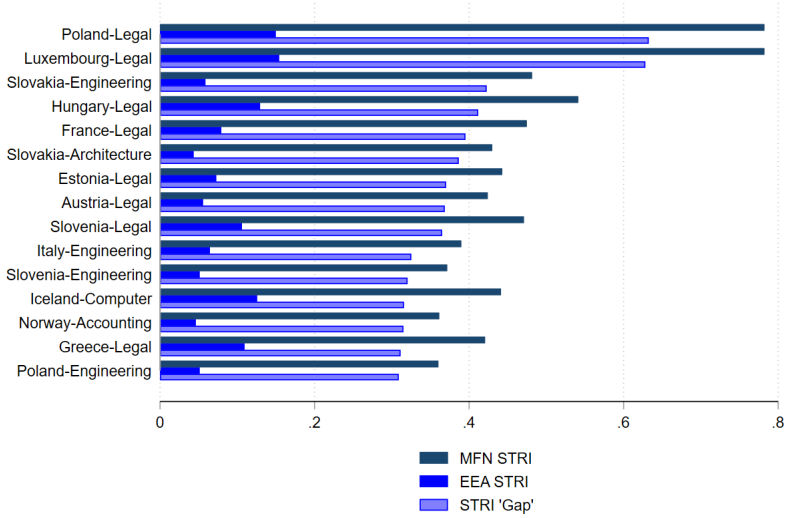
Professional services trade barrier exposure

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

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

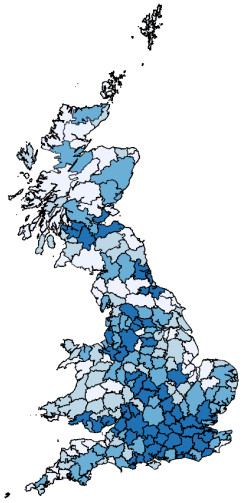
- Avg STRI $gap_{j,2014}$: difference between the 2014 MFN STRI and intra-EEA STRI for industry j in EEA country c, weighted by UK exports to EEA country c in sector j in 2015
- $Exports_{j,2015}$: UK exports from industry j to the EEA in 2015
- $L_{j,2015}$: national employment in sector j in 2015
-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

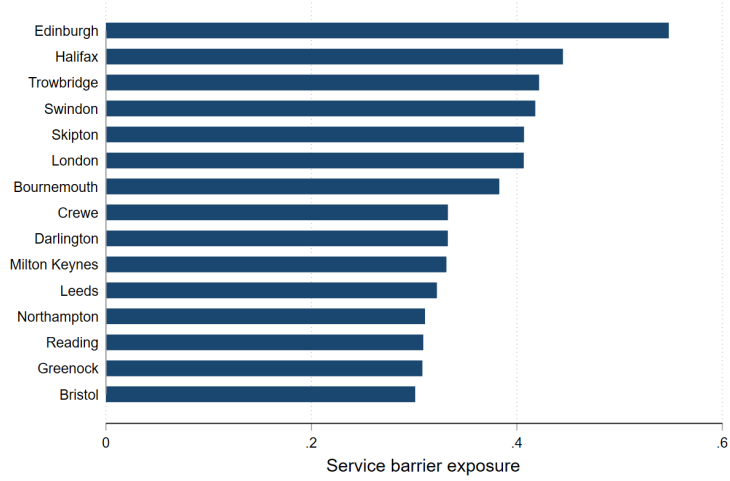
OECD STRI country-sector pairs with highest EEA vs MFN barrier 'gap'



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

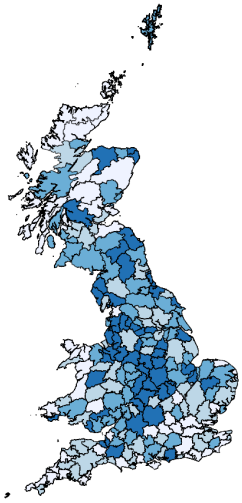
Export tariff exposure

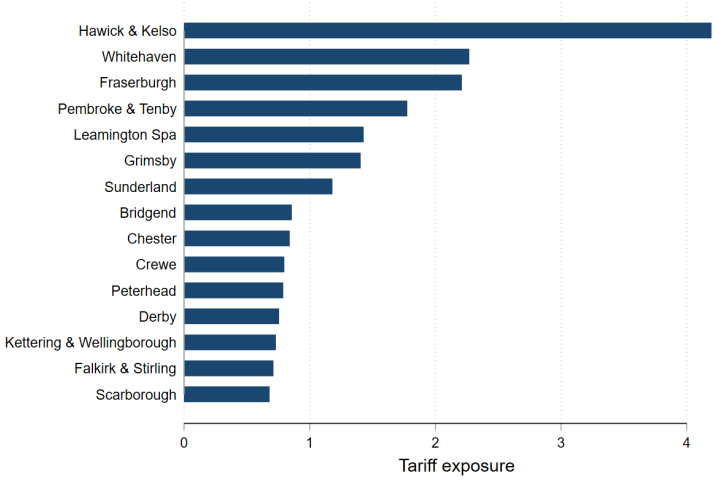
$$tariff_exposure_r = \sum_{j \in r} employment_share_{rj,2015} \times tariff_exposure_{j,2014} \tag{3}$$

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

- $employment_share_{rj,2015}$: 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



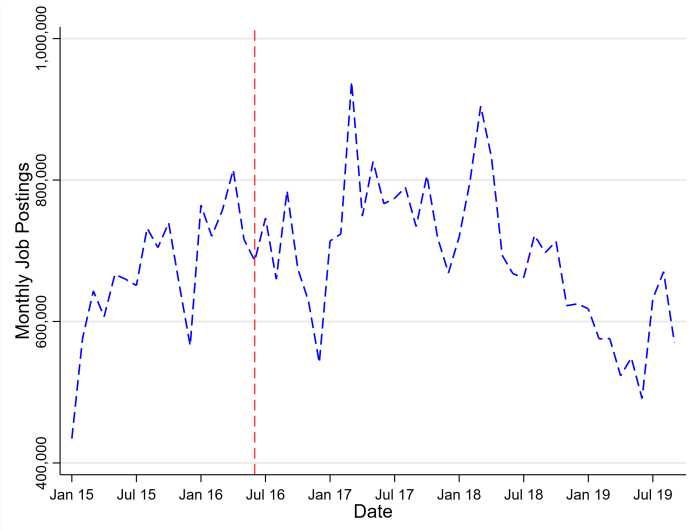


Job Postings Data

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%
- Use a weighted sum of exposure to the exchange rate depreciation depending on sector-specific trade with different countries from Costa et al. (2019)
- 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

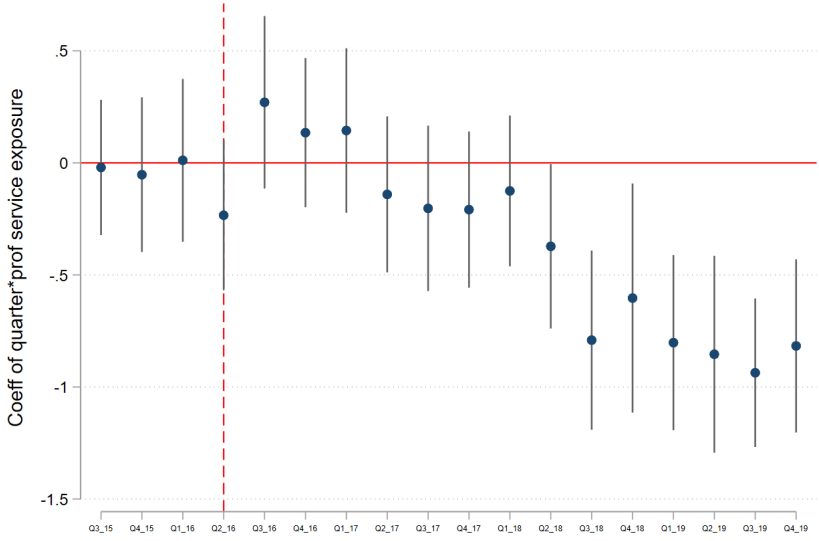
Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * prof service exposure	**-0.538*** **	**-0.540*** **	**-0.351*** **	**-0.346*** **	**-0.344*** **
	(0.132)	(0.132)	(0.124)	(0.124)	(0.128)
post vote * tariff exposure		-0.008	0.001	0.003	0.001
		(0.033)	(0.035)	(0.035)	(0.035)
post vote * EU national 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
Exchange rate controls	NO	NO	YES	YES	YES
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

Professional services impact by quarter



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

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

TheCityUK also describes white paper as ‘frustrating’

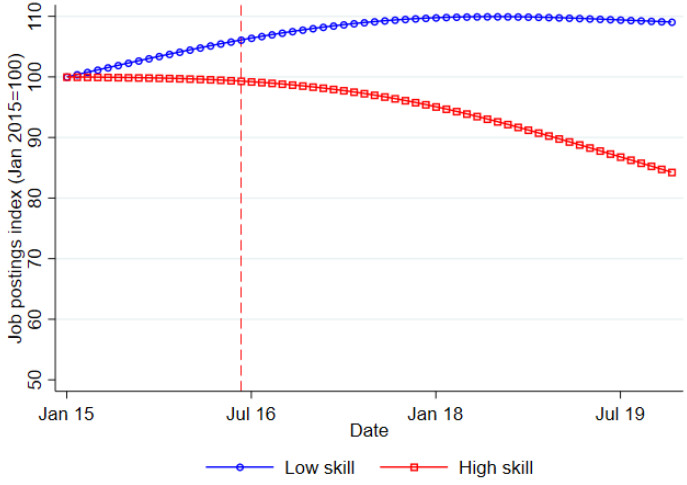
Katie Martin JULY 12 2018

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.

What happened in Q2 2018?

- July 2018 publication of a white paper fleshing out Theresa May's proposal for Britain's future relationship with the EU
- "Mrs May's white paper, which has already sparked the resignation of two Eurosceptic cabinet ministers, confirms that the prime minister is moving towards a softer form of Brexit, with Britain retaining close economic ties with the EU."
- "It 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'."
- "Jacob Rees-Mogg, backbench Tory MP described the policy outlined in the document as "the greatest vassalage since King John paid homage to Phillip II at Le Goulet in 1200".
- Quotes from FT article from 12th July 2018

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 * 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
Exchange rate controls	NO	NO	YES	YES	YES	NO	NO	YES	YES	YES
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

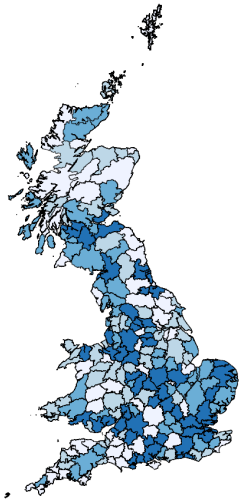
Regional Financial Services EU export exposure

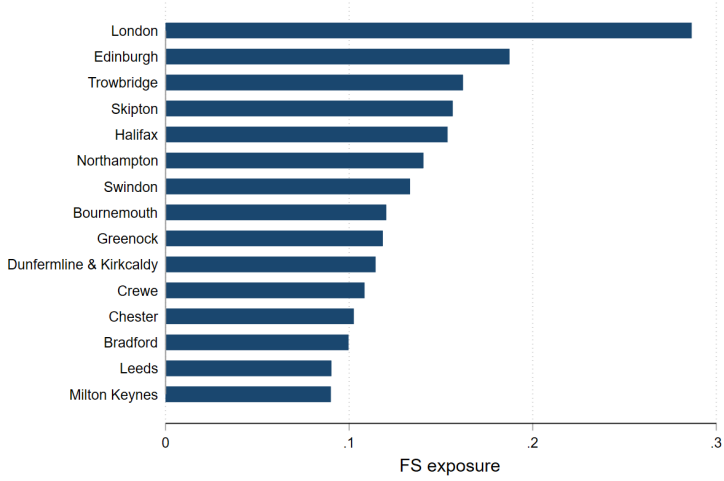
$$\text{FS exposure}_{r,NUTS1} = \text{FS employment share}_{r,2015} \times \text{Regional FS exposure}_{NUTS1} \quad (7)$$

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

- 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

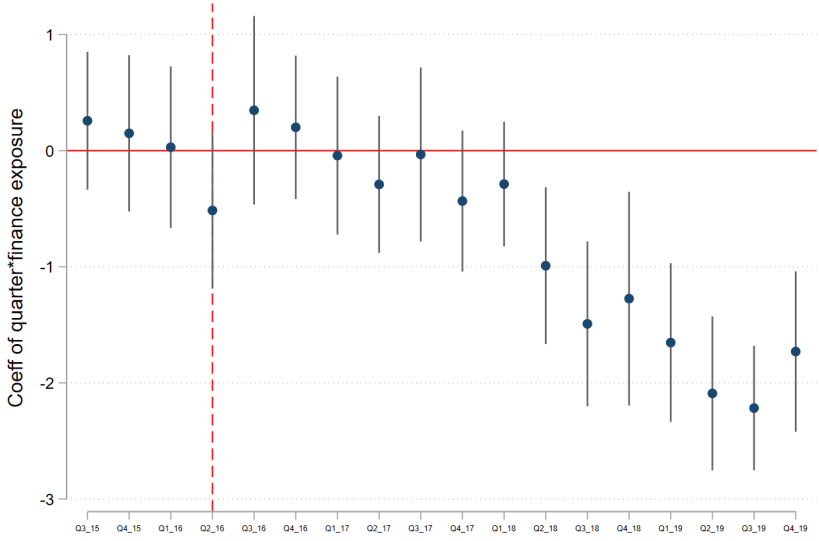
Dep variable: log postings	(1)	(2)	(3)	(4)	(5)
post vote * financial services exposure	**-1.201*** **	**-1.201*** **	**-0.817*** **	**-0.868*** **	**-0.826*** **
	(0.296)	(0.295)	(0.279)	(0.254)	(0.269)
post vote * tariff exposure		-0.003	0.004	0.007	0.004
		(0.033)	(0.035)	(0.035)	(0.036)
post vote * 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
Exchange rate controls	NO	NO	YES	YES	YES
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%

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 * 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
Exchange rate controls	NO	NO	YES	YES	YES	NO	NO	YES	YES	YES
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)
Observations	12,780	12,780	12,780	12,780	12,780
TTWA FE	YES	YES	YES	YES	YES
Month-Year FE	YES	YES	YES	YES	YES

	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)
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 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

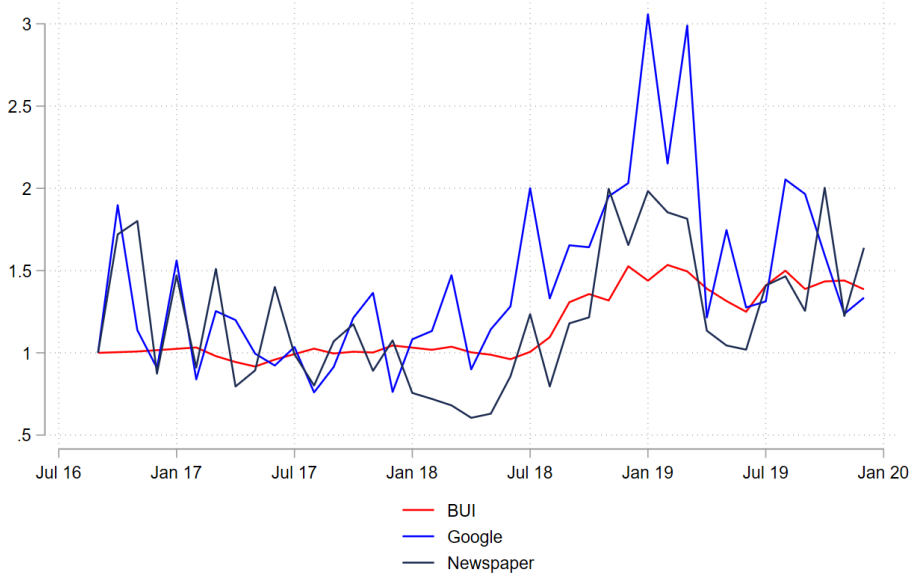
Time-varying perceptions about future trade policy

- 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

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 * 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
Exchange rate controls	NO	NO	YES	YES	YES
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 * 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
Exchange rate controls	NO	NO	YES	YES	YES
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: 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 * 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
Exchange rate controls	NO	YES	NO	YES	NO	YES	NO	YES
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 * 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
Exchange rate controls	NO	NO	YES	YES	YES
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 * 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
Exchange rate controls	NO	NO	NO	YES	YES
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

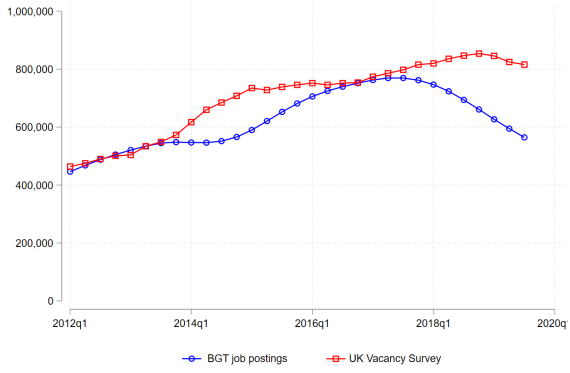
Dep variable: log US postings	(1)	(2)	(3)	(4)	(5)	(6)
	Google		Newspaper		BUI	
measure* FS exposure	-0.010	-0.012	-0.011	-0.010	-0.003	-0.004
	(0.036)	(0.034)	(0.016)	(0.015)	(0.004)	(0.004)
measure *tariff exposure	-0.001	-0.001	-0.000*	-0.000**	-0.000	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(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%.

