The Spillover Effect of Services Offshoring on Local Labour Markets
Online Appendix

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A Data Construction and Weights

The Office of National Statistics (ONS) records all firms in the UK with a VAT or PAYE scheme in the Inter-Departmental Business Register (IDBR), which covers approximately 2.1 million enterprises. For all plants, the IDBR contains information on employment, turnover, sector and geographical location at the postcode level. Then a sample of firms is selected for the Annual Respondent Database (ARD), used by the ONS to construct national statistics. The sample includes the universe of large firms (with more than 250 employees) and a rotating representative sample of medium and small firms (repeated cross-section). The selected ARD sample receives a comprehensive questionnaire on balance sheet information, employment and trade activities. In 2007, ONS split ARD into the Annual Business Survey (ABS), containing information on firms' financial activities, and the Business Register and Employment Survey (BRES), collecting detailed data on employment. ABS maintains the same sampling procedure and timing of the questionnaire as the ARD, while BRES follows a different sampling and timing. For data consistency, I only use the information contained in the ARD and ABS and discard the information in the BRES.

In all datasets, ONS distinguishes between reporting unit, the plant receiving the questionnaire and providing information for the whole enterprise, and plant, not directly surveyed but part of the same firm. Reporting units are generally the largest plants where the core production takes place and the administrative headquarters. For single-plant firms, reporting units and local units coincide. UK statistical agencies then use the questionnaires sent to reporting units to produce national statistics on the state of the economy.

ARD/ABS questionnaire contains, among others, questions on whether the firm has traded services in the last 12 months, recording the total amount of imports and exports of service, with no further action required for firms that traded in services for less than £10,0000. Instead, firms above the services trade value threshold receive the International Trade in Service Survey (ITIS), and continue to receive the survey for all subsequent years irrespective of ARD/ABS sampling. ITIS contains detailed information on services trade flows, including type (52 categories equivalent to the UN EBOPS services industry classification), value and partner country of traded services on a yearly and quarterly basis, covering more than half of the UK's services imports and exports. The dataset represents the most comprehensive set of information at the firm level available to researchers. ITIS contains information on all services supplied via cross border (mode 1), consumption abroad (mode 2) and movement of people (mode 4). However, the dataset do not contain information on affiliates sales (mode 3), collected in the Annual Foreign Direct Investment Dataset (AFDI). Unfortunately, ITIS does not include passenger transport, higher education, financial and banking sectors, and data sources containing that information are not available to researchers. The International Passenger Survey contains information on travel passengers, while the Higher Education Statistic Agency and the IPS collect data on higher education. Finally, the Bank of England and ONS's security dealers' survey own information on the financial and banking services not included in the ITIS.

To construct the final dataset I proceed in three steps. First, I construct an unbalanced panel of firms at the reference unit level combining the ARD and ABS. Then, I merge reference units with their local ones to obtain detailed information on firms' locations and plants. Finally, I link the ARD/ABS data with the ITIS through firms' unique identification numbers. Following the recommendation of the data provider, for multi-plant firms (reporting units with multiple local plants), I identify as an importer/exporter of the plant with the highest number of employees. In the robustness checks of the analysis, I relax this assumption and consider only single-plant firms. Further, I conduct part of the analysis using services trade information from the ARD/ABS, which does not require any assumption on the plant importing services.

I construct and employ population weights to obtain meaningful aggregate information and account for sampling issues deriving from small firms exiting and entering the survey. Information on the population of firms is available for each year in secure access, such that it is possible to construct yearly sample probability weights. Consistent with the empirical specification and the sampling methodology, I use three stratification layers: local area, sector and employment band. I compute the weights as the shares of firms surveyed within each layer and year on the firms' population within the same unit. Table A.1 provides an overview of the average number of firms selected for the ARD/ABS, the entire universe of firms and population weights statistics for each year. The final dataset is an unbalance panel containing information on firms (including geographical location) and services trade activities for the period 2000-2015. I restrict the sample until 2015 to exclude any Brexit and anticipatory effects. Further, I exclude Northern Ireland as information at the firm level is unavailable through ONS from 2001 onwards.

Table A.1: **Sample and Universe of firms**

	Mean
Number of reporting units, Universe	1,299,143
Number of reporting units, ARD /ABS	49,678.64
Number of local units per reporting unit, ARD/ ABS	611.32
Number of firms per sector-local area, Universe	1,342.24
Number of firms per sector-local area, ARD/ABD	16.50
Number of plants per sector-local area, ARD/ABS	134.51
ONS Population weights	36.28 (mean) 48.70 (St.Dev.)
Computed population weights	20.92 (mean) 28.09 (St. Dev.)

Source: Own computation using ARD/ABS (ONS) . Values refer to average number per year.

B Additional Stylised facts

Services trade has been increasing substantially in the past twenty years. Figure B shows the patters of goods, services and total trade of the UK between 1997 and 2021. Since 2007 services trade has increased more steeply compared to goods, and overtaking the growth rate beginning with 2015. Similarly, the data employed in the analysis show a steep increase in services trade, with a high growth rate for services imports beginning with 2009 (Figure B.2).

UK services trade partners cover the majority of the EU countries and the largest economy as US, India and China. For the main fifteen trade partners, I show the three most traded services with firms in the UK. The shares listed in tables B.2 and B.3 suggest that, except for intra-firms trade and royalties & licensing, UK firms trade different services with different countries, reflecting the comparative advantages for each country-pair. E.g. one of the most imported services from Spain is manufacturing services, which accounts for 23.6% of total imports in manufacturing in the UK.

Heterogeneities on the type of services traded exist and depend on the sector of origin/destination of traded services. Consistent with the literature on the "servitisation" of economies and the manufacturing sector, non-services industries are offshoring as well exporting services (Bernard et al., 2017; Breinlich et al., 2018; Crozet and Milet, 2017). For e.g. firms in manufacturing sectors with low or medium technology intensity account for 30% of the overall exports of engineering services (Table B.1).

Figure B.1: **Pattern of Goods, Services and Total trade for the years 1997-2021**

(a) Imports

(b) Exports

Source: ONS. Pattern of imports and exports of goods, services and total trade from 1997 until 2021. UK trade annual flows are computed with implied deflators (IDEF), based on the UK Balance of Payments and seasonally adjusted using as reference year 2019.

Table B.1: **Import and Export of services by sector**

Sector	Imported Service	Share	Exported Service	Share
Agriculture & Mining	Operation Leasing	89.66%	Operating Leasing	71.56%
	Engineering	16.26%	Business & Management	3.81%
	Intra-Firms	1.19%	Mining & oil gas ex.	35.03%
Manufacturing, Low Tech	Royalties & Licensing	14.74%	Engineering	30.47%
	Intra-Firms	8.70%	Manufacturing	84.65%
	Business & Management	14.90%	Intra-Firms	6.92%
Manufacturing, High Tech	Intra-Firms	7.86%	Maintenance & Repair	50.20%
	Royalties& Licensing	5.90%	Royalties & Licensing	7.09%
	R&D	9.76%	R&D	7.18%
Commodity & Construction	Construction	33.42%	Construction	54.45%
	Business & Management	4.25%	Financial	3.83%
	Intra-Firms	0.50%	Other Business Professional	1.48%
Wholesale & Retail	Intra-Firms	27.20%	Other	71.73%
	Royalties & Licensing	5.79%	Trade related	74.13%
	Trade related	40.12%	Intra-Firms	10.11%
Hospitality	Royalties & Licensing	1.05%	Royalties & Licensing	1.66%
	Business & Management	1.35%	Other Business Professional	3.12%
	Information	4.42%	Business & Management	0.19%
ICT	Telecommunication	96.89%	Telecommunication	97.34%
	Royalties & Licensing	41.01%	Royalties & Licensing	42.78%
	Computer	64.33%	Computer	67.63%
Real Estate	Business & Management	1.13%	Property Management	42.21%
	Royalties & Licensing	0.15%	Other Business Professional	4.17%
	Other Business Professional	0.65%	Business & Management	2.30%
Professional	R&D	84.36%	Engineering	63.44%
	Intra-Firms	29.77%	Intra-Firms	47.40%
	Royalties & Licensing	16.43%	Legal	99.12%
Administrative & Support	Royalties & Licensing	6.84%	Financial	58.47%
	Intra-Firms	4.34%	Recruiting	69.68%
	Construction	18.66%	Royalties & Licensing	5.83%
Education	Trade related	0.91%	Training & Education	28.62%
	Royalties & Licensing	0.07%	Trade related	0.53%
	Training & Education	9.03%	Recruiting	0.91%
Health & Recreational	Royalties & Licensing	7.05%	Royalties & Licensing	18.49%
	Heritage & Recreational	35.55%	Heritage & Recreational	59.69%
	Other Business Professional	4.91%	Advertising	2.51%
Other Services	Computer	4.82%	Other	2.93%
	Maintenance & Repair	8.95%	Computer	2.77%
	Other	4.49%	Maintenance & Repair	5.27%

Source: Own computation using ITIS (ONS). Column "Service" refers to the three most imported services by sector of the importing firms in 2015. The percentage refers to the share of imports of service i from sector x on the overall imports of service i. Sector "Agriculture & Mining" includes Fishing and Forestry. "Commodities & Construction" includes Electricity, Water Supply and Waste Management. "Hospitality" includes Accommodation and Food Services. "Professional" includes Scientific and Technical. "Health & Recreational" includes social works. "Personal Services" imported and exported include health and recreational services.

Table B.2: **Traded services with top EU countries**

Country	Imported Service	Share	Exported Service	Share
Belgium	Intra-Firms	2.30%	R&D	5.55%
	Business & Management	6.90%	Royalties & Licensing	2.06%
	Royalties & Licensing	1.40%	Manufacturing	9.02%
France	Intra-Firms	7.00%	Computer	8.96%
	Royalties & Licensing	5.00%	Financial	3.82%
	Computer	8.80%	Royalties & Licensing	3.94%
Germany	Intra-Firms	7.80%	Computer	9.99%
	Telecommunication	16.00%	Royalties & Licensing	5.18%
	Other Business Professional	28.90%	Intra-Firms	5.06%
Ireland	Advertising	27.00%	Intra-Firms	14.10%
	Computer	14.10%	Financial	7.75%
	Royalties & Licensing	5.80%	Computer	13.35%
Italy	Telecommunication	4.40%	Mining & oil gas ex.	61.13%
	Intra-Firms	1.90%	Financial	2.42%
	Financial	4.40%	Telecommunication	4.02%
Netherlands	Royalties & Licensing	6.00%	Manufacturing	40.40%
	Intra-Firms	5.70%	Intra-Firms	7.72%
	Telecommunication	5.30%	Royalties & Licensing	6.90%
Spain	Intra-Firms	1.90%	Royalties & Licensing	2.33%
	Royalties & Licensing	1.80%	Other Business Professional	7.30%
	Manufacturing	23.60%	Financial	1.48%
Sweden	Intra-Firms	7.90%	Royalties & Licensing	3.01%
	R&D	7.70%	Telecommunication	3.27%
	Computer	4.00%	Advertising	4.19%
Poland	Intra-Firms	0.90%	Royalties & Licensing	1.16%
	Computer	1.60%	Intra-Firms	0.93%
	Audio-Visual	9.40%	Financial	0.62%
Luxembourg	Telecommunication	18.80%	Financial	7.35%
	Computer	7.80%	Legal	3.82%
	Royalties & Licensing	3.40%	Business & Management	2.46%

Source: Own computation using ITIS (ONS). Most traded services with main EU trade partners. Column "Percentage" refers to the share of imports (export) of service i from (to) country x on the overall imports (exports) of service i in 2015.

Table B.3: **Traded services with top non EU countries**

Country	Imported Service	Share	Exported Service	Share
Australia	Intra-Firms	3.40%	Intra-Firms	2.45%
	Royalties & Licensing	3.30%	Financial	1.95%
	Maintenance & Repair	10.30%	Royalties & Licensing	1.24%
Hong Kong	Intra-Firms	2.90%	Financial	1.90%
	Financial	2.80%	Royalties & Licensing	2.01%
	Telecommunication	2.00%	Business & Management	1.54%
India	Computer	10.60%	Engineering	3.62%
	Intra-Firms	4.70%	Telecommunication	3.20%
	Other Business Professional	12.70%	Royalties & Licensing	1.51%
Japan	Royalties & Licensing	9.60%	R&D	9.30%
	Financial	8.00%	Financial	3.15%
	Intra-Firms	2.40%	Royalties & Licensing	1.77%
UAE	Engineering	14.40%	Royalties & Licensing	2.93%
	Telecommunication	2.60%	Engineering	4.32%
	Intra-Firms	0.80%	Telecommunication	3.13%
Singapore	Intra-Firms	3.70%	Engineering	6.73%
	Operating leasing	42.90%	Intra-Firms	3.18%
	Other	22.00%	Royalties & Licensing	2.69%
Switzerland	Royalties & Licensing	16.00%	Royalties & Licensing	7.82%
	Intra-Firms	2.30%	Intra-Firms	6.07%
	Business & Management	5.30%	Business & Management	10.04%
United States	Royalties & Licensing	33.00%	Financial	27.01%
	Intra-Firms	25.70%	Intra-Firms	33.69%
	R&D	52.30%	Royalties & Licensing	26.03%
China	Postal & Courier	23.40%	Postal & Courier	18.36%
	Intra-Firms	1.00%	Royalties & Licensing	1.35%
	Financial	2.60%	Financial	0.99%

Source: Own computation using ITIS (ONS). Most traded services with non-EU trade partners. Column "Percentage" refers to the share of imports (export) of service i from (to) country x on the overall imports (exports) of service i in 2015.

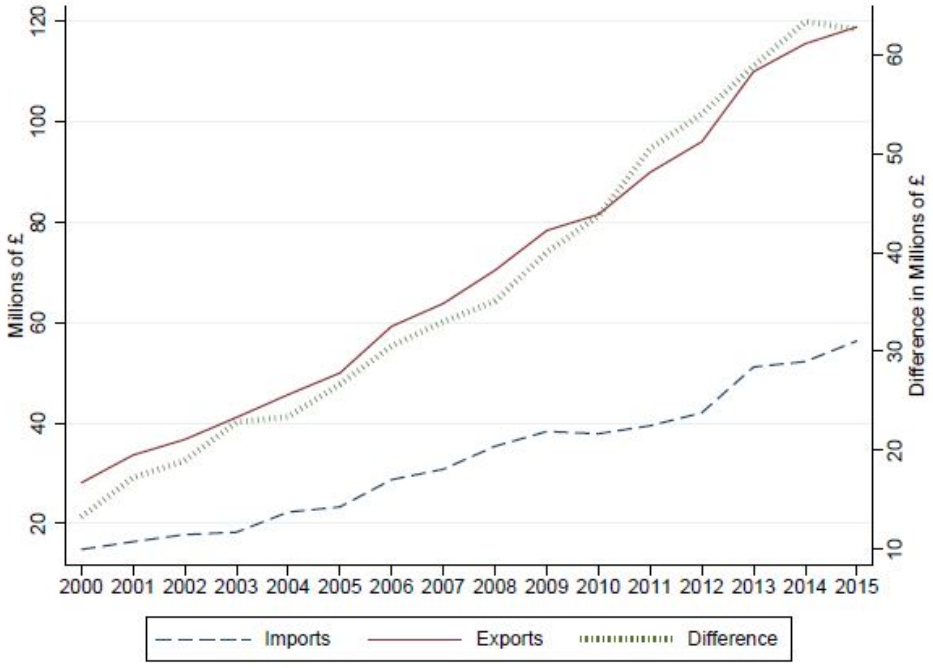
Table B.4: **SIC2007 and ITIS conversion table**

Sic (4 digit specification)	**Services Description**
0161, 0162, 0163, 0164, 0170, 0240	Agricultural, Forestry and Fishing
0910, 0990	Mining and Oil Gas Extraction
3600, 3700, 3811, 3812, 3821, 3822, 3831, 3832, 3900	Waste Treatment and De-Pollution
3311, 3312, 3313, 3314, 3315, 3316, 3317, 3319, 3320, 6920, 7022, 9511, 9512, 9521, 9522, 9523, 9524, 9525, 4520, 4540, 9529	Maintenance and Repair
NA	Manufacturing Services on Goods Owned by Others
7311, 7312,7320	Advertising, Market Research and Public Opinion Polling
7010	Business Management and Management Consulting
7021	Public Relations
7810, 7820,7830	Recruitment
6910	Legal
7711, 7712, 7721, 7722, 7729, 7731, 7732, 7733, 7734, 7735, 7739	Operating Leasing
5229	Procurement services
6810, 6820, 6831, 6832	Property Management
741,074,207,430	Other Business and Professional
721,172,197,220	Provision of R&D services
NA	Provision of Product Development and Testing Activities
7740	Royalties and Licensing
53,105,320	Postal and Courier
6110, 6120,6130, 6190	Telecommunication
6201, 6202, 6203, 6209	Computer
5811, 5812, 5813, 5814, 5819, 5821, 5829	Publishing
6391	News Agency

Sic (4 digit specification)	Services Description
6311, 6312, 6399	Information
4110, 4120, 4311, 4312, 4313, 4321, 4322, 4329, 4331, 4332, 4333, 4334, 4339, 4391, 4399	Construction
6411, 6419, 6420, 6430, 6490, 6492, 6499	Financial
651, 165, 126, 520	Insurance
6611, 6612, 6619, 6621, 6622, 6629, 6630	Auxiliary
6530	Pension
NA	Standardised Guarantee Services Claims
NA	Standardised Guarantee Service Premiums
4531, 4532, 4611, 4612, 4613, 4614, 4615, 4616, 4617, 4618, 4619, 4621, 4622, 4623, 4624, 4630, 4632, 4633, 4634, 4635, 4636, 4637, 4638, 4639, 4641, 4642, 4643, 4644, 4645, 4646, 4647, 4648, 4649, 4651, 4652, 4661, 4662, 4663, 4664, 4665, 4666, 4669, 4671, 4672, 4673, 4674, 4675, 4676, 4677, 4690, 4711, 4719, 4721, 4722, 4723, 4724, 4725, 4726, 4729, 4730, 4741, 4742, 4743, 4751, 4752, 4753, 4754, 4759, 4761, 4762, 4763, 4764, 4765, 4771, 4772, 4773, 4774, 4775, 4776, 4777, 4778, 4779, 4781, 4782, 4789, 4791, 4799	Merchanting and other trade-related
5911 ,5912, 5913, 5914, 5920	Audio-Visual and Related
8610, 8621, 8622, 8623, 8690	Health
8510, 8520, 8531, 8532, 8541, 8542, 8551, 8552, 8553, 8559, 8560	Training and Educational
9001, 9002, 9003, 9004, 9101, 9103, 9104, 9200, 9311, 9312, 9313, 9319, 9321, 9329	Heritage and Recreational
9601, 9602, 9603, 9604, 9609, 9700	Social, Domestic and Other Personal
7111	Architectural
7112, 4211, 4212, 4213, 4221, 4222, 4291, 4299	Engineering
7120, 7490	Scientific and Other Technical (Including Surveying)
NA	Transactions Between Related Businesses Not Included Elsewhere
NA	Other Trade in Services

Source: Own computation. Conversion table between SIC07 industry classification and service classification contained in the ITIS used to construct narrow offshoring measures.

Figure B.2: **Pattern Trade in Services for the years 2000-2015**



Source: Own computation. Data obtained using ITIS (ONS). Pattern of aggregate UK services trade for the period 2000-2015.

C Instrument Validity

The instrument employs service-industry-specific shocks of a selection of countries, then allocated to each local labour market depending on the initial employment and services input shares. The instrument belongs to the population of the shift-share IVs, widespread in the international and labour economics literature. Using a notation similar to Borusyak et al. (2022) and focusing on employment as an outcome variable, the second stage regression follows the form:[1]

$$Empl_{jkt} = \beta \widehat{Off}_{jkt} + \gamma' X_{jkt} + \epsilon_{jkt} \tag{1}$$

Where the computation of β coefficient follows the specification:

$$\hat{\beta} = \frac{\sum_{jkt} Off^{o}_{jkt} Empl^{\perp}_{jkt}}{\sum_{jkt} Off^{o}_{jkt} Off^{\perp}_{jkt}} = \frac{\sum_{jkt} \sum_{s} share_{sjk} M^{o}_{sJt-1} Empl^{\perp}_{jkt}}{\sum_{jkt} \sum_{s} share_{sjk} M^{o}_{sJt-1} Off^{\perp}_{jkt}} =$$

$$= \frac{\sum_{sJ} M_{Js} \sum_{jkt} \frac{1}{L} share_{jkt} Empl^{\perp}_{jkt}}{\sum_{sJ} M_{Js} \sum_{jkt} \frac{1}{L} share_{jkt} Off^{\perp}_{jkt}} = \frac{\sum_{Js} share_{Js} M^{o}_{Js} \overline{Empl}^{\perp}_{jkt}}{\sum_{Js} share_{Js} M^{o}_{Js} \overline{Off}^{\perp}_{jkt}}$$

The estimation of the coefficient of interest β corresponds to:

$$\hat{\beta} = \frac{\sum_{Js} share_{Js} M^{o}_{Js} \overline{Empl}^{\perp}_{jkt}}{\sum_{Js} share_{Js} M^{o}_{Js} \overline{Off}^{\perp}_{jkt}}$$

where $share_{Js} = \frac{1}{L} \sum_{jk} share_{jkt}$. The average residual ($\bar{\epsilon}_{jkt}$) indicates the average of unobservable determinants of sector-local area employment in the sector-local areas with the highest shares at the service-macro-sector level.

The first necessary condition for the instrument to be consistent is a significant first stage.[2] I show in table C.1 the results when implementing the instrument using the different allocation shares: employment, input usage and employment conditional on using a service. All specifications show statistically significant first stages, and the F-tests are well above the ten-value threshold, hence the instrument has good predicting power of local labour market offshoring.

The other necessary condition for IV validity is the quasi-random assignment of the shocks. Recent econometric studies shed further light on the requirements to satisfy this condition, and depending on the nature of the instrument variation, from the shock or the share, the solution proposed to control for the bias diverge. Borusyak et al. (2022) shows that if the variation of the instrument comes for the shock, the shares do not need to satisfy the exogeneity condition. However, the quasi-randomness of the shocks implies that each service-macro industry flow has the same expected value, conditional to the shock-level unobservables. In notation

[1] To ease the readability, I omit the logarithm of the variables.

[2] I refer to Angrist and Pischke (2009) for an entertaining discussion on IV exclusion restriction and random assignment assumptions.

Table C.1: **First Stage results**

	Employment share				Usage Share	
	(1)	(2)	(3)	(4)	(5)	(6)
	Fixed	Period	Import, fixed	Import, period	Fixed	Period
A. Broad Offshoring						
IV	0.7076^{***}	0.7254^{***}	0.8844^{***}	0.9236^{***}	1.0275^{***}	1.0777^{***}
	(0.0169)	(0.0127)	(0.0308)	(0.0296)	(0.0449)	(0.0257)
Observations	203,684	203,684	203,684	203,684	203,684	203,684
Adjusted R2	0.2973	0.3327	0.2592	0.2636	0.2524	0.2952
DoF	43438	43438	43438	43438	43438	43438
F-stat (Kleibergen-Paap)	912	1200	743	790	640	978
B. Narrow Offshroing						
IV	0.6751^{***}	0.7437^{***}	0.8071^{***}	0.8634^{***}	0.9658^{***}	1.1084^{***}
	(0.0454)	(0.0329)	(0.1084)	(0.099)	(0.1483)	(0.059)
Observations	203,684	203,684	203,684	203,684	203,684	203,684
Adjusted R2	0.2085	0.2264	0.191	0.1927	0.1921	0.214
DoF	43438	43438	43438	43438	43438	43438
F stat (Kleibergen-Paap)	303	355	277	285	267	352
C. Input Offshoring						
IV	0.5902^{***}	0.6032^{***}	0.7419^{***}	0.7737^{***}	0.8320^{***}	0.8645^{***}
	(0.0159)	(0.0122)	(0.0325)	(0.0314)	(0.0391)	(0.0288)
Observations	203,684	203,684	203,684	203,684	203,684	203,684
Adjusted R2	0.2493	0.2817	0.21	0.2133	0.2052	0.2349
DoF	43438	43438	43438	43438	43438	43438
F stat (Kleibergen-Paap)	713	901	554	582	517	623
Controls	√	√	√	√	√	√
TTWA # Year	√	√	√	√	√	√
Sector # Year	√	√	√	√	√	√

Source: Own computation. Data obtained combining ARD/ABS, ITIS (ONS). Each column shows the regression coefficients of the first stage specification. IV is the offshoring of services in Australia, Canada, Japan and South Korea from the US, Germany, France and Ireland. "Fixed" is the instrument constructed using employment or usage shares fixed in 1999. "Period" is the instrument constructed as employment or usage share computed in different periods (2000, 2005, 2010)."Import, fixed" is the instrument constructed with employment share conditional on importing a service in 1999."Import, period" is the instrument constructed with employment share conditional on importing a service in each year and computed in different periods (2000,2005,2010). Each row indicates the instrument used as an explanatory variable specifying the construction of the shares. Each column indicates the offshoring variable employed as the outcome variable in the first stage. Standard errors in parenthesis clustered at the sector-local area levels. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

terms:

$$E[M^o_{sJ}|\bar{\epsilon}, share_{jkt}] = \mu \ \ \forall sJ \tag{2}$$

Equation 2 implies that the allocation of the shock is independent of unobservables at the sector-local area level and the service-macro industry level.

Hence, I first investigate whether the shocks correlate with sector-local areas control variables used in the analysis, implementing the regressions as follows:

$$x_{jkt} = \gamma_0 + \gamma_1 M^o_{sJt-1} + \sigma_{kt} + \sigma_{jt} + \eta_{jkt} \tag{3}$$

where x_{jkt} is the generic time-varying control variable at the sector-local area level (population of firms, the share of British firms, expenditure in ICT). Similarly to the main specification, equation 2, I include local area-time and sector-time fixed effects. Results are included in table C.2, showing no correlation between the control variables and the shocks when looking at the broad offshoring measure. The results indicate that once controlling for local area-time and sector-time fixed effects, the shock flows do not affect local labour market characteristics used as control variables such as British-owned firms, number of firms in the labour market and ICT expenditure. However, there is a mild correlation between narrow offshoring and the share of British-owned firms and between Input offshoring and the number of firms in a local labour market. The correlations imply that the local labour markets with larger narrow offshoring have a relatively lower share of British-owned firms and that local labour markets with a higher input offshoring have a mildly higher number of firms. Nonetheless, the coefficient magnitude is very small and can be considered negligible for the main analysis.

Second, I check whether the shocks are independent to service-macro industry characteristics, implementing the following regression specification:

$$Share_{Jst} = \alpha_0 + \alpha_1 M^o_{sJt} + \varrho_J + \eta_{Jst} \tag{4}$$

where $share_{Jst}$ is the generic time-varying shares at the macro industry and services level, ϱ_J are macro-industry fixed effects and the error is clustered at the service level. Shares $Share_{Jst}$ includes: total employment in each sJ, wage bill in each sJ, total ICT expenditure in each sJ, and gross value added in each sJ. While employment and wage bill shares are self-explanatory, I test whether there is correlation between the shocks and macro-industry-service technology intensity and productivity using as proxy total ICT expenditure and and gross value-added respectively. Results are included in table C.3, showing that the allocation of the offshoring measures is independent of macro-sector-service characteristics (employment, wage bill, ICT expenditure and value-added). The third row of table C.3 shows a mild negative correlation between offshoring complementary

Table C.2: **Summary of correlation of the shock and sector local areas observable**

	(1) Competition	(2) ICT	(3) UK fims
Broad Offshoring	0.0016	-0.0008	0.0006
	(0.0012)	(0.003)	(0.0027)
Narrow Offshoring	-0.0027	-0.0088	-0.0067**
	(0.0023)	(0.0068)	(0.0033)
Input Offshoring	0.0021*	0.0013	0.002
	(0.0011)	(0.003)	(0.0025)
N	339,243	587,673	337,799
TTWA # Year	√	√	√
Sector # Year	√	√	√

Source: Own computation. Data obtained combining ARD/ABS, ITIS (ONS). Each column indicates the outcome variable measured at the sector-local area level. Each row shows the explanatory variable used in the regression specification. All regressions include sector-time and local area-time fixed effects. Standard errors in parenthesis are robust. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

to firms' output portfolio and macro-industry-services characteristics. However, as in the previous case the magnitude of the correlation is negligible and should not undermine the main findings.

Table C.3: **Summary of correlation of the shock and macro-industry-services characteristics**

	(1) Employment	(2) ICT	(3) Wage Bill	(4) GVA
Broad Offshoring	-0.0002736	-0.002379	-0.0004902	-0.0006853
	(0.0007539)	(0.0020657)	(0.001192)	(0.0011817)
Narrow Offshoring	0.0084938	-0.0053192	0.0137513	0.0147223
	(0.0068652)	(0.0147564)	(0.0106181)	(0.0105138)
Input Offshoring	-0.0016445*	-0.0013582	-0.0027066*	-0.0030480*
	(0.0008742)	(0.0014006)	(0.0014181)	(0.0015342)
N	6,576	6,576	6,576	6,576
Year	√	√	√	√
Macro Industry	√	√	√	√

Source: Own computation. Data obtained combining ARD/ABS, ITIS (ONS). Each column indicates the outcome variable measured at the macro industry and services level. Each row shows the explanatory variable used in the regression specification. All regressions include macro industry fixed effects. Standard errors in parenthesis clustered at the services level. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

In a further step, I test whether the instrument is composed of many uncorrelated shocks and check the

distribution of the shares:

$$E[\sum_{s} share_{sij}^2] \to 0 \forall (s, s'), s \neq s' \tag{5}$$

$$Cov(Imp_{Js}, Imp_{Js'} | \bar{\epsilon}, s) = 0 \tag{6}$$

Equation 5 implies that the expected Herfindal Indexes of the average shocks converge to zero. I look at the shock distribution, weighted by the shares. I weight the shocks using employment and usage shares, including the specification with different periods (column "Period") and fixing the initial year to 1999 (column "Fixed"). Further, I take into account that some service and macro industries might be driving the results by adjusting the shares as in Borusyak et al. (2022) (column "Adjusted"). In all of the specifications, the shock is distributed across all the sector local labour market and even when looking at distribution in the macro sectors, the concentration is low for both employment and usage share (tables C.4 and C.5).

Table C.4: **Shock distribution weighted by employment shares**

	(1) Unweighted	(2) Fixed	(3) Period	(4) Import, Fixed	(5) Import, Period	(6) Adjusted
Mean	3837	2790	3465	2631	2859	3211
Sd	11579	8384	10654	6359	7941	8342
Interquartile	3382	2133	2632	2299	2219	3023
hh		0.00013	0.00009	0.00051	0.00053	0.00001
HH		7610	10734	1967	1871	94648
Top Share		0.00087	0.00054	0.00251	0.00142	0.00003
Sector-TTWA	13393	13393	13393	1575	1575	13108
Services-MacroSec	1624	1624	1624	409	409	1068
Sectors	663	663	663	354	354	662
MacroSec	56	56	56	49	49	54
Services	29	29	29	14	14	22
TTWA	226	226	226	178	178	226
Macro Sector						
hh		0.03501	0.0315	0.05102	0.05788	0.09889
HH		29	32	20	17	10
Top Share		0.06265	0.05358	0.09568	0.10542	0.19316

Source: Own computation. Data obtained combining ARD/ABS, ITIS (ONS). Summary of the shock distribution weighted by the share measures. Each column indicates the share used in the weight: employment share (column 2), usage share (column 3), employment share conditional on importing the service (column 4), employment share using the re-weighting measure proposed by Borusyak et al. (2022) (column 5), usage share using the re-weighting measure proposed by Borusyak et al. (2022) (column 6).

The results are reassuring considering that the instrument is incomplete when using the usage share, hence, if a service is not input at the beginning, the shock would be unallocated. Further, when computing the concentration by aggregate macro sectors and adjusting by the trade shock, the distribution using employment shares seems relatively less homogeneous with a top value of around 20%. However, when repeating the same exercise with the usage shares, the allocation of the shocks is still homogenously distributed. For this reason, the preferred IV specification in the firm-level and quantile analysis employs usage shares.

Table C.5: **Shock distribution weighted by usage shares**

	(1) Unweighted	(2) Fixed	(3) Period	(4) Adjusted
Mean	3837	2354	3687	4032
Sd	11579	3829	9576	5042
Interquartile	3382	2690	2901	4735
hh		0.00197	0.00123	0.00008
HH		507	812	13129
Top Share		0.00566	0.00413	0.00213
Sector-TTWA	13393	13393	13393	11582
Services-MacroSec	1624	1624	1624	604
Sectors	663	663	663	617
MacroSec	56	56	56	48
Services	29	29	29	19
TTWA	226	226	226	224
Macro Sector				
hh		0.03849	0.0264	0.0590
HH		26	38	17
Top Share		0.08662	0.04939	0.132

Source: Own computation. Data obtained combining ARD/ABS, ITIS (ONS). Summary of the shock distribution weighted by the share measures. Each column indicates which share is used in the weight: employment share (column 2), usage share (column 3), employment share conditional on importing the service (column 4), employment share using the re-weighting measure proposed by Borusyak et al. (2022) (column 5), usage share using the re-weighting measure proposed by Borusyak et al. (2022) (column 6).

As final step, I estimate the employment and average wage elasticity re-weighting the shocks as suggested in Borusyak et al. (2022), comparing the results of the main analysis (Table C.6). When accounting for the confidence interval, the coefficients are similar across all specifications for employment. For average wages the results change in sign when implementing the specification as in Borusyak et al. (2022) and are substantially different even when accounting for the confidence interval. However, the F-test for columns 3-5 for average wages are extremely low and one should be careful in interpreting these results.

I have identified the main variation of the instrument changes in the services trade flow at the industry level. However, the shift-share literature discusses the cases when the variation of the instrument comes from the allocation terms and the necessary condition to satisfy the quasi-random assignment of the shocks. Jaeger et al. (2018) highlight how initial shares, even if fixed at the beginning of the analysis, might be endogenously determined by unobservable at the unit level, which might affect the precision of the second stage. It is the case for the studies using initial shares of immigrants in local labour markets to allocate shocks. The argument is that initial immigration shares might be determined by unobservable, affecting the validity of the IV. As a solution, the authors propose a double instrument using the initial shares and further lagged shares. In the case of the present study, it would require implementing an instrument taking into account the initial shares and the shares 5-10 years before the analysis. Unfortunately, such a solution is not feasible with the research question and the data availability: Services trade and its recording of the flows rise from 2000 onwards; constructing

Table C.6: **Shift-share estimate**

	(1)	(2)	(3)	(4)	(5)
A. Employment					
Broad Offshoring	0.2466***	0.2466***	0.3089***	0.6880***	0.6880***
	(0.0025)	(0.0138)	(0.0751)	(0.1976)	(0.2071)
F-test	1848	534	16	12	11
B. Average Wage					
Broad Offshoring	0.1089***	0.0640***	-0.1908**	-0.5327***	-0.5327**
	(0.002)	(0.0113)	(0.0935)	(0.2054)	(0.2348)
F-test	1848	534	4	6	5
TTWA # Year	√	√			
Sector # Year	√	√			
Year			√	√	√
Service			√	√	√
Macro Industry				√	√
N	203,669	203,669	4,408	4,408	4,408

Source: Own computation. Data obtained combining ARD/ABS, ITIS (ONS). Standard errors in parenthesis are clustered at the sector-local area level in column 1, at the macto-sector level in columns 2 and 5, robust in columns 3-4. Dependent variables: Logarithm of Employment (panel A), Logarithm of Average Wage (Panel B). Columns 1 and 2 show the second stage coefficient when implementing as IV the offshoring of services in Australia, Canada, Japan and South Korea from the US, Germany, France and Ireland. The instrument constructed with usage share computed in different periods (2000, 2005, 2010). * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

input shares before 2000 would omit a large shares of local labour markets (similarly for employment shares).

Similarly, Goldsmith-Pinkham et al. (2020) shows the importance of exogenous shares, proposing to test for the correlation with the industry composition, check for pre-trends and to perform over-identification tests. If I assume that the exogeneity of the instrument comes from the shares, enough arguments exist to support their exogeneity. In the empirical specifications, the first and second stage regressions include time-varying control variables at the sector-local area. Therefore the model includes observable characteristics in the sector-local area that might determine higher shares in the first place. Further, the unit of analysis allows for the inclusion of both industry-time and local area-time fixed effects to absorb any sector and geographical shocks. Finally, as shown in tables C.4 and C.5, employment and usage shares are small on average and at the extremes; meaning that there are not sector-local areas or macro sectors working as an outlier and driving the main results even when accounting for incomplete shares.

D Robustness and Sensitivity checks

Table D.1: **Employment and average wage elasticity to services offshoring**

	(1) OLS	(2) IV Emp 1999	(3) IV Emp	(4) IV Use	(5) IV Emp Imp
A. Employment					
Broad Offshoring	0.1324^{***}	0.1981^{***}	0.2049^{***}	0.1479^{***}	0.1440^{***}
	(0.0021)	(0.0073)	(0.0057)	(0.0067)	(0.0096)
B. Average Wage					
Broad Offshoring	0.0505^{***}	0.0719^{***}	0.0718^{***}	0.0640^{***}	0.0701^{***}
	(0.002)	(0.0072)	(0.0058)	(0.0073)	(0.011)
		First Stage			
IV		0.7076^{***}	0.7254^{***}	1.0777^{***}	0.9236^{***}
		(0.0169)	(0.0127)	(0.0257)	(0.0296)
F stat (Kleibergen-Paap)		1742	3239	1753	976
Controls	√	√	√	√	√
TTWA # Year	√	√	√	√	√
Sector # Year	√	√	√	√	√
N	203,669	203,669	203,675	203,675	203,669

Source: Own computation. Data obtained combining ARD/ABS, ITIS datasets (ONS). Standard errors in parentheses are clustered at the sector-local area level. Dependent variable: Logarithm of Employment (panel A), Logarithm of Average Wage (Panel B). IV is the offshoring of services in Australia, Canada, Japan and South Korea from the US, Germany, France and Ireland. "IV Emp 1999" is the instrument constructed using employment shares fixed in 1999. "IV Emp" is the instrument constructed as employment share computed in different periods (2000, 2005, 2010). "IV Use" is the instrument constructed with usage share computed in different periods (2000, 2005, 2010). "IV Emp Imp" is the instrument constructed with employment share conditional on importing a service in each year and computed in different periods (2000,2005,2010). Control variables LLM: log of share of British owned firms, log population of firms and the log of expenditure in computer service, lagged 1 year. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

Table D.2: **Employment and average wage elasticity to services offshoring**

	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV
A. Employment						
Broad Offshoring	0.1324^{***}	0.2049^{***}				
	(0.0021)	(0.0057)				
Broad Offshoring, ARD			0.0959^{***}	0.2225^{***}		
			(0.0013)	(0.0065)		
Narrow Offshoring					0.1230^{***}	0.2043^{***}
					(0.0025)	(0.0135)
B. Average Wage						
Broad Offshoring	0.0505^{***}	0.0718^{***}				
	(0.002)	(0.0058)				
Broad Offshoring, ARD			0.0808^{***}	0.0779^{***}		
			(0.0015)	(0.0062)		
Narrow Offshoring					0.0576^{***}	0.1404^{***}
					(0.0025)	(0.0151)
First Stage						
IV		0.7254^{***}		0.6681^{***}		0.7437^{***}
		(0.0127)		(0.0136)		(0.0329)
F stat (Kleibergen-Paap)		3239		2417		510
Controls	√	√	√	√	√	√
TTWA # Year	√	√	√	√	√	√
Sector # Year	√	√	√	√	√	√
N	203,669	203,669	203,675	203,675	203,669	203,669

Source: Own computation. Data obtained combining ARD/ABS, ITIS datasets (ONS). Standard errors in parentheses are clustered at the sector-local area level. Dependent variable: Logarithm of Employment (panel A), Logarithm of Average Wage (Panel B). IV is the offshoring of services in Australia, Canada, Japan and South Korea from the US, Germany, France and Ireland. The instrument is constructed with employment share computed in different periods (2000,2005,2010). Control variables LLM: log of share of British owned firms, log population of firms and the log of expenditure in computer service, lagged 1 year. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

Table D.3: **Employment and average wage elasticity to services offshoring, controlling for services exports**

	Base			Export Controls		
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV Emp	IV Use	OLS	IV Emp	IV Use
A. Employment						
Broad Offshoring	0.12***	0.17***	0.14***	0.11***	0.18***	0.11***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)
Services Exports,				0.03***	0.00	0.02***
1 year lag				(0.00)	(0.00)	(0.00)
B. Average Wage						
Broad Offshoring	0.05***	0.06***	0.06***	0.04***	0.03***	0.04***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)
Services Exports,				0.02***	0.02***	0.02***
1 year lag				(0.00)	(0.00)	(0.00)
	First Stage					
IV		0.85***	1.17***		0.53***	0.76***
		(0.01)	(0.02)		(0.01)	(0.02)
F stat (Kleibergen-Paap)		5463.14	2807.08		5463.14	1293.45
Controls	√	√	√	√	√	√
TTWA # Year	√	√	√	√	√	√
Sector # Year	√	√	√	√	√	√
N	203,527	203,527	203,527	203,291	203,291	203,291

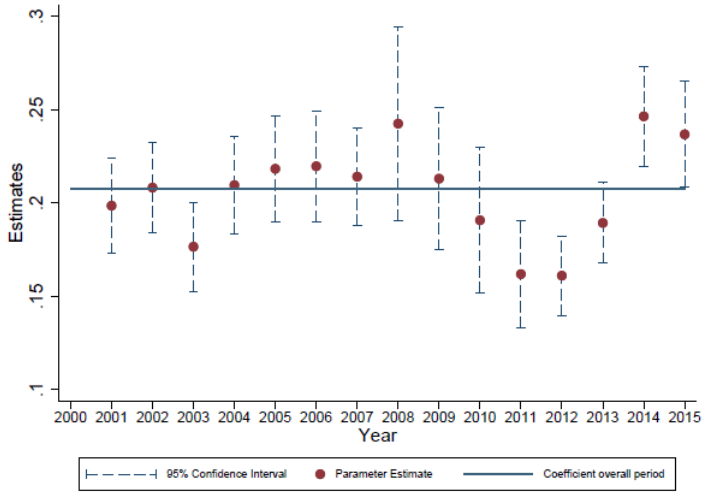
Source: Own computation. Data obtained combining ARD/ABS, ITIS datasets (ONS). Standard errors in parentheses are clustered at the sector and local area level. Dependent variable: Logarithm of Employment (panel A), Logarithm of Average Wage (Panel B). IV is the offshoring of services in Australia, Canada, Japan and South Korea from the US, Germany, France and Ireland. "IV Emp" is the instrument constructed as employment share computed in different periods (2000, 2005, 2010). "IV Use" is the instrument constructed with usage share computed in different periods (2000, 2005, 2010). Control variables LLM: log of share of British owned firms, log population of firms and the log of expenditure in computer service, lagged 1 year. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

Table D.4: **Employment and average wage elasticity to services offshoring, lagged by 1 or 2 years**

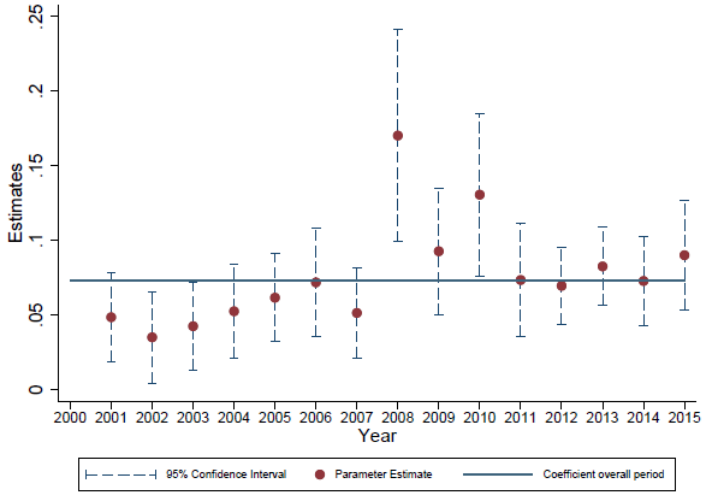
	(1) OLS	(2) IV Emp	(3) IV Use	(4) OLS	(5) IV Emp	(6) IV Use
A. Employment						
Offshoring,	0.0852^{***}	0.1854^{***}	0.1318^{***}			
1 year lag	(0.0023)	(0.0063)	(0.0074)			
Offshoring,				0.0775^{***}	0.1548^{***}	0.1169^{***}
2 years lag				(0.0024)	(0.0066)	(0.0082)
B. Average Wage						
Offshoring,	0.0295^{***}	0.0796^{***}	0.0648^{***}			
1 year lag	(0.0023)	(0.0065)	(0.0084)			
Offshoring,				0.0298^{***}	0.0628^{***}	0.0578^{***}
2 years lag				(0.0024)	(0.0071)	(0.0091)
First Stage						
Broad Instrument,		0.7248^{***}	1.0512^{***}			
2 years lag		(0.0141)	(0.0271)			
Broad Instrument,					0.7638^{***}	1.0544^{***}
3 years lag					(0.0162)	(0.0293)
F stat (Kleibergen-Paap)		2,650	1,509		2,212	1,296
Controls	√	√	√	√	√	√
TTWA # Year	√	√	√	√	√	√
Sector # Year	√	√	√	√	√	√
N	156,316	156,316	156,316	128,154	128,154	128,154

Source: Own computation. Data obtained combining ARD/ABS, ITIS datasets (ONS). Standard errors in parentheses are clustered at the sector and local area level. Dependent variable: Logarithm of Employment (panel A), Logarithm of Average Wage (Panel B). IV is the offshoring of services in Australia, Canada, Japan and South Korea from the US, Germany, France and Ireland. "IV Emp" is the instrument constructed as employment share computed in different periods (2000, 2005, 2010). "IV Use" is the instrument constructed with usage share computed in different periods (2000, 2005, 2010). Control variables LLM: log of share of British owned firms, log population of firms and the log of expenditure in computer service, lagged 1 year. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

Figure D.1: **Elasticity of employment and average wage to services offshoring by year**



(a) Employment Elasticity



(b) Average Wage Elasticity

Source: Own computation. Data obtained combining ARD/ABS, ITIS datasets (ONS). Second stage regression coefficients by year. IV is the offshoring of services in Australia, Canada, Japan and South Korea from the US, Germany, France and Ireland. The instrument constructed with usage share computed in different periods (2000, 2005, 2010). Control variables LLM: log of share of British owned firms, log population of firms and the log of expenditure in computer service, lagged 1 year. Each regression contains sector and local area fixed effects.

Table D.5: **Productivity elasticity to services offshoring**

	(1) OLS	(2) IV Emp	(3) IV Use	(4) OLS	(5) IV Emp
Broad Offshoring	0.1681^{***}	0.2649^{***}	0.1891^{***}		
	(0.0052)	(0.012)	(0.0149)		
Broad Offshoring, ARD measure				0.1366^{***}	0.2876^{***}
				(0.0034)	(0.0132)
		First Stage			
Broad Instrument		0.7254^{***}	1.0777^{***}		0.6681^{***}
		(0.0127)	(0.0257)		(0.0136)
F stat (Kleibergen-Paap)		3239	1753		1922
Controls	√	√	√	√	√
TTWA # Year	√	√	√	√	√
Sector # Year	√	√	√	√	√
N	203,669	203,669	203,669	203,675	203,675

Source: Own computation. Data obtained combining ARD/ABS, ITIS datasets (ONS). Standard errors in parentheses are clustered at the sector and local area level. Dependent variable: Logarithm of Productivity. 'IV is the offshoring of services in Australia, Canada, Japan and South Korea from the US, Germany, France and Ireland. "IV Emp" is the instrument constructed as employment share computed in different periods (2000, 2005, 2010). "IV Use" is the instrument constructed with usage share computed in different periods (2000, 2005, 2010). Control variables LLM: log of share of British owned firms, log population of firms and the log of expenditure in computer service, lagged 1 year. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

Table D.6: **Robustness Check**

	Employment			Average Wage		
	OLS	IV Emp	IV Use	OLS	IV Emp	IV Use
A. Excluding 2008						
Broad Offshoring	0.13***	0.21***	0.15***	0.05***	0.07***	0.06***
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
IV		0.74***	1.09***		0.74***	1.09***
		(0.01)	(0.03)		(0.01)	(0.03)
N	182,540	182,540	182,540	182,540	182,540	182,540
B. Excluding 2014 and 2015						
Broad Offshoring	0.13***	0.20***	0.15***	0.05***	0.07***	0.06***
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
IV		0.77***	1.07***		0.77***	1.07***
		(0.01)	(0.03)		(0.01)	(0.03)
N	164,677	164,677	164,677	164,677	164,677	164,677
C. Excluding London						
Broad Offshoring	0.14***	0.22***	0.16***	0.05***	0.06***	0.05***
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
IV		0.71***	1.08***		0.71***	1.08***
		(0.01)	(0.03)		(0.01)	(0.03)
N	183,251	183,251	183,251	183,236	183,236	183,236
D. Excluding Royalties and Licensing						
Broad Offshoring	0.13***	0.21***	0.15***	0.05***	0.07***	0.07***
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
IV		0.70***	1.07***		0.70***	1.07***
		(0.01)	(0.03)		(0.01)	(0.03)
N	203,046	203,046	203,046	203,031	203,031	203,031
E. Including trade between related firms						
Broad Offshoring	0.13***	0.20***	0.15***	0.05***	0.07***	0.06***
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
IV		0.75***	1.09***		0.75***	1.09***
		(0.01)	(0.03)		(0.01)	(0.03)
N	203,690	203,690	203,690	203,675	203,675	203,675
F. Using Information from Local Units						
Broad Offshoring	0.1479***	0.2785***	0.2142***	0.0269***	0.0291***	0.0367***
	(0.0021)	(0.0061)	(0.0073)	(0.0019)	(0.0052)	(0.0072)
IV		0.7397***	1.1185***		0.7397***	1.1185***
		(0.0125)	(0.026)		(0.0125)	(0.026)
N	308,507	308,507	308,507	308,490	308,490	308,490
Controls	√	√	√	√	√	√
TTWA # Year	√	√	√	√	√	√
Sector # Year	√	√	√	√	√	√

Source: Own computation. Data obtained combining ARD/ABS, ITIS datasets (ONS). Standard errors in parentheses are clustered at the sector-local area level if not specified differently. Dependent variables: Logarithm of Employment and Logarithm of Average Wage. IV is the offshoring of services in Australia, Canada, Japan and South Korea from the US, Germany, France and Ireland. "IV Emp" is the instrument constructed as employment share computed in different periods (2000, 2005, 2010). "IV Use" is the instrument constructed with usage share computed in different periods (2000, 2005, 2010). Control variables LLM: log of share of British owned firms, log population of firms and the log of expenditure in computer service, lagged 1 year. All regressions include sector-year and local area-year fixed effects. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

Table D.7: **Sensitivity Check**

	Employment			Average Wage		
	OLS	IV Emp	IV Use	OLS	IV Emp	IV Use
A. Robust Standard Errors						
Broad Offshoring	0.13^{***}	0.21^{***}	0.15^{***}	0.05^{***}	0.07^{***}	0.07^{***}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
IV		0.73^{***}	1.08^{***}		0.73^{***}	1.08^{***}
		(0.01)	(0.02)		(0.01)	(0.02)
N	189,100	189,100	189,100	189,100	189,100	189,100
B. Macro-Sector Cluster						
Broad Offshoring	0.13^{***}	0.21^{***}	0.15^{***}	0.05^{***}	0.07^{***}	0.06^{***}
	(0.004)	(0.01)	(0.01)	(0.004)	(0.01)	(0.01)
IV		0.73^{***}	1.08^{***}		0.73^{***}	1.08^{***}
		(0.04)	(0.05)		(0.04)	(0.05)
N	203,669	203,669	203,669	203,669	203,669	203,669
C. Average Instrument						
Broad Offshoring	0.13^{***}	0.21^{***}	0.15^{***}	0.05^{***}	0.07^{***}	0.07^{***}
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
IV		0.73^{***}	1.08^{***}		0.73^{***}	1.08^{***}
		(0.01)	(0.03)		(0.01)	(0.03)
N	189,100	189,100	189,100	189,085	189,085	189,085
D. Excluding Ireland from Instrument						
Broad Offshoring	0.13^{***}	0.21^{***}	0.15^{***}	0.05^{***}	0.07^{***}	0.07^{***}
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
IV		0.73^{***}	1.08^{***}		0.73^{***}	1.08^{***}
		(0.01)	(0.03)		(0.01)	(0.03)
N	189,100	189,100	189,100	189,085	189,085	189,085
E. Using ONS population weights						
Broad Offshoring	0.1141^{***}	0.1961^{***}	0.1498^{***}	0.0436^{***}	0.0553^{***}	0.0407^{***}
	(0.0018)	(0.0042)	(0.0054)	(0.0018)	(0.0047)	(0.0047)
IV		0.7892^{***}	1.1902^{***}		0.7892^{***}	1.1901^{***}
		(0.0125)	(0.0228)		(0.0125)	(0.0228)
N	189,071	189,071	189,071	189,056	189,056	189,056
F. No Weights						
Broad Offshoring	0.1571^{***}	0.2718^{***}	0.2155^{***}	0.0400^{***}	0.0551^{***}	0.0580^{***}
	(0.0023)	(0.0059)	(0.0073)	(0.0021)	(0.0048)	(0.0061)
IV		0.8352^{***}	1.1814^{***}		0.8352^{***}	1.1814^{***}
		(0.011)	(0.0198)		(0.011)	(0.0198)
N	189,765	189,765	189,765	189,594	189,594	189,594
Controls	√	√	√	√	√	√
TTWA # Year	√	√	√	√	√	√
Sector # Year	√	√	√	√	√	√

Source: Own computation. Data obtained combining ARD/ABS, ITIS datasets (ONS). Standard errors in parentheses are clustered at the sector-local area level if not specified differently. Dependent variables: Logarithm of Employment and Logarithm of Average Wage. IV is the offshoring of services in Australia, Canada, Japan and South Korea from the US, Germany, France and Ireland. "IV Emp" is the instrument constructed as employment share computed in different periods (2000, 2005, 2010). "IV Use" is the instrument constructed with usage share computed in different periods (2000, 2005, 2010). Control variables LLM: log of share of British owned firms, log population of firms and the log of expenditure in computer service, lagged 1 year. All regressions include sector-year and local area-year fixed effects. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

E Extensions

In section 4, I define services offshoring as the imports of intermediate services in a sector-local area. However, a firm can be affected by other firms' trade in the same sector, as mentioned in the study of Autor et al. (2013), or the same geographical area as in the research by Kovak (2013). In the final step, I explore how the results may differ depending on the definition of local labour markets: sector-local area versus sector versus local area. The unit of analysis for the dependent variables is at the firm level, while sector and local area offshoring are the aggregates of firms' imports within each sector or local area lagged one year. Of all the three offshoring measures, sector-local area services offshoring is the only one with a positive impact on employment, differently from the sector and local area offshoring leading to a reduction in it (panel A Table E.1). Similarly, average wage elasticity to services offshoring is the highest in the sector-local area compared to the other two measures. Hence, depending on the definition of local labour markets, employment and average wage elasticity to services offshoring have dissimilar signs highlighting potential differences in labour market adjustment mechanisms, as stated in Helm (2020) .

The country of origin of offshoring might lead to diverse effects on the labour market. Ebestein et al. (2014), for example, show that manufacturing offshoring towards low-income countries tends to decrease wages and employment in routine occupations, while the effects are non-significant when offshoring toward high-income countries. Furthermore, I look at the employment and average elasticity to services offshoring depending on the country of origin of services. I distinguish services trade flows between EU countries, North America (the US and Canada), BRICS (Brasil, Russia, India, China and South Africa) and the composite of countries I labelled as "fast-growing": India, UAE, Singapore, Poland and China. I implement a different regression for each country group at the firm level, lagging the services trade flows by one year to reduce the endogeneity of the observation. Further, I only consider the broad services offshoring as the distinction between narrow and input offshoring would limit the power of the data.

Fast-growing countries have the highest employment elasticity to services offshoring compared to the mean elasticity, followed by offshoring to BRIC (Figure E.1). As for average wages, the results are similar across all countries. Therefore, and differently from manufacturing, services offshoring towards low-income countries does not have detrimental effects on local employment and average wage. The latter result is consistent with what was observed by Liu and Trefler (2019) estimating the impact on the labour force of services imports from China and India in the US. However, the type of service offshored to each country might drive the overall results, a fruitful topic I leave for future research.

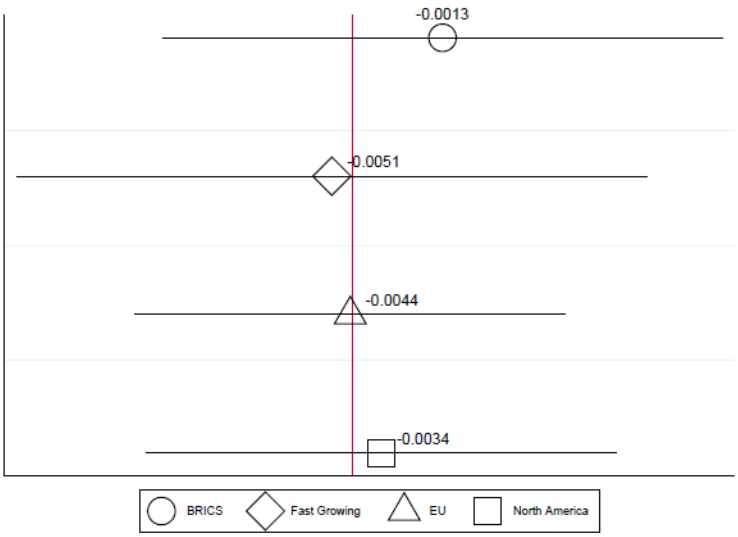
Table E.1: **Employment and average wage elasticity to services offshoring, different definition of local labour markets**

	(1) Sector-Local Area	(2) Sector	(3) Local Area	(4) All
A. Employment				
Importer status =1	0.3172***	0.3333***	0.3400***	0.3342***
	(0.036)	(0.0365)	(0.0331)	(0.0336)
Offshoring,	0.0056***			0.0070***
1 year lag	(0.0011)			(0.0011)
Sector Offshoring ,		-0.0147***		-0.0165***
1 year lag		(0.0022)		(0.0021)
Local Area Offshoring ,			-0.0081***	-0.0103***
1 year lag			(0.0012)	(0.0012)
B. Average Wage				
Importer status =1	0.2553***	0.2588***	0.2821***	0.2886***
	(0.09)	(0.0903)	(0.0881)	(0.0889)
Offshoring,	-0.0044			0.0035
1 year lag	(0.0035)			(0.0035)
Sector Offshoring ,		-0.0072		-0.0067
1 year lag		(0.0067)		(0.0065)
Local Area Offshoring ,			-0.0052	-0.0054
1 year lag			(0.0037)	(0.0037)
Control LLM	√	√	√	√
Control Firm	√	√	√	√
TTWA # Year	√		√	
Sector # Year	√	√		
TTWA		√		√
Year		√	√	√
Sector			√	√
N	452,846	452,982	453,079	453,212

Source: Own computation. Data obtained combining ARD/ABS, ITIS datasets (ONS). Standard errors in parentheses are robust. All offshoring measure are Broad Offshoring. Dependent variables: Logarithm of Employment (panel A), Logarithm of Average Wage (Panel B).Control variables LLM: log of share of British owned firms, log population of firms and the log of expenditure in computer service, lagged 1 year. Control variables firms: productivity measured as gross value added at market price, dummy variable on ownership status, dummy variable on exporting status. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

Figure E.1: **Elasticity to services offshoring by country of origin of services**

(a) Employment Elasticity



(b) Average Wage Elasticity

Source: Own computation. Data obtained combining ARD/ABS, ITIS datasets (ONS). Offshoring flows are lagged by one year. Each regression contains sector-year and local area-year fixed effects. All regressions contain firm-level control variables: productivity measured as gross value added at market price, dummy variable on ownership status, dummy variable on exporting and importing status. Control variables LLM: log of share of British owned firms, log population of firms and the log of expenditure in computer service, lagged 1 year. The red line in each graph indicates the regression coefficient when the trade flows are aggregated.

Table E.2: **Imitation Channel**

	(1) Start Importing	(2) Start Importing next period
Broad Offshoring	0.0849***	0.0564***
	(0.0047)	(0.004)
British Owned firms	-0.0218	-0.1076***
	(0.0158)	(0.0138)
ICT	0.0095	0.0183***
	(0.0068)	(0.0061)
Firms population	-0.0557***	0.0016
	(0.0123)	(0.0111)
Firm Productivity	0.0598***	0.0501***
	(0.0075)	(0.0079)
Firm ICT	0.0356***	0.0940***
	(0.0102)	(0.0084)
Firm exporting status	1.6459***	0.3716***
	(0.0479)	(0.053)
Observations	418,818	429,977

Source: Own computation. Data obtained combining ARD/ABS, ITIS datasets (ONS). Standard errors in parentheses are clustered at the sector-local area level. Dependent variables: Probability to start importing services in subsequent periods. * $(p < 0.10)$, ** $(p < 0.05)$, *** $(p < 0.01)$

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