Within-industry co-agglomeration patterns*

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Abstract

This study focuses on the spatial distribution patterns of manufacturing and service firms in France and the United Kingdom. By exploiting a large micro-dataset covering the whole population of French and British establishments over the period 2008-2015, I analyse the specific co-agglomeration patterns that characterise various types of plant within each industry. Industry-group location patterns are analysed interpreting agglomeration/coagglomeration estimates within a common framework. By comparing the main within-industry patterns identified in the two macro-sectors, I am able to test some of the most relevant dynamics predicted in the recent literature on agglomeration economies. I find significant within-industry heterogeneity in spatial agglomeration. Large plants, and more productive and multi-plant firms are generally more agglomerated, although the difference with the overall distribution varies across sectors and countries. On the other hand, I do not find specific location patterns for new entries and exiters. This suggests that the general dispersion trend characterising the two sectors might be driven primarily by between-firm reallocation of resources rather than demographic events.

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3.1 Introduction

This chapter analyses the spatial distribution of manufacturing and service firms in France and the United Kingdom. By exploiting a large micro-dataset covering the whole population of French and British establishments over the period 2008-2015, I analyse the specific co-agglomeration patterns that characterise various types of plants within each industry.

It is a fact that industries tend to be geographically concentrated. The benefits that firms gain by locating near each other have been studied by an extensive and heterogeneous literature (among others, Sveikauskas,1975; Moomaw, 1981; Carlton, 1983; Henderson, 1986; Nakamura, 1985; Glaeser et al, 1992; Henderson et al, 1994; and Ciccone & Hall, 1996). Marshall in 1890 was the first economist to theorise and analyse this specific dynamic; he argued that the cities foster firm productivity through labour market pooling, input sharing and technological spillovers.
Modern empirical literature on the topic has focused on the concept of agglomeration economies, i.e. the idea that firms benefit mutually from their presence on the same territory. These kinds of studies are usually referred to as 'urbanisation economies' (Jacobs externalities), when the benefits arise from the size of the overall market, and 'localisation economies' (Marshall-Arrow-Romer externalities), when they depend on geographic concentration at the industry level (Dicken & Lloyd, 1990; Glaeser et al., 1992).

In recent decades, a new branch of the literature has questioned the implicit assumption that agglomeration economies are driven by the same forces in different economic environments and industries. Several studies have separately analysed Marshall's agglomeration forces, offering empirical evidence for each of them (Fallick et al., 2006; Almazan et al., 2007; Holmes, 1999; Arzaghi & Henderson, 2008; Lin, 2012). Duranton and Puga (2004) further analysed the sources of agglomeration economies, proposing a different taxonomy on the basis of the concepts of sharing, matching and learning. Modelling each mechanism, they suggested a relevant role for firms' and workers' heterogeneity in determining the effective outcome of agglomeration forces. Strange et al. (2006) analysed the three mechanisms in relation to both urbanisation and localisation economies, suggesting competitive instability and technological innovativeness to be associated with city size, and skill-orientation to be more relevant for industry clustering. Glaeser and Kerr (2009) and Rosenthal and Strange (2010) focused instead on firm dimension, theorising an organisational dimension for agglomeration effects. In order to disentangle the drivers responsible for agglomeration dynamics in different industries, Ellison and Glaeser (2010) proposed a new approach, focusing on the concept of coagglomeration, the tendency of industries to locate together. Following this approach, Faggio, Silva and Strange (2014) develop a unified framework to analyse heterogeneity in industrial agglomeration and its implications for the micro-foundations of agglomeration economies. On the basis of a comprehensive analysis, they question the external validity of the mixed results found in the literature. Specifically, they demonstrate that agglomeration economies and, in particular, the relative and absolute strength of the underlying drivers vary consistently with respect to the specific characteristics of industries and firms.

Other studies argue that agglomeration effects could be heterogeneous even within industries. The way external economies affect firm behaviour and performance would depend on various firm-specific characteristics. Békés, Kleinert and Toubal (2009), using Hungarian data, report a heterogeneous response from agglomeration spillovers, demonstrating that while the most productive firms gain substantially, laggards lose out on higher presence of foreign firms. Combes et al. (2012) develop and econometric strategy to distinguish firm selection from the other factors behind the productivity premium of denser areas, studying the distribution pattern of total factor productivity at the firm-level. The study concludes that the observed productivity advantages that characterise French metropolitan firms are not simply due to the selection of the most productive firms, but are also driven by external economies of scale. It also demonstrates that agglomeration effects increase with the firm productivity.

This study contributes to this literature by shedding new light on the specific agglomeration and co-agglomeration patterns that characterise certain plant types within industries. Plants are analysed with respect to size, ownership, demographic characteristics and other firm and plant-level dimensions. Results are discussed on the basis of the main predictions of the recent literature on agglomeration economies.

The literature on regional and urban economics has produced various measures to analyse the distribution of industries over space. Traditional discrete indices of spatial agglomeration, such as the one proposed by Ellison and Glaeser (2003), depend heavily on the spatial unit of analysis used. This well-known issue is commonly described in the literature as the modifiable area unit problem (Openshaw & Taylor, 1979, Arabia 1989, Briant et al., 2010). Although discrete indices can still provide interesting insights with respect to the actual distribution of a set of industries belonging to a common sector at a given moment in time, they fail to provide comparable estimates for cross-country or cross-sector analysis. A new class of continuous indices have been proposed as a valuable alternative to the traditional discrete measures. In this regard, the first contribution dates back to Ripley (1976). Ripley's *K* measures the spatial concentration or dispersion of points in space, compared to a complete spatial randomness benchmark. The K function is estimated by calculating the average number of neighbouring plants within circles of increasing radius around the establishment. Since it requires the calculation of bilateral distances between all spatial points analysed, computational constraints limited its application in the early urban economics literature. Marcon and Puech (2003) proposed a Besag L-transformation of Ripley's K, with a benchmark value of 0. This index and the different extensions provided by the literature (see Marcon and Puech, 2017 for a comprehensive review) do not generally allow the weight of points on the basis of meaningful characteristics, nor provide meaningful benchmarks other than the unrealistic random distribution. With respect to the agglomeration literature, Duranton and Overman (2005) define a set of properties a spatial agglomeration index should satisfy:

- be comparable across industries;
- control for the overall agglomeration of manufacturing;

- control for industrial concentration in the sense of Ellison and Glaeser (1997);
- be unbiased with respect to scale and aggregation; and
- provide an indication of the significance of the results

Duranton and Overman develop an index that satisfies all these properties. The DO function can be interpreted as the probability density to find a neighbouring spatial point at a given distance from the point of interest. The function is subsequently analysed against a confidence interval estimated through Monte Carlo simulations over 1,000 random draws from the overall sector.

In this study I use the DO function to analyse the spatial distribution of plants within industries. Its specific characteristics make it possible to compare plant-types across industries, countries and years.
Moreover, in contrast to main discrete indices, it provides meaningful values even when analysing small group of plants and establishments of different sizes. Following Behrens (2017), I integrate the function up to different distance threshold, to get the probability for a random firm pair bilateral distance to be lower or equal than d.

3.2. Data

Establishment- and firm-level data are retrieved from two sets of confidential datasets provided by the French and British Institutes of Statistics.

France

Data are retrieved from two administrative sources made available by the INSEE (the French national statistical agency) to researchers with access to CASD secure lab. The first source is the Declarations Annuelles de Donnes sociales (DADS). Every year all French workers are expected to submit to the tax authority information about all incomes earned over the previous 12 months. The INSEE receives these data from the tax authority, merges them with other information on workers and households provided by various sources, and uses them to produce statistics about employment and wages.
The data used in this process are recorded in an exhaustive dataset, where each observation corresponds to every job contract linking a worker to a firm in a given year. For every worker, the dataset provides job-spell level information on gross and net wage, employment periods, age, sex and skills, number of hours worked, type of contract and occupational category (Professions

et categories socio-professionnelles, PCS 2003) at the 4-digit level.

The dataset FICUS/FARE, produced by INSEE/DGFiP, provides balance sheet information (output, capital, inputs, exports, number of employees, sector, etc.) for each firm registered in France from 1993 to 2016 (approximately 47 million observations). Data are retrieved from the compulsory reporting of firms and income statements to fiscal authorities in France, with no limiting threshold in terms of firm size or sales. By merging the dataset with the information provided by the Sirene (Système Informatique pour le Répertoire des Entreprises de leurs Etablissements) dataset, it is possible to assign address and precise spatial coordinates to 27 million establishments (the entire population of establishments that ever operated in France over the past 20 years). In this analysis, I drop from the sample firms subject to the micro-bin/micro-bic regimes, namely firms:

- whose principal activities are services relating to the category of business profits (BIC) or non-commercial profits (BNC)
- whose turnover does not exceed €32,600 (for 2011), excluding taxes
- which operate VAT free and do not perform an excluded activity (for example, the rental of equipment and durable consumer goods);
- which do not opt for the *régime du réel simplifié* tax system

The Liaison Financiére dataset (LIFI) provides data on all relevant financial linkages involving at least one firm located in France. For each observation, I can determine the country of residence of all foreign subsidiary/parent firms and the capital share. The median voting share owned upon acquisition is 99%, with the result that the acquisition event represents a near complete takeover of assets and control for the overwhelming majority of the sample.

Geocoded plant level data are retrieved from the Sirene database. Each plant is assigned to specific coordinates, corresponding to the address reported for fiscal purposes.
This information is missing for a small number of plants (<5%), located primarily in rural areas. In these cases, I assign the coordinate of the applicable *IRIS*. *IRIS* are the smallest French administrative unit (the French territory consists of over 49,000 IRIS areas) and plants with missing coordinates are expected to be located, on average, 400 m from their estimated location.

United Kingdom

Confidential establishments' data are retrieved from the ONS Business Structure Database 1997-2015 (Secure Access), that covers any business liable for value-added taxation and/or with at least one employee registered for tax collection. Overall, the dataset covers 99% of economic activity in the UK. The dataset provides information on postcode, ultimate owner, 5-digit industrial classification, date of creation, and number of employees for each single plant. I use

this detail to assign to each plant active in England, Wales and Scotland to the coordinates of its postcode centroid. The raw data include approximately 2.8 million local units every year. I carry out a series of checks, excluding a number of anomalous cases and checking the consistency of plants postcodes, employment and sectors of activity over the years.

Firm level data are retrieved from the Annual Respondent Database (ARD) for the period 2001-2007 and from the Annual Business Survey for the remaining years. The two datasets provide balance sheet data for a large sample of firms with more than 20 employees. In particular, the survey is known to provide particularly good coverage of manufacturing firms.

3.3. Empirical Strategy

In this section I illustrate the empirical strategy used. Following Behrens at al. (2017), I extend the continuous agglomeration index developed by Duranton and Overman (2003) and I compute agglomeration and co-agglomeration measures for a set of industries and plant types within industries. Subsequently, the distribution of the plant-type/industry-specific agglomeration indices is analysed in a common framework, to test some relevant predictions proposed in the literature.

3.3.1 Continuous agglomeration indices

Duranton and Overman's localisation index (henceforth referred to as K_j) is a continuous estimator of localisation based on the distance between every pair of plants. Denoting d_{xy} the Euclidean distance between plants x and y, the estimator of the density of bilateral distances at any point d is:

$$K_j(d) = \frac{1}{n(n-1)h} \sum_{x=1}^{n-1} \sum_{y=x+1}^{n} f\left(\frac{d - d_{xy}}{h}\right)$$

where h is the bandwidth and f is the kernel function. $K_j(d)$ will be larger when the distance between many establishment pairs is approximately d.
A slightly more advanced – although much more computationally intensive – version of the index illustrates the distribution of bilateral distances between workers in a given industry.

$$K_j^w(d) = \frac{1}{h \sum_{x=1}^{n-1} \sum_{y=x+1}^{n} (e_x + e_y)} \sum_{x=1}^{n-1} \sum_{y=x+1}^{n} f\left(\frac{d - d_{xy}}{h}\right)$$

Where d_{xy} is the distance between plant x and plant y, h is the bandwidth (500 meters), e_x and e_y are the employment levels in the two establishments.

For each industry, $K_j^w(d)$ is subsequently compared with the counterfactual K-density estimated from 1,000 simulations of bilateral distances between n randomly sampled (distinct) establishments in the aggregate industry. Local confidence intervals are then estimated for any distance between 0 and $\bar{d}$.
For each industry j, they select the 5-th and 95-th percentile to obtain a lower 5% and an upper 5% confidence interval that denote $\underline{K^w}(d)$ and $\overline{K^w}(d)$ respectively. For each industry, when $K_j^w(d) > \overline{K^w}(d)$ for at least one $d \in [0, \bar{d}]$, the industry is said to exhibit localisation at distance $\bar{d}$ (at a 5% interval). By contrast, when $K_j^w(d) < \underline{K^w}(d)$ for at least one $d \in [0, \bar{d}]$, the industry is said to exhibit dispersion at distance $\bar{d}$ (at a 5% interval).

The authors propose two simple indices to summarise the distribution pattern of each industry:

Global localisation index:

$$\gamma_j^w = \max\left(K_j^w(d) - \overline{K^w}(d), 0\right)$$

Global dispersion index:

$$\psi_w^g = \max\left(\underline{K^w}(d) - K_j^w(d), 0\right)$$

Graphically, global localisation is detected when the weighted $K_j^w(d)$ function lies above its upper confidence band, whereas global dispersion is detected when it lies below the lower confidence band and never lies above the upper confidence band.

In Figure 3. 1, I report the DO function estimated for the Nace Rev.2 industry 2361 ('Manufacture of concrete products for construction purposes') in 2008. In that year the industry counted 1,158 plants and, consequently, 1,340,964 bilateral distances. The blue line reports the weighted probability of finding a bilateral distance in each 500m bin, between 0 and 180km. The dotted lines limit the confidence interval, obtained by means of a Monte-Carlo process, where the same procedure is randomly repeated 1,000 times, on each occasion drawing a sample of 1,158 plants from the overall population of manufacturing firms (850,000 plants). For any distance threshold, the upper boundary represents the 95th percentile of the agglomeration distribution of all random draws. Symmetrically, the lower bound corresponds to the 5th percentile of the distribution. The chart shows that the probability of a pair of firms to be at a distance d from each other range between 0.01% and 3%.

Comparing the function with the sector benchmark, we can say that the concrete industry is agglomerated up to a distance threshold of 50km, while it does not deviate from the probability distribution of sector for longer distances.

The weighted K-density proposed by Duranton and Overman describes the distribution of bilateral distances between workers in a given industry. In order to obtain an index providing information on the degree of agglomeration/dispersion, I integrate the distribution function, obtaining its cumulative (CDF) up to a distance d. The values obtained represent the weighted share of plant-pairs located less than distance d from each other. Alternatively, we can view this as the probability that two randomly drawn plants in an industry will be at most d km away from each other.

$$\overline{K_j^w} = \sum\nolimits_{d \le \bar{d}} K_j^w(d)$$

This procedure was used by Behrens (2017) to study the agglomeration of Canadian manufacturing industries. The blue area in Figure 3. 2 corresponds to the $\overline{K_j^w}$ computed at a 180km threshold.

Figure 3. 1: DO function

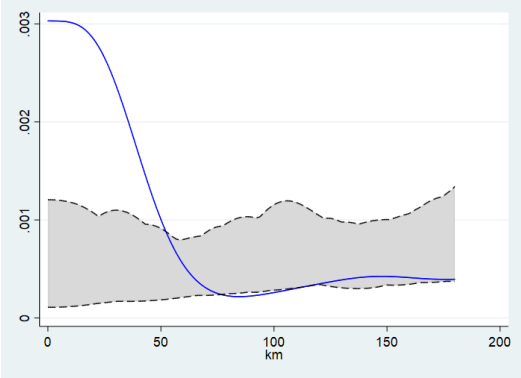
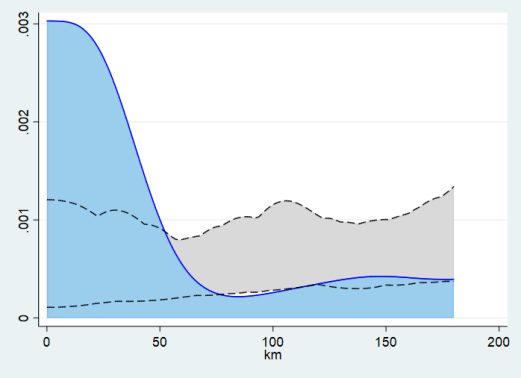


Figure 3. 2: CDF



The charts report the $\widehat{K}_w^j(d)$ agglomeration functions for the whole industry (blue line) and the confidence interval (gray area)

3.3.2 Localisation and co-localisation patterns

If the CDF can be directly used to study the location pattern of a given industry *j* in a given time *t*. A different approach is required in order to describe the location pattern of a specific group of plants *i* within an industry *j*.

Consider Figure 3. 3. Plants (blue and red dots) are clustered in three different areas. If we focus on group types and we consider the share of plants located within a distance *d* from each other, establishments *i* are found to be more agglomerated than the other plants in the area. As a matter of fact, 100% bilateral distances fall below the distance threshold. By contrast, if we measure the bilateral distances between all establishment in the industries, irrespective of the plant type, we find that *i* plants are somewhat dispersed than plants *p* (Figure 3. 4).

Figure 3. 3: Agglomeration

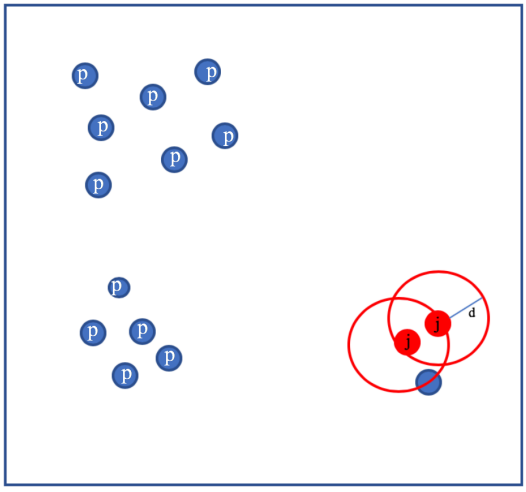
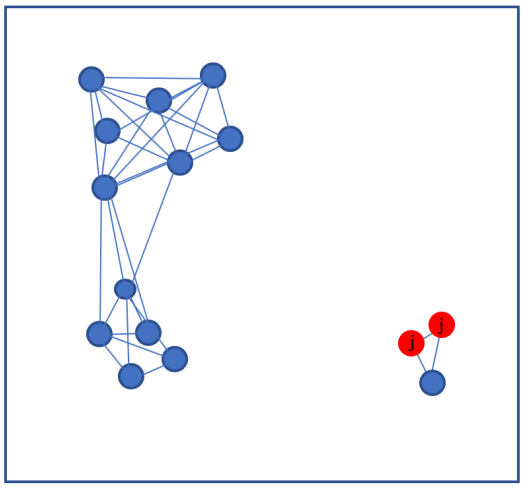


Figure 3. 4: Co-agglomeration



It is not hard to think about similar scenarios in the real world. For instance, we might find an

industry characterised by a relevant share of multi-plant firms exhibiting high levels of agglomeration of headquarters (primarily located close to the CBD) and a certain degree of dispersion when the same headquarters are related with productive plants, located in different environments, far from the CBD. It follows that industry-level measures that do not take establishment heterogeneity into account could fail to detect agglomeration or co-agglomeration patterns characterising the plants that are more sensible to agglomeration and dispersion forces. Therefore, while studying spatial agglomeration within industries, it is possible to describe three main features:

I. The agglomeration of all plants in the industry: $\overline{K_J^w}$
II. The agglomeration of plants belonging to a certain type (group agglomeration): $\overline{K_{IJ}^w}$
III. The co-agglomeration between *i*-type plants and all establishments in the industry (joint agglomeration): $\overline{K_{IJ,J}^w}$

Within each industry, we can identify various types of firms and plants on the basis of demographic characteristics, size, productivity level, foreign status, etc… All these factors might determine a different spatial configuration with respect to the other plants located in the industry. Fig. 3.5 illustrates the distribution of headquarters in the industry 2825 'Manufacture of non-domestic cooling and ventilation techniques'. In this case, the green line corresponds to the distribution of all 700 plants (490,000 bilateral distances) in the industry. The red line corresponds to the $\overline{K_{IJ}^w}(d)$ function estimated for headquarters only, while the blue line shows co-agglomeration $\overline{K_{IJ,J}^w}(d)$ estimated for all bilateral distances between a headquarter and another plant in the industry. In the case of the cooling industry, headquarters exhibit a relevant agglomeration at short distances. However, when we consider the co-agglomeration with non-headquarter, the function almost mimics the more dispersed pattern that characterise the whole sector. I provide a further example in Figure 3. 6, that illustrates the distribution of the industry 2651 'Manufacture of instruments and appliances for measuring, testing and navigation'. In this case, the distribution of the whole industry is compared with the specific spatial pattern of high-productive firms. Interestingly, firms in the top 10% of the labour productivity distribution are significantly more dispersed than less productive ones up to a 70km distance.

Figure 3. 5: DO functions, Headquarters

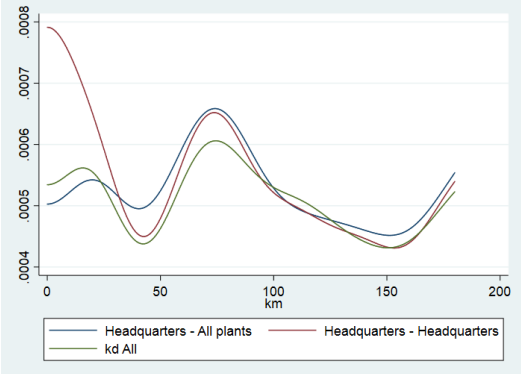
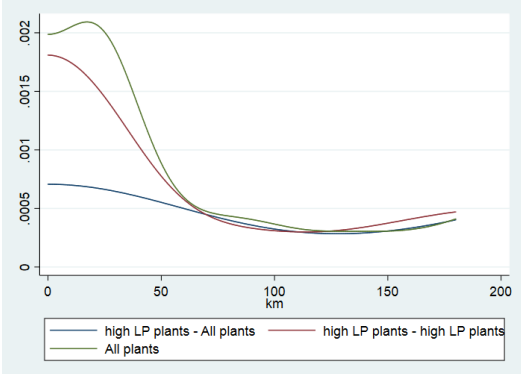


Figure 3. 6: DO functions, High LP



3.4. Agglomeration trends by macro-sectors

In this section, I analyse the evolution in agglomeration patterns of manufacturing and service firms in France and the United Kingdom. To this end, I estimate the $\overline{K_j^w}(d)$ of 124 manufacturing industries and 178 service industries in France and the United Kingdom in every year, over the period 2008-2015. Industry estimates are subsequently aggregated using employment weights.

First, it is worth noting certain geographical features that can explain the overall agglomeration (agglomeration up to 180km) in the two countries. The UK is characterised by a very agglomerated structure, with London alone accounting for more than 28% of British GDP and a very large share of service plants in many industries. Some traditional manufacturing industries are concentrated in a limited area that includes East and West Midlands, Wales and Yorkshire. France, on the other hand, has a more decentralised structure. Although Paris and the Ille de France represent a massive share of the whole economy, other important economic centres such as Lyon and Marseilles are located on the opposite side of the country, over the rural diagonal that cross the country from south-west to north-east. If the two countries cannot be compared in terms of levels, we can still compare the evolution of the respective economic geographies.

Figures 3.7-3.8 and 3.9-3.10 describe, respectively, the trends in local agglomeration patterns (up to 30km) of manufacturing and service sectors in France and the United Kingdom. In both countries, local agglomeration fluctuated over the period, with a downward trend inverted in 2012, in the aftermath of the debt crisis. France demonstrates a strikingly different pattern when plants are associated with their firm industry code, a dynamic probably associated with the general trend of domestic fragmentation. French service plants exhibit a U-shaped pattern, whereas a constant decline is registered in the UK.

Global agglomeration trends (Fig. 3.11-3.14) are more consistent, with a relevant decline in service spatial agglomeration up to 180km and a common pattern in manufacturing up to 2015, a year in which the UK experience a steady jump. Besides the fluctuating pattern that characterise the dynamic, spatial agglomeration levelled off or decreased over the period. This evidence is in line with other studies that identify a trend of de-concentration encompassing most manufacturing activities and business services in Germany (Dauth et al., 2018) and Canada (Beherens et al., 2013).

In the eight-year period under consideration, manufacturing was exposed to two main forces: technological change and trade liberalisations. On the one hand, new technologies caused a consistent reduction in labour demand for routine occupations, that once employed the large majority of British and French workers. On the other hand, reductions in trade and communication costs fostered foreign competition and offshoring. The progressive disappearance of most labour-intensive industries was complemented by the relocation of a significant part of production processes of most industries to cheaper countries. The general decline in the manufacturing sector and the consequent tertiarization process has recently been linked not only to job disruption but also to significant changes in the production process and the organisation of firms across industries. Fort (2013) analyses the recent rise of multi-plant firms in

the US manufacturing sector. In addition to merger and acquisitions (M&A) decisions, a firm might decide to segment its production over space in order to access cheaper labour or to locate different plant types in areas where they can achieve the preferred distance with respect to customers, suppliers and competitors. She demonstrates that domestic fragmentation is far more prevalent than offshoring, especially when firms can access advanced communication technology. For all these reasons, it is not surprising to see an evolution in the aggregate spatial agglomeration patterns. The same dynamics described above have driven a constant expansion of Service sector in recent years. Unlike manufacturing, however, the extreme heterogeneity that characterises the sector in terms of tradability and B2C/B2B relations makes it more difficult to define common centripetal and centrifugal forces. On the one hand, the rise in non-tradable service industries could be associated with a more dispersed distribution of plants, aimed at reaching customers far from the city centres. In contrast, new technologies have the potential to increase the tradability of certain types of services, fostering spatial agglomeration. In addition, for certain industries the dispersion could simply be driven by the dynamic pattern characterising some manufacturing industries they are connected with by significant input-output linkages.

3.5 Industrial agglomeration patterns

In this section I briefly analyse the industrial location patterns of some manufacturing and service industries. In particular, I will focus on industries exhibiting highest and lowest agglomeration levels, according to the indices used.

In Table 3. 1, I list the manufacturing industries recording the highest and lowest average levels of spatial agglomeration at 30 and 180km distance in France and in the United Kingdom. The table shows that the two countries are not symmetrical in the agglomeration ranking. However, it is possible to identify some common patterns. Among the industries recording the highest levels of local agglomeration (share of bilateral distances below 30km), I find textile and wearing apparel industries, chemical industries, industries characterised by very low transport costs (Reproduction of recorded media) or technologically advanced products (Manufacture of communication equipment) and industries that require specific environments (Manufacture of wine from grapes).

These features are also common among industries exhibiting high degree of global agglomeration (share of bilateral distances below 180km), where we also find luxury product industries (Building of pleasure and sporting boats) and craft manufactures.

Among the industries at the opposite site of the local agglomeration distribution we find manufactures of products with high storage or transport costs (manufacture of ice cream, wood, structural metal and concrete products) and industries requiring proximity to customers or dispersed geographic environments (Building of ships and floating structures). Similar patterns characterise most dispersed industries at 180km distance.

Table 3. 2 illustrates most agglomerated and dispersed service industries. In this case the patterns are even more evident. Services characterised by high tradability, such as television, sound-recording and book publishing, show the highest local and global agglomeration scores, together with the wholesale of luxury products.

The lowest local agglomeration levels are recorded for the wholesale of agricultural products and the services that are usually predominant in remote regions (Camping grounds and recreational vehicle parks, holiday and other short-stay accommodation). At 180km distance we also find the retail of products characterised by high frequency of consumption. In Appendix (Table 3. 5and Table 3. 6), I report spatial agglomeration indices for all industries in the two economies, aggregated at the 2-digit industry level using employment weights.

Overall, results are consistent with previous studies (Ellison and Glaeser, 1997; Duranton and Overman, 2005, 2008). However, before moving to the main analysis, it is important to evaluate how the continuous agglomeration index performs with respect to the standard indices used in the urban economics literature. In Table 3. 3, I report the same agglomeration rankings obtained using the Ellison and Glaeser agglomeration index (EGI). The EGI is a discrete measure that normalise spatial agglomeration with the market concentration. The way the index is constructed and its economic meaning are significantly different from the agglomeration measures used in this study. However, industry level results appear very similar. The relation between the two measures can be further appreciated in Table 3. 4, where I analyse the linear relation between the estimates obtained with the two indices. Results confirm that the two measures reach very similar results at the industry level.

3.6 Within-industry agglomeration patters

In this Section I analyse the co-agglomeration patterns that characterise certain plant-types and I compare them with the distribution of overall industries. The analysis separately focusses on the two macro-sectors and is conducted for both French and British plants, to allow cross-country comparisons. For each plat-type, sector and country, I report two kernel density plots, one illustrating the distribution of industry specific agglomeration indices ($\overline{K_J^w}$) and the other showing the distribution of the co-agglomeration indices ($\overline{K_{iJ,J}^w}$) estimated on the basis of the bilateral distances between type-*i* plants and all other establishments in the industry.

3.6.1 New entries and exiters

Spatial agglomeration of new-entries and plants that are going to quit the market the following year may result from spatial heterogeneity in turnover rates and/or from mobility patterns in business lifecycle.

Denser markets are generally associated with higher competitive pressure and productivity thresholds. Combes et al. (2012) extend the theoretical framework proposed by Melitz (2003) to justify the higher productivity threshold that characterises denser areas. This explanation, however, might be relevant only for industries characterised by high storability or transport costs. Industries facing negligible costs to ship their products to remote areas of the country should not be affected.

By contrast, the three traditional drivers of agglomeration – labour pooling, input sharing and knowledge spillovers (Duranton & Puga, 2002) – could affect differently entrants and incumbents. First, new firms are often the result of spinoffs from incumbents. Even when this is not the case, a new firm in the start-up phase often relies on the existing business environment. As a result, it is likely to locate in areas with good access to relevant labour markets and suppliers.

Heterogeneous agglomeration patterns may also result from firm lifecycle mobility. Firms that manufacture a new product are more likely to locate in so called 'nursery cities' (Duranton & Puga, 2000), which are large diversified urban areas, where they can 'test' different kinds of production process at a reasonable cost (thanks to localisation economies). Once a firm produces a prototype with its ideal production process and moves to mass-production, internal economies of scale make it less beneficial to remain in diversified areas, and the firms can relocate to the specialised cities, where all firms use the same production process. This second model would suggest that entrants exhibit lower industrial agglomeration patterns than incumbent firms.

The kernel density distributions in Figures 3.15-3.16 compare French entrants' spatial agglomeration to the agglomeration recorded for the sector as a whole. Both manufacturing and service firms exhibit a limited degree of local dispersion with respect to other plants. Moving to the global distribution (Fig. 3.17-3.18), we find a more heterogeneous pattern, with a higher share of plants at the opposite tails of the distribution.

UK plants in both manufacturing and service entrants sector exhibit a limited degree of spatial agglomeration (Fig. 3.19-3.20). This pattern disappears for manufacturing establishments at a

larger distance threshold, whereas service entrants keep exhibiting higher agglomeration than benchmark plants (Fig. 3.21-3.22).
More pronounced differences are found among French exiters, which exhibit a significant local dispersion (Fig. 3.23-3.24), whereas global location patterns are again heterogenous (Fig. 3.25-13.26).
In contrast, UK plants are characterised by limited local agglomeration in the manufacturing sector and global agglomeration in the service sector (Fig. 3.27-30).
Overall, industries and countries do not exhibit clear patterns.

3.6.2 Large and small plants

In this section I investigate within-industry differences in spatial distribution between plants of different size. In particular, small plants are defined by a size equal to or lower than the 25th percentile of the industry plant-employment distribution recorded over the period. Similarly, establishments with employment equal to or greater than the 10th percentile are categorised as large plants.
Figures 3.31-3.32 demonstrate a clear local dispersion of both small manufacturing and service plants in France. Consistent results are obtained at a 180km distance (Fig. 3.33-3.34). British manufacturing plants exhibit a similar pattern (Fig. 3.35-3.36), whereas this is not the case for the service sector, where no clear pattern is recorded (Fig. 3.37-3.38).

Specular results are found for plants at the opposite tail of the size distribution. Large plants in France demonstrate high local and global agglomeration (Fig. 3.39-3.42). The patterns is partially confirmed by British plants, with the exception of global dispersion in Service sector (Fig. 3.43-3.46).

This spatial configuration could be explained by the trade-off between external economies of scale and proximity. Large manufacturing firms co-agglomerate in dense economic areas, where they can benefit from labour pooling and access to a multitude of suppliers, whereas smaller plants maximise proximity to local demand and lower labour costs.
The different spatial distributions in the service sector could be due to the specific agglomeration pattern that characterises British service plants, largely concentrated in the capital city, as against to the polycentric French system.
Kim (1995) analyses industrial agglomeration in the US, finding a positive correlation between concentration and average plant size per worker. Holmes and Stevens (2002) investigate within-industry differences, finding establishments located in denser areas to be larger than those located in remote regions. Lafourcade and Mion (2007) investigate whether the geographic distribution of manufacturing activities in Italy differs according to the scale of plants. They find a positive relation between size and co-agglomeration, explained by the capability of large plants to serve customers far beyond the boundaries of neighbouring markets. By contrast, small plants co-locate in wider areas, where they can share certain basic input but save in transport cost by locating close to local demand.

3.6.3 Single-plant and multi-plant firms

The industrial economics and trade literatures provide several theoretical frameworks to understand the way offshoring affects the economic environment. However, despite the increasing attention devoted to international fragmentation by media and by researchers, relatively few studies have analysed the domestic fragmentation of plants.
Markusen and Venables (2013) propose a simple theoretical framework to understand the fundamentals of firm fragmentation. According to the model, firms can be 'integrated', operating in one location, or 'fragmented', operating in various locations. Fragmented firms incur additional costs, but they benefit from higher labour productivity, thanks to functional agglomeration economies. Different combinations of fragmentation costs, local endowments and wage elasticities can determine different equilibria, ranging from a fully fragmented to a fully integrated industry. Fort (2013) empirically investigates how coordination and communication costs foster firm fragmentation and, conditionally on fragmentation, how they influence firms' choice to fragment production in the domestic market or offshore. Empirical evidence confirms a clear nexus between electronic communication and domestic fragmentation. Davis and Henderson (2007) analyse the determinants of headquarters agglomerations. Their results demonstrate that separation between production plants and headquarters is particularly beneficial for the firm when the headquarters can access a higher supply of differentiated local service inputs and locate close to other headquarters.

Figures 3.47-3.50 demonstrate that French single-plant French firms are characterised by location patterns identical to or slightly more dispersed than the overall plant distribution. No noticeable pattern is found for UK plants, although in this case both manufacturing and service single-plant firms show a limited degree of agglomeration (Fig. 3.51-3.54). In contrast, significant agglomeration patterns are found for establishment belonging to multi-plant firms in French and British manufacturing sectors and in the French service industries). An opposite pattern is found for British service multi-plant firms, that are noticeably more dispersed in the industrial spatial network (Fig. 3.55-3.62).

In Fig. 3.63-3.66 I focus on French plants, comparing the spatial agglomeration of headquarters only with the overall industry. Like other establishments belonging to multi-plant firms, headquarters demonstrate spatial concentration at both 30 and 180km distance. However, the difference with the benchmark is less significant, especially in the manufacturing sector.

Together these results confirm a tendency of multi-plant firms to collocate single establishments in more central areas of the industrial spatial network. Plant specialisation on their core business is therefore associated with a better access to inputs or local demand. However, this pattern is less evident for manufacturing headquarters, that are often located in dense urban areas, far from production plants.

3.6.4 Top decile of labour productivity

Thus far, I have analysed the way agglomeration patterns vary on the basis of plant-specific characteristics. When it comes to analysing the distribution of plants on the basis of firm-level characteristics, it is worth considering a number of issues that might limit the interpretation of the results. First, assigning the same productivity to different plants means not considering the combinations of input intensity, technologies and local organisation that might characterise plants belonging to the same company. A functional agglomeration of particularly efficient plants belonging to firms with a generally low productivity would not be recorded in this estimation strategy. Second, productivity is often associated with firm size. Larger firms are likely to be more productive, to offer higher wages and to engage in export activities (Altomonte et al., 2010). It follows that the location decision of a few large multi-product plants might affect the whole distribution of productivity over space.

The limitations of the analysis having been pointed out, the next section discusses Figures 3.67-3.74. At a 30km distance, most productive French and British firms are characterised by higher levels of agglomeration with respect to the whole industry. This is true for both the manufacturing and service sectors, with the latter exhibiting the more relevant differences (Fig. 3.67-3.68 and 3.71-3.72).

Most productive firms in France are also agglomerated at a 180 km distance (Fig. 3.69-3.70), while the pattern is less clear in the UK (3.73-3.74), where high performers are more represented at both tails of the distribution.

The empirical evidence could result from confounding factors, as suggested above, or be somewhat related to the micro-foundations of agglomeration economies. Among the three Marshallian forces, knowledge spillovers are generally associated with co-location patterns that characterise most productive and innovative firms. At the industry level, Faggio et al. (2019) find knowledge spillovers to be the main drivers of agglomeration patterns not only in the computer industry but also in less technological advanced sectors, such as the manufacturing of ceramic goods, the manufacturing of cement, lime and plaster and the preparation/spinning of textile fibres.

At the firm level, a significant literature in international trade and industrial economics has provided considerable empirical evidence and theoretical arguments supporting the presence in most industries of a limited group of frontier firms, characterised by larger size, a high degree of internationalisation and high productivity (Mayer & Ottaviano, 2008). My findings seem to support the importance of intra-industry disparities in productivity with respect to the overall spatial distribution of each industry.

3.6.4 Foreign firms

The final section illustrates the spatial distribution of foreign firms. Some studies suggest that location choice of foreign firms would be driven by the opportunity to maximise market and supplier access. For example, Amiti and Javorcik (2008) show that these features largely explain the spatial distribution of foreign firms in China. Even firms facing realative low transport costs in the foreign countries could choose to locate close to other foreign firms more interested in the local economic environment. Head et al. (1995) examine the location choices of 751 Japanese manufacturing plants in the US, finding evidence of a significant co-location pattern. Bloigen et al. (2005) examine 1485 investment decisions of Japanese firms between 1985 and 2001, demonstrating that firms belonging to invest in the same foreign region.

On the other hand, the evidence provided is primarily based on large countries. It is possible that the limited size and the low transport costs of European countries would sizeably reduce agglomeration externalities for foreign firms. Figures 3.75-3.76 show that both foreign manufacturing and Service plants tend to co-locate at short distances. The pattern is confirmed at a 180 km distance. In contrast, the pattern is less clear-cut in the UK, where foreign manufacturing firms – and to some extent even service ones - are characterised by higher degrees of agglomeration, whereas no difference is found in terms of global agglomeration (Fig. 3.79-3.82).

3.7 Conclusions

In this chapter, I have proposed a composite strategy to analyse the dynamic agglomeration patterns of industries and specific firm types.

Using the continuous agglomeration measures proposed by Duranton and Overman (2006) and extended by Behrens (2017), I have investigated two large micro datasets covering the whole population of French and British establishments from 2008 to 2015. Despite some significant differences, the results are generally consistent, supporting the external validity of the main results. I find significant within-industry heterogeneity in spatial agglomeration. Large plants, and more productive and multi-plant firms are generally more agglomerated, although the difference with the overall distribution varies across sectors and countries.

On the other hand, I do not find specific location patterns for new entries and exiters. This suggests that the general dispersion trend characterising the two sectors might be driven primarily by between-firm reallocation of resources rather than demographic events.

From a methodological perspective, this study demonstrates that continuous agglomeration indices represent a valuable tool in cross-country studies. First, working on continuous space avoids any measurement issue related to scale and aggregation and makes it possible to compare countries characterised by different geographies. Secondly, the possibility to analyse at the same time spatial distributions at different spatial scale allows the researcher to choose a distance threshold that is at once meaningful from an economic point of view and suitable for the characteristics of the territory analysed. Finally, these indices produce valuable results even when applied to the analysis of small population of plants, making it possible to analyse within-firm heterogeneity in spatial location patterns.

There are several directions this work could be taken. First, this methodology should be extended and applied to relevant policy questions (in this regard, a short application is presented in Chapter 4). In particular, it would be interesting to develop a dynamic framework to investigate co-location patterns of different economic actors. For instance, continuous agglomeration measures could be used to study occupational dynamics across industries. Second, this approach can be used to test the external validity of the main result of the agglomeration literature, extending the analysis to more countries (i.e. Spain, Germany and Italy). Finally, work is required to further extend this measure beyond the continuous space dimension to allow them to map more significant economic dimensions, such as time and carbon emissions.

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Tables

Table 3. 1: Five most and least localised manufacturing industries, by country and distance threshold

	DO, 30km				DO, 180km			
	France		United Kingdom		France		United Kingdom	
Most agglomerated	1413 - Manufacture of other outerwear	0.2139	2341 - Manufacture of ceramic household and ornamental articles	0.4894	3012 - Building of pleasure and sporting boats	0.5704	2341 - Manufacture of ceramic household and ornamental articles	0.8175
	2630 - Manufacture of communication equipment	0.1985	1310 - Preparation and spinning of textile fibres	0.3257	2053 - Manufacture of essential oils	0.4634	1414 - Manufacture of underwear	0.769
	2053 - Manufacture of essential oils	0.1805	2013 - Manufacture of other inorganic basic chemicals	0.2181	2042 - Manufacture of perfumes and toilet preparations	0.4532	2594 - Manufacture of fasteners and screw machine products	0.7644
	3212 - Manufacture of jewellery and related articles	0.14928	1820 - Reproduction of recorded media	0.21335	2319 - Manufacture and processing of glass, including technical glassware	0.4336	1393 - Manufacture of carpets and rugs	0.7637
	1102 - Manufacture of wine from grape	0.1343	1520 - Manufacture of footwear	0.2128	2313 - Manufacture of hollow glass	0.3817	2451 - Casting of iron	0.7065
Least agglomerated	1052 - Manufacture of ice cream	0.0071	1052 - Manufacture of ice cream	0.019	1086 - Manufacture of homogenised food preparations and dietetic food	0.1374	3315 - Repair and maintenance of ships and boats	0.2392
	1610 - Sawmilling and planing of wood	0.0088	1610 - Sawmilling and planing of wood	0.019	2370 - Cutting, shaping and finishing of stone	0.1403	1020 - Processing and preserving of fish, crustaceans and molluscs	0.2518
	2511 - Manufacture of structural metal products	0.0104	3011 - Building of ships and floating structures	0.0205	2512 - Manufacture of doors and windows of metal	0.1423	1712 - Manufacture of paper and paperboard	0.328
	2593 - Manufacture of wire products, chain and springs	0.011	1623 - Manufacture of other builders' carpentry and joinery	0.0231	1082 - Manufacture of cocoa, chocolate and sugar confectionery	0.1436	2670 - Manufacture of optical instruments and photographic equipment	0.3288
	2361 - Manufacture of concrete products for construction purposes	0.0112	2611 - Manufacture of electronic components	0.0237	2363 - Manufacture of ready-mixed concrete	0.145	1610 - Sawmilling and planing of wood	0.333

Table 3. 2: Five most and least localised service industries, by country and distance threshold

	DO, 30km				DO, 180km			
	France		United Kingdom		France		United Kingdom	
Most agglomerated	5911 - Motion picture, video and television programme production activities	0.656	5913 - Motion picture, video and television programme distribution activities	0.3065	5912 - Motion picture, video and television programme post-production activities	0.7646	5912 - Motion picture, video and television programme post-production activities	0.6888
	5912 - Motion picture, video and television programme post-production activities	0.6178	5920 - Sound recording and music publishing activities	0.2908	5811 - Book publishing	0.7037	5913 - Motion picture, video and television programme distribution activities	0.6755
	5814 - Publishing of journals and periodicals	0.6076	5911 - Motion picture, video and television programme production activities	0.2903	5814 - Publishing of journals and periodicals	0.6987	5920 - Sound recording and music publishing activities	0.6686
	5811 - Book publishing	0.5776	6020 - Television programming and broadcasting activities	0.2799	5920 - Sound recording and music publishing activities	0.694	7320 - Market research and public opinion polling	0.6345
	5920 - Sound recording and music publishing activities	0.594	4648 - Wholesale of watches and jewellery	0.205	6391 - News agency activities	0.6758	6202 - Computer consultancy activities	0.5987
Least agglomerated	4661 - Wholesale of agricultural machinery, equipment and supplies	0.0075	5530 - Camping grounds, recreational vehicle parks and trailer parks	0.0152	4674 - Wholesale of hardware, plumbing and heating equipment and supplies	0.1445	5520 - Holiday and other short-stay accommodation	0.2615
	4621 - Wholesale of grain, unmanufactured tobacco, seeds and animal feeds	0.0102	5520 - Holiday and other short-stay accommodation	0.0169	4764 - Retail sale of sporting equipment in specialised stores	0.1464	5530 - Camping grounds, recreational vehicle parks and trailer parks	0.2728
	7500 - Veterinary activities	0.0154	4621 - Wholesale of grain, unmanufactured tobacco, seeds and animal feeds	0.0174	4774 - Retail sale of medical and orthopaedic goods in specialised stores	0.151	4723 - Retail sale of fish, crustaceans and molluscs in specialised stores	0.2842
	4677 - Wholesale of waste and scrap	0.0163	4661 - Wholesale of agricultural machinery, equipment and supplies	0.0177	4532 - Retail trade of motor vehicle parts and accessories	0.1513	5222 - Service activities incidental to water transportation	0.2908
	4519 - Sale of other motor vehicles	0.0169	4623 - Wholesale of live animals	0.0183	4726 - Retail sale of tobacco products in specialised stores	0.152	5010 - Sea and coastal passenger water transport	0.2955

Table 3. 3: Five most and least localised manufacturing industries, by country and distance threshold (EGI index)

	EGI Zone d'emploi							
	Manufacturing sector				Service Sector			
	France		United Kingdom		France		United Kingdom	
Most agglomerated	2053 - Manufacture of essential oils	0.1793	2341 - Manufacture of ceramic household and ornamental articles	0.456	5912 - Motion picture, video and television programme post-production activities	0.3858	5913 - Motion picture, video and television programme distribution activities	0.3895
	1101 - Distilling, rectifying and blending of spirits	0.1353	1310 - Preparation and spinning of textile fibres	0.2132	5911 - Motion picture, video and television programme production activities	0.3398	5912 - Motion picture, video and television programme post-production activities	0.2842
	1439 - Manufacture of other knitted and crocheted apparel	0.1232	1439 - Manufacture of other knitted and crocheted apparel	0.169	5110 - Passenger air transport	0.336	6391 - News agency activities	0.2825
	2451 - Casting of iron	0.0992	1101 - Distilling, rectifying and blending of spirits	0.1078	5814 - Publishing of journals and periodicals	0.2663	5920 - Sound recording and music publishing activities	0.246
	1399 - Manufacture of other textiles n.e.c.	0.0906	1520 - Manufacture of footwear	0.1028	6020 - Television programming and broadcasting activities	0.2465	6020 - Television programming and broadcasting activities	0.2416
Least agglomerated	2051 - Manufacture of explosives	-0.143	2110 - Manufacture of basic pharmaceutical products	-0.004	7721 - Renting and leasing of recreational and sports goods	-0.012	4638 - Wholesale of other food, including fish, crustaceans and molluscs	-0.005
	2314 - Manufacture of glass fibres	-0.115	1107 - Manufacture of soft drinks;production of mineral waters and other bottled waters	-0.001	4636 - Wholesale of sugar and chocolate and sugar confectionery	-0.009	7430 - Translation and interpretation activities	-0.004
	2620 - Manufacture of computers and peripheral equipment	-0.004	1812 - Other printing	0.003	4613 - Agents involved in the sale of timber and building materials	-0.004	5914 - Motion picture projection activities	-0.002
	2740 - Manufacture of electric lighting equipment	-0.003	2059 - Manufacture of other chemical products n.e.c.	0.0035	6010 - Radio broadcasting	-0.004	4665 - Wholesale of office furniture	-0.002
	2041 - Manufacture of soap and detergents, cleaning and polishing preparations	-0.001	1813 - Pre-press and pre-media services	0.0047	5813 - Publishing of newspapers	-0.003	4743 - Retail sale of audio and video equipment in specialised stores	-0.001

Table 3. 4: DO and EGI agglomeration indices

Dependent variable: $\overline{\overline{K_j^w}}$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	30km		180km		30km		180km		30km		180km	
VARIABLES	Commune	Zone d'emploi	Commune	Zone d'emploi	Commune	Zone d'emploi	Commune	Zone d'emploi	Commune	Zone d'emploi	Commune	Zone d'emploi
EGI	2.957***	1.432***	3.400***	1.497***	2.957***	1.432***	3.400***	1.497***	0.258***	0.465***	0.552***	0.674***
	(0.302)	(0.0477)	(0.280)	(0.0365)	(0.302)	(0.0477)	(0.280)	(0.0365)	(0.0775)	(0.0794)	(0.126)	(0.0858)
Constant	0.0823***	0.0606***	0.239***	0.218***	0.0823***	0.0606***	0.239***	0.218***	0.0971***	0.0862***	0.255***	0.240***
	(0.00231)	(0.00200)	(0.00273)	(0.00255)	(0.00231)	(0.00200)	(0.00273)	(0.00255)	(0.000456)	(0.00206)	(0.000720)	(0.00222)
Observations	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
R-squared	0.151	0.388	0.153	0.324	0.151	0.388	0.153	0.324	0.990	0.991	0.986	0.988
Industry FE	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Graphs

Figure 3. 7: Manufacturing local agglomeration trends, France

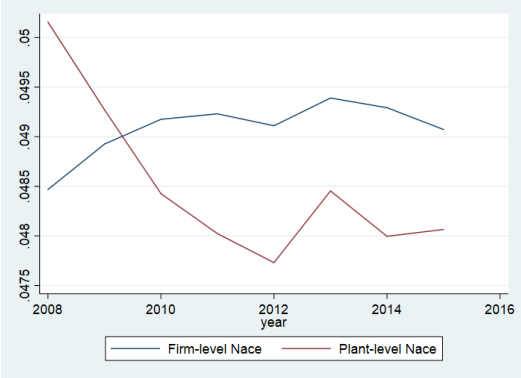
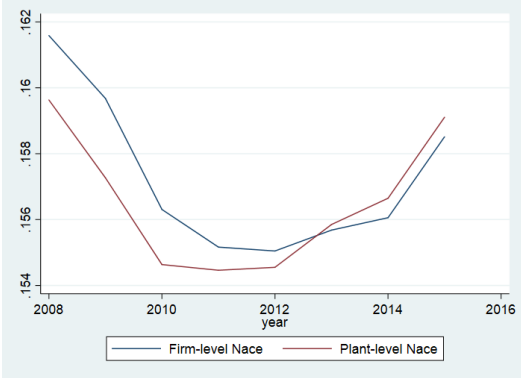


Figure 3. 8: Manufacturing local agglomeration trends, UK



Notes. The graphs show the evolution of the Weighted mean $\overline{\overline{Kj^w}}$, computed at a 30 km distance for all manufacturing industries

Figure 3. 9: Service local agglomeration trends, France

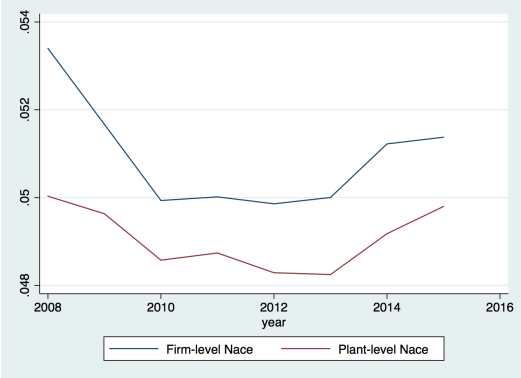
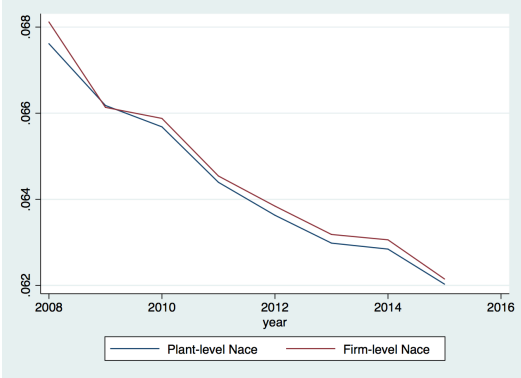


Figure 3. 10: Service local agglomeration trends, UK



Notes. The graphs show the evolution of the Weighted mean $\overline{\overline{Kj^w}}$, computed at a 30 km distance for all service industries

Figure 3. 11: Manufacturing global agglomeration trends, France

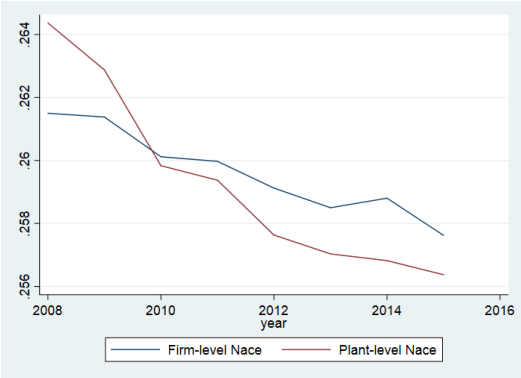
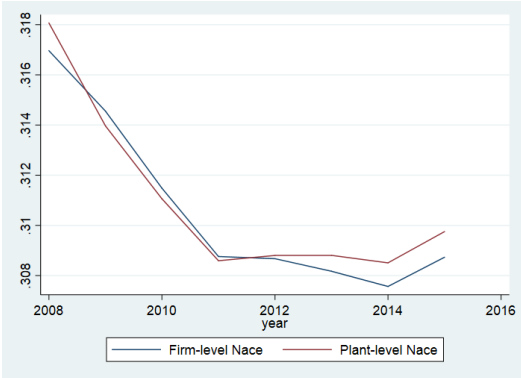


Figure 3. 12: Manufacturing global agglomeration trends, UK



Notes. The graphs show the evolution of the Weighted mean $\overline{\overline{Kj^w}}$, computed at a 180 km distance for all manufacturing industries

Figure 3. 13: Service global agglomeration trends, France

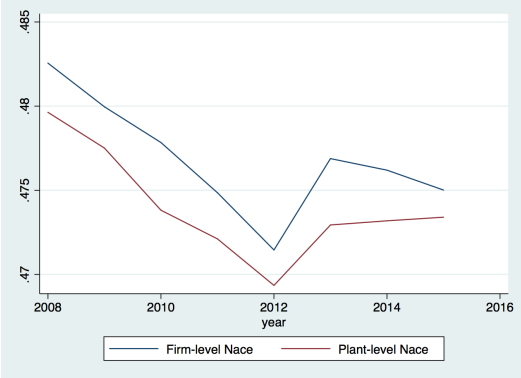
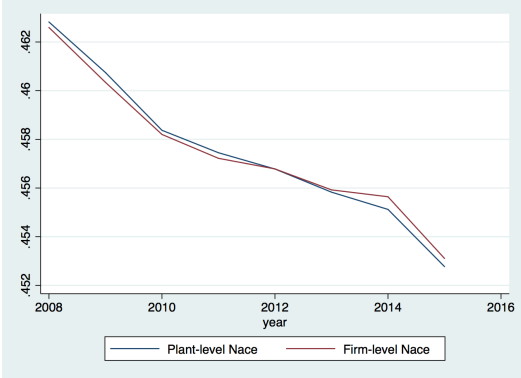


Figure 3. 14: Service global agglomeration trends, UK



Notes. The graphs show the evolution of the Weighted mean $\overline{\overline{K_j^w}}$, computed at a 180 km distance for all service industries

New entries – France

Figure 3. 15: New entries, Manufacturing, d=30km, France

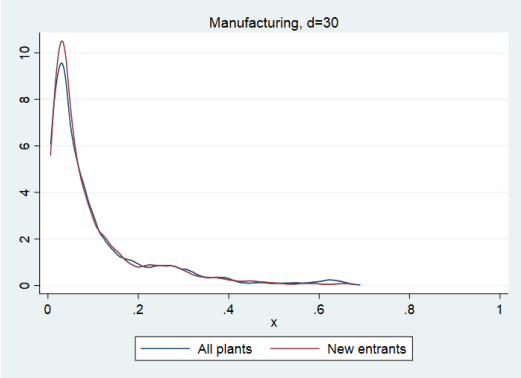
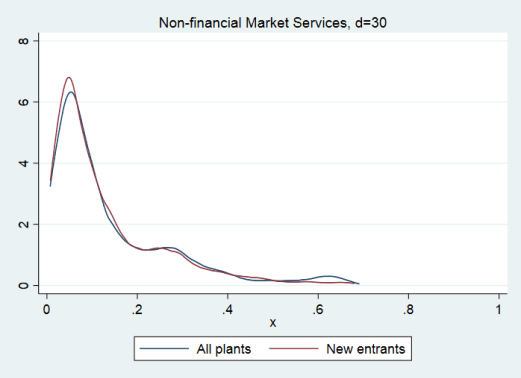


Figure 3. 16: New entries, Service, d=30km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between new entries and all other plants in the industry.

Figure 3. 17: New entries, Manufacturing, d=180km, France

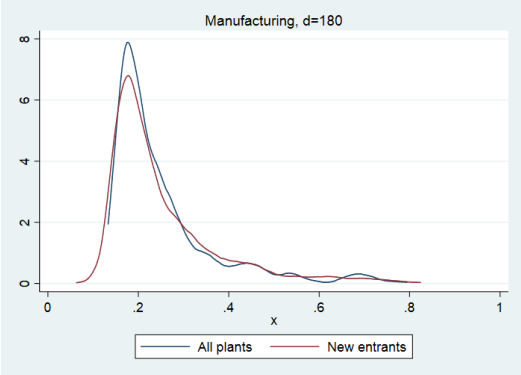
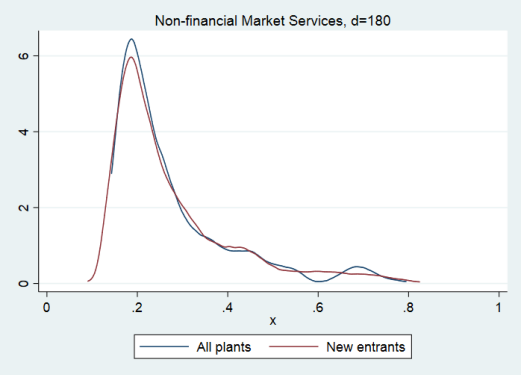


Figure 3. 18: New entries, Service, d=180km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between new entries and all other plants in the industry.

New entries– United Kingdom

Figure 3. 19: New entries, Manufacturing, d=30km, UK

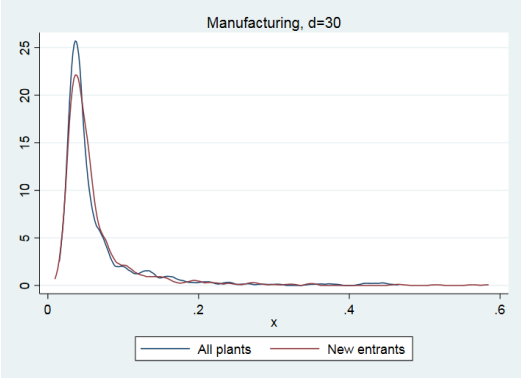
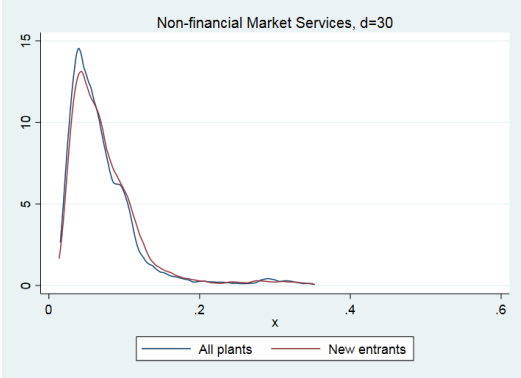


Figure 3. 20: New entries, Service, d=30km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between new entries and all other plants in the industry.

Figure 3. 21: New entries, Manufacturing, d=180km, UK

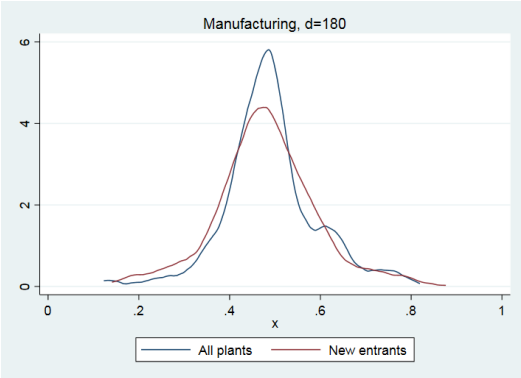
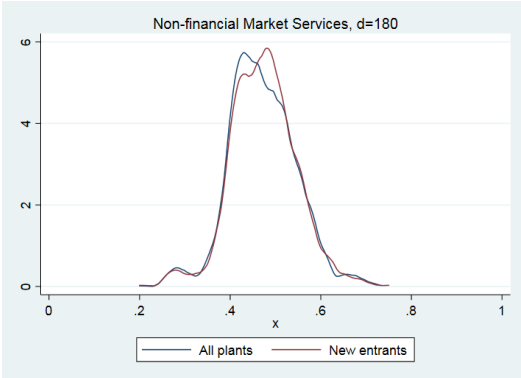


Figure 3. 22: New entries, Service, d=180km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between new entries and all other plants in the industry.

Exiters – France

Figure 3. 23: Exiters, Manufacturing, d=30km, France

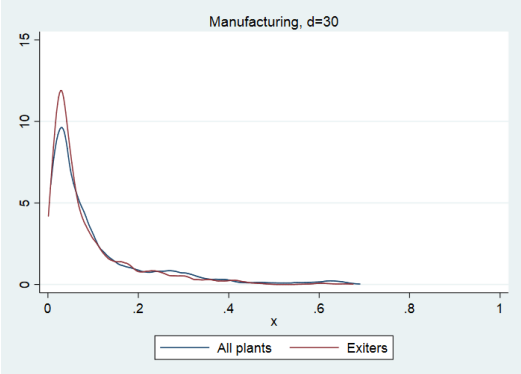
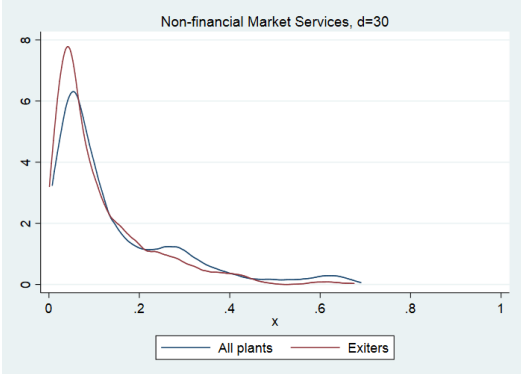


Figure 3. 24: Exiters, Service, d=30km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between plants that exit the market and all other plants in the industry.

Figure 3. 25: Exiters, Manufacturing, d=180km, France

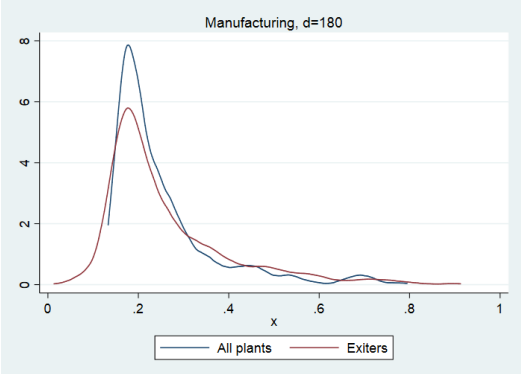
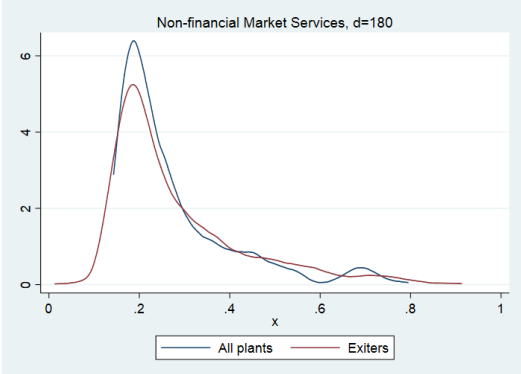


Figure 3. 26: Exiters, Service, d=180km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between plants that exit the market and all other plants in the industry.

Exiters – United Kingdom

Figure 3. 27: Exiters, Manufacturing, d=30km, UK

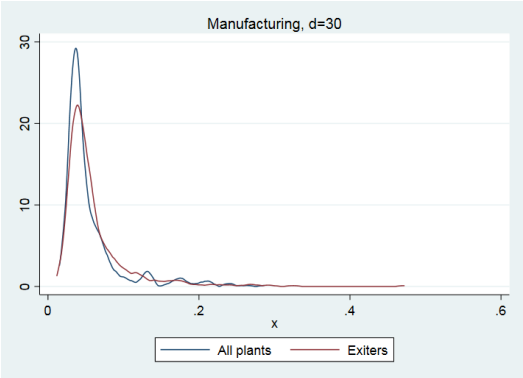
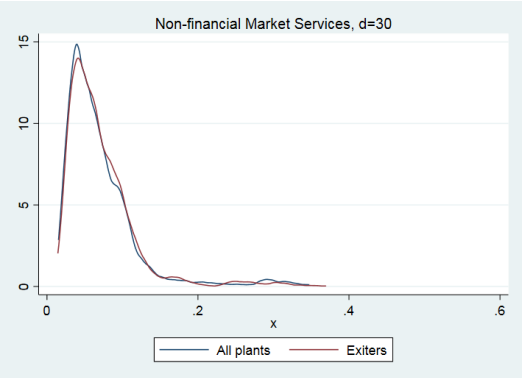


Figure 3. 28: Exiters, Manufacturing, d=30km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between plants that exit the market and all other plants in the industry.

Figure 3. 29: Exiters, Manufacturing, d=180km, UK

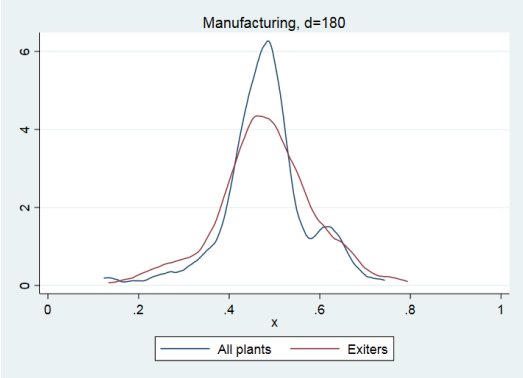
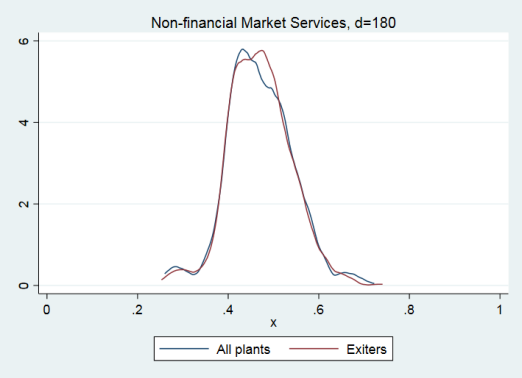


Figure 3. 30: Exiters, Service, d=180km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between plants that exit the market and all other plants in the industry.

Small plants – France

Figure 3. 31: Small plants, Manufacturing, d=30km, France

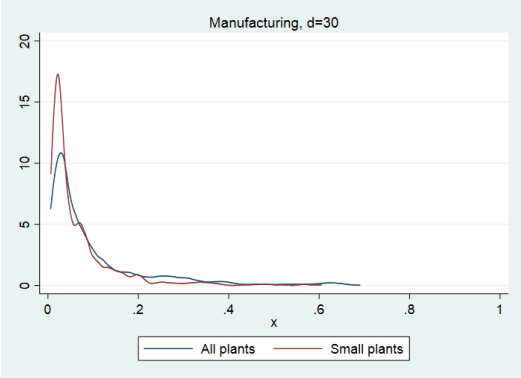
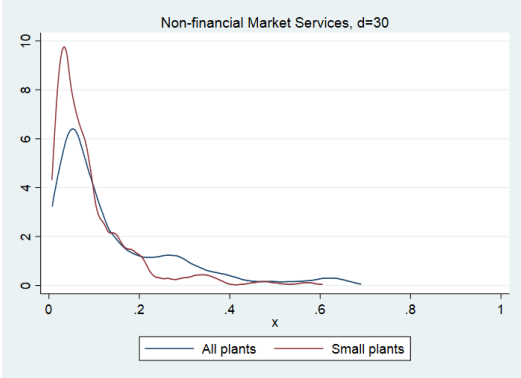


Figure 3. 32: Small plants, Service, d=30km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between small plants (below the 25th percentile of the employment distribution) and all other plants in the industry.

Figure 3. 33: Small plants, Manufacturing, d=180km, France

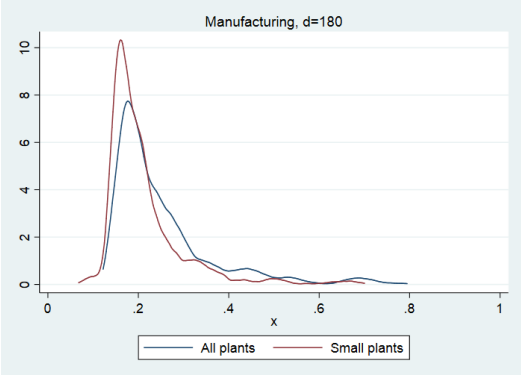
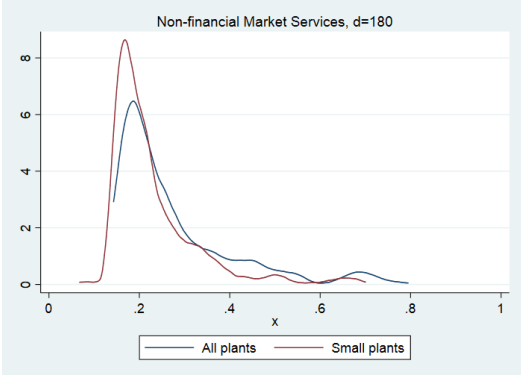


Figure 3. 34: Small plants, Service, d=180km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between small plants (below the 25th percentile of the employment distribution) and all other plants in the industry.

Small plants – United Kingdom

Figure 3. 35: Small plants, Manufacturing, d=30km, UK

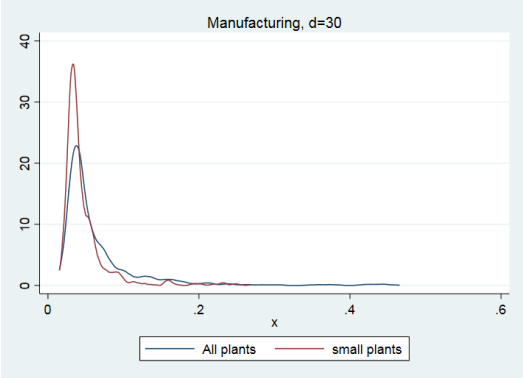
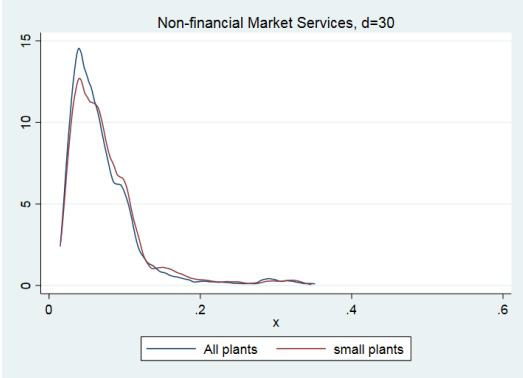


Figure 3. 36: Small plants, Service, d=30km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between small plants (below the 25th percentile of the employment distribution) and all other plants in the industry.

Figure 3. 37: Small plants, Manufacturing, d=180km, UK

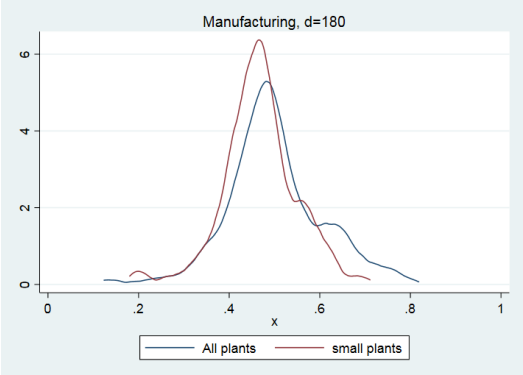
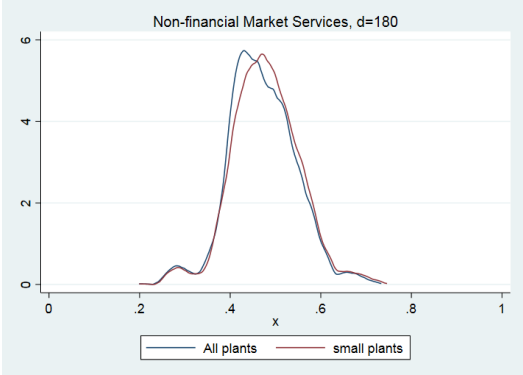


Figure 3. 38: Small plants, Service, d=180km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between small plants (below the 25th percentile of the employment distribution) and all other plants in the industry.

Large plants – France

Figure 3. 39: Large plants, Manufacturing, d=30km, France

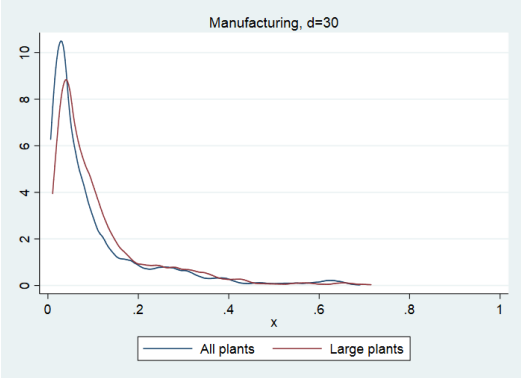
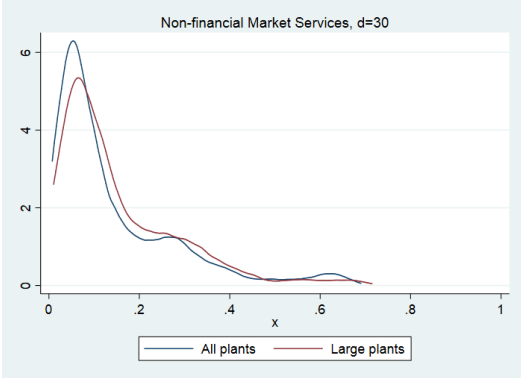


Figure 3. 40: Large plants, Service, d=30km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between large plants (above the 90th percentile of the employment distribution) and all other plants in the industry.

Figure 3. 41: Large plants, Manufacturing, d=180km, France

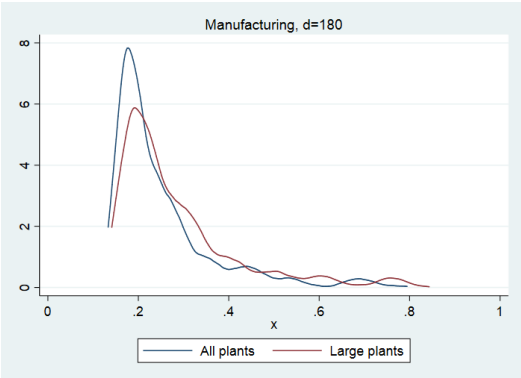
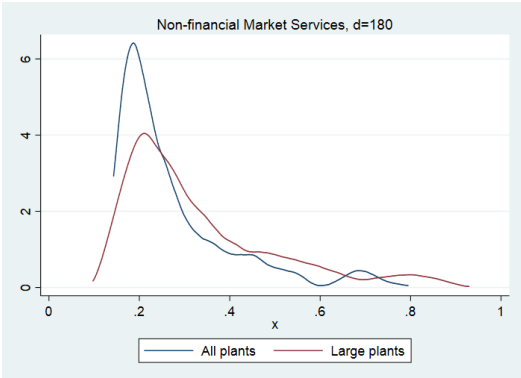


Figure 3. 42: Large plants, Service, d=180km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between large plants (above the 90th percentile of the employment distribution) and all other plants in the industry.

Large plants – United Kingdom

Figure 3. 43: Large plants, Manufacturing, d=180km, UK

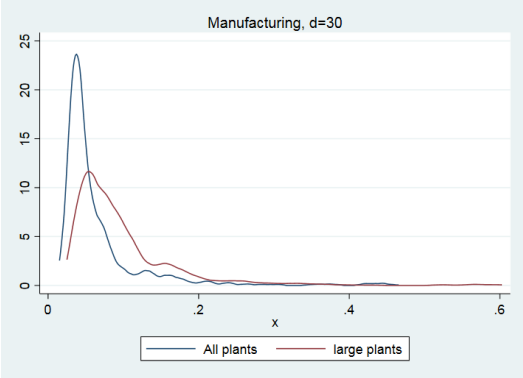
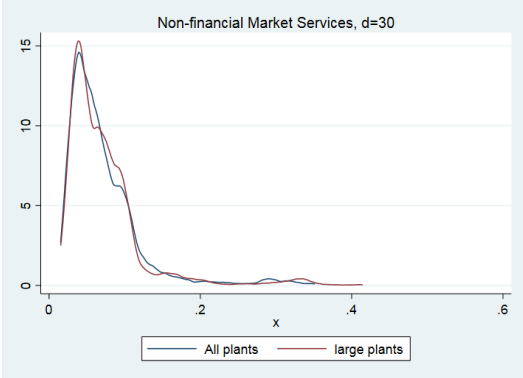


Figure 3. 44: Large plants, Service, d=180km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between large plants (above the 90th percentile of the employment distribution) and all other plants in the industry.

Figure 3. 45: Large plants, Manufacturing, d=180km, UK

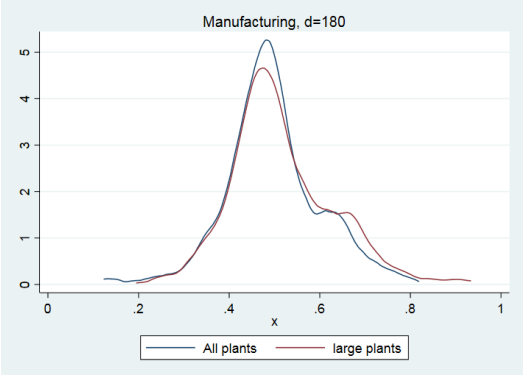
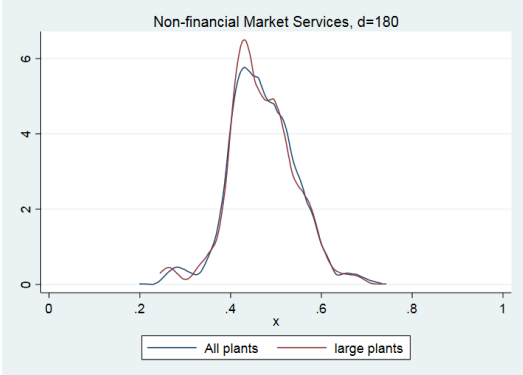


Figure 3. 46: Large plants, Service, d=180km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between large plants (above the 90th percentile of the employment distribution) and all other plants in the industry.

Single-plant firms – France

Figure 3. 47: Single-plant firms, Manufacturing, d=30km, France

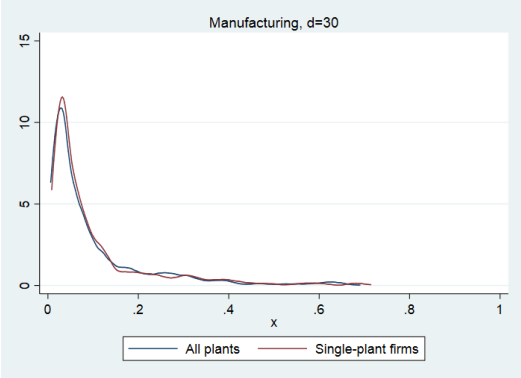
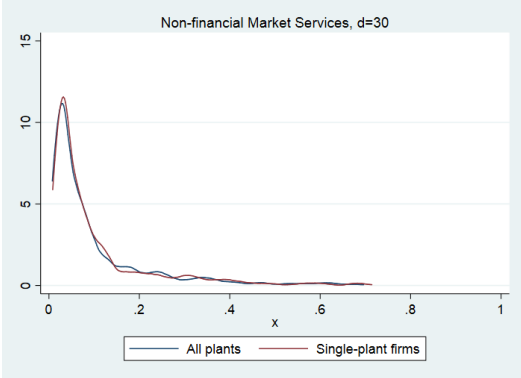


Figure 3. 48: Single-plant firms, Service, d=30km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between single-plant firms and all other plants in the industry.

Figure 3. 49: Single-plant firms, Manufacturing, d=180km, France

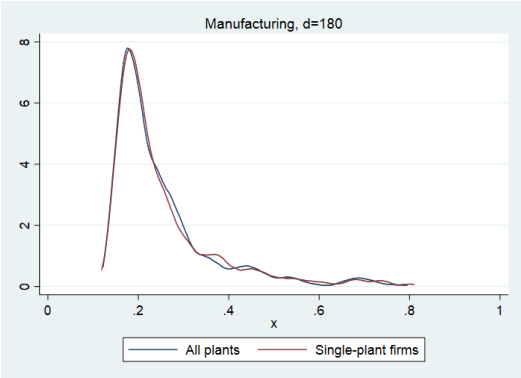
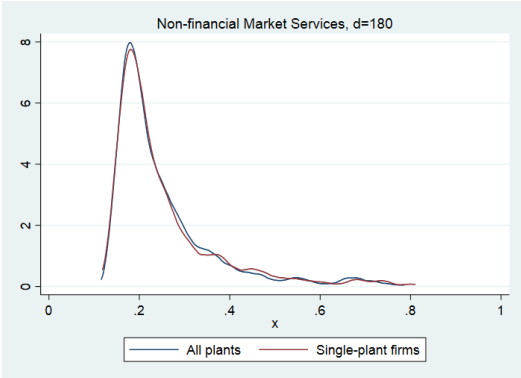


Figure 3. 50: Single-plant firms, Service, d=180km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between single-plant firms and all other plants in the industry.

Single-plant firms – United Kingdom

Figure 3. 51: Single-plant firms, Manufacturing, d=30km, UK

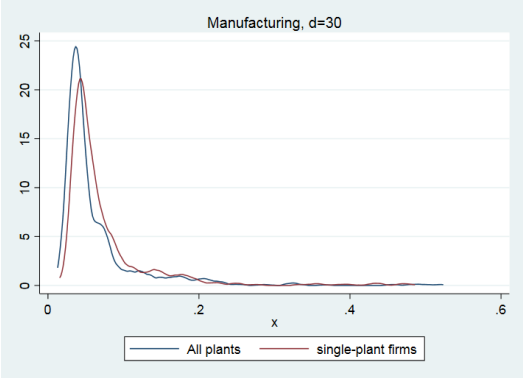
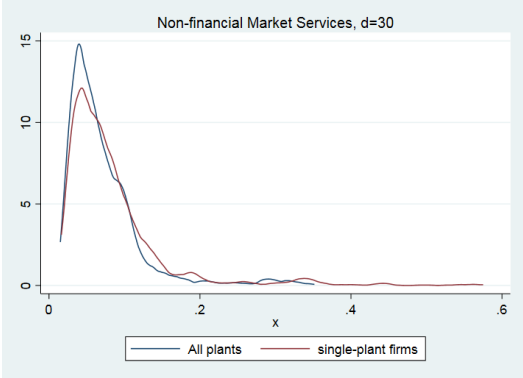


Figure 3. 52: Single-plant firms, Service, d=30km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between single-plant firms and all other plants in the industry.

Figure 3. 53: Single-plant firms, Manufacturing, d=180km, UK

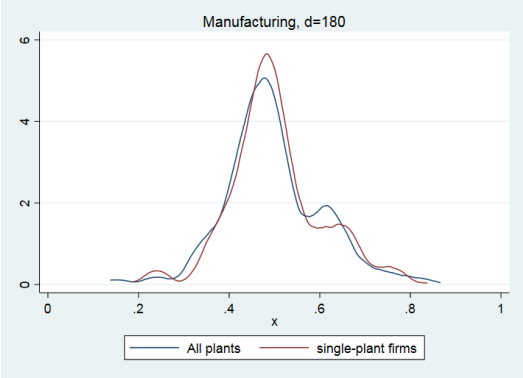
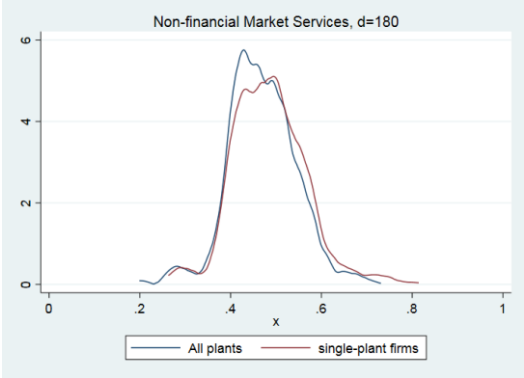


Figure 3. 54, Single-plant firms, Service, d=180km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between single-plant firms and all other plants in the industry.

Multi-plant firms – France

Figure 3. 55: Multi-plant firms, Manufacturing, d=30km, France

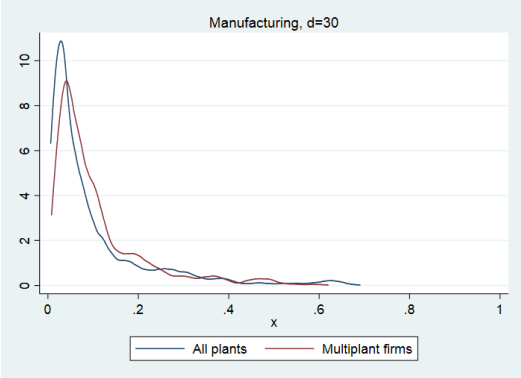
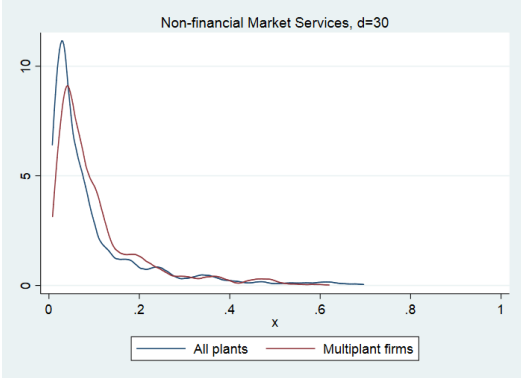


Figure 3. 56: Multi-plant firms, Service, d=30km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between plants belonging to multi-plant firms and all other plants in the industry.

Figure 3. 57: Multi-plant firms, Manufacturing, d=180km, France

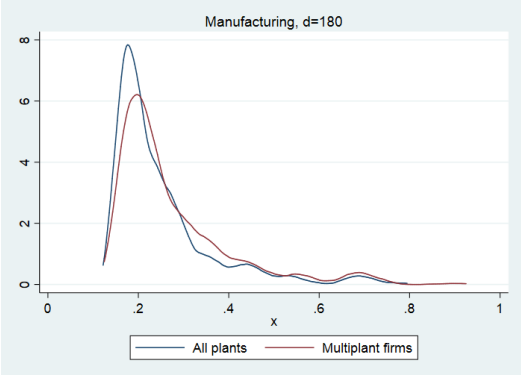
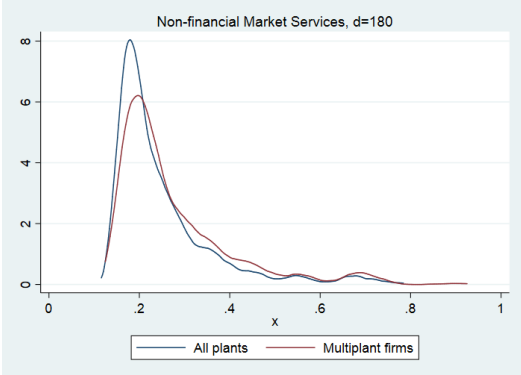


Figure 3. 58: Multi-plant firms, Service, d=180km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between plants belonging to multi-plant firms and all other plants in the industry.

Multi-plant firms – United Kingdom

Figure 3. 59: Multi-plant firms, Manufacturing, d=30km, UK

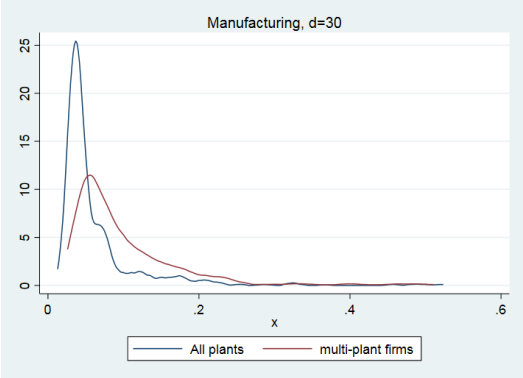
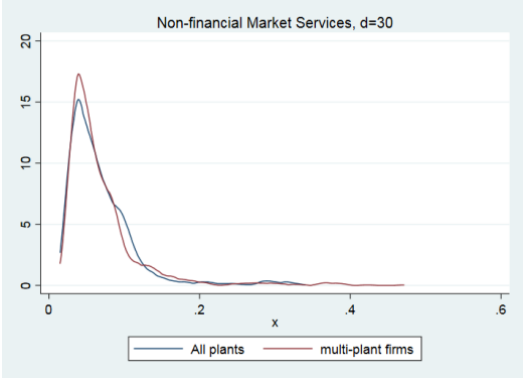


Figure 3. 60: Multi-plant firms, Service, d=30km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between plants belonging to multi-plant firms and all other plants in the industry.

Figure 3. 61: Multi-plant firms, Manufacturing, d=180km, UK

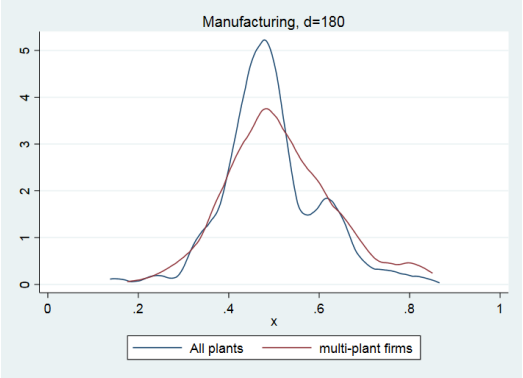
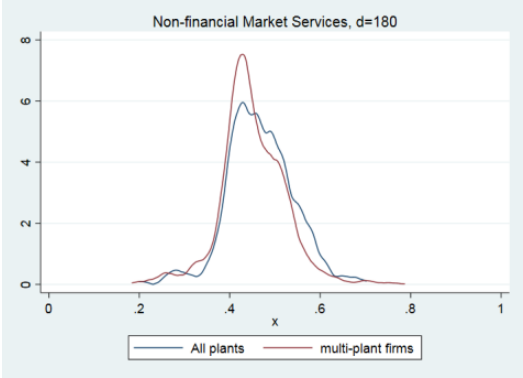


Figure 3. 62: Multi-plant firms, Service, d=180km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between plants belonging to multi-plant firms and all other plants in the industry.

Headquarters – France

Figure 3. 63: Headquarters, Manufacturing, d=30km, France

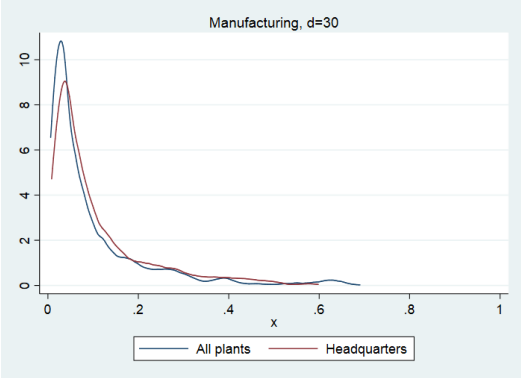
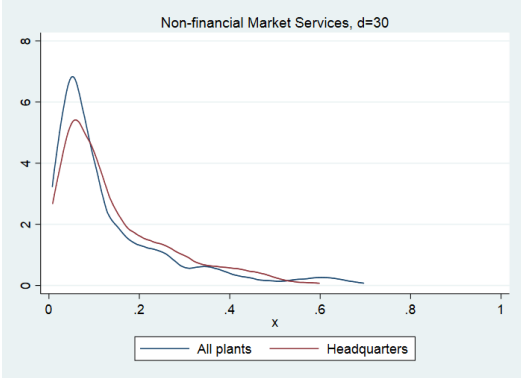


Figure 3. 64: Headquarters, Manufacturing, d=30km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between headquarters and all other plants in the industry.

Figure 3. 65: Headquarters, Manufacturing, d=180km, France

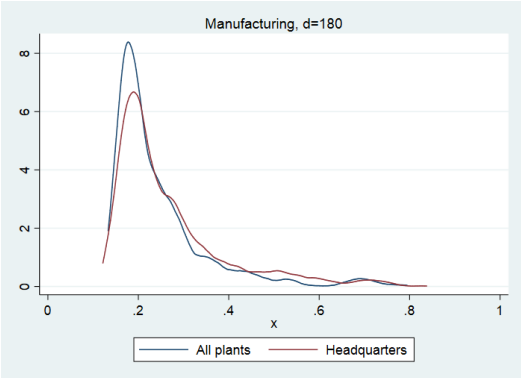
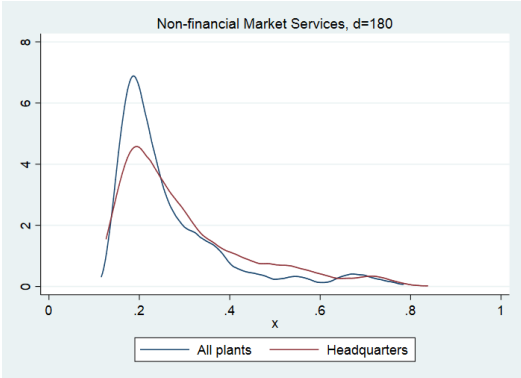


Figure 3. 66: Headquarters, Service, d=180km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between headquarters and all other plants in the industry.

High-productive firms – France

Figure 3. 67: High productive firms, Manufacturing, d=30km, France

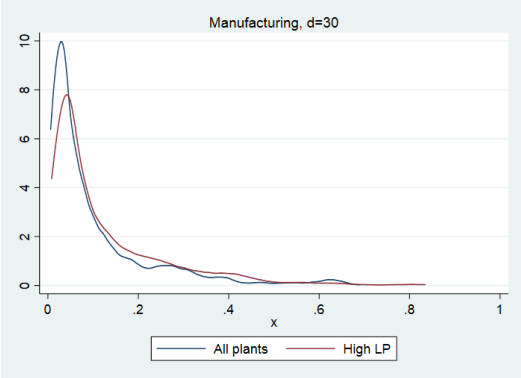
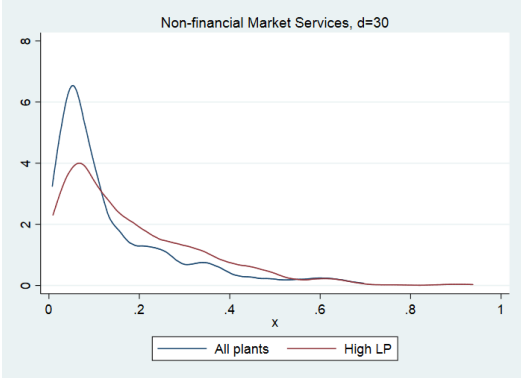


Figure 3. 68: High productive firms, Service, d=30km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between high productive firms (above the 90th percentile of productivity distribution) and all other plants in the industry.

Figure 3. 69: High productive firms, Manufacturing, d=180km, France

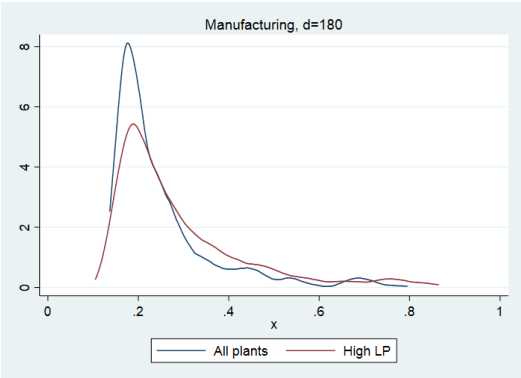
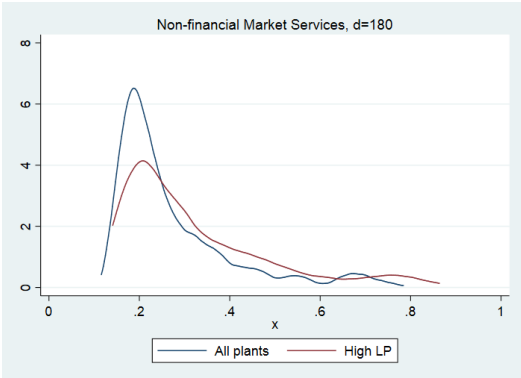


Figure 3. 70: High productive firms, Service, d=180km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between high productive firms (above the 90th percentile of productivity distribution) and all other plants in the industry.

High-productive firms – United Kingdom

Figure 3. 71: High productive firms, Manufacturing, d=30km, UK

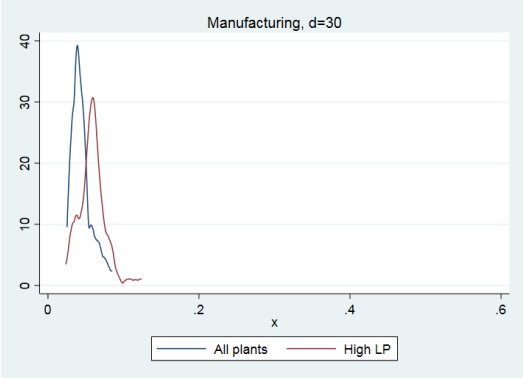
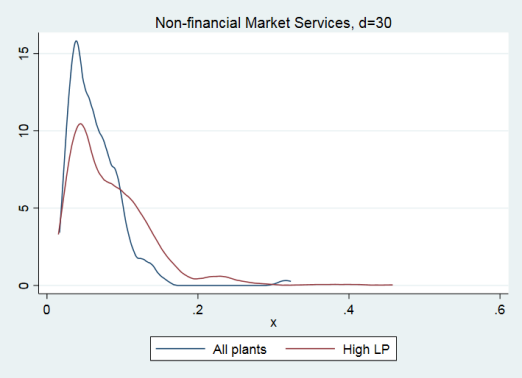


Figure 3. 72: High productive firms, Service, d=30km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between high productive firms (above the 90th percentile of productivity distribution) and all other plants in the industry.

Figure 3. 73: High productive firms, Manufacturing, d=180km, UK

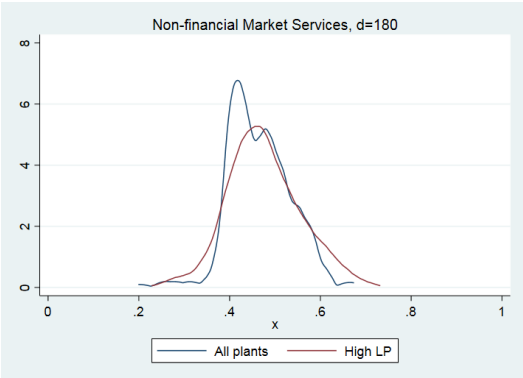
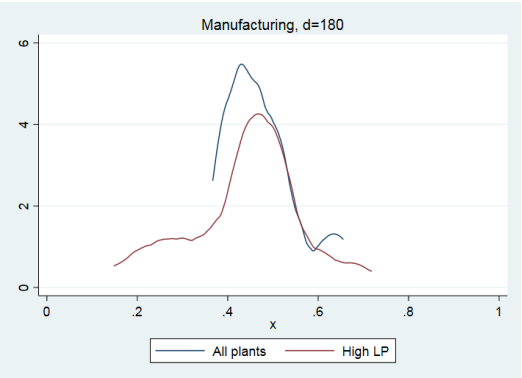


Figure 3. 74: High productive firms, Service, d=30km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances between high productive firms (above the 90th percentile of productivity distribution) and all other plants in the industry.

Foreign firms – France

Figure 3. 75: Foreign firms, Manufacturing, d=30km, France

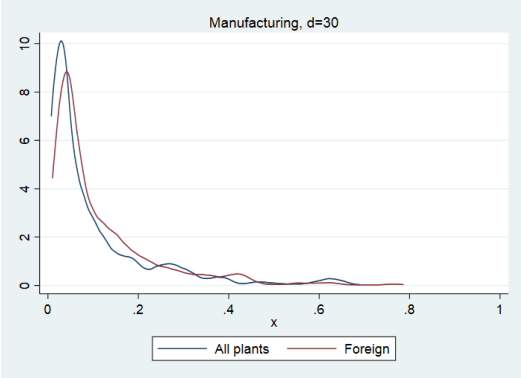
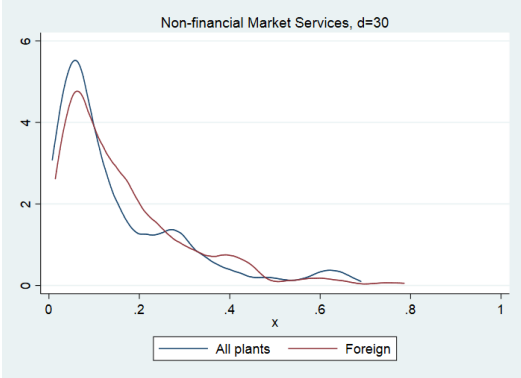


Figure 3. 76: Foreign firms, Service, d=30km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances plants belonging to foreign firms and all other plants in the industry.

Figure 3. 77: Foreign firms, Manufacturing, d=180km, France

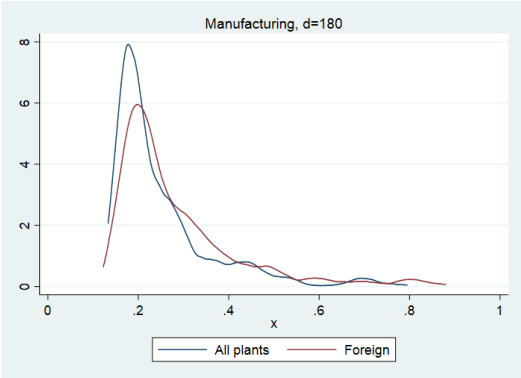
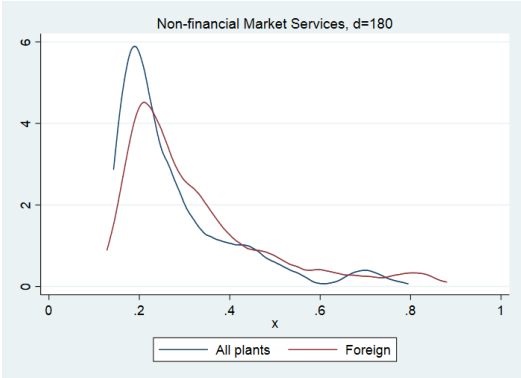


Figure 3. 78: Foreign firms, Service, d=30km, France



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances plants belonging to foreign firms and all other plants in the industry.

A.4.1 *Foreign firms – United Kingdom*

Figure 3. 79: Foreign firms, Manufacturing, d=30km, UK

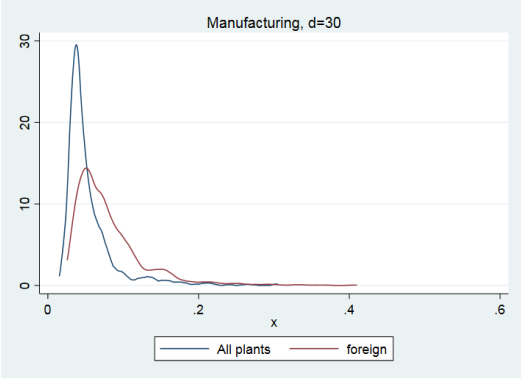
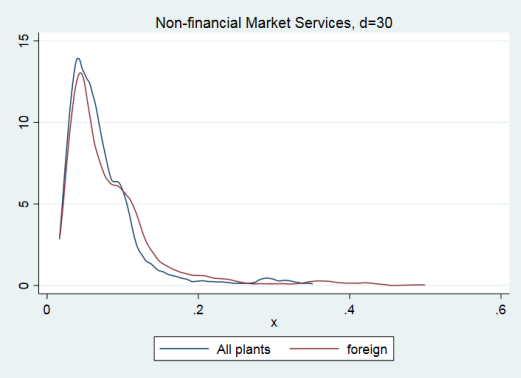


Figure 3. 80: Foreign firms, Service, d=30km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances plants belonging to foreign firms and all other plants in the industry.

Figure 3. 81: Foreign firms, Manufacturing, d=180km, UK

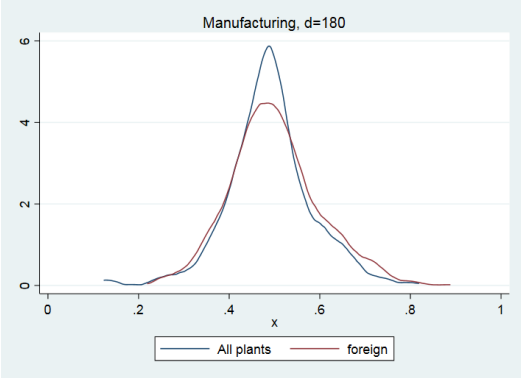
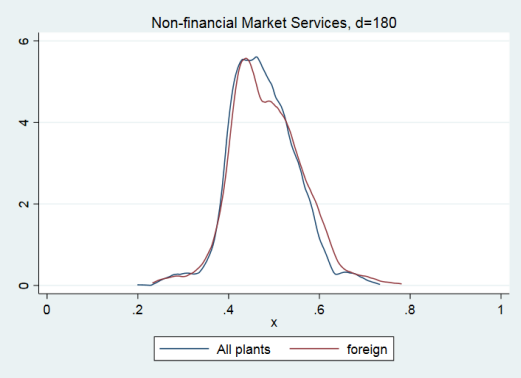


Figure 3. 82: Foreign firms, Service, d=180km, UK



Notes. The graphs show the distribution of industry-specific agglomeration indices and the distribution of co-agglomeration indices, based on bilateral distances plants belonging to foreign firms and all other plants in the industry.

Appendix

Table 3. 5: Agglomeration by 2-digit service industry

30km				180km			
France		UK		France		UK	
Industry group	Kd	Industry group	Kd	Industry group	Kd	Industry group	Kd
75 - Veterinary activities	0.0154	55 - Accommodation	0.0268	75 - Veterinary activities	0.1454	55 - Accommodation	0.3058
45 - Wholesale and retail trade and repair of motor vehicles and motorcycles	0.0256	75 - Veterinary activities	0.0269	45 - Wholesale and retail trade and repair of motor vehicles and motorcycles	0.1667	50 - Water transport	0.3621
47 - Retail trade, except of motor vehicles and motorcycles	0.0408	45 - Wholesale and retail trade and repair of motor vehicles and motorcycles	0.0327	47 - Retail trade, except of motor vehicles and motorcycles	0.1724	75 - Veterinary activities	0.3961
50 - Water transport	0.0414	53 - Postal and courier activities	0.0338	55 - Accommodation	0.1915	53 - Postal and courier activities	0.4117
49 - Land transport and transport via pipelines	0.0679	77 - Rental and leasing activities	0.0391	50 - Water transport	0.2083	47 - Retail trade, except of motor vehicles and motorcycles	0.4168
55 - Accommodation	0.0767	47 - Retail trade, except of motor vehicles and motorcycles	0.0417	49 - Land transport and transport via pipelines	0.2132	77 - Rental and leasing activities	0.4286
52 - Warehousing and support activities for transportation	0.0828	72 - Scientific research and development	0.05	71 - Architectural and engineering activities; technical testing and analysis	0.224	71 - Architectural and engineering activities; technical testing and analysis	0.4291
77 - Rental and leasing activities	0.0875	52 - Warehousing and support activities for transportation	0.0505	77 - Rental and leasing activities	0.2311	49 - Land transport and transport via pipelines	0.4361
46 - Wholesale trade, except of motor vehicles and motorcycles	0.1021	81 - Services to buildings and landscape activities	0.0588	68 - Real estate activities	0.2393	81 - Services to buildings and landscape activities	0.4409
68 - Real estate activities	0.1051	82 - Office administrative, office support and other business support activities	0.0593	72 - Scientific research and development	0.2427	52 - Warehousing and support activities for transportation	0.4604
72 - Scientific research and development	0.1074	46 - Wholesale trade, except of motor vehicles and motorcycles	0.0595	46 - Wholesale trade, except of motor vehicles and motorcycles	0.2436	45 - Wholesale and retail trade and repair of motor vehicles and motorcycles	0.4605
56 - Food and beverage service activities	0.1104	71 - Architectural and engineering activities; technical testing and analysis	0.0604	52 - Warehousing and support activities for transportation	0.2538	79 - Travel agency, tour operator and other reservation service and related activities	0.4621
71 - Architectural and engineering activities; technical testing and analysis	0.1128	49 - Land transport and transport via pipelines	0.0651	56 - Food and beverage service activities	0.2545	82 - Office administrative, office support and other business support activities	0.4724

81 - Services to buildings and landscape activities	0.1145	50 - Water transport	0.066	81 - Services to buildings and landscape activities	0.2547	46 - Wholesale trade, except of motor vehicles and motorcycles	0.4776
82 - Office administrative, office support and other business support activities	0.1286	61 - Telecommunications	0.066	78 - Employment activities	0.2579	72 - Scientific research and development	0.481
78 - Employment activities	0.1295	80 - Security and investigation activities	0.0724	82 - Office administrative, office support and other business support activities	0.2721	56 - Food and beverage service activities	0.4902
53 - Postal and courier activities	0.1467	70 - Activities of head offices; management consultancy activities	0.0799	61 - Telecommunications	0.2824	61 - Telecommunications	0.496
80 - Security and investigation activities	0.1527	79 - Travel agency, tour operator and other reservation service and related activities	0.08	53 - Postal and courier activities	0.2899	80 - Security and investigation activities	0.5006
61 - Telecommunications	0.1689	58 - Publishing activities	0.0865	80 - Security and investigation activities	0.3007	68 - Real estate activities	0.5032
74 - Other professional, scientific and technical activities	0.2025	56 - Food and beverage service activities	0.0902	79 - Travel agency, tour operator and other reservation service and related activities	0.3081	51 - Air transport	0.5058
79 - Travel agency, tour operator and other reservation service and related activities	0.2068	51 - Air transport	0.0922	74 - Other professional, scientific and technical activities	0.3158	58 - Publishing activities	0.5087
63 - Information service activities	0.2532	63 - Information service activities	0.0944	73 - Advertising and market research	0.3815	70 - Activities of head offices; management consultancy activities	0.5198
73 - Advertising and market research	0.2707	68 - Real estate activities	0.109	63 - Information service activities	0.3924	63 - Information service activities	0.5306
60 - Programming and broadcasting activities	0.3373	78 - Employment activities	0.1108	58 - Publishing activities	0.4348	78 - Employment activities	0.5472
58 - Publishing activities	0.3389	74 - Other professional, scientific and technical activities	0.1422	70 - Activities of head offices; management consultancy activities	0.4493	60 - Programming and broadcasting activities	0.5534
70 - Activities of head offices; management consultancy activities	0.3554	73 - Advertising and market research	0.1449	60 - Programming and broadcasting activities	0.5131	74 - Other professional, scientific and technical activities	0.5535
51 - Air transport	0.411	60 - Programming and broadcasting activities	0.1751	59 - Motion picture, video and television programme production, sound recording and music publishing activities	0.6454	73 - Advertising and market research	0.585
59 - Motion picture, video and television programme production, sound recording and music publishing activities	0.5556	59 - Motion picture, video and television programme production, sound recording and music publishing activities	0.243	51 - Air transport	0.6604	59 - Motion picture, video and television programme production, sound recording and music publishing activities	0.5879

Table 3. 6: Agglomeration by 2-digit manufacturing industry

30km				180km			
France		UK		France		UK	
Industry group	Kd	Industry group	Kd	Industry group	Kd	Industry group	Kd
16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.0138	16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.025	16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.1605	21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.3939
22 - Manufacture of rubber and plastic products	0.0174	26 - Manufacture of computer, electronic and optical products	0.032	17 - Manufacture of paper and paper products	0.1708	16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.4108
25 - Manufacture of fabricated metal products, except machinery and equipment	0.0182	27 - Manufacture of electrical equipment	0.0344	31 - Manufacture of furniture	0.1774	33 - Repair and installation of machinery and equipment	0.4189
17 - Manufacture of paper and paper products	0.0188	17 - Manufacture of paper and paper products	0.0355	25 - Manufacture of fabricated metal products, except machinery and equipment	0.1788	17 - Manufacture of paper and paper products	0.4385
10 - Manufacture of food products	0.0203	22 - Manufacture of rubber and plastic products	0.0359	33 - Repair and installation of machinery and equipment	0.1837	10 - Manufacture of food products	0.4556
28 - Manufacture of machinery and equipment n.e.c.	0.027	21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.0371	18 - Printing and reproduction of recorded media	0.1953	32 - Other manufacturing	0.4623
23 - Manufacture of other non-metallic mineral products	0.0275	33 - Repair and installation of machinery and equipment	0.0415	28 - Manufacture of machinery and equipment n.e.c.	0.1973	26 - Manufacture of computer, electronic and optical products	0.4675
33 - Repair and installation of machinery and equipment	0.033	10 - Manufacture of food products	0.0422	10 - Manufacture of food products	0.2031	30 - Manufacture of other transport equipment	0.4687
27 - Manufacture of electrical equipment	0.0354	28 - Manufacture of machinery and equipment n.e.c.	0.0447	22 - Manufacture of rubber and plastic products	0.2061	27 - Manufacture of electrical equipment	0.4709
24 - Manufacture of basic metals	0.0359	32 - Other manufacturing	0.0452	27 - Manufacture of electrical equipment	0.2069	20 - Manufacture of chemicals and chemical products	0.474
18 - Printing and reproduction of recorded media	0.038	31 - Manufacture of furniture	0.0466	32 - Other manufacturing	0.2075	28 - Manufacture of machinery and equipment n.e.c.	0.4786

15 - Manufacture of leather and related products	0.0435	30 - Manufacture of other transport equipment	0.0495	11 - Manufacture of beverages	0.2175	22 - Manufacture of rubber and plastic products	0.4832
32 - Other manufacturing	0.0488	25 - Manufacture of fabricated metal products, except machinery and equipment	0.0525	15 - Manufacture of leather and related products	0.2242	18 - Printing and reproduction of recorded media	0.4839
13 - Manufacture of textiles	0.0567	18 - Printing and reproduction of recorded media	0.0526	23 - Manufacture of other non-metallic mineral products	0.2243	31 - Manufacture of furniture	0.5029
29 - Manufacture of motor vehicles, trailers and semi-trailers	0.0589	29 - Manufacture of motor vehicles, trailers and semi-trailers	0.0632	24 - Manufacture of basic metals	0.2386	25 - Manufacture of fabricated metal products, except machinery and equipment	0.5051
20 - Manufacture of chemicals and chemical products	0.065	20 - Manufacture of chemicals and chemical products	0.0636	13 - Manufacture of textiles	0.2444	24 - Manufacture of basic metals	0.5095
21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.0734	24 - Manufacture of basic metals	0.0651	30 - Manufacture of other transport equipment	0.2447	11 - Manufacture of beverages	0.5162
11 - Manufacture of beverages	0.0746	11 - Manufacture of beverages	0.0805	29 - Manufacture of motor vehicles, trailers and semi-trailers	0.2469	23 - Manufacture of other non-metallic mineral products	0.5227
30 - Manufacture of other transport equipment	0.0829	13 - Manufacture of textiles	0.101	26 - Manufacture of computer, electronic and optical products	0.2663	13 - Manufacture of textiles	0.5477
26 - Manufacture of computer, electronic and optical products	0.1061	14 - Manufacture of wearing apparel	0.1161	14 - Manufacture of wearing apparel	0.269	14 - Manufacture of wearing apparel	0.5498
14 - Manufacture of wearing apparel	0.1378	15 - Manufacture of leather and related products	0.1687	20 - Manufacture of chemicals and chemical products	0.2889	29 - Manufacture of motor vehicles, trailers and semi-trailers	0.593
31 - Manufacture of furniture	0.1894	23 - Manufacture of other non-metallic mineral products	0.84	21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.2999	15 - Manufacture of leather and related products	0.6345