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Agglomeration vs. dispersion of economic activities in the districts of Paris*

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Abstract

The spatial distribution of economic activity has often been analysed for wide geographical areas such as regions or metropolitan areas, but it has rarely been subject to microanalysis, especially outside the U.S. In this paper we focus on what happens within a large European city (Paris), and analyse how the industrial composition of its districts differs and how these districts evolve.We also analyse suburbanization process for both residents and the workforce and provide empirical evidence about the changing roles of the core and *intramuros* periphery.

Keywords: agglomeration, suburbanization, Paris, micropolitan analysis

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1. Motivation

The spatial distribution of economic activity has attracted the attention of economists, geographers and policy makers because of the implications of the uneven patterns all over the world. Empirical evidence points to a considerable geographical polarization of residential and economic activities, so firms and jobs tend to agglomerate in a few cities which is also where individuals tend to settle, although to a lesser extent than firms. These spatial asymmetries are found in all continents, countries and regions, and there is plenty of empirical evidence available from analyses conducted at different spatial levels of aggregation and for different periods of time.[1] Nevertheless, data limitations have restricted most analyses to focus on broad geographical areas. As a consequence, for these levels of spatial aggregation scholars nowadays have plenty of information about where and how firms and individuals locate, but very little for more disaggregated units such as cities.

Although countries and regions are important, cities also matter, and it has not been until relatively recently that researchers have started to focus on them. This more spatially disaggregated analysis, this shift from regions, counties and cities as a whole to cities' *intramuros* has been made possible by recent developments in spatial econometric techniques and the increased availability of spatially disaggregated datasets. These trends have attracted the attention of new actors who play important roles at the city level (city planners, local government bodies, sociologists, etc.).

Accordingly, there is increasing empirical evidence to show that cities are heterogeneous areas where population and jobs are unevenly distributed. These spatial asymmetries exist not only for population and jobs as a whole (let's say, in terms of number of jobs and residents being concentrated in certain neighbourhoods of the city) but also for specific groups of jobs (in terms of the industry to which they belong to or their professional category) and

[1] It is currently being debated whether diminishing transport costs and spread of information and communications technologies boost urban sprawl and make urban agglomerations less important (Glaeser, 1998). However, even if it is accepted that urban concentrations are declining in more developed countries, they still have an important role to play.

population (in terms of income levels, religion or ethnic origin,[2] among other things).[3] As a consequence, former core-periphery approaches (e.g., monocentric models based on Alonso, 1964) which assumed that there is a considerable degree of homogeneity at the core of metropolitan areas in comparison to their outskirts, seem to be unrealistic, as they do not consider that there is also a considerable degree of heterogeneity within cores. This is why we try to show whether these central areas are heterogeneous too and whether they have the same dynamics as whole metro areas: that is, some centres and subcentres do not behave in the same way (see, for instance, Giuliano and Small, 1991, for an analysis of the Los Angeles region). Accordingly, we analyse if suburbanization exists not only in terms of population and jobs moving away to the immediate peripheries of big capitals, but also in terms of whether internal relocation processes are generated inside these big urban areas. Although the time span of our data set is limited, we try to make a dynamic analysis by combining different data sources from between 1999 and 2011 for some variables, and 2007 and 2011 for others.

As most local authorities consider that potential social conflicts due to spatial segregation within urban areas deserve priority attention, most research in this area has focused on the social segregation of the population[4] and, particularly, on identifying the clusterization of certain social groups in order to get useful measures of segregation (Apparicio et al., 2014; Wong, 1993; Massey and Denton, 1988; Duncan and Duncan, 1955). These measures are required if local policiesare to be designed and implemented to erode these clusterization levels, as they have considerable negative effects on the welfare of the whole city. Unfortunately, the spatial asymmetries of firms and jobs within urban areas have received much less attention, and for various reasons most empirical research has focused on U.S. and Canadian cities. Although these contributions have made important findings, it is not clear whether they apply to such other

[2] Racial segregation has been widely analysed by sociologists to show that individuals tend to agglomerate by nationality or ethnic origin (see, among others, Charles, 2003).
[3] Social segregation has mainly been analysed for the larger U.S. metropolitan areas, but some studies, such as those by Fitoussi et al. (2004), have focused on European cities, noticeably in France..
[4] As social segregation is mainly an intra-municipal phenomenon (Royuela, 2011) most of papers dealing with this topic use this spatial level.

urban structures as major European cities, the urban patterns of which differ considerably from their American counterparts. This is why we want to focus on a major European urban area, Paris, which has also already attracted the attention of some researchers, even though most of these previous studies tend to focus on the whole metropolitan area, and do not make a detailed analyses of the core (that is to say, the districts of Paris or *arrondissements*, in French terminology). Therefore, we will focus on *i)* identifying the spatial location patterns of population and jobs as a whole at district level, *ii*) identifying the spatial location patterns of the workforce in terms of industries and professional categories, and *iii)* identifying how trends in district specializations can vary depending on their characteristics and their geographical position within the Paris metropolitan area.

The rest of the paper is organised as follows. Section 2 reviews the theoretical and empirical literature on the determinants of agglomeration and dispersion of economic activities and households. Section 3 describes the data and the methodology. Section 4 introduces spatial exploratory analysis and discusses the results. Finally, section 5 presents the main conclusions.

2. Related literature

The suburbanization of firms and residents transforms urban patterns of bigger cities around the world by lowering the relative weight of urban cores and attracting an increasing number of new firms, jobs and residents to urban peripheries (Glaeser and Kahn, 2004). These processes are not equally distributed worldwide and are typical of mature urban systems such as those of the larger North American (Carlino, 1998; Mieszkowski and Mills, 1993)[5] and European cities (Romaní et al., 2003). They involve important changes in terms of the specialisation of both core and peripheries because the growing peripheries, also known as “edge cities”, take on traditional CBD (central business district) roles (Garreau, 1991; Stanback, 1991). These peripheries

[5] See Gaschet (2002) and Mieszkowski and Mills (1993) for an excellent review of urban sprawl determinants.

capture additional economic activities thanks to their increased attractiveness (in a process of cumulative causation) and their accessibility to traditional CBDs (Gaschet, 2002).

As literature in this field typically deals with what is happening in the larger urban areas in developed countries (noticeably North America), most attention is paid to high-order service activities, because they are overrepresented in these cities (see Coffey and Shearmur, 2002, for a detailed review). In recent years these services have tended to grow in both CBDs and their peripheries, where expansion is much greater than in the cores, as reported, among others, by Coffey and Shearmur (2002) and Coffey et al. (1996) for Montreal, Harrington and Campbell (1997) for Washington DC or Hartshorn and Muller (1989) for Atlanta. Nevertheless, although these activities are quite important in core areas, these areas are highly diversified, so approaches covering the whole range of economic activities are needed.

Although empirical evidence for the U.S. helps to explain urban processes in many large European cities, some specificities still need to be taken into account. These specificities justify why a European analysis is required and, in this regard, Paris emerges as an interesting case study in view of its size (2.2 million people), its diversified economic structure, its economic role at the geographical core of the EU and the heterogeneity between the central and peripheral districts (Veltz, 2013). Surprisingly, suburbanization and industry specialization trends have both been analysed for the extended metropolitan area of Paris (namely, the Île-de-France region), but less is known about the dynamics of *intramuros* Paris. This is why it is of considerable interest to check whether trends that have been reported for Paris' peripheral areas also exist within the city. At this point it should be mentioned that a particular feature of France is the macrocephaly of its capital. Because the centralisation of the population, firms and economic activity around Paris has typically threatened the dynamism of the whole French economy, in 1963 the public authorities decided to create the *Délégation interministérielle à l'aménagement et à la compétitivité des territoires* (DATAR), a public organism entrusted with establishing a more balanced economic development at the regional level

(Monod and de Castelbajac, 2010). The policy was successful and France became slightly more uniform[6] despite its traditional inequalities.[7]

Guillain et al. (2006) and Boiteux-Orain and Guillain (2004) show that during the period 1978-1997, suburbanisation was considerable in the Île-de-France, the French region to which Paris belongs. They demonstrate that the traditional CBD structure is moving to a polycentric one, just as in many other major French cities – for example, Lyon (Buisson et al., 2001) and Bordeaux (Gaschet, 2003) – but not in middle-sized cities such as Dijon (Baumont et al., 2004b). Nevertheless, at the industry specific level some location patterns are different (Baumont et al., 2004a) and the specific characteristics of both central cities and peripheries influence the process and help drive it forward (Gaschet, 2002). However, as has been demonstrated by Shearmur and Alvergne (2002) for several high-order business services in Île-de-France, this empirical evidence is still unclear. In particular, they show that these types of service have heterogeneous location patterns not only across industries but also within the same industry, and that, although some centrifugal forces push firms to the periphery, the CBD still has an influence.[8] Gaschet's analysis (2002) is of great interest because he focuses not on a given metropolitan area but on the 50 biggest French metropolitan areas between 1976 and 1997. He divides them into three sub-areas: central city, suburban centre and other suburbs.

Segregation also needs to be taken into account in any study of suburbanization. The two phenomena are related in the sense that suburbanization allows individuals to spread over greater distances into homogeneous groups (income, ethnic origin, etc.), so the greater the decentralization, the larger the segregation (Glaeser, 1998). In the case of Paris (and even for the whole Île-de-France region) there is clear empirical evidence of social segregation (Tovar and Bourdeau-Lepage, 2013). Poverty tends to cluster in the northern and southern municipalities of Paris and this

[6] By way of example, in 1962 Paris had 6.0% of the population of France, while in 2011 this percentage had decreased to 3.6%.
[7] See Combes et al. (2011) for a historical approach to these inequalities.
[8] It is important to notice that Shearmur and Alvergne (2002) use data at a municipality level considering the whole city of Paris as the CBD of the region, i.e. without disaggregating data into Paris' districts.

clusterization to some extent includes the peripheral city districts close to these municipalities.

Finally, the measurement of suburbanisation is of fundamental importance because there is a wide variety of different procedures. Most empirical contributions use density-related measures with a critical mass of employment as a cut-off (for example, Shearmur and Coffey (2002) for Toronto, Montreal, Vancouver and Ottawa-Hull; Anderson and Bogart (2001) for Cleveland, Indianapolis, Portland and St. Louis; Giuliano and Small (1991) for Los Angeles; and McDonald (1987) for Chicago). These methodologies, however, were largely designed for North-American urban areas, and are not fully suitable for Europe. In this regard, some of the more recently published research also incorporates methodologies such as employment-population ratios – for example, Boiteux-Orain and Guillain (2004)[9] for Île-de-France – or spatial exploratory analysis – for example, Guillain and Le Gallo (2010, 2008) and Guillain et al. (2006) for Île-de-France, and Baumont et al. (2004b) for Dijon.

3. Data and methodology

3.1 Data

Since the aim of this paper is to look inside a large city, the data used is from the intra-municipal level. This contrasts with previous studies carried out in France, which rarely use smaller geographical units and rely almost exclusively on data at the municipal level.[10] One exception to this is Baumont et al. (2004a,b) who use IRIS units.[11] Although IRIS spatial aggregation makes it possible to use smaller spatial units, these are quite heterogeneous and there

[9] Concretely Boiteux-Orain and Guillain (2004) use a so-called employment location quotient, defined as the ratio of the employment/population ratio of a given municipality to the employment/population ratio of the province (*département*) where this municipality is located.
[10] It is important to notice that municipalities have traditionally been the smallest administrative level for which the French statistical office (INSEE) provides official data.
[11] IRIS (*Ilots Regroupés pour l'Information Statistique*) is an intraurban statistical area available for all urban municipalities with more than 10,000 inhabitants and for most of those between 5,000 and 10,000. As their name indicates, IRIS units are groups of contiguous houses inside a municipality (INSEE, 2000).

are several subtypes (e.g., residential IRIS and business IRIS), so we decided to work at the district level (*arrondissements*),[12] a spatial administrative unit into which only the three largest French cities are divided: Paris (20 districts), Marseille (16) and Lyon (9). These district units emerged from the administrative decentralization that was initiated in 1982 to bring local administrations closer to citizens without breaking municipality unity.[13]

More specifically, data about the districts of Paris comes from INSEE (*Institut national de la statistique et des études économiques*), and includes detailed information about the distribution of the workforce into 38 industries (see Table A.1 in the annexes), 29 socio-professional categories (see Table A.2 in the annexes) and residential population. The data about the workforce comes from the *Bases de tableaux détaillés: emploi au lieu de travail*, which report the active working population in the area (district) in which the workplace is located.

[INSERT FIGURE 1]

Several methodologies have been used to identify centres and sub centres but as the aim of this paper is not to discuss these methodological issues we will use the IAURIF (1999) typology that considers the CBD of the Île-de-France region (and, consequently, that of Paris) is made up of the 1st, 2nd, 8th, 9th and 17th districts (see Figure 1). Although these districts are located in the west of Paris and are not, therefore, the geographical core of the city (from this point of view we would select the 1st to 7th districts), they are the central area where firms have traditionally located.[14]

[INSERT TABLE 1]

[12] Although our territorial unit of analysis is the Parisian *arrondissement*, throughout this paper we use the English term "district".
[13] Despite the fact that the current *arrondissements* were designed in 1859 (*Loi du 16 juin 1859*), they were initially created in 1795 (*Loi du vendémiaire an IV*) when Paris was divided into 12 different districts. In 1982, the decentralization law promoted under François Mitterrand's presidency (*Loi du 2 mars 1982*) meant that additional competences were transferred to local units (municipalities and *arrondissements*).
[14] There are various, slightly different definitions of the core of Paris: for example, Boiteux-Orange and Guillain (2004) only consider the 2nd, 8th, 9th and 17th districts.

A comparison of the aggregate data from core districts (1st, 2nd, 8th, 9th and 17th) and periphery districts (3rd, 4th, 5th, 6th, 7th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 18th, 19th and 20th) shows that although jobs and inhabitants have increased throughout the city of Paris (particularly jobs, which have increased twice as much as population), there are considerable differences between the core and the periphery (see Table 1). More specifically, whereas jobs increased considerably in peripheral districts between 1999 and 2011 but decreased in the core, population increased in the core and the periphery at a balanced rate (slightly higher for the core). Previous results suggest some sprawl of economic activities and a slight centralisation of the residential population.

[INSERT TABLE 2]

The analysis of the aggregate workforce trends at district level (see Table 2) shows that the greater the distance from the core, of the more workers there are. However, at the same time, there are also considerable heterogeneities in the capacity of districts to increase their workforce, as there are also other "central" districts (e.g., 3rd, 5th, 6th and 10th) that show great dynamism in terms of employment growth.

[INSERT TABLE 3]

The same data provides unclear results about population trends (see Table 3). Although the more distant districts seem to be more dynamic in this respect there is not a direct, clear relationship between population growth rates and proximity to the city centre. These results point to the existence of important district heterogeneities which need to be identified and analysed.

The results of a crude analysis of suburbanisation – the ratio between jobs and population at the district level (see Table 1) – confirm the existence of this phenomenon, as ratios decreased in the core (from a ratio of 1.71 jobs per inhabitant in 1999 to 1.59 in 2011) but increased in the periphery from 0.60 (1999) to 0.67 (2011).

3.2 Methodology

In order to get a complete picture of the location patterns of economic activities that is robust to alternative methodologies, the spatial distribution of the workforce at the district level in Paris was analysed using the following indicators: Location Quotients (LQ), the Gini index, the Entropy index (ENTRO), the Dissimilarity index (D), the Absolute Concentration index (ABCON), the Ellison-Glaeser index (EG), the Suburbanization index (SUB), the Proportion in Central City index (PCC), and the Absolute Centralization index (ACE).

Location Quotients (LQ) vary by industry and district and report the ratio between the district percentage of employment in a given industry and the district percentage of total employment. If a district specialises in a specific industry, LQ will be higher than 1.

$$\mathrm{LQ}_{ij} = \frac{\text{district i's (j's) share of employment in m}}{\text{district i's (j's) share of total employment}}$$

where *m* is the industry and *i* and *j* are indices for districts ($i \neq j$). It is important to notice that LQ (like all the indices used in this paper) compute the district's distribution of workforce in relation to the total distribution of workforce in Paris.

The Gini index is another well-established inequality indicator (Duncan and Duncan, 1955) that makes it possible to determine whether jobs from different industries are equally distributed across districts. As the Gini index ranges between 0 (perfect equality: *i.e.*, equal distribution of industries across districts) and 1 (perfect inequality: *i.e.*, maximum concentration of industries across districts), values close to 0 indicate that industry *x* has roughly the same weight across all districts, whilst values close to 1 indicate that thepercentage of jobs in each industry differs considerably across districts.

The entropy index (ENTRO) is another indicator of inequality (Theil, 1972). It takes values between 0 and 1 and is typically used to detect whether a spatial unit (i.e., district) is homogenous or diverse. In this case we apply the entropy

index to the industry distribution of employment. Values close to 0 indicate a district in which there is a predominant industry, while values close to 1 indicate a district in which the relative weights of each industry are quite similar.

Inequalities in the spatial distribution of jobs and population can also be analysed using the Dissimilarity Index (D) (Wong, 1993). This index analyses whether the spatial distribution of population and jobs (whatever the industry may be) is similar across all units of the whole area (e.g., whether the weights of jobs or residential population in certain areas are than the weights in the city as a whole). The D index ranges between 0 (perfect similarity across all areas) and 1 (perfect dissimilarity). However, it does not take into account the spatial distribution of the units analysed (i.e., districts), so it needs to be completed with an indicator of Absolute Concentration (ABCON). On the basis of the proposal by Massey and Denton (1998), ABCON takes into account the extent to which the "inequity" is concentrated in contiguous districts and ranges from 0 when there is no contiguity and close to 1 (but always less than 1) if absolute concentration is maximum.

The Ellison-Glaeser (1997) index ranges between -1 and 1 and indicates whether the spatial concentration of a given industry in an area is high or low. More specifically, Ellison-Glaeser values above 0.05 indicate that industries are highly spatially concentrated, whilst values below 0.02 indicate that they are not.

As well as identifying whether population and jobs are concentrated or dispersed, it is necessary to control for the (potential) existence of suburbanization trends. Before this, however, *i)* clear definitions must be given for the centre and, consequently, the periphery and *ii)* it must be decided how suburbanization from this centre to the periphery is to be measured. In a seminal study, McDonald (1987) discusses several indicators that could be used to identify employment sub centres and suggests using both the employment-population ratio and gross employment density (employment divided by land area). However, this measure could suffer from bias depending on the geographical scale of the analysis (Gaschet, 2002). Other options

include using the share of employment located in the peripheries – although this measure is quite sensitive to how the centre and periphery are defined – or industrial specialisation in activities that depend heavily on face-to-face interactions such as those typically provided in cores (for example, office work) (Gaschet, 2002).

Gaschet (2002) suggests a measure of suburbanization (SUB) that can be adapted to the specificities of our data set:

$$SUB = \frac{\left(E_c / E_p\right)_{t+n} - \left(E_c / E_p\right)_t}{\left(E_c / E_p\right)_t}$$

where E is total employment, c is the subscript for centre and p is the subscript for periphery, t is the starting period, and $t+n$ is the final period.

The above approach can be complemented by two indexes that measure the centralization of economic activity (Massey and Denton, 1988): the Proportion in Central City (PCC) index and the Absolute Centralization index (ACE).

Proportion in Central City (PCC) ranges from 0 to 1 and measures whether an activity is located in the core. This index can be represented in the following way:

$$PCC = \frac{x_{cc}}{x}$$

where x_{cc} is the workforce in the core and x is the total workforce in the whole area.

The Proportion in Central City index is a very simple index that needs to be completed with more sophisticated indexes such as the Absolute Centralization index (ACE), which measures a group's spatial distribution in the core relative to the extant distribution in the periphery. More specifically, positive (negative)

values illustrate a tendency to be located close to the core (periphery) and values around zero show a uniform distribution across the whole city:

$$ACE = \left(\sum_{i=1}^{n} x_{i-1} - A_i \right) - \left(\sum_{i=1}^{n} x_i A_{i-1} \right)$$

where A_i refers to the cumulative proportion of land area through unit *i* and *x* refers to both the industrial workforce and professional groups.

4. Results

4.1 Some descriptive statistics

Although the data on population and workforce at district level is quite similar in 1999 and 2011, some interesting trends should be highlighted (see figures 2 and 3). Whilst both population and workforce are roughly in steady state in the more central districts, they tend to increase in the more peripheral ones (particularly the workforce).

[INSERT FIGURE 2]

As well as these slightly different trends, the spatial distribution within Paris is also different, as residential activity is clustered in peripheral districts (i.e., mainly outside the first inner ring).[15] The workforce is more homogeneously spread around most districts, although there is an important concentration in districts 8 and 15, on the western side of the city.

[INSERT FIGURE 3]

If we take into account the geographical position of districts, some additional specificities arise. Figure 4 shows the relationship between population-job

[15] There are 20 districts in Paris, which are arranged in a snail shell pattern. The 1st to the 4th districts make up the first (inner) ring, the 5th to the 11th are the second (intermediate) ring and the 12th to the 20th are the third (peripheral) ring.

density and distance to the centre of the city:[16] as population density increases from the core to the periphery, job density shows a slightly more balanced pattern when moving in the same direction.

[INSERT FIGURE 4]

The ratio between jobs and population also depends on distance to the centre. Districts close to the city centre (see figure 5) have a higher ratio (i.e., they have more jobs per inhabitant than other districts) than those located further away (the only clear exception to this rule is the 8th district). Additionally, between 1999 and 2011 this ratio tends to decrease in those districts with higher ratios (i.e., most of which are located closer to the city centre) and increase in more peripheral districts and those with lower ratios.

[INSERT FIGURE 5]

The analysis of a wider area provides exactly the same result. If we focus on the whole Île-de-France region (see figure 6) and divide it into a core (Paris), a first ring and a second ring,[17] the jobs/population ratios are larger in the core than in the periphery and increased slightly in the first ring between 1999 and 2011. The opposite occurred in Paris and the second ring.

[INSERT FIGURE 6]

An overall view of the inequalities in the spatial distribution of jobs and population can be obtained using a Dissimilarity (D) index (Wong, 1993). Our results (see Table 4) show that dissimilarity is quite small and even diminishes between 2007 and 2001.[18] If measured in the industrial workforce (i.e., 38 industries) the dissimilarity moves from 0.1597 (2007) to 0.1242 (2011), and in

[16] ArcView has been used to generate centroids of each district and we have computed these distances from the 1st district, which we assume to be the city centre.
[17] The first ring includes the *départements* of Hauts-de-Seine, Seine-Saint-Denis and Val-de-Marne, and the second ring includes Seine-et-Marne, Yvelines, Essone and Val-d'Oise.
[18] Typically, values between 0 and 0.3 imply low dissimilarity, between 0.3 and 0.7 indicate moderate dissimilarity and over 0.7 high dissimilarity.

the professional workforce (i.e., 29 groups) it moves from 0.1242 to 0.1169, a similar trend.[19]

[INSERT TABLE 4]

The spatial distribution of the workforce also needs to be analysed in terms of the industries and the professional groups studied. The results of the Gini indexes in Table 5 confirm the results of the Dissimilarity index and indicate that spatial inequalities in the distribution of industries are of no great importance at the district level and, in fact, they decreased between 2007 and 2011. The activities of extra-territorial organizations are by far the most unevenly distributed. It should also be pointed out that spatial inequalities are greater for activities that need to cluster due to knowledge spillovers (R&D) and those that benefit from intraindustry spillovers (Manufacture of textiles). On the other hand, some activities show a clear dispersed pattern (for example, Retail, Accommodation and restaurants, among others).

[INSERT TABLE 5]

The Gini indexes for professional workforce (see Table 6) are also quite evenly distributed (even more than for the industrial workforce). The professional groups that show moderate uneven patterns are lecturers, science-related workers and clergy, followed at certain distance by civil service managers and health and social work professions.

[INSERT TABLE 6]

Nevertheless, the GINI index does not take into account the spatial distribution of units (i.e., districts), so our approach can be completed with an absolute concentration index (ABCON). ABCON (Massey and Denton, 1998) computes

[19] As well as the D index other similar indexes like a multigroup Gini index (Reardon and Firebaugh, 2002), a relative diversity index (Carlson, 1992) and an entropy index (Theil, 1972) have been computed, all of which provided similar results.

whether inequality is clustered in neighbouring districts[20] and ranges from 0 if there is a lack of contiguity and close to (but lower than) 1 if spatial concentration is maximum. Therefore, ABCON provides a clearer insight into the spatial distribution of workforce by identifying clusterization processes that spill over district borders.

[INSERT TABLE 7]

In general the ABCON index shows that there is a moderate level of spatial concentration for both the industrial workforce and the professional group workforce that went unchanged between 2007 and 2011. For the industrial workforce (see Table 7) spatial isolation is more intense for several manufacturing activities (Textiles, Wood and paper, Repair of machinery) and for Financial and insurance activities, whilst for services, higher levels are found among Retail activities and Scientific and technical activities. Finally, results are more homogeneous within professional groups (see Table 8) and no clear higher and/or lower patterns can be identified.

[INSERT TABLE 8]

The Ellison-Glaeser index (see Table 9) shows quite heterogeneous results for specific activities and professions. Data from 2007 and 2011 indicates that agglomeration forces that push firms to concentrate in just a few districts operate only for such industries as Agriculture, Manufacture of textiles, Chemical and pharmaceutical activities, Transport equipment and R&D activities. For professionals, agglomeration is noticeable only for Intellectual and scientific professions.

[INSERT TABLE 9]

Following Gaschet (2002), we calculated the suburbanization of both employment and the residential population. The resulting variables show

[20] In this case, neighboring districts are those sharing a common border.

opposite trends (see Table 10) as jobs were suburbanized between 1999 and 2011 (specially between 1999 and 2007) whilst the residential population increased its geographical concentration in the core between 1999 and 2011 (specially between 2007 and 2011).

[INSERT TABLE 10]

These results show that, in relative terms, jobs are moving very slightly away from the core (which is reasonable given the short time lag considered) whilst the opposite is true for residents. Furthermore, a complementary way of approaching suburbanization processes is to study what happens for certain activities and agents, like the industrial and professional workforces. One strategy that can complement results on suburbanization is to calculate a Proportion in Central City index (PCC) and an Absolute Centralization index (ACE) (Massey and Denton, 1988).

[INSERT TABLE 11]

The PCC results show considerable heterogeneities when a detailed industrial workforce classification is analysed (see Table 11). There is an important concentration of activities such as Manufacturing of chemicals, Electricity, gas and steam and Financial and insurance activities and, to a lesser extent, also of IT and other information services, Legal, management and technical activities and Manufacture of textiles. At the same time, some activities are clearly underrepresented at the core (for example, R&D, Human health activities, Social work activities, Manufacture of computers and Education).

For professional groups (see Table 12), the results are more homogeneous, although some groups are overrepresented in the core (for example, Managers in businesses, Heads of businesses, Administrative business employees, Administrative and commercial associate professionals and Engineers and technical managers in businesses), whilst most public employees (Health and social work professionals, Civil service employees, Civil service managers) and researchers tend to locate in peripheral areas.

[INSERT TABLE 12]

As the Proportion in central city index (PCC) is quite simple, it should be complemented with more sophisticated measures like the absolute centralization index (ACE). This index measures a group's spatial distribution in the core relative to its distribution in the periphery.

[INSERT TABLE 13]

As expected, the results of the absolute centralization index are in line with those of the PCC, but they provide additional insights. In terms of the industrial workforce (see Table 13), for instance, some activities are distributed uniformly across the city (Transportation and storage, Human health activities and Residential care and social work activities) and one (Water supply) evolved towards a peripheral location between 2007 and 2011.

[INSERT TABLE 14]

Finally, the new index provides new insights into professional groups (see Table 14) by identifying those with a more homogeneous pattern across Paris (Intellectual and scientific professions, Health and social work professionals, Civil service employees and Skilled workers in handling, storage and transport). However, the index relies on an ex-ante definition of core and periphery, which applies to all activities, and our results suggest the existence of multiple cores for specific activities.

[INSERT FIGURE 7]

Although most industries grow (decline) at similar rates in terms of workforce in both the core and the periphery (see Figure 7), some of them grow (decline) at quite different rates (for example, Water supply, Mining and quarrying, Manufacture of machinery and equipment, Public administration and defence, Publishing or Agriculture) and others evolve in opposite directions (for example,

Education, R&D, Financial and insurance activities, Telecommunications, Wholesale and retail trade, Construction, Electricity and gas and Manufacture of electrical equipment).

4.2 Spatial Exploratory Analysis

As we have explained above, the workforce has been disaggregated into 38 industries and 29 professional categories in an attempt to capture whether these activities tend to show a clustered / dispersed pattern, and whether these patterns change during the period analysed.

[INSERT TABLE 15]

[INSERT TABLE 16]

A location quotient can provide useful insights into the distribution of the workforce. Table 15 shows that in 2011 some industries were clearly concentrated in one district (Scientific research and development in the 5th district and Activities of extra-territorial organizations and bodies in the 16th district). Table 16, on the other hand, shows that professional groups were less concentrated, even though some of them tend to cluster (for example, Intellectual and scientific professions in the 5th district and Police and military in the 4th).

[INSERT FIGURE 8]

[INSERT FIGURE 9]

Figures 8 and 9 also provide some insights into the general location quotients for some of those industries and professional groups at the district level. These figures show not only an unequal location pattern at the district level but also some contiguity effects, as lower and higher values tend to cluster.

Another useful indicator is Theil's Entropy measure (H2) also known as the diversity index (Theil, 1972). It ranges between 0 and 1 and is used to identify whether a spatial unit (i.e., Paris districts) is homogeneous or diverse. As entropy can be measured using various indicators, in this case we calculated the distribution of the industrial workforce (Figure 10) and professional groups (Figure 11). Values close to 0 indicate that there is a predominant industry in the district (i.e., in terms of workforce), whilst values close to 1 indicate that all the industries have similar weights. It is important to notice that weight distribution is not measured in absolute terms as the values are corrected for the industrial distribution for the whole of Paris, so this index is in some ways a relative measure of industrial diversity.

[INSERT FIGURE 10]

The results for the industrial workforce are quite surprising as all districts are moving towards a more unequal distribution with one predominant industry gaining relative weight, although in the short/medium term it is not easy for local industrial structures to undergo huge transformations. It is important to notice that this is a general trend in all districts.

Nevertheless, in terms of professional groups, the results from 2007 and 2011 show a stable situation characterized by considerable homogeneity across districts only slightly broken in some core districts (i.e., 2^{nd}, 8^{th} and 9^{th}).

[INSERT FIGURE 11]

Some authors consider that the Entropy index is an indicator of Jacobs externalities (Frenken et al., 2007): the larger the index, the larger the diversity. If this assumption is reasonable, this type of externality could be playing a major role in the districts of Paris, especially for the industrial workforce.

Finally, as we have explained above, the analysis of georeferenced data is driven by how the geographical position of units (i.e., districts) influences/determines the values of given variables. As this implies that there is

some kind of spatial dependence, workforce location patterns cannot be analysed without considering the geographical position of each district in terms of its spatial proximity to others.

In order to account for this spatial dependence we investigated whether the distribution of the workforce in terms of industries and professional groups is spatially autocorrelated at the district level (e.g., whether the values in each district are related to values in neighbouring districts). To do so, we used a spatial-neighbour matrix (*W*) and defined a neighbouring criterion. Typically, *W* can be approached in different ways (distance-based neighbours, *k*-nearest neighbours, contiguous neighbours and inverse-distance-based neighbours); nevertheless, bearing in mind that this is an intraurban analysis in which spatial units (districts) are quite close to each other we considered that the most appropriate measure was a contiguous neighbours approach (i.e., two districts are considered neighbours if they share a common border). Once *W* is identified, we can calculate whether our variables of interest are spatially related. In order to do this, we calculate both global and local measures of spatial autocorrelation: Moran's I (Moran, 1948) and the Local Index of Spatial Association (LISA), respectively. The values of Moran's I are interpreted as follows: if they range from -1 to 0, there is negative spatial autocorrelation; if they are around 0, there is a random distribution of the variable; and if they range from 0 to 1, there is positive spatial autocorrelation. Table 17 shows Moran's I results for the variables of industry-specific workforce and professional groups. Spatial autocorrelation is noticeable only for a few industries (e.g., Real estate activities, Manufacture of textiles and leather) and professional groups (e.g., Self-employed professionals, Personal services staff).

[INSERT TABLE 17]

It should be pointed out that spatial dependence phenomena can be local in nature rather than global, so we must check whether results are driven by the general characteristics of the data on the territory under analysis or, on the contrary, they are driven by specific local characteristics that exist only in some areas (i.e., districts). Accordingly, we estimated a Local Index of Spatial

Association (LISA) for the change in total workforce (Figure 12) and population (Figure 13) between 1999 and 2011, in which red areas indicate high-high spatial autocorrelation, dark blue areas indicate low-low spatial autocorrelation, light blue areas indicate low-high spatial autocorrelation, light red areas indicate high-low spatial autocorrelation and grey areas indicate that spatial autocorrelation is not significant. On the whole, Moran's I values are larger for workforce change (0.31) than for population change (0.21) although both are moderate, indicating that growth trends of jobs and population at district level do not seem to be strongly spatially dependent. Nevertheless, LISA maps provide additional clear insights into these patterns.

[INSERT FIGURE 12]

Workforce changes across the districts of Paris (see figure 12) mainly show non-significant values in terms of local spatial autocorrelation, except for central areas (1st, 6th, 7th and 8th districts), where there is a significant low-low pattern (i.e., low values surrounded by low values), and eastern areas, where there is a high-high pattern (19th district) and a low-high pattern (12th district).

[INSERT FIGURE 13]

Nevertheless, the results for population change (see figure 13) differ considerably as there is a significant high-high pattern in the northern areas of the city (9th and 18th districts), close to a low-high area (10th district), whilst the opposite is the case in central-southern areas where there is a low-low area (5th and 6th districts) close to a high-low area (district 13th).

5. Conclusions

The aim of this paper was to analyse the location trends of both jobs and households in terms of the agglomeration and dispersion forces within a big city. As most empirical analyses rely on what happens in metropolitan areas as

a whole, less attention is paid to the core of these areas, although centrifugal and centripetal forces that drive the spatial distribution of economic and residential activity also play a role at this intrametropolitan level.

Paris was selected as a case study for an empirical application for several reasons: firstly, it is a large urban area located in a polycentric dynamic region; secondly, these urban phenomena have mainly been studied in U.S. or Canadian cities, and European urban structures have been analysed considerably less; thirdly, European cities are different from their North-American counterparts, so they deserve specific treatment; and, fourthly, several studies have focused on the whole Paris metropolitan area but they have paid little attention to the core of the area (i.e., Paris).

As we aimed to provide a broad picture of these economic and residential location trends, we calculated several indicators that proxy the spatial distribution of these activities at district level. They are related but focus on specific issues, so a general overview can be acquired by jointly taking them into account. In terms of the state of the art for French cities, our results are quite similar to those obtained by Gaschet (2002) from a sample of the 50 biggest French metropolitan areas and indicate that, although suburbanization processes have triggered economic and urban growth in the peripheral districts of Paris, central downtown is still attractive thanks to the competitiveness of the area, even if some activities are moving to peripheral districts (and even to other neighbouring municipalities) to stay. Generally speaking, during the period analysed jobs seem to be sprawling slightly at the same time as the residential population is recovering in the core. In this regard, our results coincide with those of previous empirical studies (e.g., Boiteux-Orain and Guillain (2004), which show that Paris is decentralizing activities towards a polycentric urban structure, but maintaining the primacy of Paris's central districts. In any case, and as it has been demonstrated by Guillain et al. (2006), suburbanization is a complex and diverse phenomenon that can evolve in different ways, so local characteristics and local specialization clearly matter.

Although evidence can be found of localisation economies arising from the concentration of certain activities in some areas (noticeably those related to R&D), urbanisation economies seem to be much more important. In this regard, it should be taken into account that Paris is a highly diversified city with several cores (depending on specific economic activities) and that this polycentric pattern tends to expand over time. As a result of these heterogeneities (at both the industrial and spatial levels), we assume that the spatial interactions within Paris are quite heterogeneous and include not only neighbouring areas but the whole city.

Therefore, a complex pattern arises as centralization/decentralization depends on the types of economic (and residential) activity, which do not all behave in the same way. Nevertheless, although some activities which are key for the French economy are clearly agglomerated (R&D activities are one clear example), Paris's assets rely mainly on its diverse industrial structure (Veltz, 2013).

Since most previous empirical research has focused on the Paris region as a whole and not the city in particular and this paper focuses on the core of this area, future extensions should analyse interactions between these core areas (Paris districts) and peripheral areas (municipalities in the rest of the metropolitan area) in an attempt to better define these agglomeration and dispersion patterns.

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Tables

1. Workforce and population (1999-2011) in the districts of Paris

District	Jobs 1999	Jobs 2011	Change (%)	Population 1999	Population 2011	Change (%)	Job/Pop 1999	Job/Pop 2011
Core	500,378	493,513	-1.37	292,759	311,253	6.32	1.71	1.59
Periphery	1,100,437	1,294,688	17.65	1,833,092	1,938,722	5.76	0.60	0.67
TOTAL	1,600,815	1,788,201	11.71	2,125,851	2,249,975	5.84	0.75	0.79

Note: Core includes the 1st, 2nd, 8th, 9th and 17th districts; and Periphery includes the 3rd, 4th, 5th, 6th, 7th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 18th, 19th and 20th districts.
Source: author with data from INSEE

2. Workforce (1999-2011) in the districts of Paris

District	Jobs 1999	% jobs 1999	Jobs 2011	% jobs 2011	Change (%)
Paris 1st	63,056	3.94	56,515	3.16	-10.37
Paris 2nd	61,672	3.85	58,389	3.27	-5.32
Paris 3rd	29,723	1.86	31,475	1.76	5.89
Paris 4th	43,955	2.75	41,679	2.33	-5.18
Paris 5th	48,909	3.06	54,713	3.06	11.87
Paris 6th	43,691	2.73	45,129	2.52	3.29
Paris 7th	76,212	4.76	70,838	3.96	-7.05
Paris 8th	171,444	10.71	158,691	8.87	-7.44
Paris 9th	111,939	6.99	109,718	6.14	-1.98
Paris 10th	71,962	4.50	83,716	4.68	16.33
Paris 11th	67,687	4.23	85,916	4.80	26.93
Paris 12th	112,336	7.02	121,806	6.81	8.43
Paris 13th	89,316	5.58	125,524	7.02	40.54
Paris 14th	71,836	4.49	87,893	4.92	22.35
Paris 15th	144,667	9.04	162,149	9.07	12.08
Paris 16th	106,971	6.68	118,236	6.61	10.53
Paris 17th	92,267	5.76	110,200	6.16	19.44
Paris 18th	70,285	4.39	95,361	5.33	35.68
Paris 19th	68,101	4.25	90,284	5.05	32.57
Paris 20th	54,786	3.42	79,970	4.47	45.97
Core	*500,.378*	*31.26*	*493,513*	*27.60*	*-1.37*
Periphery	*1,100,437*	*68.74*	*1,294,688*	*72.40*	*17.65*
TOTAL	1,600,815	100.00	1,788,201	100.00	11.71

Note: Core includes 1st, 2nd, 8th, 9th and 17th districts; and Periphery includes 3rd, 4th, 5th, 6th, 7th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 18th, 19th and 20th districts. Core districts are in grey.
Source: author with data from INSEE

3. Population (1999-2011) in the districts of Paris

District	Population 1999	% pop. 1999	Population 2011	% pop. 2011	Change (%)
Paris 1st	16,895	0.79	17,443	0.78	3.24
Paris 2nd	19,640	0.92	22,927	1.02	16.74
Paris 3rd	34,232	1.61	36,120	1.61	5.52
Paris 4th	30,671	1.44	27,887	1.24	-9.08
Paris 5th	58,841	2.77	60,800	2.70	3.33
Paris 6th	44,903	2.11	43,880	1.95	-2.28
Paris 7th	56,988	2.68	57,786	2.57	1.40
Paris 8th	39,303	1.85	40,589	1.80	3.27
Paris 9th	55,783	2.62	60,120	2.67	7.77
Paris 10th	89,685	4.22	94,027	4.18	4.84
Paris 11th	149,166	7.02	154,647	6.87	3.67
Paris 12th	136,662	6.43	144,402	6.42	5.66
Paris 13th	171,577	8.07	183,260	8.14	6.81
Paris 14th	132,822	6.25	140,317	6.24	5.64
Paris 15th	225,467	10.61	238,395	10.60	5.73
Paris 16th	161,817	7.61	169,942	7.55	5.02
Paris 17th	161,138	7.58	170,174	7.56	5.61
Paris 18th	184,581	8.68	203,127	9.03	10.05
Paris 19th	172,587	8.12	186,090	8.27	7.82
Paris 20th	183,093	8.61	198,042	8.80	8.16
Core	*292,759*	*13.77*	*311,253*	*13.83*	*6.32*
Periphery	*1,833,092*	*86.23*	*1,938,722*	*86.17*	*5.76*
TOTAL	2,125,851	100.00	2,249,975	100.00	5.84

Note: Core includes 1st, 2nd, 8th, 9th and 17th districts; and Periphery includes 3rd, 4th, 5th, 6th, 7th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 18th, 19th and 20th districts. Core districts are in grey.
Source: author with data from INSEE

4. Index of dissimilarity (D) (2007-2001) in the districts of Paris

Workforce classification	2007	2011
Industrial (N=38)	0.1597	0.1467
Professional (N=29)	0.1242	0.1169

Source: author using Geo-Segregation Analyzer (Apparicio et al., 2014) with data from INSEE

5. Gini index for the industrial workforce (2007-2011) in the districts of Paris

Industry	2007	2011
Agriculture, forestry and fishing	0.4357	0.3452
Mining and quarrying	0.3293	0.4878
Manufacture of food products, beverages and tobacco products	0.1107	0.1016
Manufacture of textiles, wearing apparel, leather and related products	0.4396	0.3506
Manufacture of wood and paper products; printing and reproduction of recorded media	0.2906	0.2857
Manufacture of coke and refined petroleum products	0.2939	0.3895
Manufacture of chemicals and chemical products	0.3641	0.3100
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.3143	0.3060
Manufacture of rubber and plastics products, and other non-metallic mineral products	0.2741	0.1705
Manufacture of basic metals and fabricated metal products, except machinery and equipment	0.2591	0.2757
Manufacture of computer, electronic and optical products	0.2865	0.3067
Manufacture of electrical equipment	0.3290	0.3464
Manufacture of machinery and equipment n.e.c.	0.2148	0.1839
Manufacture of transport equipment	0.3685	0.3604
Other manufacturing; repair and installation of machinery and equipment	0.2216	0.2152
Electricity, gas, steam and air-conditioning supply	0.3589	0.2733
Water supply; sewerage, waste management and remediation	0.3097	0.4469
Construction	0.1251	0.1219
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.1177	0.0989
Transportation and storage	0.2700	0.2420
Accommodation and food service activities	0.0854	0.0770
Publishing, audiovisual and broadcasting activities	0.1708	0.1733
Telecommunications	0.2624	0.2700
IT and other information services	0.1725	0.1599
Financial and insurance activities	0.3183	0.2874
Real estate activities	0.1461	0.1291
Legal, accounting, management, architecture, engineering, technical testing and analysis activities	0.2286	0.2146
Scientific research and development	0.4438	0.4135
Other professional, scientific and technical activities	0.1747	0.1895
Administrative and support service activities	0.1123	0.0982
Public administration and defence; compulsory social security	0.2779	0.2645
Education	0.2535	0.2516
Human health activities	0.3062	0.2961
Residential care and social work activities	0.2323	0.1971
Arts, entertainment and recreation	0.1787	0.1599
Other service activities	0.0832	0.0880
Activities of households as employers; undifferentiated goods- and services- producing activities of households for own use	0.2430	0.2377
Activities of extra-territorial organizations and bodies	0.5864	0.5597

Source: author using Geo-Segregation Analyzer (Apparicio et al., 2014) with data from INSEE

6. Gini index for the professional workforce (2007-2011) in the districts of Paris

Professional group	2007	2011
Farmers	0.2139	0.2419
Craftsmen	0.1333	0.1186
Shopkeepers and similar	0.1030	0.1146
Heads of businesses with 10 or more employees	0.1771	0.1652
Self-employed professionals and similar	0.1990	0.1905
Civil service managers	0.2889	0.2779
Intellectual and scientific professions	0.3173	0.3064
Artistic professions	0.1463	0.1476
Managers in businesses	0.2469	0.2289
Engineers and technical managers in businesses	0.1358	0.1229
Teaching	0.1702	0.1569
Health and social work professionals	0.2860	0.2667
Clergy, religious	0.3264	0.3776
Civil service administrative employees	0.2572	0.2351
Administrative and commercial associate professionals in companies	0.1075	0.0942
Technicians	0.0770	0.0619
Foremen, supervisors	0.0560	0.0548
Civil service employees	0.2228	0.2191
Police and military	0.1901	0.1736
Administrative business employees	0.1100	0.1020
Shop employees	0.1239	0.1167
Personal services staff	0.1055	0.1007
Skilled workers in manufacturing	0.1485	0.1087
Skilled workers in craftsmanship	0.0777	0.0696
Drivers	0.1270	0.1213
Skilled workers in handling, storage and transport	0.2075	0.1758
Non-skilled workers in manufacturing	0.1923	0.1319
Non-skilled workers in craftsmanship	0.1599	0.1264
Farm workers	0.2684	0.2696

Source: author using Geo-Segregation Analyzer (Apparicio et al., 2014) with data from INSEE

7. Absolute concentration (ABCON) index for the industrial workforce (2007-2011) in the districts of Paris

Industry	2007	2011
Agriculture, forestry and fishing	0.4982	0.5275
Mining and quarrying	0.6608	0.6416
Manufacture of food products, beverages and tobacco products	0.6566	0.6524
Manufacture of textiles, wearing apparel, leather and related products	0.7811	0.7531
Manufacture of wood and paper products; printing and reproduction of recorded media	0.6967	0.7030
Manufacture of coke and refined petroleum products	0.6628	0.6946
Manufacture of chemicals and chemical products	0.6786	0.6547
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.5943	0.6599
Manufacture of rubber and plastics products, and other non-metallic mineral products	0.6182	0.6513
Manufacture of basic metals and fabricated metal products, except machinery and equipment	0.6498	0.6472
Manufacture of computer, electronic and optical products	0.6205	0.6881
Manufacture of electrical equipment	0.6438	0.6630
Manufacture of machinery and equipment n.e.c.	0.6989	0.6885
Manufacture of transport equipment	0.5469	0.5798
Other manufacturing; repair and installation of machinery and equipment	0.7009	0.7044
Electricity, gas, steam and air-conditioning supply	0.6948	0.6718
Water supply; sewerage, waste management and remediation	0.6668	0.6718
Construction	0.6508	0.6471
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.7057	0.6978
Transportation and storage	0.5819	0.6025
Accommodation and food service activities	0.6902	0.6868
Publishing, audiovisual and broadcasting activities	0.6545	0.6584
Telecommunications	0.6471	0.6806
IT and other information services	0.6804	0.6750
Financial and insurance activities	0.7231	0.7135
Real estate activities	0.6469	0.6439
Legal, accounting, management, architecture, engineering, technical testing and analysis activities	0.6672	0.6766
Scientific research and development	0.6705	0.6568
Other professional, scientific and technical activities	0.6873	0.6990
Administrative and support service activities	0.6765	0.6796
Public administration and defence; compulsory social security	0.6715	0.6746
Education	0.6756	0.6739
Human health activities	0.6230	0.6229
Residential care and social work activities	0.6333	0.6272
Arts, entertainment and recreation	0.6685	0.6736
Other service activities	0.6668	0.6515
Activities of households as employers; undifferentiated goods- and services- producing activities of households for own use	0.5837	0.5633
Activities of extra-territorial organizations and bodies	0.4721	0.4830

Source: author using *Geo-Segregation Analyzer* (Apparicio et al., 2012) with data from INSEE

8. Absolute concentration (ABCON) index for the professional workforce (2007-2011) in the districts of Paris

Professional group	2007	2011
Farmers	0.6196	0.6541
Craftsmen	0.6605	0.6529
Shopkeepers and similar	0.6697	0.6606
Heads of businesses with 10 or more employees	0.6709	0.6692
Self-employed professionals and similar	0.6404	0.6447
Civil service managers	0.6472	0.6482
Intellectual and scientific professions	0.6695	0.6643
Artistic professions	0.6772	0.6787
Managers in businesses	0.6931	0.6963
Engineers and technical managers in businesses	0.6600	0.6651
Teaching	0.6404	0.6374
Health and social work professionals	0.6267	0.6275
Clergy, religious	0.7019	0.6487
Civil service administrative employees	0.6531	0.6589
Administrative and commercial associate professionals in companies	0.6955	0.6954
Technicians	0.6499	0.6589
Foremen, supervisors	0.6571	0.6572
Civil service employees	0.6562	0.6532
Police and military	0.6591	0.6662
Administrative business employees	0.6925	0.6814
Shop employees	0.6963	0.6964
Personal services staff	0.6519	0.6484
Skilled workers in manufacturing	0.6586	0.6585
Skilled workers in craftsmanship	0.6640	0.6626
Drivers	0.6277	0.6213
Skilled workers in handling, storage and transport	0.5860	0.6136
Non-skilled workers in manufacturing	0.6613	0.6564
Non-skilled workers in craftsmanship	0.6525	0.6527
Farm workers	0,5743	0,5939

Source: author using Geo-Segregation Analyzer (Apparicio et al., 2014) with data from INSEE

9. Ellison-Glaeser index of geographical concentration (2007-2011) in the districts of Paris for the industrial and professional workforce

Industry	2007	2011	Professional group	2007	2011
Agriculture, forestry and fishing	0.061	0.030	Farmers	0.007	0.011
Mining and quarrying	0.015	0.061	Craftsmen	0.003	0.003
Manufacture of food products, beverages and tobacco products	0.002	0.002	Shopkeepers and similar	0.002	0.003
Manufacture of textiles, wearing apparel, leather and related products	0.040	0.023	Heads of businesses with 10 or more employees	0.006	0.005
Manufacture of wood and paper products; printing and reproduction of recorded media	0.018	0.017	Self-employed professionals and similar	0.009	0.008
Manufacture of coke and refined petroleum products	0.013	0.018	Civil service managers	0.018	0.015
Manufacture of chemicals and chemical products	0.035	0.019	Intellectual and scientific professions	0.023	0.020
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.030	0.038	Artistic professions	0.004	0.004
Manufacture of rubber and plastics products, and other non-metallic mineral products	0.014	0.007	Managers in businesses	0.010	0.009
Manufacture of basic metals and fabricated metal products, except machinery and equipment	0.011	0.015	Engineers and technical managers in businesses	0.003	0.002
Manufacture of computer, electronic and optical products	0.019	0.021	Teaching	0.005	0.004
Manufacture of electrical equipment	0.023	0.037	Health and social work professionals	0.014	0.012
Manufacture of machinery and equipment n.e.c.	0.008	0.006	Clergy, religious	0.017	0.028
Manufacture of transport equipment	0.041	0.041	Civil service administrative employees	0.012	0.009
Other manufacturing; repair and installation of machinery and equipment	0.008	0.008	Administrative and commercial associate professionals in companies	0.002	0.001
Electricity, gas, steam and air-conditioning supply	0.031	0.015	Technicians	0.001	0.001
Water supply; sewerage, waste management and remediation	0.019	0.044	Foremen, supervisors	0.000	0.000
Construction	0.002	0.002	Civil service employees	0.008	0.008
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.002	0.001	Police and military	0.007	0.006
Transportation and storage	0.018	0.012	Administrative business employees	0.002	0.002
Accommodation and food service activities	0.001	0.001	Shop employees	0.002	0.002
Publishing, audiovisual and broadcasting activities	0.006	0.006	Personal services staff	0.002	0.002
Telecommunications	0.013	0.011	Skilled workers in manufacturing	0.004	0.002
IT and other information services	0.005	0.004	Skilled workers in craftsmanship	0.001	0.001
Financial and insurance activities	0.018	0.015	Drivers	0.003	0.003
Real estate activities	0.005	0.004	Skilled workers in handling, storage and transport	0.012	0.008
Legal, accounting, management, architecture, engineering, technical testing and analysis activities	0.013	0.010	Non-skilled workers in manufacturing	0.007	0.003
Scientific research and development	0.049	0.044	Non-skilled workers in craftsmanship	0.005	0.003
Other professional, scientific and technical activities	0.005	0.006	Farm workers	0.013	0.013
Administrative and support service activities	0.002	0.001			
Public administration and defence; compulsory social security	0.013	0.011			
Education	0.011	0.011			
Human health activities	0.016	0.015			
Residential care and social work activities	0.009	0.007			
Arts, entertainment and recreation	0.006	0.004			
Other service activities	0.001	0.001			
Activities of households as employers; undifferentiated goods- and services- producing activities of households for own use	0.017	0.018			
Activities of extra-territorial organizations and bodies	0.115	0.106			

Source: author.

10. Suburbanization process (1999-2011) of jobs and population in the districts of Paris

Variable	1999 to 2007	2007 to 2011	1999 to 2011
Jobs	-0.136	-0.030	-0.162
Population	0.000	0.005	0.005

Source: author with data from INSEE

11. Proportion in central city (PCC) index for the industrial workforce (2007-2011) in the districts of Paris

Industry	2007	2011
Agriculture, forestry and fishing	0.1783	0.2240
Mining and quarrying	0.3233	0.3733
Manufacture of food products, beverages and tobacco products	0.2686	0.2683
Manufacture of textiles, wearing apparel, leather and related products	0.3699	0.3491
Manufacture of wood and paper products; printing and reproduction of recorded media	0.2044	0.1997
Manufacture of coke and refined petroleum products	0.3333	0.3175
Manufacture of chemicals and chemical products	0.4996	0.4418
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.2500	0.2442
Manufacture of rubber and plastics products, and other non-metallic mineral products	0.2183	0.2531
Manufacture of basic metals and fabricated metal products, except machinery and equipment	0.2128	0.2386
Manufacture of computer, electronic and optical products	0.1731	0.1766
Manufacture of electrical equipment	0.2123	0.1858
Manufacture of machinery and equipment n.e.c.	0.3430	0.2796
Manufacture of transport equipment	0.3240	0.3372
Other manufacturing; repair and installation of machinery and equipment	0.2951	0.2966
Electricity, gas, steam and air-conditioning supply	0.5027	0.4296
Water supply; sewerage, waste management and remediation	0.3158	0.2018
Construction	0.2583	0.2431
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.3092	0.2980
Transportation and storage	0.2044	0.2078
Accommodation and food service activities	0.3066	0.2941
Publishing, audiovisual and broadcasting activities	0.2680	0.2493
Telecommunications	0.2182	0.2753
IT and other information services	0.3719	0.3661
Financial and insurance activities	0.4910	0.4638
Real estate activities	0.3242	0.3089
Legal, accounting, management, architecture, engineering, technical testing and analysis activities	0.4011	0.3902
Scientific research and development	0.1081	0.1203
Other professional, scientific and technical activities	0.3427	0.3300
Administrative and support service activities	0.3130	0.3154
Public administration and defence; compulsory social security	0.1906	0.2009
Education	0.1688	0.1598
Human health activities	0.1173	0.1202
Residential care and social work activities	0.1618	0.1649
Arts, entertainment and recreation	0.2327	0.2267
Other service activities	0.2588	0.2501
Activities of households as employers; undifferentiated goods- and services- producing activities of households for own use	0.2235	0.2053
Activities of extra-territorial organizations and bodies	0.2233	0.2323

Source: author using *Geo-Segregation Analyzer* (Apparicio et al., 2012) with data from INSEE

12. Proportion in central city (PCC) index for the professional workforce (2007-2011) in the districts of Paris

Industry	2007	2011
Farmers	0.2299	0.3329
Craftsmen	0.2340	0.2292
Shopkeepers and similar	0.2809	0.2719
Heads of businesses with 10 or more employees	0.3587	0.3451
Self-employed professionals and similar	0.3246	0.3202
Civil service managers	0.1826	0.1797
Intellectual and scientific professions	0.1233	0.1259
Artistic professions	0.2397	0.2332
Managers in businesses	0.4300	0.4122
Engineers and technical managers in businesses	0.3452	0.3319
Teaching	0.1984	0.1919
Health and social work professionals	0.1342	0.1376
Clergy, religious	0.2213	0.1481
Civil service administrative employees	0.1812	0.1851
Administrative and commercial associate professionals in companies	0.3382	0.3239
Technicians	0.2653	0.2608
Foremen, supervisors	0.2862	0.2722
Civil service employees	0.1635	0.1585
Police and military	0.2376	0.2531
Administrative business employees	0.3464	0.3325
Shop employees	0.3027	0.2951
Personal services staff	0.2658	0.2584
Skilled workers in manufacturing	0.2262	0.2340
Skilled workers in craftsmanship	0.2557	0.2511
Drivers	0.2346	0.2283
Skilled workers in handling, storage and transport	0.2036	0.2150
Non-skilled workers in manufacturing	0.2283	0.2352
Non-skilled workers in craftsmanship	0.2275	0.2338
Farm workers	0.2382	0.2347

Source: author using *Geo-Segregation Analyzer* (Apparicio et al., 2012) with data from INSEE

13. Absolute centralization (ACE) index for the industrial workforce (2007-2011) in the districts of Paris

Industry	2007	2011
Agriculture, forestry and fishing	0.0058	0.1092
Mining and quarrying	0.3754	0.4078
Manufacture of food products, beverages and tobacco products	0.2098	0.2283
Manufacture of textiles, wearing apparel, leather and related products	0.3495	0.3373
Manufacture of wood and paper products; printing and reproduction of recorded media	0.1977	0.2122
Manufacture of coke and refined petroleum products	0.3261	0.3318
Manufacture of chemicals and chemical products	0.4669	0.3872
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.1254	0.1192
Manufacture of rubber and plastics products, and other non-metallic mineral products	0.1551	0.1468
Manufacture of basic metals and fabricated metal products, except machinery and equipment	0.1299	0.1544
Manufacture of computer, electronic and optical products	0.1630	0.2230
Manufacture of electrical equipment	0.1047	0.1221
Manufacture of machinery and equipment n.e.c.	0.3242	0.2976
Manufacture of transport equipment	0.2986	0.3307
Other manufacturing; repair and installation of machinery and equipment	0.2515	0.2675
Electricity, gas, steam and air-conditioning supply	0.4505	0.3622
Water supply; sewerage, waste management and remediation	0.1704	-0.0274
Construction	0.1943	0.1824
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.2787	0.2664
Transportation and storage	0.0673	0.0850
Accommodation and food service activities	0.2727	0.2546
Publishing, audiovisual and broadcasting activities	0.2690	0.2505
Telecommunications	0.1087	0.2091
IT and other information services	0.2922	0.2817
Financial and insurance activities	0.4143	0.3794
Real estate activities	0.3007	0.2790
Legal, accounting, management, architecture, engineering, technical testing and analysis activities	0.3539	0.3430
Scientific research and development	0.1400	0.1090
Other professional, scientific and technical activities	0.3049	0.3130
Administrative and support service activities	0.2649	0.2679
Public administration and defence; compulsory social security	0.1688	0.1676
Education	0.1396	0.1229
Human health activities	0.0125	0.0101
Residential care and social work activities	0.0662	0.0801
Arts, entertainment and recreation	0.1679	0.1726
Other service activities	0.2184	0.1764
Activities of households as employers; undifferentiated goods- and services- producing activities of households for own use	0.2323	0.1949
Activities of extra-territorial organizations and bodies	0.3296	0.3265

Source: author using *Geo-Segregation Analyzer* (Apparicio et al., 2012) with data from INSEE

14. Absolute centralization (ACE) index for the professional workforce (2007-2011) in the districts of Paris

Industry	2007	2011
Farmers	0.2291	0.3462
Craftsmen	0.1812	0.1815
Shopkeepers and similar	0.2618	0.2560
Heads of businesses with 10 or more employees	0.3488	0.3356
Self-employed professionals and similar	0.3033	0.2987
Civil service managers	0.1848	0.1625
Intellectual and scientific professions	0.1144	0.0866
Artistic professions	0.2275	0.2206
Managers in businesses	0.3637	0.3440
Engineers and technical managers in businesses	0.2632	0.2462
Teaching	0.1349	0.1232
Health and social work professionals	0.0217	0.0331
Clergy, religious	0.3508	0.1974
Civil service administrative employees	0.1458	0.1378
Administrative and commercial associate professionals in companies	0.2821	0.2693
Technicians	0.1866	0.1879
Foremen, supervisors	0.2219	0.2113
Civil service employees	0.1050	0.0869
Police and military	0.1848	0.2034
Administrative business employees	0.2860	0.2631
Shop employees	0.2712	0.2693
Personal services staff	0.2367	0.2229
Skilled workers in manufacturing	0.1853	0.1853
Skilled workers in craftsmanship	0.2108	0.2069
Drivers	0.1777	0.1535
Skilled workers in handling, storage and transport	0.0908	0.1317
Non-skilled workers in manufacturing	0.1667	0.1719
Non-skilled workers in craftsmanship	0.1728	0.1823
Farm workers	0.1330	0.1919

Source: author using *Geo-Segregation Analyzer* (Apparicio et al., 2012) with data from INSEE

15. Location quotient of industrial workforce (2011) in the districts of Paris

District	AZ	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	DZ	EZ	FZ	GZ
Paris 1	0.39	0.44	0.74	1.77	0.74	1.02	1.88	0.52	0.82	0.54	0.50	0.71	0.64	0.66	1.26	0.65	1.73	0.66	1.26
Paris 2	1.55	0.25	0.67	3.56	0.78	0.75	2.03	1.38	1.71	1.19	0.65	0.70	0.72	0.56	1.30	0.67	0.26	0.76	1.26
Paris 3	0.58	0.42	0.99	2.83	1.53	3.59	0.98	0.96	0.99	2.93	1.22	1.33	0.53	0.36	3.56	0.27	0.25	0.79	1.56
Paris 4	0.29	1.79	1.11	0.74	0.57	1.91	0.31	0.55	0.77	0.71	0.47	0.31	0.55	0.52	0.93	0.32	1.50	0.75	1.18
Paris 5	0.96	0.19	1.05	0.39	0.86	0.81	0.59	1.04	0.65	0.34	0.98	0.32	0.96	0.57	0.59	0.32	0.44	0.83	0.77
Paris 6	1.17	0.64	1.19	1.01	0.73	3.06	0.39	0.72	1.32	0.94	0.51	0.55	1.38	0.58	1.83	0.57	0.29	0.67	1.28
Paris 7	2.34	2.40	0.94	0.53	0.68	0.86	0.92	0.70	0.58	0.65	1.46	0.81	1.39	0.55	0.50	0.87	0.30	0.85	0.87
Paris 8	0.68	0.79	1.29	0.88	0.41	2.03	1.85	0.86	0.85	0.65	0.68	0.63	0.96	0.91	0.76	1.74	0.87	0.87	0.95
Paris 9	0.52	0.68	0.71	0.91	0.90	1.29	1.25	0.64	0.56	0.88	0.45	0.65	1.37	0.69	1.35	1.84	0.53	0.80	1.14
Paris 10	0.68	0.41	0.76	2.41	2.37	0.17	0.65	0.68	1.14	1.30	2.72	2.12	1.46	0.58	0.93	0.57	0.40	1.09	0.95
Paris 11	0.71	0.75	1.01	1.72	1.98	1.16	0.60	0.79	1.08	2.45	2.09	0.98	1.10	0.69	1.63	0.84	1.97	1.23	1.13
Paris 12	2.89	0.20	0.93	0.59	0.64	0.68	0.53	0.64	0.87	1.83	0.79	1.10	0.87	0.50	0.94	1.00	1.06	1.06	0.82
Paris 13	0.52	0.58	0.78	0.45	0.64	0.96	1.08	1.19	1.92	0.62	0.61	0.49	0.44	0.48	0.75	0.91	0.62	0.89	0.80
Paris 14	0.64	0.47	1.14	0.35	0.68	0.60	0.44	4.62	0.96	0.38	1.18	0.67	0.95	0.61	0.63	0.53	2.26	1.01	0.82
Paris 15	0.99	2.16	0.97	0.42	0.95	0.88	0.77	0.85	0.82	0.70	1.75	0.67	1.36	2.25	0.65	1.13	0.36	1.03	0.90
Paris 16	1.74	1.39	1.11	0.69	0.47	1.44	2.00	1.11	1.16	0.72	0.39	0.63	0.46	2.24	0.76	0.56	0.39	0.87	1.01
Paris 17	1.10	3.92	1.05	0.69	0.97	0.00	1.22	1.10	1.00	1.15	0.84	0.72	1.09	2.84	1.05	1.94	0.46	1.15	1.02
Paris 18	0.33	0.00	1.21	1.04	1.89	0.48	0.74	0.60	0.83	1.18	1.02	2.01	1.35	0.65	1.36	1.27	0.54	1.42	1.18
Paris 19	0.49	0.28	1.04	1.06	1.31	0.64	0.46	0.44	1.02	0.86	0.76	0.62	1.09	0.41	0.86	0.72	2.33	1.30	1.01
Paris 20	0.67	0.54	1.17	1.10	1.69	0.00	0.28	0.44	0.95	1.13	0.70	4.44	0.87	0.56	0.93	0.67	4.05	1.40	0.97

Source: author with data from INSEE. Industry classification is NA38 (see Table A.1 in annexes for details).

15. Location quotient of the industrialy workforce (2011) in the districts of Paris (cont.)

District	HZ	IZ	JA	JB	JC	KZ	LZ	MA	MB	MC	NZ	OZ	PZ	QA	QB	RZ	SZ	TZ	UZ
Paris 1	0.84	1.41	0.66	0.73	0.91	1.50	0.79	1.02	0.59	0.73	1.12	1.34	0.37	0.33	0.50	1.52	0.94	0.53	0.40
Paris 2	0.51	0.88	1.27	0.66	1.86	2.23	0.92	1.02	0.85	1.59	1.14	0.68	0.47	0.30	0.42	0.71	0.62	0.52	0.33
Paris 3	0.53	0.90	1.39	2.03	1.25	0.69	0.88	1.01	0.46	1.81	0.91	0.69	1.24	0.44	0.81	1.53	0.79	0.71	0.20
Paris 4	0.76	1.06	0.68	0.26	0.55	0.47	0.81	0.65	0.49	0.72	0.58	2.70	0.82	1.18	1.00	1.51	0.79	0.55	0.37
Paris 5	0.52	1.09	0.93	0.43	0.60	0.53	1.11	0.61	6.13	0.68	0.69	0.79	3.05	1.06	0.88	1.42	1.19	0.90	0.37
Paris 6	0.58	1.51	1.31	0.36	0.49	0.62	1.10	0.81	1.64	0.79	0.87	0.93	2.12	0.64	0.84	0.93	1.08	0.96	0.63
Paris 7	0.52	0.85	0.76	0.56	0.55	0.81	1.07	0.99	0.76	0.69	0.77	2.60	0.72	0.56	0.84	0.90	1.23	1.53	3.56
Paris 8	0.78	1.14	0.70	1.06	1.19	1.77	1.19	1.83	0.34	1.07	1.15	0.65	0.46	0.40	0.42	0.60	0.97	0.66	1.61
Paris 9	0.80	0.93	1.05	0.84	1.45	2.10	1.00	1.26	0.36	1.14	1.15	0.58	0.65	0.45	0.58	0.87	0.85	0.62	0.27
Paris 10	1.65	1.03	1.07	1.57	1.06	0.60	0.86	0.80	0.56	1.43	1.27	0.74	0.85	1.59	0.98	0.93	0.88	0.67	0.19
Paris 11	0.72	1.04	1.26	1.71	1.16	0.69	0.86	1.00	0.55	1.57	1.08	0.65	1.12	0.79	1.12	1.20	0.95	0.93	0.35
Paris 12	2.26	0.89	0.58	0.64	1.02	0.87	0.71	0.72	0.89	0.58	0.85	1.38	0.86	1.38	1.07	0.97	1.12	0.83	0.22
Paris 13	1.06	0.91	0.78	1.18	0.97	0.98	0.77	0.78	1.83	0.63	0.78	1.15	1.43	1.62	1.18	1.10	1.21	0.67	0.44
Paris 14	1.34	1.06	0.84	1.65	0.80	0.57	0.92	0.71	1.40	0.71	0.90	0.87	0.99	2.24	1.60	0.85	1.21	0.90	0.33
Paris 15	1.11	0.89	1.56	1.45	0.87	1.01	0.94	0.81	1.62	0.79	0.92	1.18	0.89	1.18	1.15	0.72	0.90	1.09	1.37
Paris 16	0.68	0.91	1.35	0.59	0.90	0.91	1.62	1.53	0.93	0.94	1.02	0.53	0.92	0.82	1.01	0.89	0.91	2.75	5.00
Paris 17	0.74	1.02	0.99	1.38	1.33	0.93	1.41	1.37	0.35	1.47	1.14	0.70	0.85	0.61	1.02	0.79	1.00	1.23	0.80
Paris 18	1.38	1.10	1.12	0.45	0.94	0.56	0.85	0.68	0.69	1.28	1.14	0.71	1.08	1.16	1.23	1.32	0.93	1.13	0.35
Paris 19	0.77	0.92	0.72	1.32	0.81	0.60	0.97	0.66	0.35	0.82	1.16	1.23	1.31	1.17	1.43	1.37	1.25	1.00	0.29
Paris 20	1.10	0.87	1.02	0.34	0.79	0.47	0.82	0.67	0.63	1.06	0.97	1.08	1.27	1.35	1.64	1.31	0.97	0.93	0.27

Source: author with data from INSEE. Industry classification is NA38 (see Table A.1 in annexes for details).

16. Location quotient of professional workforce (2011) in the districts of Paris

District	10	21	22	23	31	33	34	35	37	38	42	43	44	45
Paris 1	0.98	0.70	0.97	1.02	0.99	1.37	0.36	0.81	1.07	0.94	0.57	0.48	0.64	1.21
Paris 2	1.13	0.87	1.01	1.30	0.74	0.65	0.36	1.14	1.69	1.28	0.61	0.36	0.38	0.81
Paris 3	0.95	1.24	1.51	1.18	1.14	0.82	1.09	1.61	0.89	1.06	0.85	0.50	0.60	0.92
Paris 4	0.44	0.81	1.03	0.88	0.77	1.59	0.83	0.96	0.52	0.56	0.81	0.80	1.55	2.43
Paris 5	1.10	0.89	0.93	1.00	1.02	1.50	4.15	0.99	0.53	0.72	1.14	1.12	1.15	1.48
Paris 6	1.56	0.82	1.19	1.51	1.27	1.19	1.93	1.07	0.72	0.65	1.32	0.58	1.83	0.96
Paris 7	1.90	0.88	1.05	1.04	1.23	2.96	0.75	0.78	0.84	0.63	0.75	0.57	0.72	2.02
Paris 8	1.04	0.67	0.82	1.43	1.38	0.61	0.37	0.62	1.71	1.22	0.60	0.38	0.55	0.61
Paris 9	1.70	0.86	0.96	1.18	0.82	0.45	0.51	0.97	1.59	1.35	0.67	0.48	0.59	0.46
Paris 10	0.73	1.09	1.02	0.94	0.72	0.56	0.92	1.19	0.77	1.04	0.91	1.44	0.21	0.80
Paris 11	0.76	1.38	1.32	1.04	1.14	0.68	0.89	1.50	0.77	0.94	1.27	0.96	1.50	0.78
Paris 12	0.51	0.96	0.79	0.71	0.70	1.35	0.88	0.72	0.85	1.16	1.01	1.27	0.21	1.36
Paris 13	0.64	0.90	0.64	0.64	0.64	1.11	1.75	0.80	0.88	1.07	1.11	1.53	0.92	1.28
Paris 14	0.83	0.96	0.89	0.72	0.94	1.16	1.45	0.87	0.80	0.97	1.06	1.83	2.51	1.10
Paris 15	0.88	0.98	0.89	0.91	0.86	1.46	0.99	1.06	1.03	1.10	1.00	1.18	1.54	1.23
Paris 16	1.98	0.98	1.35	1.48	1.80	0.71	0.92	0.96	1.15	0.94	1.05	0.66	1.50	0.53
Paris 17	1.12	1.08	1.23	1.16	1.49	0.54	0.63	0.90	1.20	1.13	0.97	0.77	0.49	0.62
Paris 18	0.65	1.43	1.17	0.82	0.77	0.52	0.84	1.55	0.60	0.81	1.29	1.39	2.50	0.66
Paris 19	0.70	1.27	0.97	0.62	0.62	0.79	0.92	1.03	0.70	0.81	1.53	1.39	0.52	0.92
Paris 20	0.45	1.33	0.95	0.57	0.76	0.97	1.11	1.28	0.53	0.73	1.51	1.58	0.28	1.18

Source: author with data from INSEE. Industry classification is CS3_29 (see Table A.2 in annexes for details).

16. Location quotient of professional workforce (2011) in the districts of Paris (cont.)

District	46	47	48	52	53	54	55	56	62	63	64	65	67	68	69
Paris 1	1.07	0.90	1.25	0.97	1.42	1.28	1.49	0.94	0.83	1.03	0.80	0.75	0.79	0.78	0,82
Paris 2	1.27	1.10	0.98	0.45	0.64	1.13	0.97	0.70	0.98	0.88	0.82	0.72	1.14	0.82	1,17
Paris 3	1.16	0.96	1.03	0.75	0.78	0.85	1.41	0.88	1.08	1.07	0.77	0.89	1.01	0.79	0,50
Paris 4	0.79	0.90	1.05	1.99	3.17	0.76	1.37	0.83	1.00	0.97	0.90	0.84	0.96	0.86	1,47
Paris 5	0.77	1.09	0.88	1.26	0.85	0.68	0.82	0.91	0.81	0.97	0.76	0.88	0.77	0.78	1,99
Paris 6	0.93	0.88	1.16	0.93	0.78	0.79	1.60	1.39	1.01	1.01	0.83	0.80	0.76	0.90	1,45
Paris 7	0.79	0.84	0.87	1.32	1.47	0.89	0.93	1.00	0.74	0.97	0.93	0.73	0.73	0.82	0,65
Paris 8	1.23	0.93	0.90	0.48	0.92	1.26	0.88	0.88	0.75	0.90	0.90	0.87	0.73	0.75	0,83
Paris 9	1.23	0.91	0.90	0.48	0.68	1.32	1.32	0.87	0.89	0.79	0.66	0.74	0.86	0.81	0,26
Paris 10	1.09	1.11	0.92	0.97	0.95	1.11	0.96	0.96	1.54	1.08	0.80	1.79	1.56	1.24	1,16
Paris 11	1.11	1.12	1.02	0.79	0.70	0.99	1.13	1.02	1.19	1.13	0.94	0.73	1.18	1.01	0,59
Paris 12	0.96	1.14	1.08	1.27	1.17	0.97	0.78	0.87	1.10	0.97	1.41	1.97	1.20	0.93	1,38
Paris 13	0.81	1.14	1.05	1.41	1.37	0.94	0.82	0.83	1.01	0.93	0.94	1.15	1.08	0.91	0,68
Paris 14	0.84	1.09	1.02	1.44	0.78	0.83	0.82	1.04	0.90	0.96	1.07	0.91	0.82	1.01	0,40
Paris 15	0.94	1.05	0.96	1.07	0.83	0.88	0.84	0.95	0.92	0.92	1.02	0.90	0.94	0.93	0,68
Paris 16	0.99	0.79	0.93	0.68	0.77	0.91	0.84	1.46	0.87	0.95	1.03	0.79	0.75	0.95	2,09
Paris 17	1.03	0.94	1.07	0.66	1.04	1.02	0.93	1.21	0.88	1.00	0.91	0.72	0.91	1.07	1,31
Paris 18	0.95	0.98	1.19	1.10	0.92	0.86	1.21	1.15	1.35	1.35	1.56	1.40	1.34	1.51	1,06
Paris 19	0.95	1.07	1.06	1.30	0.98	1.19	1.03	0.98	1.19	1.12	1.04	1.03	1.30	1.47	0,65
Paris 20	0.93	0.98	0.89	1.37	0.85	0.90	1.04	1.07	1.16	1.24	1.40	0.76	1.20	1.54	1,43

Source: author with data from INSEE. Industry classification is CS3_29 (see Table A.2 in annexes for details).

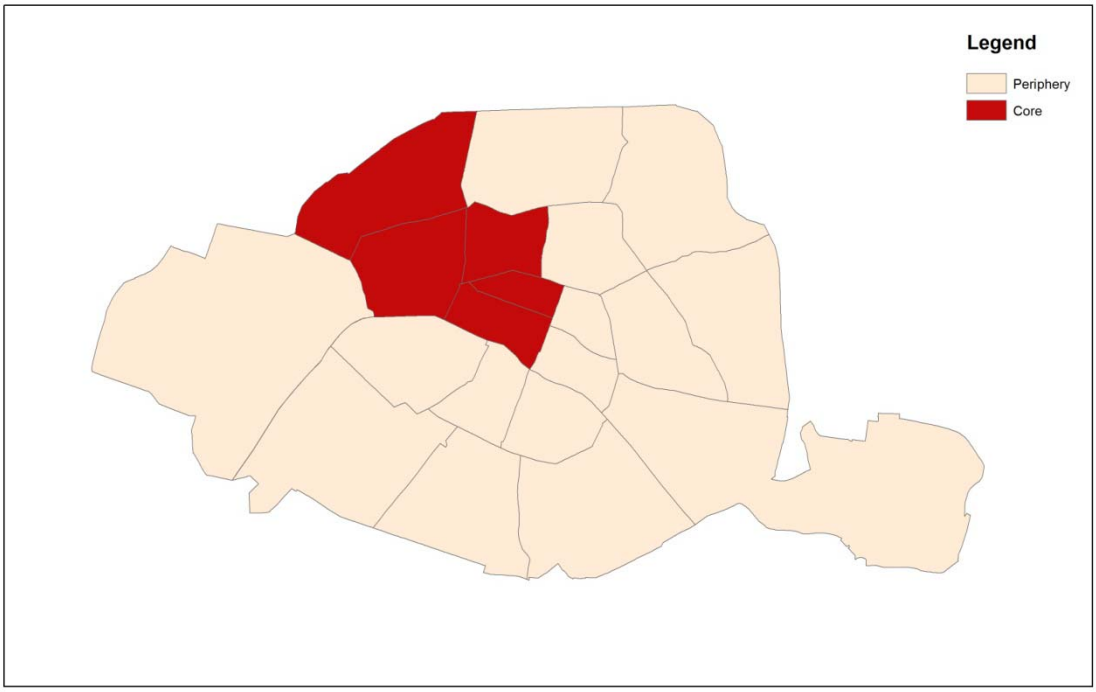
17. Moran's I for the industrial and professional workforce (2011) in the districts of Paris

Industry	Moran's I	Professional group	Moran's I
Agriculture, forestry and fishing	0.147736	Farmers	0.385691
Mining and quarrying	0.177994	Craftsmen	0.273716
Manufacture of food products, beverages and tobacco products	0.263329	Shopkeepers and similar	0.347636
Manufacture of textiles, wearing apparel, leather and related products	0.368002	Heads of businesses with 10 or more employees	0.299398
Manufacture of wood and paper products; printing and reproduction of recorded media	0.245646	Self-employed professionals and similar	0.399404
Manufacture of coke and refined petroleum products	-0.107699	Civil service managers	0.315982
Manufacture of chemicals and chemical products	0.291506	Intellectual and scientific professions	0.331073
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.189661	Artistic professions	0.141858
Manufacture of rubber and plastics products, and other non-metallic mineral products	-0.022148	Managers in businesses	0.227002
Manufacture of basic metals and fabricated metal products, except machinery and equipment	0.143293	Engineers and technical managers in businesses	0.128481
Manufacture of computer, electronic and optical products	-0.067401	Teaching	0.293314
Manufacture of electrical equipment	0.111666	Health and social work professionals	0.254397
Manufacture of machinery and equipment n.e.c.	0.146976	Clergy. religious	0.143675
Manufacture of transport equipment	0.260281	Civil service administrative employees	0.174395
Other manufacturing; repair and installation of machinery and equipment	-0.036556	Administrative and commercial associate professionals in companies	0.181163
Electricity, gas, steam and air-conditioning supply	0.214013	Technicians	0.101925
Water supply; sewerage, waste management and remediation	0.205321	Foremen. supervisors	0.190707
Construction	0.268441	Civil service employees	0.256563
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.216888	Police and military	0.044630
Transportation and storage	0.066646	Administrative business employees	0.181068
Accommodation and food service activities	0.165029	Shop employees	0.132542
Publishing, audio-visual and broadcasting activities	0.133166	Personal services staff	0.379386
Telecommunications	-0.036708	Skilled workers in manufacturing	0.168066
IT and other information services	0.195580	Skilled workers in craftsmanship	0.236742
Financial and insurance activities	0.149412	Drivers	0.225742
Real estate activities	0.403972	Skilled workers in handling. storage and transport	0.044082
Legal, accounting, management, architecture, engineering, technical testing and analysis activities	0.294768	Non-skilled workers in manufacturing	0.155284
Scientific research and development	0.224159	Non-skilled workers in craftsmanship	0.330629
Other professional, scientific and technical activities	0.291845	Farm workers	0.101939
Administrative and support service activities	0.276120		
Public administration and defence; compulsory social security	0.113593		
Education	0.227625		
Human health activities	0.275072		
Residential care and social work activities	0.335090		
Arts, entertainment and recreation	0.103204		
Other service activities	0.278531		
Activities of households as employers; undifferentiated goods- and services- producing activities of households for own use	0.345621		
Activities of extra-territorial organizations and bodies	0.367922		

Source: author.

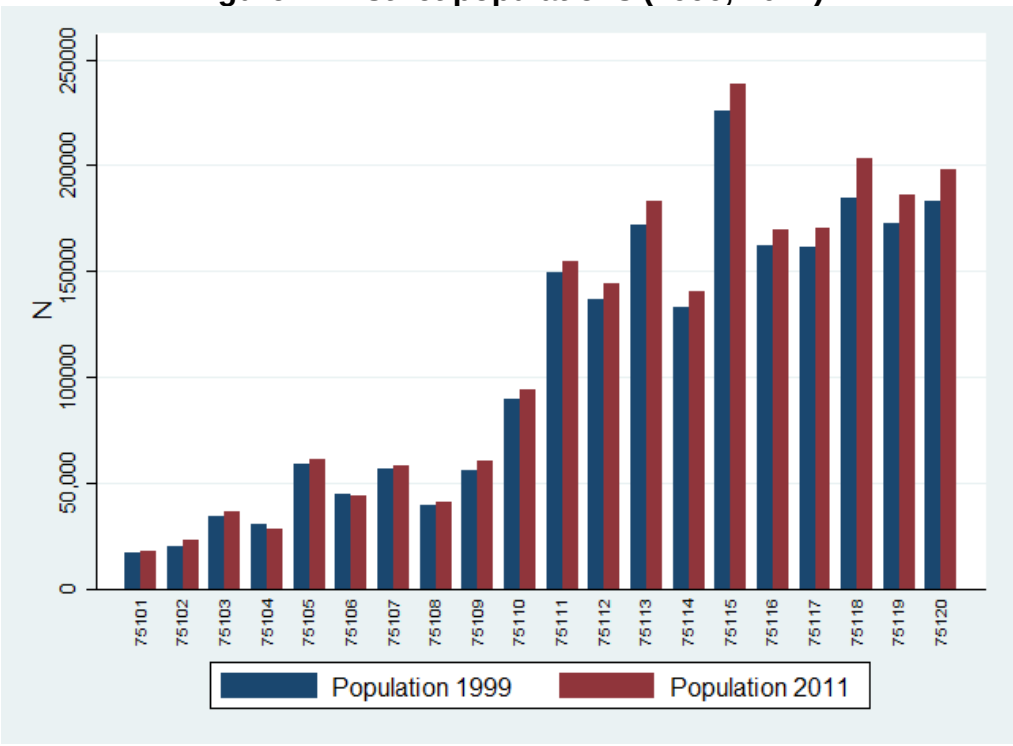
Figures

Figure 1: Core and peripheral districts



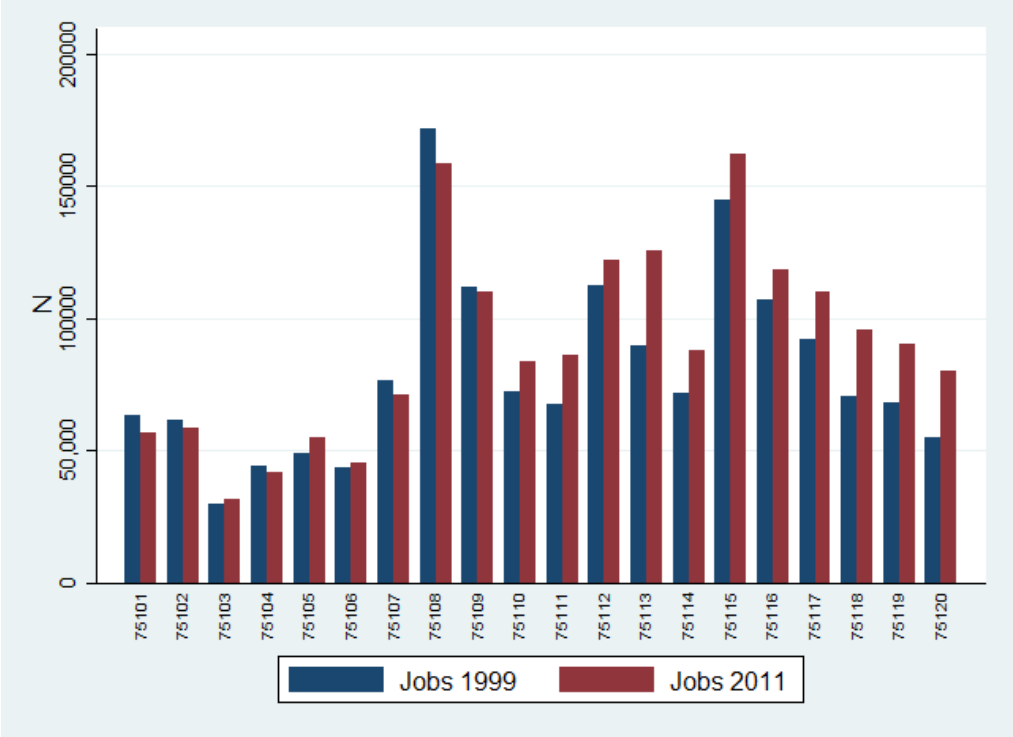
Source: author

Figure 2: District populations (1999, 2011)



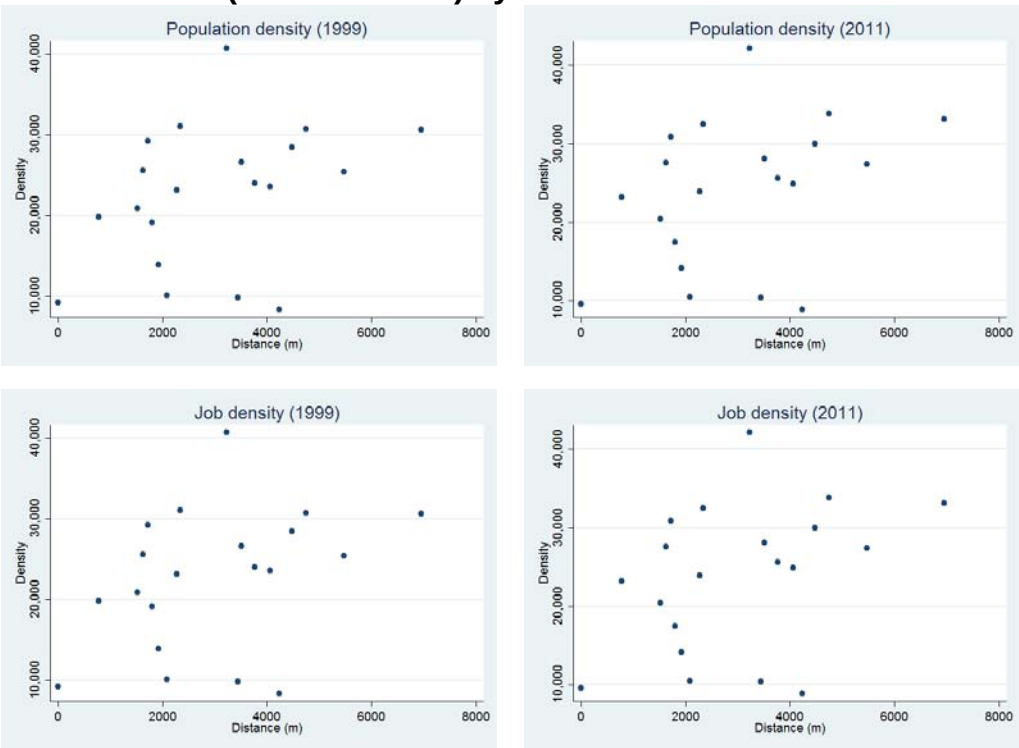
Source: author

Figure 3: District jobs (1999, 2011)



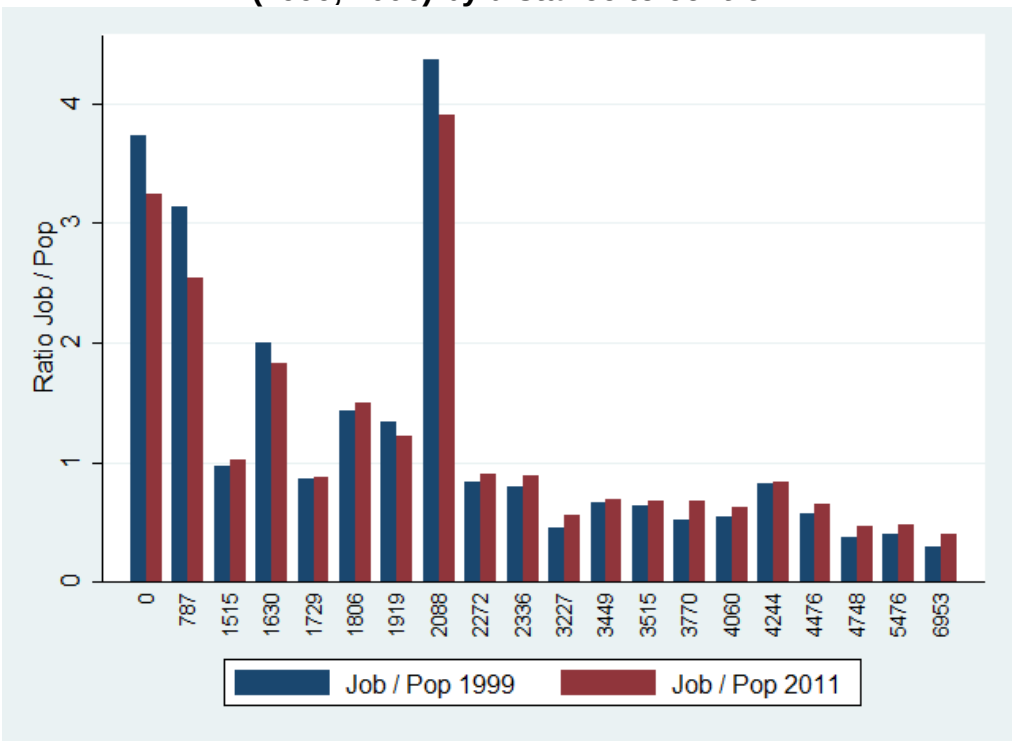
Source: author

Figure 4: Population and job densities in districts (1999 and 2011) by distance to centre



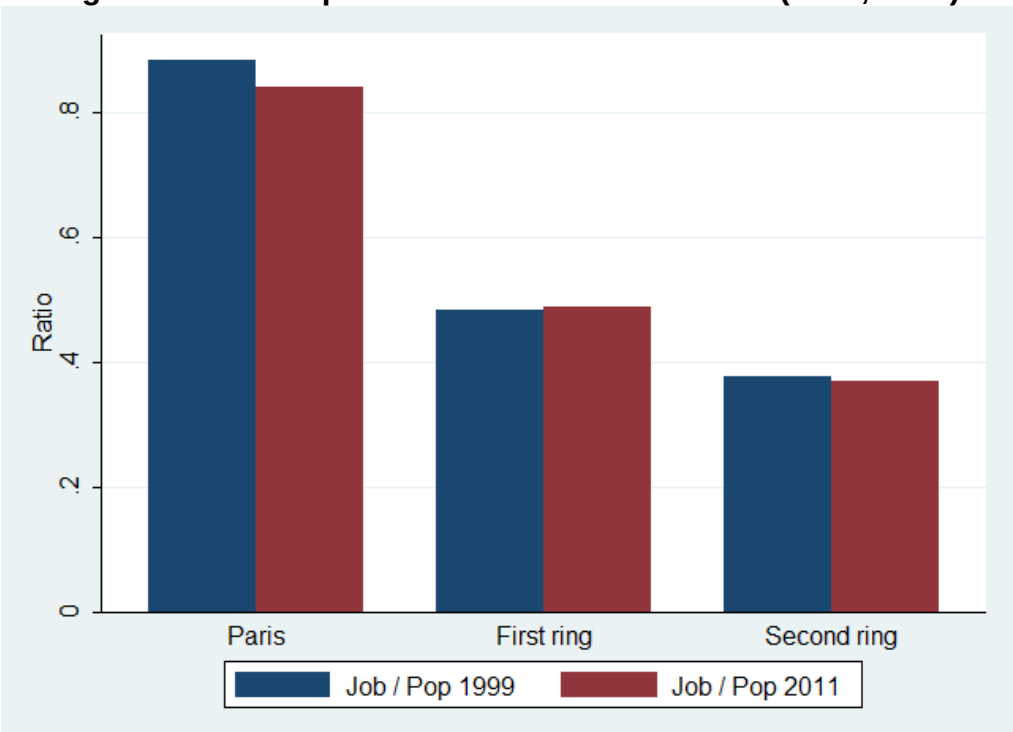
Source: author

Figure 5: Jobs / Population ratio in districts (1999, 2006) by distance to centre



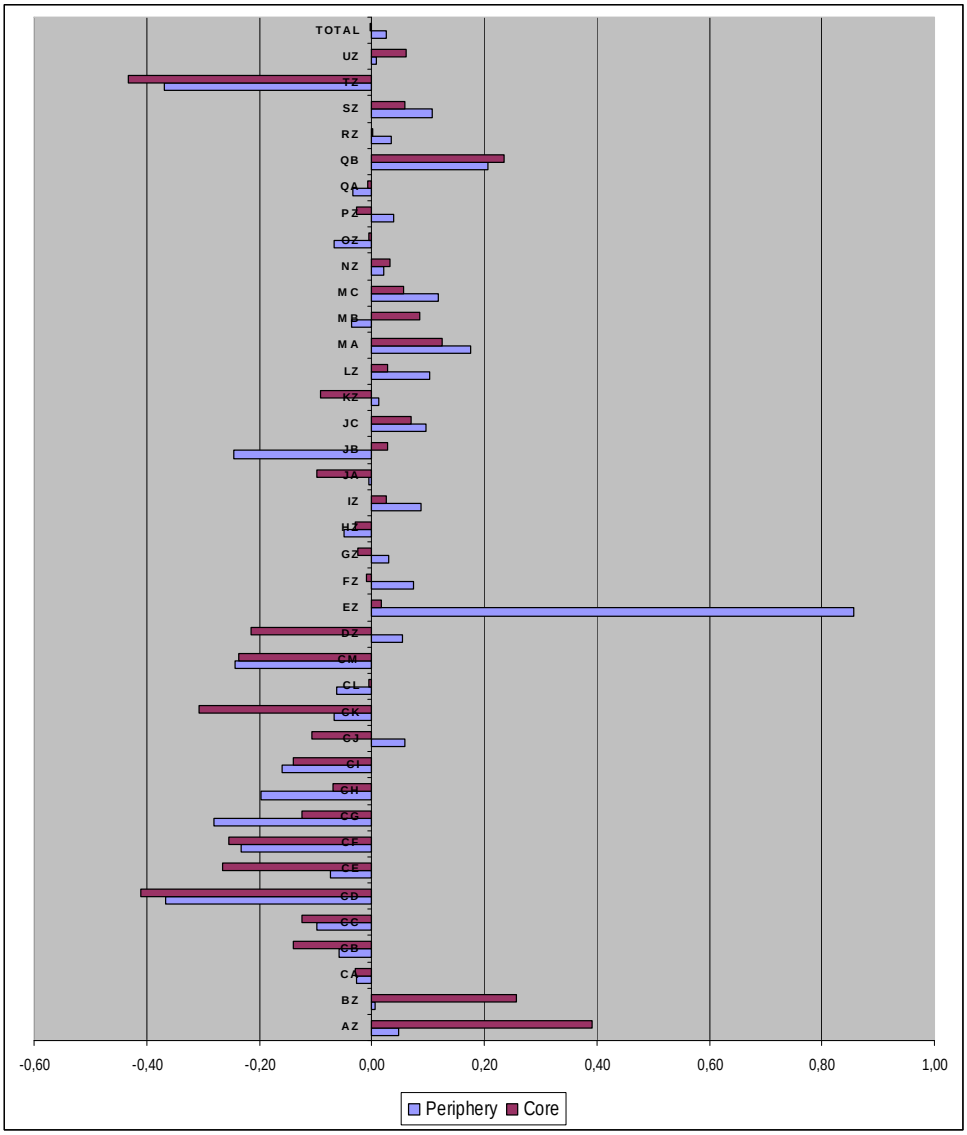
Source: author

Figure 6: Jobs/Population ratio in Île-de-France (1999, 2006)



Source: author

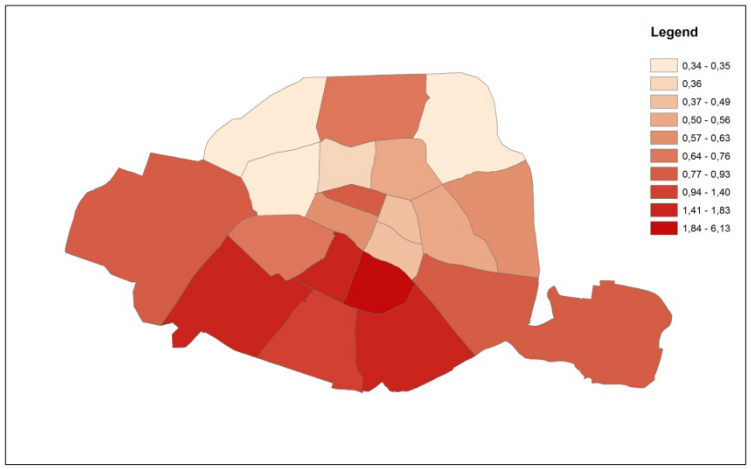
Figure 7: Changes in industrial workforce (2007-2011)



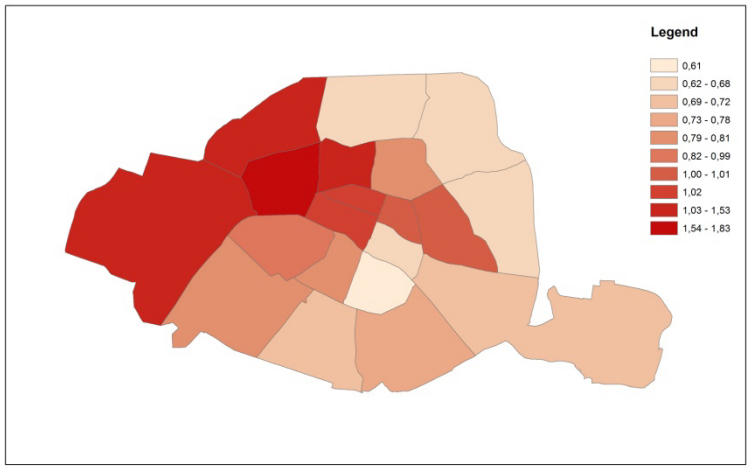
Source: author. See Annexes (Table A.1) for industry classification.

Figure 8: Location quotient of workforce by industry (%) (2011)

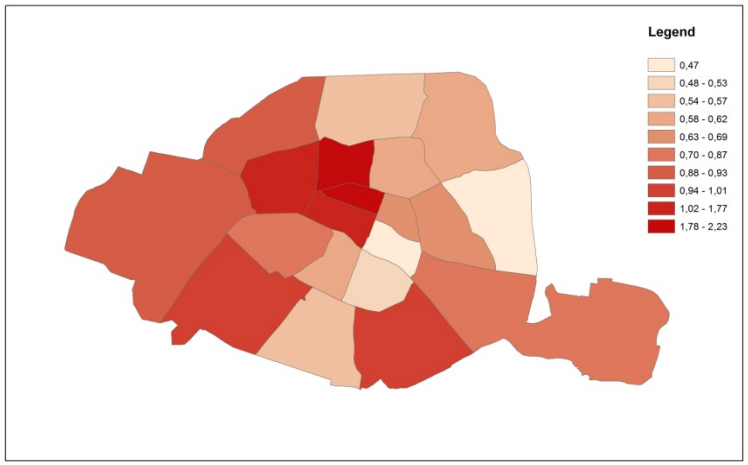
Scientific research and development



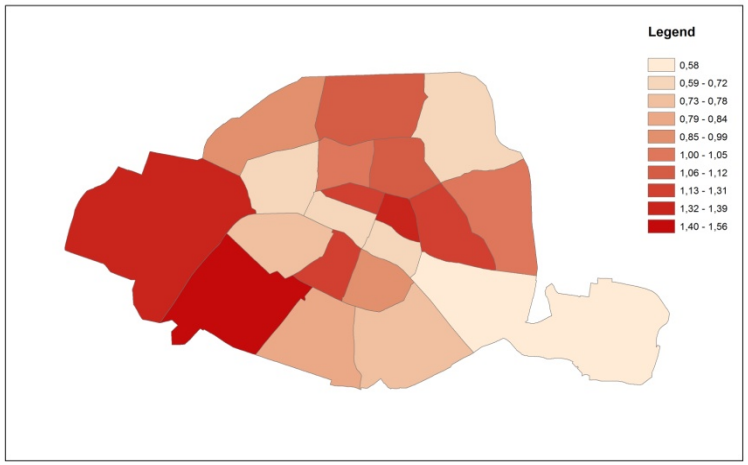
Legal, account., manage., architect., engine., tech. testing and analysis act.



Financial and insurance activities



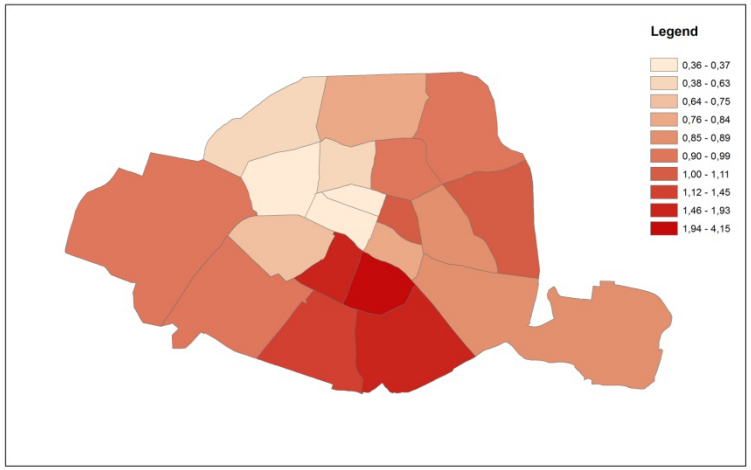
Publishing, audiovisual and broadcasting activities



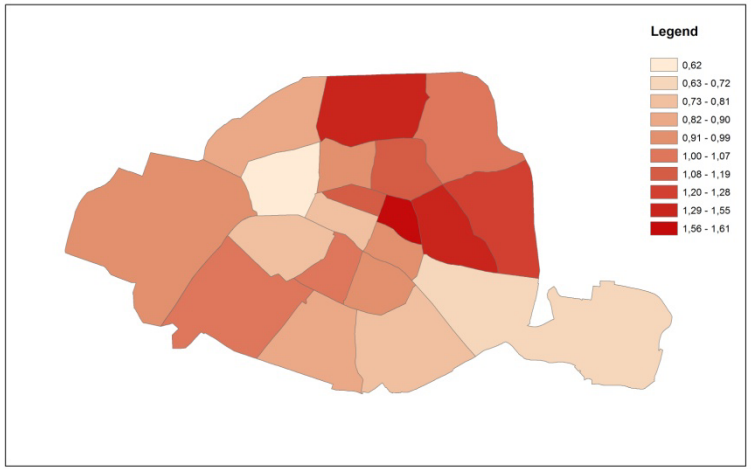
Source: author

Figure 9: Location quotient of workforce by professional group (%) (2011)

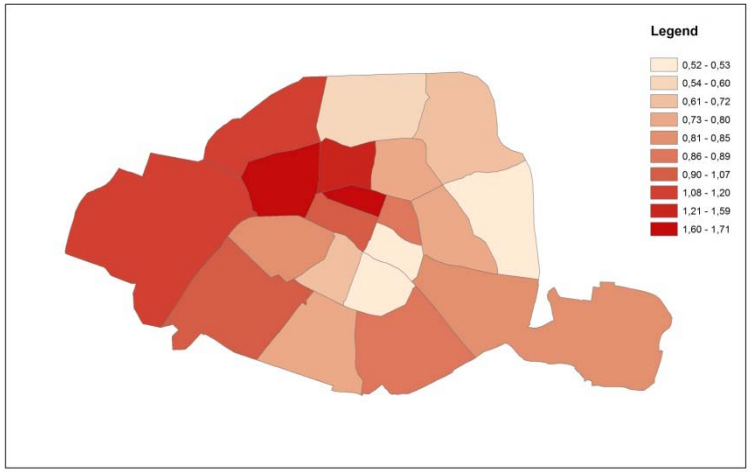
Intellectual and scientific professions



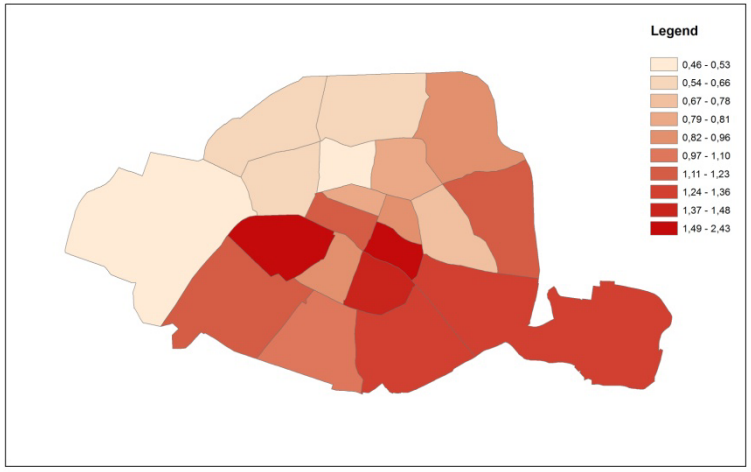
Artistic professions



Managers in businesses



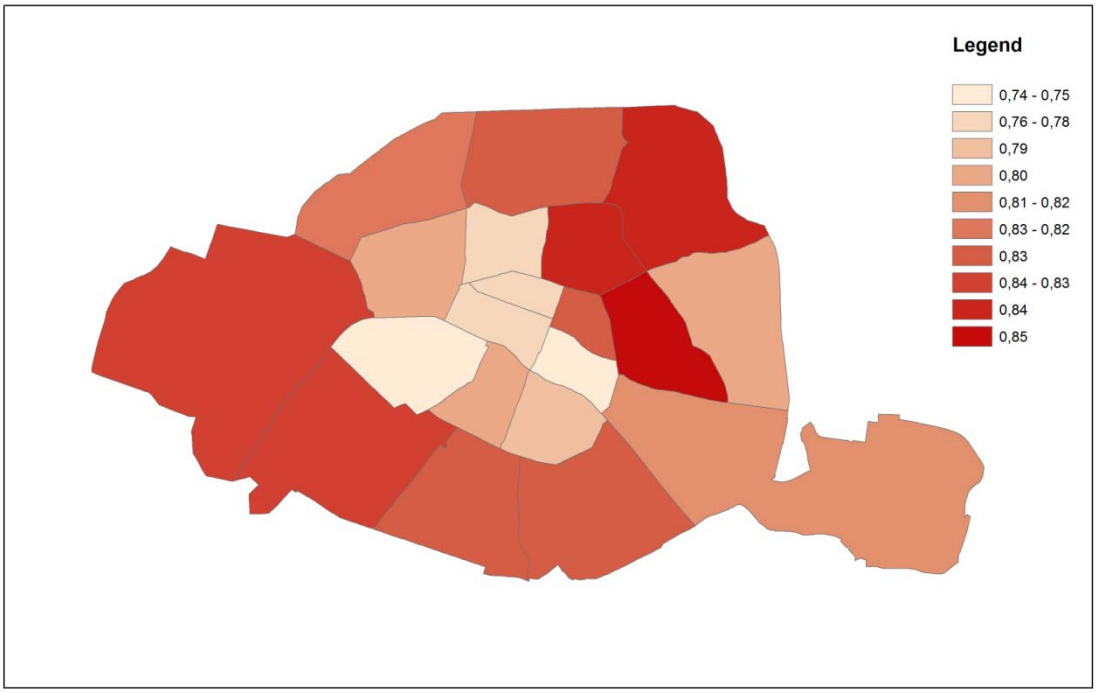
Civil service administrative employees



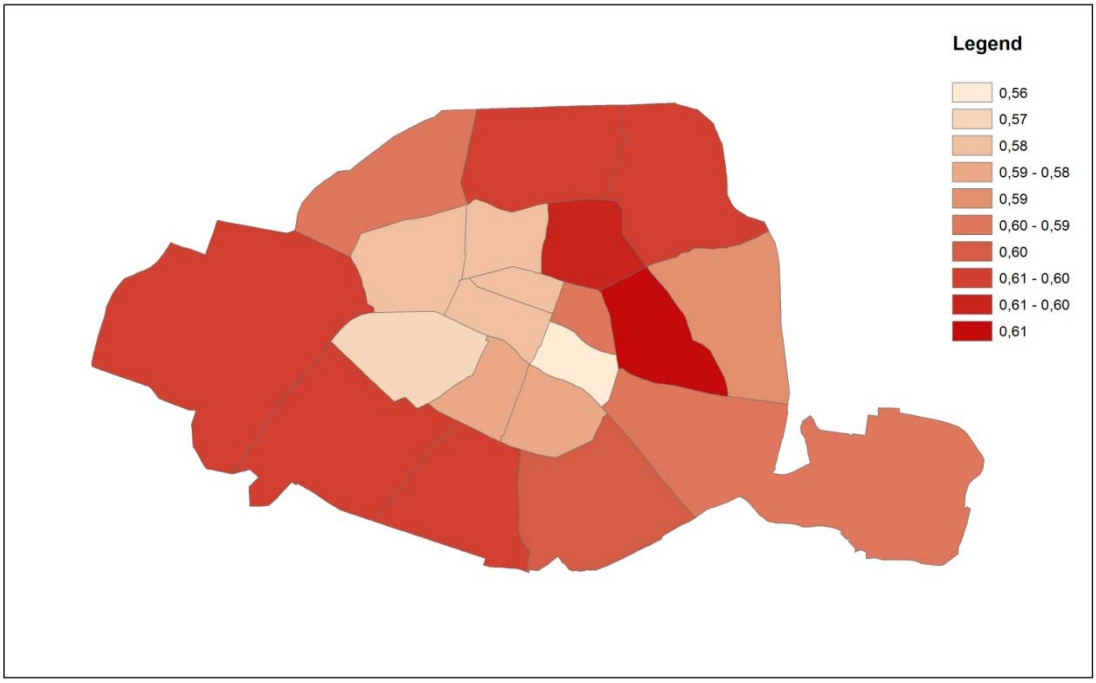
Source: author

Figure 10: Entropy index for workforce by industry (2007, 2011)

2007



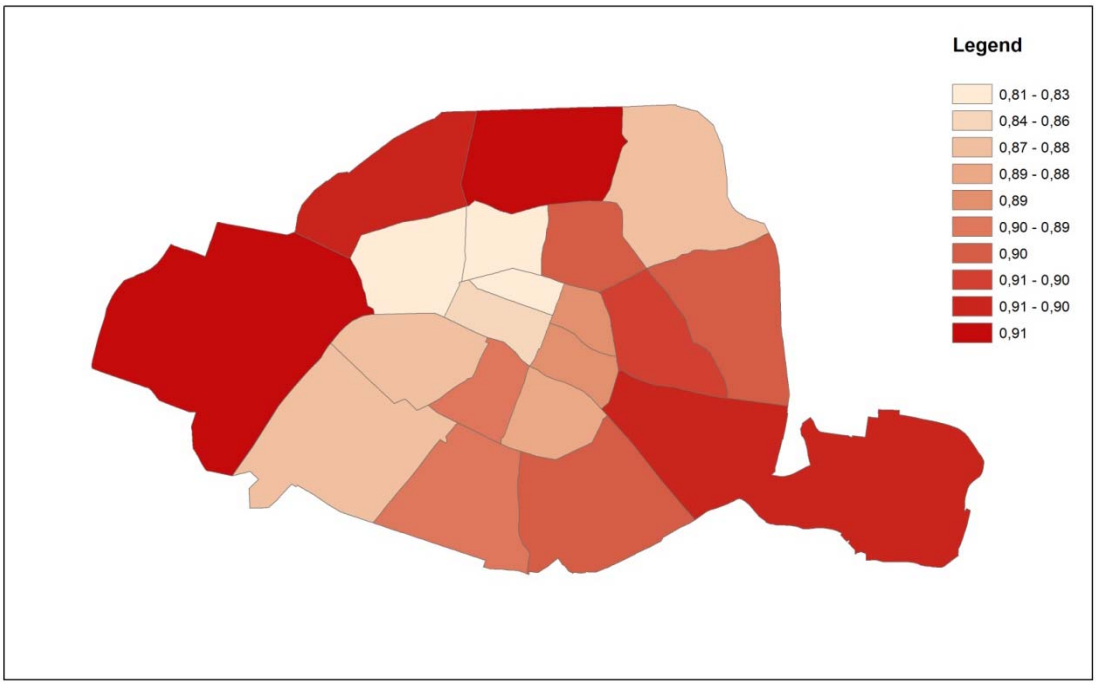
2011



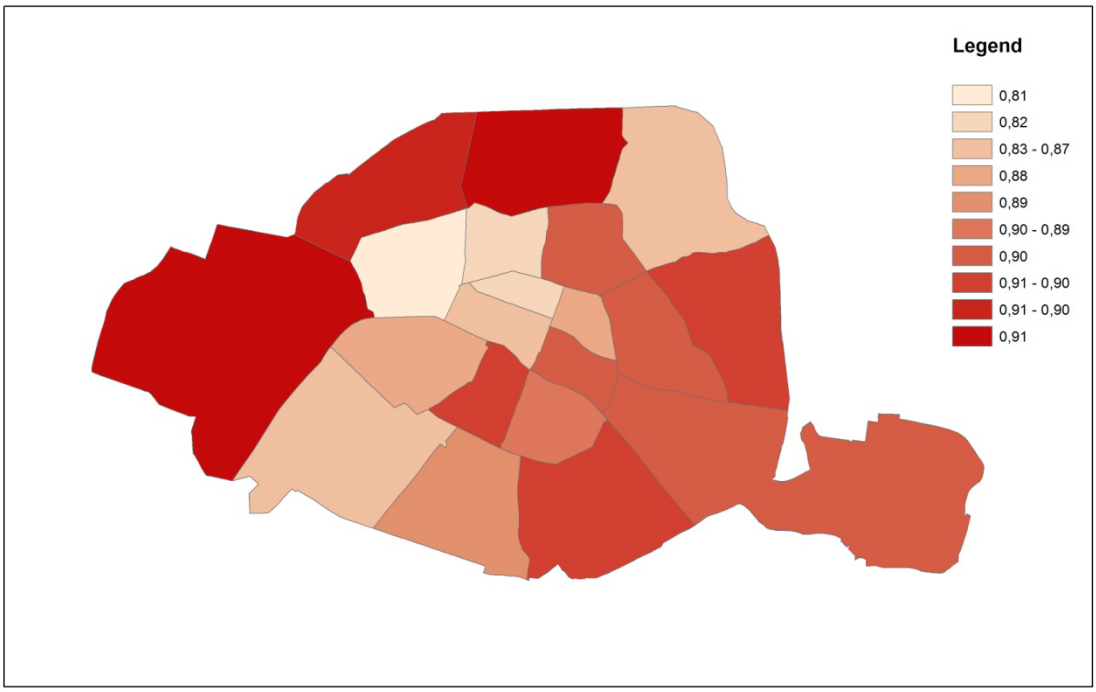
Source: author using Geo-Segregation Analyzer (Apparicio et al., 2012).

Figure 11: Entropy index for workforce by professional group (2007, 2011)

2007

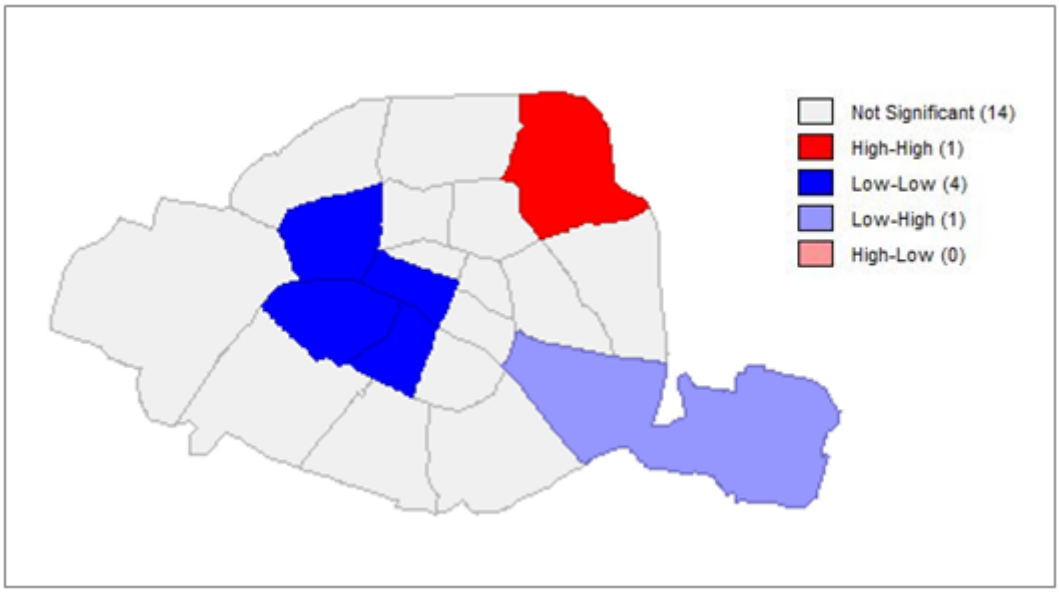


2011



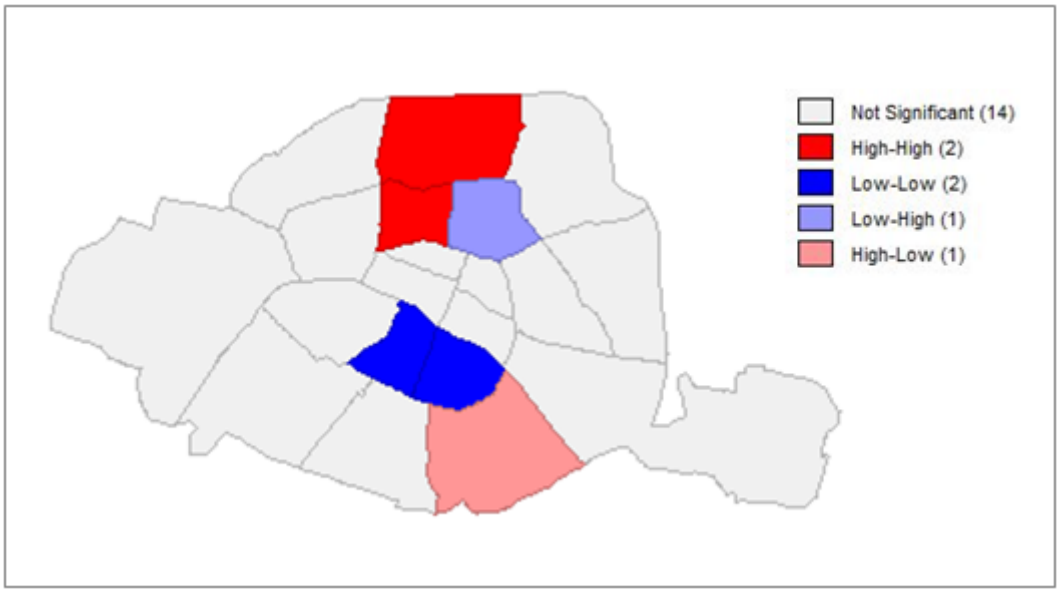
Source: author using Geo-Segregation Analyzer (Apparicio et al., 2012).

Figure 12: Local spatial autocorrelation (LISA) for workforce change (1999-2011)



Source: author

Figure 13: Local spatial autocorrelation (LISA) for population change (1999-2011)



Source: author

Annexes

A.1. Industry classification NA38

Code	Description
AZ	Agriculture, forestry and fishing
BZ	Mining and quarrying
CA	Manufacture of food products, beverages and tobacco products
CB	Manufacture of textiles, wearing apparel, leather and related products
CC	Manufacture of wood and paper products; printing and reproduction of recorded media
CD	Manufacture of coke and refined petroleum products
CE	Manufacture of chemicals and chemical products
CF	Manufacture of basic pharmaceutical products and pharmaceutical preparations
CG	Manufacture of rubber and plastics products, and other non-metallic mineral products
CH	Manufacture of basic metals and fabricated metal products, except machinery and equipment
CI	Manufacture of computer, electronic and optical products
CJ	Manufacture of electrical equipment
CK	Manufacture of machinery and equipment n.e.c.
CL	Manufacture of transport equipment
CM	Other manufacturing; repair and installation of machinery and equipment
DZ	Electricity, gas, steam and air-conditioning supply
EZ	Water supply; sewerage, waste management and remediation
FZ	Construction
GZ	Wholesale and retail trade; repair of motor vehicles and motorcycles
HZ	Transportation and storage
IZ	Accommodation and food service activities
JA	Publishing, audio-visual and broadcasting activities
JB	Telecommunications
JC	IT and other information services
KZ	Financial and insurance activities
LZ	Real estate activities
MA	Legal, accounting, management, architecture, engineering, technical testing and analysis activities
MB	Scientific research and development
MC	Other professional, scientific and technical activities
NZ	Administrative and support service activities
OZ	Public administration and defence; compulsory social security
PZ	Education
QA	Human health activities
QB	Residential care and social work activities
RZ	Arts, entertainment and recreation
SZ	Other service activities
TZ	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
UZ	Activities of extra-territorial organizations and bodies
ZZ	Unknown

Source: INSEE.

A.2. Professional classification CS3_29

Code	Description
10	Farmers
21	Craftsmen
22	Shopkeepers and similar
23	Heads of businesses with 10 or more employees
31	Self-employed professionals and similar
33	Civil service managers
34	Intellectual and scientific professions
35	Artistic professions
37	Managers in businesses
38	Engineers and technical managers in businesses
42	Teaching
43	Health and social work professionals
44	Clergy, religious
45	Civil service administrative employees
46	Administrative and commercial associate professionals in companies
47	Technicians
48	Foremen, supervisors
52	Civil service employees
53	Police and military
54	Administrative business employees
55	Shop employees
56	Personal services staff
62	Skilled workers in manufacturing
63	Skilled workers in craftsmanship
64	Drivers
65	Skilled workers in handling, storage and transport
67	Non-skilled workers in manufacturing
68	Non-skilled workers in craftsmanship
69	Farm workers

Source: INSEE.