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ANALYSIS OF THE JOB CREATION PROCESS IN METROPOLITAN AREAS: A SPATIAL PERSPECTIVE

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Abstract

This paper seeks to challenge the view that metropolitan areas are characterized by a general positive trend in the job creation process. It rests upon an empirical analysis of the 13 French metropolitan areas over the 2004-2010 period. The estimations of employment growth run using spatial econometrics modeling techniques show that spatial spillover effects intervene in the growth process of the areas under review and that density matters in determining the employment growth rate. We have been unable to identify a unique model of metropolitan dynamics. Indeed, each metropolitan area is characterized by a specific combination of explanatory variables which, finally, attests of the variety of the metropolitan frameworks.

Keywords

Metropolitan areas; agglomeration effects; spatial econometrics; spillover effects.

JEL codes / Codes JEL

R11, R12, R50

Résumé

Cet article cherche à mettre à l'épreuve des faits l'idée que toutes les aires métropolitaines suivent une tendance favorable en matière de création d'emplois. Il repose sur une analyse empirique de 13 métropoles françaises au cours de la période 2004-2010. Les estimations de la croissance de l'emploi sont réalisées à l'aide des techniques de l'économétrie spatiale car l'exploration spatiale a mis en évidence une autocorrélation spatiqle. Les résultats montrent également qu'en plus des effets de débordement, la croissance de l'emploi est positivement influencée par la densité. Toutefois, au-delà de ces éléments permanents, nos résultats ne permettent pas d'identifier un modèle unique de croissance métropolitaine. Ils mettent au contraire en relief une diversité des taux de création et des combinaisons de variables différentes selon les métropoles.

Mots clefs

Territoires métropolitains; métropoles institutionnelles; effets d'agglomération; économétrie spatiale; effets de débordement.

Introduction

The idea that big cities contributed to economic efficiency and growth is broadly agreed. On one hand, policy makers are convinced that the solution to the deficit in competitiveness and growth will be solved by a more intense agglomeration process and are supported by a huge literature that tends to show that metropolitan cities, areas or regions perform better than rural areas. Several research (Combes et al., 2011, Fujita et al., 1999) have provided empirical evidence for the metropoles' argument. Workers located in big cities are more productive than others (Combes et al., 2012), people tend to have more chances to learn and acquire skills in urban agglomerations that ensure them higher returns (Edward Glaeser, 2011), the employment growth rate is higher too (Glaeser et al. 1992), large urban agglomerations, tend to have higher per capita incomes than those that do not (Brülhart & Sbergami, 2009), large cities produce more output per capita than small cities (Behrens et al., 2014), etc. In the same vein, Ahrend and Schumann (2014) demonstrate that, between 1995 and 2010, regions, which contain urban agglomerations with more than 500,000 inhabitants, have been growing approximately 0.2 percentage points faster on a per capita basis than regions without them.

France does not escape to this phenomenon. Several papers and reports emphasize the economic advantages related to concentration. Urban areas tend to be characterized by significantly higher growth rates, a higher productivity of labor and higher salaries than rural areas (Combes et al., 2012). It seems to be clearly established that metropolitan areas fueled the French economy over the forty last years and that their rate of change in the number of employees is significantly higher than the one computed for other cities (Baude, 2016).

In challenging the view that metropolitan areas are characterized by a general positive trend in the job creation process, the article provides additional arguments in favor of the thesis that metropolitan areas do not compose a consistent group. In this perspective, our research is in line with theoretical ideas and empirical evidence brought by existing literature which points out that different firms do better in different types of places, and that the benefits of industry-clustering vary by industry and size of establishment (Fothergill & Houston, 2016). The focus is mainly on French's big cities, particularly the 13 regional metropolitan areas; but Paris area. This choice is made on two grounds. First, these cities have been the main focus of recent policy attention in

France. Second, as mentioned above, metropolitan areas have been emphasized in contemporary theory on urban and regional growth and productivity. Paris is excluded due to its peculiar place in the French economy[1].

Following Robert Lucas (1988) who noticed about international differences in economic development "I do not see how one can look at figures like these without seeing them as representing possibilities.", we admit that, on average, metropolitan areas make a determinant contribution to the French economic growth. This however does not mean that this positive relation is verified for all the metropolitan areas and does not implies that the metropolitan areas are consistent in the sense that the economic dynamism of the municipalities that compound them benefit from their inclusion in the administrative metropolitan area. Thanks to a unique dataset providing the number of employees in every municipalities of the 13 regional metropolitan areas over the 2004-2010 period, we empirically consider this second issue looking at two aspects. The first one concerns the internal consistency of metropolitan areas. We checked for that considering the existence and the importance of spatial autocorrelation within metropolitan areas. The second one deals with the economic model that drives the job creation or destruction process at the metropolitan level. Are all the explanatory factors the same in the different metropolitan areas? To what extend do they influence job creation in private companies? The productive power of many of the largest cities outlines just how far the possibilities afforded by urbanization can stretch for economic growth. The question is to bring about evidence about the robustness and the level of generality of this phenomenon.

The remainder of the paper is structured in the following manner. Section 2 summarizes the engines of job creation in metropolitan areas and identifies hypotheses to be tested to verify the existence and the importance of the relation. Then, the article then moves on to the Section 3 which presents the model specification, the sources and the data used to empirically test the previous hypotheses. Section 4 check for the existence of a spatial autocorrelation and Section 5 specifies a model to determine the explanatory factors of the growth rate of employment controlling for spatial autocorrelation. Section 6 presents and discusses the obtained results

[1] The *région* is the country's preeminent decision-making centre, in both the public and private sectors. It remains a major industrial hub, although employment is concentrated overwhelmingly in the service sector.

whereas Section 7 concludes, putting some emphasis on the consequence of our results for the implementation of regional policies.

1 Metropolitan areas: engine of local development?

It is broadly admitted that cities occupy a central role in contemporary thinking on regional economic growth. Papers in the field of 'New Economic Geography' (NEG) and 'New Urban Economics' (NUE) bring evidence about the positive influence of 'agglomeration economies' that benefit larger cities. Businesses located in this concentrated areas benefit a competitive advantage over companies elsewhere. The economic advantages of big cities are not limited to their administrative boundaries. They are presented as the engine of growth at the regional and even at the national level (Schaltegger & Zemp, 2003) through various complementary and interdependent activities. As pointed out by several scholars and experts, metropolitan regions can also be considered as places with the highest level of centrality they assume service functions for a large surrounding area and also beyond this area. Their performance boosts thus the dynamic of suburban areas and, beyond this close neighborhood, the economic activity in the whole metropolitan cluster (ibid). Empirical evidence regarding the 'engines of growth' hypothesis and the geographic scope of any spillovers are provided by the literature.

However, dissenting views with regard to the systematically positive effect point out some weaknesses in the arguments in favor of this thesis. Examining the relationship between national productivity growth and the spatial agglomeration of economic activity across the EU-15 countries for the period 1981–2007, Gardiner et al. (2011) find mixed results. The tradeoff between the rate of growth experienced and the degree of agglomeration is far from being systematically confirmed. The link between national economic growth observed and the concentration of economic activity strongly depends on the definition of agglomeration adopted and the spatial scale at which the analysis is conducted. Its instability also results from several weaknesses in the analysis (a detailed presentation may be found in Fothergill & Houston (2016)).

The first weakness in the analysis is a conceptual one. The vast majority of empirical research in the new urban economics which supports the positive effect of concentration on economic growth, tends to analyze cities as single entities disconnected from the regional and national production system (Dijkstra, 2013). Though, cities and suburbs are not independent from each other (Andrew & Haughwout, 1999). Urban studies bring strong evidence about the interdependence between central cities and surrounding areas. Indeed, central cities may contain amenities, may offer unique chances to connect different transportation systems, and provide unique agglomeration economies that define their important and specialized role in the regional economy. All these characteristics provide a significant monopolistic advantage for the "core" toward the "periphery" (Schaltegger & Zemp, 2003).

Most of the time, periphery benefits from spatial spillovers but their intensity depends on several conditions (infrastructures, tax regimes, transfer policies, etc.). This general conclusion should, however, be nuanced. First, because it is sensitive to the territorial unit chosen to perform the analysis. Indeed, most studies have grouped industries and plants into administratively defined areas. This territorial organization creates boundary effects. In addition, papers making comparison between metropolitan areas and the remaining of the region (implicitly non metropolitan areas) consider that the core has no effect on the region under study, and that the region is homogenous (Rosenthal and Strange, 2004). Second, economic agglomeration effects are often measured in a-spatial frameworks in the sense that geographic units are considered spatially independent of each other (Guillain & Le Gallo, 2010). This feature leads to mis-estimate the agglomeration effects and their influence.

The second major weakness of the research advocating the capacity of metropolitan areas to drive the regional or national growth process comes from the publication of a growing number of papers which do not find a clear and stable correlation between these two elements. Mainly, this literature points out that because of the way NEG models are formulated, they also imply that a similar trade-off may exists within regions: spatial agglomeration of activity within a region raises that region's growth rate. These result strongly depends on an underlying assumption that agglomerated regions defined as those in which a nation's economic activity is particularly concentrated grow faster than other regions (Martin, 2005).

The third weakness of in the normative point of view of the relationship between size and density on one hand and growth or productivity on the other is the embeddedness of the economic activity within metropolitan areas in a general decline in manufacturing employment in the cities. Over the last thirty years, many developed countries destroyed thousands of manufacturing jobs and manufacturing has been accounting for an ever-smaller share of GDP and total employment. This industrial change gives advantage to big cities as plants foreclosure happens in rural or peri-urban areas whereas other sectors of the city economy begin to have a bigger influence on overall growth. In a context of replacement of industrial activities by services, a new form of dependence between big cities and regional hinterlands emerges. It results in greater employment in the city since the residential specialization of the suburban areas becomes the key motor of core city prosperity. In other terms, "the city follows what is happening elsewhere rather than drives growth itself" (Fothergill & Houston, 2016, p. 11). In France, an additional problem comes from the business organization and the economic role played by business groups. They tend to capture the value added and, as their headquarters are located in big cities, this accounting organization tends to bias the economic performance of metropolitan areas.

We consider these weaknesses proposing a threefold checking of the metropolitan advantage. We question the compactness and consistency of metropolitan areas, examine if all the cities compounding metropolitan areas take advantage from the agglomeration process and, finally, test the existence of a unique development framework of metropolitan areas. Consistent with these considerations, we formulate our hypotheses:

H1: All metropolitan areas are characterized by a positive spatial auto-correlation

H2: Employment growth is positively correlated to population density

H3: Explanatory factors of employment growth have the same sign and the same significance regardless the metropolitan area considered

2 Sources, data and field covered

To assess the employment dynamics of metropolitan areas, we use a unique large dataset depicting municipalities obtained by merging three sources provided by the French National Institute of Statistics and Economic Studies (INSEE): Local Knowledge of the Productive System (CLAP or "Connaissance Locale de l'Appareil Productif") dataset provides the major sources over the 2004-2010 period. They are completed by data extracted from Financial Links between Enterprises Survey (LIFI or "Enquête sur les LIaisons FInancières entre sociétés") to compute the share of stand-alone companies and *ad hoc* series on the number of unemployed workers to compute the rate of unemployment. All the variables are computed at the municipality level, and we collect information for 13 metropoles but Paris defined by the law enacted at the end of 2015. As our analysis is centered on activities integrated in values chain, we restrict the field covered to the so-called "productive" activities. According INSEE, they produce goods and services mainly by economic agents located in other areas, or by other establishments located in the same area[2].

Several definitions of metropolitan areas are available in the literature. A survey of this notion is provided by Bretagnolle et al. 2011) whereas Cottineau et al. (2017) show that these definitions matter since scaling estimations are subject to large variations. The general concept of a metropolitan area (MA below) is that of a core area containing a large population nucleus, together with adjacent communities that have a high degree of economic and social integration with that core. Most of the time, a MA combines an urban agglomeration (the contiguous, built-up area) with zones not necessarily urban in character, but closely bound to the center by employment or other commerce. All the data are computed at the municipality level in MA defined this way.

After the merge of the different datasets, our dataset is thus a balanced panel which includes data for seven years, from 2004 to 2010, for 13 French urban areas corresponding to the 13 metropolitan cities (Aix-Marseille, Bordeaux, Brest, Grenoble, Lille, Lyon, Montpellier, Nantes, Nice, Rennes, Rouen, Strasbourg, and Toulouse)[3].

3 Analysis of the spatial distribution of the data

In order to examine spatial patterns of business creation rates, we assess their global pattern using Moran's I test (Moran 2016, Cliff and Ord 1981):

$$I = \left(\frac{n}{\Sigma_{i=1}^{n}\Sigma_{j=1}^{n} w_{ij}}\right) * \left(\frac{\Sigma_{i=1}^{n}\Sigma_{j=1}^{n} w_{ij}(y_i-\bar{y})(y_j-\bar{y})}{\Sigma_{i}^{n}(y_i-\bar{y})^2}\right) \quad (1)$$

[2] The quantification of the productive sectors at the employment area level from 1975 to 2010 are made available by data provided at the municipal level by INSEE at: http://www.insee.fr/fr/themes/detail.asp?reg_id=99&ref_id=sphere. To compute the share of employment in the productive sphere as a function of the total number of employees for every employment area, we started from data provided at the district level and aggregated them in accordance with the administrative scale.

[3] Descriptive statistics concerning the number of cities included in each metropolitan areas and the number of employees are available on request.

where n is the number of spatial units indexed by i and j; y is the outcome variable of interest; $\bar{y}$ is the mean of y; and w_{ij} is an element of spatial weighting matrix, W, which corresponds to the spatial weights assigned to pairs of units i and j.

Moran's I statistic is a weighted correlation coefficient used to explore a specific type of spatial clustering. It helps determine whether high values are located in proximity to other high values or whether low values are located in proximity to other low values. Values range from -1, corresponding to a perfect negative correlation, to +1, corresponding to a perfect positive correlation, whereas 0 implies no spatial correlation.

When computed for the number of employments at the municipality level, the global Moran's statistic, I, lets us find a clear and strong spatial dependence over the studied areas between 2004 and 2010 (Appendix 2). Their values range from 0.29 for Rennes to 0.65 for Nice. Employment is thus characterized by a quite high and positive spatial autocorrelation.

However, Moran's global statistic does not allow identifying the effects of an agglomeration. It only reveals the existence of spatial dependence at a global level and is not sensitive to local deviations from the global autocorrelation pattern. Following Anselin (1995), we compute local Moran's *I*, defined as follows:

$$I_i = \frac{z_i \sum_{j=1}^{n} w_{ij} z_j}{\sum_{j=1}^{n} z_j^2 / n} \qquad (2)$$

for any *i = 1, . . . , n*. Large positive I_i values indicate local clustering of data values around the *i*-th location, similar to that at *i* and which deviate strongly from the average, either positively or negatively. In contrast, large negative $I_i$values indicate that the sign of data value at the *i*-th location is the opposite to those of its neighbors. It is also possible to check whether a region is surrounded by neighbors with high or low values of the analyzed variable. As a result of this local analysis, a map of local spatial clusters is obtained[4].

Using the local Moran's I the local spatial pattern of employment is examined again. Several distinct significant hot spots appear and it is quite obvious that a clustering pattern characterizes

[4] The results obtained are very similar regardless the matrix used (first and second order contiguity queen shape, and inverse distance). They are available on demand from the authors.

the metropolitan areas under reviews. However, the spatial repartition of the clusters differs according the areas. Three patters may be identified:

i. Concentric metropolitan areas with High-High municipalities clustered in the central part of the urban area whereas the Low-Low municipalities are rejected on the periphery. Between the two clusters, we find no significant spatial autocorrelation. Five metropolitan areas correspond to this pattern: Bordeaux, Toulouse, Lyon, Nantes, Rennes

ii. Metropolitan areas made of two parallel stripes, one composed of High-High municipalities and the other one of Low-Low municipalities. Yet, no significant spatial autocorrelation can be identified. Marseille, Montpellier, Nice, Rouen and Strasbourg correspond to this framework.

iii. Weakly ordered metropolitan areas exhibit several High-High and Low-Low clusters, without significant spatial autocorrelation between them. This is the case for Brest, Grenoble and Lille.

The spatial pattern observed necessitates the adoption of spatial econometric model to take into account the clustering effects.

4 A spatial model of employment growth

In accordance with the review of the literature, the local business climate is split into different variables, showing how outside characteristics may influence individual performance. Referring to Combes (2000), we propose a reduced form employment growth function where the rate of change of the total number of jobs depends on different local characteristics.

The following model is specified:

$$Growth_{i,t} = f(Dens, Cs3, Indep, BC, HHI, Unempl) \qquad (3),$$

where the explained variable named $Growth_{it}$, corresponds to the change in the number of employees in municipality *i* at time *t*. As in Ciccone and Hall (1996), we approximate agglomeration effects using the ratio given by the total number of employees in a given area, divided by its area measured in square kilometers expressed as a logarithm (*Dens*). As education and skills have been identified as sources of influence on firm growth, we introduce the share of white-collar workers in the labor force (*Cs3*) as an explanatory variable in the model[5]. It is complemented by the share of employees working in stand-alone companies as a function of the total number of employees in a given area (*Indep*). We also consider the number of employees working in industrial manufacturing and in the business services sector compared to the total number of employees (*BC*), which may also be introduced as a proxy for MAR external economies. Average size and competition in a given area may either encourage entrepreneurs to carry out their projects or deter them from doing so. We consider that the domination of the market by a few establishments can be a driving force in such a process. To capture this phenomenon, we compute the Hirmann-Herfindahl Index[6] (*HHI*) which provides a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. Finally, we add the unemployment rate (*Unempl*) as a proxy for the local economic context, firstly because there is no available data of the demand or incomes at the employment area level and, secondly, as the number of unemployed may influence the level of local demand through its impact on the available income of households. The definitions and sources of the explained and explanatory variables are presented in the Appendix 1 whereas the Appendix 3 contains a table with the main descriptive statistics and the correlation matrices for every area.

Equation (3) can then be written as:

$$Growth_{i,t} = \beta_0 + \beta_1 Dens_{it-1} + \beta_2 Cs3_{it-1} + \beta_3 Indep_{it-1} + \beta_4 BC_{it-1} + \beta_5 HHI_{it-1} + \beta_6 Unempl_{it-1} + y_t + \varepsilon_{it} \qquad (4),$$

The β coefficients capture the effect of the different variables on the employment growth rate, *i* designates municipality, and *t* the period. All the explanatory variables are lagged as mentioned by the subscript *t-1*. ε_{it} is an error term.

Due to the presence of spatial autocorrelation, we estimate the equation 4 considering the possibility of spatial interactions. Equation 4 becomes then:

$$Growth_{i,t} = \boldsymbol{\rho} \mathrm{we}_{jt} + X_{it-1}\beta + d_t + \varepsilon_{it} \qquad (5),$$

[5] The annual periodicity of the estimations run prevents us from using the education level of inhabitants per area, which is not provided yearly. INSEE provides the education level at the employment area level for the years 1999, 2006 and 2011, which is compatible neither with the period under review, nor with the panel structure of the model.
[6] $HHI = \sum_{i=1}^{n} S_i^2$ where S_i is the market share of enterprise i and n is the number of firms.

ρ and β are unknown parameters and ε_{it} is an error term. X_{it} is a matrix of explanatory variables specific to commune *i* in year *t-1*. d_t represents a set of 6 fixed-time dummies in order to control for time-specific effects common to all municipalities in a given year (e.g. business cycles). The panel structure of the data added to the presence of a spatial clustering leads us to adopt spatial panel models (Elhorst, 2014). The following provides a brief discussion of the GWR framework. An in-depth discussion of this method can be found in Fotheringham et al. (2002).

5 Empirical results and comments

We ran estimations for three types of models. The detailed results are presented in the Appendix 4. The results obtained for the DSM are close from those obtained with the SAR model. This similarity confirms that the spatial autocorrelation is not significant for the spatially lagged explained variables. Estimation results of the basic spatial model indicate that there are very significant spatial interactions between municipalities. The ρ parameter is significant for the 13 metropolitan areas. Its value corresponds to the intensity of the spatial spreading of a positive or negative change in the number of employments. Our first hypothesis is thus confirmed since all the metropolitan areas are characterized by a positive spatial auto-correlation.

Undoubtedly, agglomeration effects intervene in 11 French metropolitan areas out of 13, Montpellier and Rennes being the only two exceptions find out. This may come from the demand side as the needs and purchases are higher in areas advantaged from a demographic point of view. Our finding are similar to those obtained by Martin et al. (2011) who, in a paper estimating the effect of agglomeration on firm productivity, show that “agglomeration externalities in France take the form of localization economies in the short-run” (ibid, p. 192). The second hypothesis, which considers the positive effect of population density on employment growth, is thus confirmed.

The other results obtained permit to consider the third hypothesis according to explanatory factors of employment growth have the same sign and the same significance regardless the metropolitan area considered. They show it is clearly not the case.

Whatever the metropolitan area considered, the share of white collars always negatively influence on the growth rate. This relation suggests that locations characterized by a higher rate of high skilled jobs create fewer jobs than the others. The apparent contradiction between our results and the results usually obtained in the literature comes from our focus on the productive activities which still employ more white collars than their complement, i.e. "presential" activities. This is specially the case in manufacturing industry which represents an important part of the productive activities. As the total number of employees in manufacturing industry is decreasing, it is not surprising to find this negative sign associated with the variable *Cs3* as in Levratto and Garsaa (2016).

In the majority of metropolitan areas, our estimations do not detect any correlation between the unemployment rate and the growth in the number of jobs in the productive activities. The correlation is negative and significant in four cases (Aix-Marseille, Lyon, Nantes, and Strasbourg) where the keynesian relationship between demand and economic growth is confirmed. In this case the unemployment rate is a proxy of the demand whose decreasing trend leads to a decrease in the number of employments. With a positive sign for the variable *Unempl*, Brest is an exception.

The number of employees working in stand-alone companies scaled by the total number of employees at the municipality level is negative, except for Brest, Montpellier and Strasbourg. The peculiar structure of the French productive system explains this negative correlation. Business groups tend to make the trend in the productive activities with a certain lag (Duhautois et al., 2014), so that one cannot be surprised to observe that areas presenting a higher share of employees in strand-alone entities are more likely to create jobs in these sectors.

Looking at HHI index, it is clear that results are not convergent. Two distinct groups can be identified. In the first one, one finds metropolitan areas in which a higher concentration degree deters employment growth (Aix-Marseille, Bordeaux, Brest, Montpellier, Nice, Rennes, and Rouen). The merger and acquisition movement observed during the crisis and still important after the peak in 2009 was accompanied by some drastic reorganization operations in the companies. A higher concentration level is thus associated with a decrease in the number of employees. This result confirms the conclusions reached by Bunel et al. (2009) according to when the acquired and acquiring companies are simultaneously considered in the analysis, mergers and acquisitions may have a negative effect on employment. In the second group, (Grenoble, Lille, and Lyon) the correlation is positive.

Specialization, at a broad sense, intervene too since in most cases, the sign associated with the variable BC is positive. It means that, even during this low conjuncture period, areas in which BtoB activities are important create more jobs than the ones dominated by BtoC sectors. Brest and Nice are exceptions.

Looking at the results, it appears clearly that the engines of employment growth strongly differ from one metropolitan area to another. Our analysis do not confirm the existence of a unique or, at least, consistent model of growth in metropolitan areas. Instead, we have found out several mixes of explanatory variables of employment growth attesting that metropolitan phenomenon is characterized by a strong heterogeneity mentioned by Carruthers (2003). Our third hypothesis is thus not confirmed.

Conclusion

This objective of this paper was to identify the engine of growth in metropolitan areas considering two kinds of effects (proximity effects through spatial autocorrelation and agglomeration effects through density) and to determine a pattern of economic development looking at the influence of different variables usually considered to have an effect on job creation. In order to cancel the noise possibly produced by activities having no impact on economic competitiveness, we restricted our research to the so-called productive activities, mainly consisting in industry and business services. The analysis was conducted for the 13 French regional metropolitan areas at the municipality level over the 2004-2010 period.

Our results show that spatial spillover effects intervene in the growth process of the areas under review and that density matters in determining the employment growth rate. We have been unable to identify a unique model of metropolitan dynamics. Indeed, each metropolitan area is characterized by a specific combination of explanatory variables which, finally, attests of the variety of the metropolitan frameworks.

Some limits should be considered in the future. Because this research uses discrete areal units, a well known spatial analytical issue, namely the modifiable areal unit problem (MAUP), influences the results. This means that a certain modeling outcome can result from the underlying aggregation level and the configuration of zones and that our results are mainly one manifestation of a range of possible results. Other tests are thus required to consider the scale and the aggregation problem and to determine to what extent they influence our results.

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Appendix 1 - Definitions and sources of the variables

Variable	Definition	Source
Explained variable		
$Growth_{it}$	Difference between the logarithm of the establishment number of employees at the end of the year t and t-1	CLAP
Explanatory variables (1 period lag)		
$Unempl_{i,t-1}$	12-month average unemployment rate by ZE	INSEE
$Indep_{i,t-1}$	Number of employees working in stand-alone companies, companies affiliated in a micro group or uncontrolled subsidiary companies / total number of employees, by municipality	LIFI
$BC_{i,t-1}$	Share of workers employed in manufacturing industry / total number of employees, by municipality	CLAP
$HHI_{i,t-1}$	Sum of the squares of the share of employment for all the establishments of a given municipality such as: share of an establishment in the total number of employees = Number of employees in this establishment/ Total number of employees in the municipality.	CLAP
$Dens_{i,t-1}$	Number of employees working in establishments located in a municipality / surface of the municipality in km^2	CLAP
$Cs3_{i,t-1}$	Number of skilled (or white-collar) employees[7] working in establishments located in a given municipality / total number of employees in this municipality	CLAP

Appendix 2 – Moran's I Statistics (2004 and 2010, First Order Queen Contiguity matrix)

	Bordeaux	**Brest**	**Grenoble**	**Lille**	**Lyon**	**Aix-Marseille**	**Montpellier**
N. Obs.	253	52	195	132	517	122	116
2004	0,521421	0,482248	0,408006	0,447618	0,462178	0,485282	0,456848
2010	0,562244	0,498041	0,401371	0,428409	0,478653	0,443662	0,527359

	Nantes	Nice	Rennes	Rouen	Strasbourg	Toulouse
N. Obs.	114	133	190	284	265	442
2004	0,382878	0,634094	0,312520	0,395224	0,378283	0,485253
2010	0,400258	0,650652	0,291897	0,372255	0,413370	0,498340

Appendix 3 – Descriptive statistics and correlation matrix for the 13 metropolitan areas

Bordeaux	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	5,198	1,000						
Cs3	0,098	0,366	1,000					

[7] This socio-professional category contains scientific professors and professions which directly apply very thorough knowledge in the fields of the exact or human sciences and have activities of general interest such as research, teaching or health. It refers to managers and administrative officers, as well as workers who have important responsibilities in corporate management. It also includes engineers and technical staff mobilising skills requiring in-depth scientific knowledge. Finally, this class groups professionals whose activity is related to arts and media.
For a detailed presentation of this category, see: http://www.insee.fr/fr/methodes/default.asp?page=nomenclatures/pcs2003/n1_3.htm

Unempl	0,070	0,124	0,051	1,000				
Indep	0,876	-0,577	-0,216	0,018	1,000			
HHI	0,142	-0,538	-0,122	-0,135	0,043	1,000		
BC	0,257	0,427	0,167	-0,081	-0,523	-0,034	1,000	
Dens	85,294	0,585	0,265	0,195	-0,305	-0,223	0,142	1,000

Brest	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	5,644	1,000						
Cs3	0,105	0,210	1,000					
Unempl	0,060	0,160	-0,047	1,000				
Indep	0,901	-0,625	-0,310	0,022	1,000			
HHI	0,128	-0,559	0,144	-0,200	0,163	1,000		
BC	0,242	0,366	0,094	-0,237	-0,638	-0,229	1,000	
Dens	70,259	0,611	0,260	0,303	-0,553	-0,126	0,128	1,000

Grenoble	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	4,903	1,000						
Cs3	0,139	0,193	1,000					
Unempl	0,049	0,313	-0,062	1,000				
Indep	0,875	-0,655	-0,234	-0,204	1,000			
HHI	0,214	-0,575	-0,085	-0,225	0,270	1,000		
BC	0,320	0,472	0,080	0,136	-0,612	-0,272	1,000	
Dens	128,133	0,577	0,255	0,293	-0,358	-0,185	0,124	1,000

Lille	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	6,469	1,000						
Cs3	0,133	0,237	1,000					
Unempl	0,061	0,659	0,130	1,000				
Indep	0,781	-0,666	-0,216	-0,269	1,000			
HHI	0,116	-0,603	-0,048	-0,447	0,361	1,000		
BC	0,379	0,298	0,016	-0,041	-0,374	-0,013	1,000	
Dens	397,944	0,713	0,324	0,655	-0,453	-0,334	0,037	1,000

Lyon	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	5,342	1,000						
Cs3	0,129	0,156	1,000					
Unempl	0,049	0,475	0,046	1,000				
Indep	0,838	-0,586	-0,152	-0,250	1,000			
HHI	0,163	-0,540	0,066	-0,274	0,106	1,000		
BC	0,368	0,447	0,014	0,143	-0,484	-0,245	1,000	
Dens	212,000	0,526	0,253	0,361	-0,250	-0,200	0,022	1,000

Aix-Marseille	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	7,085	1,000						
Cs3	0,138	0,311	1,000					
Unempl	0,089	0,526	0,144	1,000				
Indep	0,809	-0,656	-0,419	-0,312	1,000			
HHI	0,084	-0,682	0,038	-0,241	0,236	1,000		
BC	0,297	0,431	0,304	-0,038	-0,682	-0,204	1,000	
Dens	254,488	0,679	0,311	0,719	-0,393	-0,323	0,025	1,000

Montpellier	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	4,902	1,000						

Cs3	0,123	0,186	1,000					
Unempl	0,084	0,055	-0,085	1,000				
Indep	0,915	-0,544	-0,116	0,053	1,000			
HHI	0,175	-0,583	-0,145	-0,014	0,183	1,000		
BC	0,257	0,337	0,132	0,013	-0,195	-0,254	1,000	
Dens	79,473	0,583	0,155	0,196	-0,385	-0,231	0,098	1,000

Nantes	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	6,285	1,000						
Cs3	0,105	0,362	1,000					
Unempl	0,050	0,274	0,100	1,000				
Indep	0,847	-0,586	-0,236	-0,112	1,000			
HHI	0,094	-0,359	-0,143	-0,091	-0,098	1,000		
BC	0,371	0,333	-0,025	-0,134	-0,612	0,267	1,000	
Dens	93,320	0,654	0,389	0,507	-0,356	-0,217	0,071	1,000

Nice	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	5,082	1,000						
Cs3	0,126	0,155	1,000					
Unempl	0,060	0,438	-0,011	1,000				
Indep	0,893	-0,598	-0,214	-0,221	1,000			
HHI	0,216	-0,721	0,036	-0,384	0,314	1,000		
BC	0,211	0,515	0,197	0,205	-0,655	-0,418	1,000	
Dens	130,892	0,651	0,176	0,330	-0,408	-0,284	0,260	1,000

Rennes	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	4,984	1,000						
Cs3	0,107	0,073	1,000					
Unempl	0,047	0,186	-0,057	1,000				
Indep	0,866	-0,406	-0,002	0,058	1,000			
HHI	0,168	-0,514	0,070	-0,127	0,098	1,000		
BC	0,299	0,562	-0,058	0,016	-0,569	-0,181	1,000	
Dens	56,072	0,491	0,145	0,223	-0,348	-0,110	0,194	1,000

Rouen	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	4,258	1,000						
Cs3	0,108	0,026	1,000					
Unempl	0,051	0,480	0,038	1,000				
Indep	0,897	-0,570	-0,018	-0,314	1,000			
HHI	0,243	-0,544	-0,036	-0,269	0,119	1,000		
BC	0,275	0,398	-0,068	0,161	-0,484	-0,088	1,000	
Dens	89,287	0,592	0,097	0,402	-0,361	-0,246	0,126	1,000

Strasbourg	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens
Growth	4,651	1,000						
Cs3	0,121	0,027	1,000					
Unempl	0,040	0,431	0,035	1,000				
Indep	0,877	-0,520	-0,052	-0,173	1,000			
HHI	0,194	-0,439	0,005	-0,278	0,147	1,000		
BC	0,319	0,488	0,048	0,154	-0,434	-0,146	1,000	
Dens	79,641	0,588	0,128	0,387	-0,429	-0,232	0,206	1,000

Toulouse	Mean	Growth	Cs3	Unempl	Indep	HHI	BC	Dens

Growth	3,918	1,000						
Cs3	0,146	-0,054	1,000					
Unempl	0,051	0,340	-0,045	1,000				
Indep	0,926	-0,341	-0,009	-0,146	1,000			
HHI	0,275	-0,632	0,187	-0,337	0,246	1,000		
BC	0,246	0,358	-0,054	0,107	-0,349	-0,258	1,000	
Dens	47,800	0,498	0,071	0,153	-0,390	-0,230	0,208	1,000

Appendix 4 - Estimation results

SAR Model	Bordeaux	Brest	Grenoble	Lille	Lyon	Marseille	Montpellier
Cs3	-0.040*** (-6.337)	-0.023* (-2.036)	-0.079*** (-8.342)	-0.019 (-1.893)	-0.049*** (-4.351)	-0.023* (-2.379)	-0.064** (-3.076)
Unempl	-0.011 (-0.977)	0.080** (2.604)	0.009 (0.769)	0.009 (0.744)	-0.051** (-2.831)	-0.080*** (-3.933)	-0.002 (-0.048)
Indep	-0.216*** (-6.069)	-0.350 (-1.666)	-0.141* (-2.415)	-0.131** (-3.013)	-0.236*** (-5.440)	-0.059 (-1.372)	-0.010 (-0.065)
HHI	-0.256*** (-6.706)	-0.432*** (-5.881)	0.153*** (3.353)	0.106* (2.456)	0.105*** (4.527)	-0.269*** (-11.836)	-0.374*** (-3.679)
BC	0.237*** (3.478)	-0.088 (-0.479)	0.453*** (5.958)	0.693*** (9.046)	0.719*** (10.869)	0.276*** (3.366)	0.841*** (5.010)
Dens	0.003*** (8.131)	0.007*** (5.128)	0.002*** (5.284)	0.001*** (10.866)	0.001*** (14.355)	0.002*** (6.347)	0.001 (1.958)
ρ / λ	0.294*** (9.975)	0.190** (2.945)	0.061 (1.399)	0.213*** (4.380)	0.199*** (4.259)	0,2648*** (3.845)	0.155* (2.547)
LIK	669.226	176.510	224.241	640.090	836.836	774.862	-219.990
Moran I	9.480*** (0.000)	13.040*** (0.000)	3.620*** (0.000)	4.080*** (0.000)	12.580*** (0.000)	1.880*** (0.000)	2.560*** (0.000)
LM_{ERR}	82.900*** (0.000)	36.450*** (0.000)	0.600*** (0.000)	4.450*** (0.000)	99.300*** (0.000)	60.200*** (0.000)	29.300*** (0.000)
RLM_{ERR}	0.298 (0.585)	0.339 (0.561)	0.410 (0.522)	0.295 (0.587)	0.387 (0.534)	1.294 (0.255)	1.609 (0.205)
LM_{LAG}	512.650*** (0.000)	112.550*** (0.000)	141.750*** (0.000)	77.900*** (0.000)	888.200*** (0.000)	1.400*** (0.000)	155.800*** (0.000)
RLM_{LAG}	8.893** (0.003)	1.861 (0.173)	3.233* (0.072)	1.763 (0.184)	16.164*** (0.000)	0.119 (0.731)	4.139** (0.042)

SAR Model	Nantes	Nice	Rennes	Rouen	Strasbourg	Toulouse
Cs3	-0.037*** (-5.107)	-0.066*** (-5.706)	-0.031 (-1.879)	-0.074*** (-5.890)	-0.046*** (-3.647)	-0.114*** (-5.410)
Unempl	-0.081*** (-4.012)	-0.001 (-0.091)	-0.060 (-1.846)	-0.009 (-0.609)	-0.008 (-0.662)	-0.070** (-3.138)
Indep	-0.455*** (-8.669)	-0.207 (-1.331)	-0.352*** (-3.304)	-0.271** (-2.803)	-0.169 (-1.914)	-0.224* (-2.440)
HHI	0.008 (0.165)	-0.149** (-3.079)	-0.307** (-3.082)	-0.518*** (-8.343)	-0.008 (-0.119)	0.012 (0.162)
BC	0.320***	-0.253*	0.766***	0.896***	0.317**	0.396**

	(3.889)	(-2.014)	(4.238)	(9.276)	(2.620)	(2.734)
Dens	0.002*** (6.490)	0.002*** (4.582)	0.001 (1.151)	0.004*** (5.600)	0.003*** (5.131)	0.001*** (5.415)
ρ / λ	0.253*** (5.422)	0.214*** (4.619)	0.015 (0.337)	0.065 (1.920)	0.033 (0.821)	0.138* (2.377)
LIK	739.386	272.667	-508.403	-681.769	-435.564	306.316
Moran I	8.100*** (0.000)	8.020*** (0.000)	14.760*** (0.000)	12.340*** (0.000)	11.420*** (0.000)	9.840*** (0.000)
LM_{ERR}	27.750*** (0.000)	27.050*** (0.000)	398.300*** (0.000)	254.250*** (0.000)	227.900*** (0.000)	29.950*** (0.000)
RLM_{ERR}	0.110 (0.740)	0.075 (0.784)	0.827 (0.363)	0.022 (0.883)	0.004 (0.951)	0.272 (0.602)
LM_{LAG}	255.450*** (0.000)	211.150*** (0.000)	1052.350*** (0.000)	1098.850*** (0.000)	984.000*** (0.000)	72.950*** (0.000)
RLM_{LAG}	4.664** (0.031)	3.757* (0.053)	13.907*** (0.000)	16.914*** (0.000)	15.126*** (0.000)	1.132 (0.287)