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Changes in rural *versus* urban manufacturing employment: a shift and share analysis on French data.

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Abstract:

From a shift and share analysis on French data, we examine whether the differential of changes in manufacturing employment between urban and rural areas can be due to differences in their sectoral composition rather than to space-specific factors affecting all sectors indifferently. The increase in the share of industrial employment in rural areas is shown to be ascribable to advantages specific to low-density territories. These 'rural' advantages are not negligible while that such areas attract firms belonging rather to declining sectors. Conversely, urban centers, and especially the largest ones, combine a positive composition effect (*i.e.* preferential urban location of the more dynamic sectors) with a negative geographical effect (*i.e.* a tendency for urban industrial employment to fall). The urban fringes provide attracting characteristics for location of any industrial sector without the existing sectoral structure playing a significant role either positively or negatively.

Keywords: local growth, manufacturing employment, shift and share analysis, urban-rural areas

JEL classification: R12, O4

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1. Introduction

Whereas the industrialization of Western economies was accompanied by the urbanization of industrial employment (Mokyr, 1995), the crisis of the 1970s seems to have hit urban industrial employment harder than rural industrial employment. This is reflected by a relative decentralization of industrial employment to the benefit of rural areas (Bryden and Bollman, 2000). This phenomenon is observed both in North America (Holmes and Stevens, 2003) and in Europe (Champion, 1989). However, we do not know whether this contrasting spatial change in industrial employment is due to differences in sectoral composition between rural and urban areas or to space-specific factors affecting all sectors indifferently. The first dimension means that the higher (resp., lower) employment growth in one type of area is due to the greater (resp., lesser) weight of the more growing sectors (in terms of employment) in this kind of area. This dimension is akin to a sector-based composition effect or to a 'sectoral effect'. The second dimension means that the employment growth may be locally higher (resp., lower) because each sector is growing faster (resp., slower) in this area than in other areas. Thus, we can seek the factors explaining this among the local characteristics and this dimension corresponds to a 'geographical effect'.

This paper uses an estimable stochastic formulation of a shift and share analysis to determine whether the different patterns of change in manufacturing employment in the French urban and rural areas are due to sectoral or geographical effects or to both. Contrary to the standard method, this approach, which was first introduced by Berzeg (1978) and then further developed by Jayet (1993) and Esteban (2000), takes explicitly account of any geographical effect (rather than assuming a residual geographical effect as in the standard method) and determines the significance of the composition and geographical effects. The study is based on 1990 and 1999 French population censuses data (wherein the working population in employment is recorded at the place of work). France is divided into the three major categories generally used: urban centers, urban fringe (or periurban areas) and rural areas. These three spatial categories are evolving in different ways in France. Beside the fall in the total number of industrial jobs which affects both French urban centers and rural areas, the share of manufacturing employment located in the urban centers has declined since the late 1970s relative to that in the rural areas (see Appendix A). Over the same period, the urban fringe has seen an absolute increase in their level of industrial employment.

The aim of this paper is not to study precisely the factors determining the local growth of industrial employment. However, beyond our empirical findings, we suggest lines of research that may help us to understand spatial inequalities in employment growth. Indeed in order to guide studies toward the more relevant theoretical schemes, we need to determine whether the spatial differential of changes in industrial employment is due to a sectoral effect or a geographical effect. If the sectoral effect is predominant, then we need to find out what determines this particular spatial allocation of industrial sectors. In this case, the static nature of these models notwithstanding, the theoretical frameworks of economic geography mobilizing both technological and pecuniary static externalities (*e.g.* Fujita and Thisse, 2002, *chs* 8 & 9) remain relevant when accounting for the economic growth of such areas. However, if the geographical effect alone explains the regional discrepancies in growth, the frameworks that emphasize factors specific to the region seem the more appropriate. One thinks here, for example, of frameworks that consider local dynamic externalities related to local specialization or to sectoral diversity (Glaeser *et al.*, 1992; Henderson *et al.*, 1995; Combes, 2000) or of the dynamic effects of local public infrastructure (Gramlich, 1994).[1]

The main results can be summarized as follows. The increase in the proportion of manufacturing employment in rural areas can be ascribable to advantages specific to low-density territories. These 'rural' advantages are far from negligible as they offset the fact that such areas attract firms belonging rather to the declining sectors. Conversely, urban centers, and especially large ones, benefit to the

[1] Note that this empirical literature on the local growth does not control for the « sectoral effect ». Thus, these studies tend to amplify the role of local externalities in the local growth.

presence of the more growing sectors but supply disadvantages specific to high-density cities (as higher land rents or wages) so that the share of urban industrial employment falls. However, the urban fringe provides favorable characteristics for the location of any industrial sector; the existing sectoral structure does not play any significant role neither positively nor negatively. The existence of geographical effect, which is negative for urban centers and positive in rural areas, suggest two comments. First, without challenging the existence of externalities whose intensity increases with the density of firms, lesser density areas are also the source of externalities for industrial activities, whose the nature remains to be analyzed. Second, these results show that the net effects of industrial agglomeration may, above a certain level, become negative with urban costs progressively offsetting the externalities related to agglomeration. It is also shown that these results are robust to the outsourcing of some activities by industrial firms, which movement has powered the employment growth in business activities, and to phenomena of specialization of French great region in particular industries. It should be noticed that these results are not only characteristic of the most recent period. Indeed a similar analysis for the period 1982–1990 confirms this trend.

The remainder of the paper is organized as follows. Section 2 sets out the shift and share method used. Section 3 describes the data, the various spatial delineations and the industrial nomenclature used. The main results are set out in Section 4 while Section 5 proposes additional estimations designed to test how robust the results are. Two ways are explored. First, business activities are worked into the analysis alongside industrial sectors in an attempt to examine the role played by outsourcing of these services by industrial firms. Next, the hypothesis is tested of a possible regional differentiation of our results in relation to differences in regional specialization. In the final section, we discuss the implications of our main results for future researches.

2. Methodology : a estimable stochastic formulation of shift and share analysis

The conventional shift and share analysis consists to partition the growth rate (over the time interval from 0 to 1) of the *i*-th industry in the *j*-th region (r_{ij}) in three 3 components as follows:

$$r_{ij} = r + (r_i - r) + (r_{ij} - r_i) \qquad (1)$$

where r is the national growth rate of the all industrial sectors and r_i is the growth rate of the ith national industry. By using the following notation - X_{ijt} the employment in the sector i and the region j at the period t ($t = 0,1$), $X_{it} = \Sigma_j X_{ijt}$, the total employment of sector i at the period t and $X_t = \Sigma_i \Sigma_j X_{ijt}$, the national employment of industries at the period t - the expression of these three terms are given by:[2]

$$r_{ij} = (X_{ij1} - X_{ij0}) / X_{ij0} \qquad r = (X_1 - X_0) / X_0 = \sum_i \sum_j \frac{X_{ij0}}{X_0} r_{ij}$$

$$r_i = (X_{i1} - X_{i0}) / X_{i0} = \sum_j \frac{X_{ij0}}{X_{i0}} \; r_{ij}$$

whereas the growth rate in the j-th region (r_j) is given by:

$$r_j = (X_{j1} - X_{j0}) / X_{j0} = \sum_i \frac{X_{ij0}}{X_{j0}} \; r_{ij} \qquad \text{where } \sum_i X_{ijt} = X_{jt}$$

Then, by calculating the regional mean of the equation (1), we obtain the composition-geographical equality. It is expressed as follows:

$$r_j = r + s_j + g_j \qquad \text{where } s_j = \sum_i \frac{X_{ij0}}{X_{j0}} (r_i - r) \text{ and } g_j = \sum_i \frac{X_{ij0}}{X_{j0}} (r_{ij} - r_i)$$

Therefore, the employment growth rate in the jth region, r_j, is equal to the sum of three components: *(i)* r, the national growth rate; *(ii)* s_j, the composition effect; *(iii)* g_j, the geographical effect.

[2] Note that these equalities hold when $X_{ij0} \neq 0$ and $X_{ij1} \neq 0$, $\forall i$ and $\forall j$.

However, a significance test of both geographical and sectoral effects cannot be applied because this conventional shift-share approach is formulated as a tautology. Thus, we adopt the estimable stochastic formulation suggested by Berzeg (1978). This method consists to write the equation (1) as a linear model given by:[3]

$$r_{ij} = a + b_i + g_j + e_{ij} \qquad (2)$$

where a is a constant, b_i (resp., g_j) is the fixed effect of the i-th sector (resp., the j-th region) and e_{ij} is a random error term. Without constraints on the parameters, this model is not identified. Then, we use the two following assumptions:

$$\sum_i \left(\sum_j w_{ij} \right) b_i = \sum_i \frac{X_{i0}}{X_0} b_i = 0$$

$$\sum_j \left(\sum_i w_{ij} \right) g_j = \sum_j \frac{X_{j0}}{X_0} g_j = 0 .$$

where $w_{ij}=X_{ij0}/X_0$ is a weighting coefficient. Therefore, the identity (1) and the model (2) are identical (because, in this case, we have $\hat{a} = r$). Because of the weighting coefficient, the variance of residuals is not homoscedastic and is given by:

$$V(e_{ij}) = \frac{s^2}{w_{ij}}$$

We can now test whether both composition and geographical effects are significant or not for each region. To do this, we must calculate both composition and geographical effects from the estimators $\hat{b}_i$ et $\hat{g}_j$ as follows (Jayet, 1993):

$$s_j = \sum_i \frac{X_{ij0}}{X_{j0}} \hat{b}_i \qquad \text{and} \qquad g_j = \hat{g}_j$$

The composition and geographical effects for each region are therefore constructed as linear combinations of parameters of the model (2). Thus, we can calculate their variance and determine whether these effects are significant or not.

3. Data

The data used are taken from the 1990 and 1999 population censuses (quarter sample) conducted by the French national statistics institute (INSEE). This source can be used to evaluate the local employment by sector by counting the active population in employment at their place of work. In contrast to other data sources for France, the population census is comprehensive both for the sectors covered by the analysis and for the types of employment taken into account.[4] The census data are put together and yield the number of industrial jobs by sector and by spatial category. It is well known that this type of analysis is highly sensitive to the classification of industrial sectors selected and the division into spatial categories (Combes and Overman, 2003). Thus, we will use different classifications and spatial categories. Before analyzing some descriptive statistics prior to the shift and share analysis, we shall examine the nomenclatures and the divisions used.

[3] See Knudsen and Barff (1991) who suggest three alternative shift-share linear models that give qualitatively identical results.

[4] The Annual Corporate Data Returns (*Déclarations annuelles de données sociales* – DADS) include only employees and omit the self-employment. Likewise the annual business surveys (*Enquêtes annuelles d'entreprises* – EAE) used by Combes (2000) and Combes *et al.* (2002) only cover employment in plants greater than 20 employees.

3.1. Industrial nomenclatures

The changes made to the sectoral nomenclatures in France in 1993 make it an intricate matter to match the 1999 and 1990 census data at a fine scale. The INSEE proposes such a connection but the sectoral data derived can only be used for aggregated levels of sectoral and geographical divisions. The usable sector-based disaggregations (NES16 and NES36) can be used to distinguish either 6 or 17 industrial sectors and these data are reliable only for areas with more than 5000 jobs in NES16 and more than 10,000 jobs in NES36. The list of sectors used at these two levels is shown in Appendix B1.

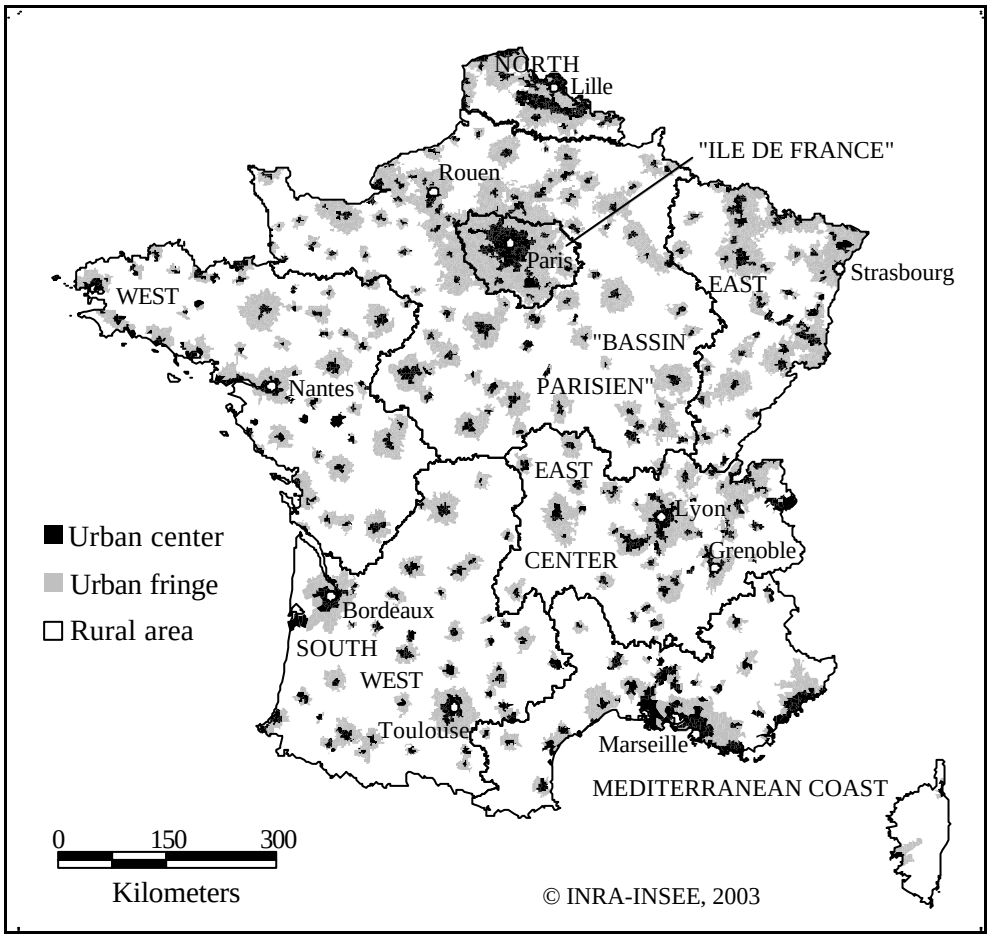
3.2. Spatial delineations

For geographical divisions, we use the 1990 delineation proposed by the INSEE and the INRA called *Urban and Rural Area Zoning* (Schmitt and Perrier-Cornet, 1998). It divides France into five categories of area (that we shall call "URAZ5"):

(i) *Urban centers*: urban units with more than 5,000 jobs (361 centers in all), corresponding to almost all urban units of more than 20,000 inhabitants and to a fifth of those numbering 5,000 to 20,000 inhabitants. They account for 60% of the French population and % of jobs in France in 7.4% of the land area.

(ii) *Urban fringes* or *Periurban areas*: communes (French municipalities) from where at least 40% of the resident working population commute to one or more urban centers. They cover more than 20% of the national land area in 1990 and accommodate about 10 million inhabitants in 1999, or 16.5% of the French population (cf. Appendix C and Map 1).

Map 1. France's urban centers, periurban areas and rural areas in 1990 and the location of the major cities and of the *Regional Planning and Study Areas* (RPSA)



These two categories of area together make up the *predominantly urban areas*, which are contrasted with the *predominantly rural areas*. The latter can be divided into three categories:

(iii) *Rural areas under weak urban influence*: communes defined as having between 20% and 40% of commuters to urban areas. They cover nearly one fourth of the land area and have 5.3 million inhabitants.

(iv) *Rural centers*: communes or urban units providing at least 2000 jobs and *their fringe*, which includes communes where more than 20% of the resident population work in rural centers. These cover less than 10% of the land area and have 3.3 million inhabitants.

(v) *Remote rural areas*: the remainder of the predominantly rural areas and consist of communes free from influence urban or rural centers. They cover 37.1% of the land area and have 5 million inhabitants.

This first level of delineation was combined with a second level of delineation allowing for the internal heterogeneity of these broad spatial categories. Urban centers are subdivided in relation to their size, and urban fringes are subdivided by the size of the urban center to which most of their working population commuted. Four types of urban center were used: centers with less than 20,000 jobs; centers with 20,000–100,000 jobs; centers with more than 100,000 jobs other than Paris; and, finally, Paris. Communes belonging to the three predominantly rural areas were subdivided by the size of the nearest urban center (shortest distance as the crow flies between the commune and the boundary of an urban area). This subdivision, proposed by Bessy *et al*. (2001), can be used to identify *rural hinterlands of urban centers* within the predominantly rural areas and to subdivide them by size of the urban center to which they are related. In order to comply with the constraint of geographical areas with sufficient industrial jobs, only three groups of urban center size are used for these three categories of area: urban centers with fewer than 20,000 jobs; centers with 20,000–100,000 jobs; and centers with more than 100,000 jobs, including Paris. This subdivision means we have 17 geographical areas.

3.3. Descriptive statistical features

Tables 1 and 2 show a few features of descriptive statistics. They confirm that industrial employment is concentrated in urban centers: 67% and 63% of industrial jobs were located there in 1990 and 1999, respectively. However, it should be noted that these jobs were less concentrated than total employment (70% of total employment was located in urban centers in 1999, cf. Appendix B) and that, as noted above, their degree of concentration declined between 1990 and 1999. The relative decentralization of industrial employment is the result of the growth gap between the decline of urban industrial employment (-16% in 9 years), the growth in periurban areas (+5%) and the moderate decline in rural areas (-5.7%). The share of rural industrial employment then rose from 23 % to 25% and that of periurban employment from 10% to 12%.

Each of the main types of industry identified in Tables 1 and 2 is affected by this shift in relative balance of industrial employment between urban areas and rural and periurban areas. However, this shift in balance occurs at different rates and affects industries with unequal initial degrees of concentration.

Table 1. Distribution of employment by manufacturing sectors and by type of areas (1990)

Industrial sectors	Urban centers		Urban fringe		Rural under urb. Infl.		Rural centers		Remote rural areas	
Food product, beverage and tobacco	343795	*54*	72752	*12*	65196	*10*	62460	*10*	87724	*14*
Final goods industries	650888	*70*	71129	*8*	54210	*6*	80592	*9*	78689	*8*
Automotive	233124	*77*	41656	*14*	10548	*3*	11168	*4*	7364	*2*
Equipment goods industries	716119	*77*	83185	*9*	38608	*4*	47548	*5*	39716	*4*
Intermediate goods industries	990506	*60*	187807	*11*	145209	*9*	159456	*10*	159744	*10*
Energy	209652	*78*	13244	*5*	11184	*4*	20452	*8*	13588	*5*
Total	3144084	*67*	469773	*10*	324955	*7*	381676	*8*	386825	*8*

In italics: the share of industrial employment located in a type of area. *Source: RP 1990, at workplace*

Table 2. Distribution of employment by manufacturing sectors and by type of areas (1999)

Industrial Sectors	Urban centers		Urban fringe		Rural under urb. Infl.		Rural centers		Remote rural areas	
Food product, beverage and tobacco	309319	*50*	82643	*13*	71254	*11*	63614	*10*	95892	*15*
Final goods industries	512279	*68*	68424	*9*	47881	*6*	62664	*8*	60705	*8*
Automotive	198821	*74*	38950	*15*	12025	*4*	11951	*4*	6750	*3*
Equipment goods industries	604819	*74*	92127	*11*	39709	*5*	45672	*6*	38870	*5*
Intermediate goods industries	816032	*57*	197081	*14*	133974	*9*	146698	*10*	149556	*10*
Energy	186298	*76*	13882	*6*	11762	*5*	19619	*8*	12681	*5*
Total	2627568	*63*	493107	*12*	316605	*8*	350218	*8*	364454	*9*

In italics : the share of industrial employment located in a type of area. *Source: RP 1999, at workplace*

The agro-food industry, the sector where the fall in employment is the lowest nationally, is both the least concentrated industrial sector and a sector where very intense decentralization occurred over the period under study. The strong employment growth in this sector in rural and periurban areas, +7% and +13% respectively, contrasts with its 10% fall in urban areas. As a result, in 1999, the distribution of agro-food industry between urban areas and rural and periurban areas is close to 50–50%. Somewhat less concentrated at the beginning of the period, intermediate goods industries (which account for 35% of industrial employment nationwide) also become deconcentrated, although a little slower than in the agro-food industry. The national decline of employment observed in this sector was more concentrated in urban areas (-18%) than in the rural ones, where employment still fell by 7% over the period. The growth in periurban areas is limited to 5%. Accordingly, the weight of urban centers in the spatial distribution of employment in this industry declined from 60% in 1990 to 57% in 1999.

Historically very concentrated industrial sectors (equipment goods industries, automobile manufacturing, and energy industries) follow a comparable decentralization but it does not bring into question their high degree of agglomeration. These three sectors account respectively for 20, 6.5, and 6% of national industrial employment. Behind a national decline of the same magnitude, decentralization in these three sectors is not based on exactly the same factors. The equipment goods industries and, to a lesser extent, the energy sector, follow the 'classical' scheme of decentralization: the fall in employment is more intense in urban areas (-16% for equipment goods industries) than in rural ones (-1%) together with a spectacular periurban growth (+11%). By contrast, the automobile industry recorded a 6.5% fall in periurban employment and a 6% rise in rural employment.

Lastly, the final goods industries, another important industrial sector that accounts for 18% of industrial employment in France, are a little more concentrated than the average. However, they have undergone a stronger geographical decentralization of their employment than the other sectors. The decline, which has been large everywhere, reached 20% in urban and rural areas alike, this decline in the periurban areas is just 4% in 9 years.

So, overall, industrial employment in France has undergone relative dispersion with a combination of a spread of industrial employment from urban areas to their fringe (i.e. periurban areas) and a relative redistribution of activity between predominantly urban and predominantly rural areas. The latter phenomenon is the result of differences in the rates of decline in employment. Analysis by major sectors confirms this trend and also brings out a spatial differentiation in the rates of change by sector, which follow identical trends within each category. This suggests there is a geographical effect that is systematically positive in urban fringe and rural areas and systematically negative in urban areas. However, these first results are much less clear when it comes to the existence of composition-sectoral effects. The shift and share analysis whose results are set out below should allow us to analyze this latter effect and to measure the true significance of the former.

4. Results of the shift and share analysis

We begin by analyzing the results of equation (2) estimation from the spatial division into five categories (URAZ5) before examining the results obtained when allowance is made for the size of urban centers.

4.1. Composition and geographical effect at the URAZ5 level

When using the NES16 sectoral division, the relatively less unfavorable change in employment in the rural areas seems to be due to advantages specific to this type of area. Indeed, the geographical effect is significant and positive there, except for the rural centers where it is non-significantly different from zero (Table 3). The composition-sectoral effect is usually non-significant at this level of the industrial nomenclature, which is no longer the case when we switch to the NES36 level. At this level of sectoral aggregation, more effects become significant. The increase in the share of industrial employment in the three types of rural areas then appears to be due to a significantly positive geographical effect (whichever the rural category) that partly offsets systematically significant and negative sectoral effects. Rural areas are therefore characterized by the presence of industrial sectors having experienced more intense decline in terms of jobs. However, these same areas provide specific advantages thereby offsetting the drawback of a more rural location of the sectors in decline. This means that rural industrial employment has fallen at a slower rate than the national average. However, it seems that the rural centers, where more than one-third of rural industrial employment is concentrated (Appendix C), are less well endowed in specific advantages than the other two categories of rural area, where employment is more dispersed. Their industrial change is affected accordingly.

It should be noticed that these results are not only characteristic of the most recent period. A similar analysis for the period 1982–1990 confirms this double trend (see Appendix D1): in each of the three categories of rural areas, the positive geographical effects were already strong and largely offset the negative composition-sectoral effects. The only shift relates to the rural centers and their fringes, where the geographical effect in the period 1982–1990 was the same as in the other two categories of rural area. The weakening of this geographical effect over the recent period could be a worrying sign that these rural centers are becoming fragile as places where a non-negligible share of rural economic activity is concentrated.

Table 3. Composition and geographical effects at URAZ5 level, 1990-1999
(national growth rate of industrial employment: -0.11)

		NES16		NES36	
URAZ5	**Growth rate**	**Composition effect (s_j)**	**Geographical effect (g_j)**	**Composition effect**	**Geographical effect**
Urban centers	-0.164	-0.001	-0.044***	0.007***	-0.053***
Urban fringe	0.049	0.003**	0.164***	5.10-6	0.167***
Rur under urb. infl.	-0.025	0.004*	0.087***	-0.015***	0.108***
Rural centers	-0.082	8. 10-4	0.036	-0.020***	0.056**
Remote rural area	-0.057	0.004	0.056**	-0.023***	0.083***

*, ** and *** : significant respectively at 1%, 5% and 10%

A opposite phenomena seems to apply to industrial employment in urban centers: the fall in the number of their jobs is due to a negative geographical effect that is not offset by the slightly positive composition effect (in NES36). The previous period (1982–1990) displayed the same combination of determinants of the fall in urban industrial employment (see Appendix D1). Thus, despite the presence of the faster growing industrial sectors in terms of changes in employment, urban centers seem to offer substantial disadvantages that are sufficiently intense to offset the positive sectoral effect. These first findings confirm the urban/rural differences on the two dimensions studied here. First, rural areas enjoy intrinsic advantages able to attract any industry whereas the urban centers suffer from symmetrical disadvantages. And the more dynamic industrial sectors in terms of change in employment are located mostly in urban centers, whereas the industries that are in the worst decline are over-represented in the predominantly rural areas.

For the urban fringes, the change of industrial employment is affected only by an intense positive geographical effect, while the composition-sectoral effect is very weak (at NES 16), or even non-significant (at NES36). Theseareas therefore seem indifferent to the type of sectors they accommodate and to their composition changes. On the other hand, the periurban areas seem to provide intense advantages common to all sectors because the geographical effect is highly positive and significant. Thus, on the two dimensions studied here, this category of area is fundamentally opposed to the urban centers. It is more like the rural areas in the size of the geographical advantages it procures, but less like them in terms of the low specificity of the sectors locating there.[5]

These results suggest a marked opposition between rural areas and urban centers. The former attract preferentially the more declining sectors in terms of employment, such as certain agro-food industries or intermediate goods industries, sectors which, in France, are known to be labor-intensive and/or competitive. It may be that these sectors find advantageous production conditions in these areas, such as lower labor costs (or lower land rents). Alongside this, the specific environment of rural areas seems favorable to the relative development of industrial employment. This might be interpreted as *the existence of dynamic externalities as a result of low densities*, as shown by Kim *et al.* (2000) for US data.

Conversely, the more dynamic industrial sectors in terms of employment set up historically in urban centers so as to benefit from the advantages of agglomeration, such as the presence of diversified inputs and workers, the possibility of sharing information that can only be exchanged by face-to-face communication, and so on (see Duranton and Puga, 2003, for a survey on the micro-foundations of urban agglomeration economies). However, the recent conditions of change in the sectors set up in urban centers have become highly unfavorable. This may be the effect of land rents that have become prohibitive for these sectors where large firms are numerous. This is an incentive to relocate a part of their production activity. They seem to do this, largely, toward the urban fringes, as suggested by the very largely positive geographical effect in the periurban areas. This is the decentralization of industrial employment around urban centers, which occurs largely in France by relocation of plants (Delisle and Lainé, 1998). This movement can be explained both by the effect of low land rents and their consequences in terms of lower labor costs in the urban fringe (as shown by Ota and Fujita, 1993, or Fujita *et al.*, 1997) and, by the indirect effects of the population spread (Henry *et al.*, 2001; Schmitt and Henry, 2000).

[5] Note that, in the period 1982–1990, the composition-sectoral effect was also very weak but negative rather (cf. Appendix D1). It is as if the major changes in economic activity in these areas were such as to alter the actual nature of the industries present. But as the effect is weak, it is difficult to be more conclusive on this point.

4.2. The effect of the size of urban centers

Estimates based on spatial delineation in five URAZ5 categories are subdivided by the size of the urban center to which they are attached. The results are given in Table 4 and show the powerful character of the urban center size in the emergence of geographical effects and, to a lesser extent, of sectoral effects. The intensity, and even the sign, of these different effects varies with the urban centers and, in their nearby (periurban areas) and more remote (rural hinterlands) zones of influence, with the center size.

Note first that the results obtained with a highly aggregated industrial nomenclature (NES16) are more difficult to interpret than with the preceding estimates, while significant effects are rare. Accordingly, the following analyses are based on the results obtained for NES36.

Table 4. Composition and geographical effects at URAZ5 level * size of urban center, 1990-1999
(national growth rate of industrial employment: -0.11)

		NES16		NES36	
URAZ5*size of urban center	**Growth rate**	**Composition effect (s_j)**	**Geographical effect (g_j)**	**Composition effect**	**Geographical effect**
UC * S<20	-0.100	0.0007	0.017	-0.007***	0.025*
UC * S:20-100	-0.140	0.001	-0.024*	-0.0003	-0.022**
UC * S>100	-0.136	0.0007	-0.018	0.017***	-0.035***
UC * Paris	-0.269	-0.006**	-0.145***	0.024***	-0.175***
UF * S<20	0.093	-0.0005	0.212***	-0.016***	0.228***
UF * S:20-100	0.056	0.005***	0.168***	-0.008***	0.182***
UF * S>100	0.108	0.001	0.224***	0.006***	0.220***
UF * Paris	-0.086	-0.001	0.033	0.009***	0.021
RUI * S<20	-0.042	0.002	0.072**	-0.022***	0.097***
RUI * S:20-100	-0.017	0.002	0.097**	-0.022***	0.122***
RUI * S>100	0.007	-0.0008	0.126*	-0.0120***	0.137**
RC * S<20	-0.100	-0.003***	0.021	-0.027***	0.044*
RC * S:20-100	-0.067	0.001	0.049	-0.025***	0.076**
RC * S>100	-0.058	-0.006***	0.066	-0.011***	0.071
RR * S<20	-0.070	0.002	0.044	-0.027***	0.075***
RR * S:20-100	-0.034	0.001	0.082**	-0.035***	0.119***
RR * S>100	-0.079	0.0006	0.037	-0.010***	0.048

*, ** and *** : significant respectively at 1%, 5% and 10%

Focus first on the urban centers and their periurban areas. Industrial sectors where employment has evolved less unfavorably than total industrial employment tend to be located in the largest urban areas (urban centers and their periurban areas). The composition-sectoral effect is thus positive for urban centers greater than 100,000 jobs (including Paris) and the corresponding periurban areas, while other urban centers and their periurban areas display a negative or zero sectoral effect. However, the specific features of Paris and of the 21 other urban centers greater than 100,000 jobs, have a negative impact on the change in their industrial employment whatever the industrial sector. Alongside this, although periurban areas related to the centers greater than 100,000 jobs clearly display a positive geographical effect (amplifying the positive composition effect), this is not true of the periurban area of Paris. The geographical effect there is non-significantly different from zero. Thus, the predominantly urban areas related to the 21 urban centers greater than 100,000 jobs (excluding the Paris urban center) offset the geographical disadvantages of their urban centers by the geographical advantages of their fringe and the favorable structure of the sectors locating there. Conversely, the fall in industrial employment in 'Greater Paris' is due to the combination of the geographical disadvantages of the center with the lack of intrinsic advantages of its periurban area, which cannot be offset by a favorable sectoral structure of industrial employment. It may then be that the effect of high land rents affects both Paris and its periurban area.

The two categories of urban centers with less than 100,000 jobs and the urban fringes related to them attract sectors having larger fall in their industrial employment than this observed at national level (composition effects are negative there). However, except for the urban centers with 20,000–100,000 jobs, these different areas provide specific advantages that are common to all sectors (geographical effects are positive) and are high enough to offset the decline in employment in these sectors. More specifically, both categories of periurban areas related to urban centers with less than 100,000 jobs offer geographical advantages that can generate positive growth of industrial employment in the area despite the presence of sectors that are declining. This confirms the idea put forward before whereby the land rent, and more generally all urban costs, are decisive factors in the changing pattern of industrial employment in urban areas: although big cities suffer from substantial geographical disadvantages, which, as in Paris, may be passed on to their periurban areas, small cities do not suffer such disadvantages. Industrial sectors drawn to urban areas therefore find an incentive to set up on the fringe of the urban centers where the differential in land rent may be high.

For the rural areas, Table 4 confirms that there is a negative sectoral effect for all the categories of rural area regardless of the size of the urban center to which they are attached. Rural areas therefore accommodate more particularly those industrial sectors that have seen a sharp decline in employment over the last decade. The positive geographical effect already observed before is seen again. The advantages procured by these areas are enjoyed by all industrial sectors, whatever their activity, and partly offset the decline of industries that set up there historically. Then, the increase in the relative proportion of rural industrial employment can be due to specific rural features benefiting all industries, whatever their activity, and not to the presence, in rural areas, of sectors characterized by their enhanced resistance to the late 20th century crisis in industrial employment. However, these rural advantages seem to be less apparent or even absent, in the rural centers and isolated rural areas making up the more remote hinterlands of the large urban centers (greater than 100,000 jobs). The proximity of such rural areas to large urban centers seems to be detrimental to the advantages related to rural location.

Consequently, the industry location in rural areas or in small urban centers provides the benefit of geographical advantages specific to such areas and shared by all sectors. This confirms the idea that low-density areas are source of externalities for manufacturing industries. Conversely, large urban centers are the seat of negative geographical effects whereas, like their periurban areas, they attract the faster growing industrial sectors. It should be noted that these different results apply not just to the 1990–1999 period since, as seen before, similar results were found for the preceding period (1982–1990). The sign and significance of the composition and geographical effects for the period 1982–1990 were often the same as those obtained in 1990–1999 whichever division is used (see Appendix D2).

These results are important for two reasons. Without challenging the existence of externalities whose intensity increases with the density of firms, they show first of all that such externalities can also be expressed in areas of lesser density or that such areas are the source of externalities of another kind. They further show that the net effects of industrial agglomeration may, above a certain level, become negative with urban costs progressively offsetting the externalities related to agglomeration.

5. Robustness of the results

In this section, we evaluate the sensitivity of our results to two phenomena. The first is the outsourcing by industrial firms of part of the service jobs they manage. Although accounted for in the industry at the beginning of the period, some of these jobs are assigned to the business services sector at the end of the period. In order to study their role, we attempt to determine whether allowance for business services modifies the conclusions of our analyses. The second bias lies in the fact that, alongside the distribution of activities by spatial categories, the French regions also have their own principle of sectoral specialization. As allowance for regional phenomena may bias our results, we modify our

spatial distribution by breaking down each of the five URAZ5 categories by region to which it belongs.

5.1. Allowance for the 'outsourcing bias' of business activities

The outsourcing by industrial firms of certain activities appears as a transfer of employment from manufacturing to business activities. A non-negligible share of jobs that were classified in 1990 as belonging to industry were therefore reclassified in 1999 as being in the business services sector. So, with 2.8 million jobs, business activities represented *40%* of total employment in 'industry + business activities' in 1999 (Table 5). Moreover, over the period 1990–1999, the high growth of employment in such services (+24% in 9 years at national level) offset the fall in industrial employment (-11.8%), with the result that the total number of jobs in 'industry + business activities' remained stable over this period (-0.2 percent nationwide).[6]

Table 5. Distribution (in 1999) and growth rate (between 1990 and 1999) of employment in business activities by type of area

	Posts and Telecom.	Consultancy and others	Renting without operator	Research and Development	Total Business activities	Manufacturing industries	Total
Urban centers:							
Number 99	385,229	1,011,592	803,260	121,357	2,321,438	2,627,568	4,949,006
Share 99	81.7%	87.6%	77.7%	87.3%	82.9%	63.3%	71.2%
Growth 90-99	-2.5	+14.7	+41.1	+13.4	+18.9	-16.4	-2.9
Urban fringe:							
Number 99	26,173	62,675	95,496	8,934	193,278	493,107	686,385
Share 99	5.6%	5.4%	9.2%	6.4%	6.9%	11.9%	9.9%
Growth 90-99	+8.2	+62.3	+129.4	+14.5	+72.2	+5.0	+17.9
Rural under weak urban influence:							
Number 99	19,228	24,596	44,844	1,787	90,455	316,605	407,060
Share 99	4.1%	2.1%	4.3%	1.3%	3.2%	7.6%	5.9%
Growth 90-99	+0.6	+34.3	+162.3	+31.4	+61.9	-2.6	+6.9
Rural centers:							
Number 99	16,061	31,570	47,783	5,416	100,830	350,218	451,048
Share 99	3.4%	2.7%	4.6%	3.9%	3.6%	8.4%	6.5%
Growth 90-99	-2.8	+27.0	+115.4	-22.1	+43.0	-8.2	-0.3
Remote rural areas:							
Number 99	24,826	24,469	42,887	1,591	93,773	364,454	458,227
Share 99	5.3%	2.1%	4.1%	1.1%	3.3%	8.8%	6.6%
Growth 90-99	-6.1	+21.0	+148.8	-22.0	+42.2	-5.8	+1.2
Total:							
Number 99	471,517	1,154,902	1,034,270	139,085	2,799,774	4,151,952	6,951,726
Share 99	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Growth 90-99	-2.0	+17.4	+55.0	+11.1	+24.0	-11.8	-0.2

Source: RP1990 & 1999, at workplace

Table 5 shows the very high level of geographical concentration of business activities: 83% of jobs in business services are located in urban centers (*versus* just 63% for industrial employment). However, their inclusion in a broader industrial sector does not challenge the observation made earlier of employment decentralization in these sectors. The 3% fall in such employment in urban centers goes

[6] The outsourcing, however, is not wholly responsible for the change in employment in business activities. Two other factors, whose weight cannot be measured here, must also be considered: first, the creation or generalization of new services (*e.g.* computing services) and, secondly, productivity gains in services (whose effects on changes in employment are not so clear cut).

along with fast growth in urban fringes (+18%) and with stability or moderate growth in the different rural categories. This can be explained by the fact that the two largest business activities (consultancy and others and renting without operator that make up 80% of business service jobs) have clearly greater growth in employment outside the urban centers as opposed to within urban centers. The post & telecommunications and research & development sectors behave in a different way: the fall in jobs in the former affects both urban and rural centers and the remote rural areas while the latter continues to have a strong tendency toward concentration.

This descriptive approach suggests that the broadening of the field of analysis should have little effect on our previous results. However, it may be thought that the outsourcing of some activities by industrial firms might entail a double bias. First, it gives firms that take on such activities a new autonomy in terms of location. Their generally innovative character associated with the search for new outlets and for scale economies may reinforce their tendency to concentrate. It could intensify the composition-sectoral effects (positive in the urban centers and negative in rural areas) brought out before. In parallel, it may be thought that the recourse to outsourcing is differentiated not only by sector but also within a sector depending on the location of its firms. Indeed, with a given sector, a firm located in an urban center can outsource some of its activities more easily as it finds a denser and more diversified supply of services locally. By contrast, rural firms, for opposite reasons, will tend to maintain a larger number of such functions within the firm. Of course, they may buy services from providers based in urban centers, but all else being equal, the costs related to distance will mean there is less incentive to outsourcing. This latter phenomenon may therefore be reflected by an increase of the positive geographical effect already observed in rural areas.

Table 6. Composition and geographical effects at URAZ5 level, 1990-1999, Manufacturing industries & business activities (national growth rate: -0.0019)

		NES36	
URAZ5	**Growth Rate**	**Composition effect**	**Geographical effect**
Urban centers	-0.029	0.002***	-0.055***
Urban fringe	0.179	-0.048	0.229***
Rur under urb. infl.	0.068	-0.089***	0.160***
Rural centers	-0.002	-0.085***	0.085**
Remote rural areas	0.012	-0.101***	0.114***

*, ** and *** : significant respectively at 1%, 5% and 10%

Table 7. Composition and geographical effects at URAZ5* size of urban center level, 1990-1999, Manufacturing industries & business activities (national growth rate: -0.0019)

URAZ5*size of urban center	Growth Rate	NES36 Composition Effect	NES36 Geographical Effect
UC * S<20	-0.008	-0.047***	0.040*
UC * S:20-100	-0.020	-0.013	-0.005
UC * S>100	0.001	0.048***	-0.046***
UC * Paris	-0.071	0.092***	-0.162***
UF * S<20	0.200	-0.093***	0.296***
UF * S:20-100	0.162	-0.067***	0.231***
UF * S>100	0.248	0.038***	0.289***
UF * Paris	0.097	0.017***	0.117**
RUI * S<20	0.054	-0.102***	0.159***
RUI * S:20-100	0.067	-0.100***	0.169***
RUI * S>100	0.119	-0.082***	0.204**
RC * S<20	-0.017	-0.097***	0.081**
RC * S:20-100	0.012	-0.098***	0.113**
RC * S>100	0.011	-0.065***	0.078
RR * S<20	-0.002	-0.110***	0.110***
RR * S:20-100	0.035	-0.116***	0.153***
RR * S>100	0.002	-0.089***	0.093

*, ** and *** : significant respectively at 1%, 5% and 10%

Tables 6 and 7 show the results obtained with the URAZ5 and with the URAZ5 crossed with the size of the relevant urban center and by adding the four business service sectors to the 17 industrial sectors of NES36. Despite a sizeable shift in the rate of change in jobs at national level and for each type of areas, the interpretations remain qualitatively the same. The results do not change whether or not business services are taken into account: the level of significance and the direction of the geographical and sectoral effects are similar. The comparison between the results in Table 7 and those in Table 4, both obtained by breaking down the URAZ5 by urban center size could help the analysis of the impact of the industrial outsourcing. As expected, the positive composition-sectoral effect is reinforced in urban centers greater than 100,000 jobs and, as a corollary, the negative sectoral effect is reinforced in the different rural categories. Alongside this, while the geographical effects remain unchanged in urban centers (notably in the biggest ones), they are heightened in both periurban areas (the geographical effect of the Paris periurban area even becoming significantly positive) and rural areas (even if rural centers and the remote rural areas related to the major urban centers still display a non significant geographic effect). Thus, without fundamentally changing the trends revealed by the analysis based on the only manufacturing sectors, outsourcing of production services by industrial firms appears to have a dual effect. It apparently reinforces concentration in the biggest urban centers of the faster growing industries. However, as outsourcing is more difficult to implement for firms located outside the urban centers because of the additional costs related to distance that outsourcing might generate, it apparently reinforces the 'advantages' associated with rural or periurban locations.

5.2. Allowance for 'regional bias'

To allow for a possible 'regional bias' due to the specialization of French regions and to their specific dynamics, we now use a spatial delineation introducing a 'regional' dimension into the analysis. It crosses the URAZ5 with the French 'Regional Planning and Study Areas' (RPSA, *Zones d'Etudes et d'Aménagement du Territoire*) which combine France's 22 administrative regions into 8 large regions (see Map 1): 'Ile-de-France' (Paris and its periurban area), 'Bassin Parisien' (the 6 regions of the outer belt around Paris), 'North', 'East', 'West', 'South-West', 'Center-East' and Mediterranean Coast. We

obtain 37 geographical areas crossing a spatial (URAZ5) category and a regional (RPSA) category, the latter capturing the regional differences.[7] The results obtained with NES36 are shown in Table 8.

Table 8. Composition and geographical effects at URAZ5* RPSA level, 1990-1999, manufacturing employment (national growth rate of manufacturing employment: -0.11)

		NES36	
URAZ5* RPSA	**Growth rate**	**Comp. Effect**	**Geo. Effect**
UC * IdF	-0.267	0.023***	-0.173***
UC * BP	-0.159	0.014***	-0.056***
UC * N	-0.154	-0.027***	-0.009
UC * E	-0.160	-0.001	-0.041**
UC * W	-0.047	0.011***	0.059***
UC * S-W	-0.099	0.002	0.015
UC * C-E.	-0.125	0.003**	-0.011
UC * Med.	-0.122	0.015***	-0.020
UF * IdF	-0.083	0.009***	0.024
UF * BP	-0.034	0.007***	0.075***
UF * N	0.061	-0.025***	0.204***
UF * E	0.064	-0.013***	0.196***
UF * W	0.212	2.10-4	0.329***
UF * S-W	0.079	-0.031***	0.229***
UF * C-E	0.121	-0.003	0.243***
UF * Med.	0.237	0.014***	0.341***
RUI * BP (IdF)	-0.116	-0.009***	0.010
RUI * N	-0.171	-0.047***	-0.005
RUI * E	-0.072	-0.034***	0.079
RUI * W	0.106	-0.029***	0.254***
RUI * S-W	-0.039	-0.039***	0.118**
RUI * C-E	0.033	-0.012***	0.164***
RUI * Med.	0.130	0.005*	0.242***
RC * BP (dt IdF)	-0.117	-0.017***	0.018
RC * N	-0.057	-0.019***	0.080
RC * E	-0.061	-0.025***	0.082*
RC * W	-0.001	-0.025***	0.141***
RC * S-W	-0.134	-0.031***	0.014
RC * C-E	-0.043	-0.024***	0.098**
RC * Med.	-0.128	-0.041***	0.030
RR * BP (dt IdF)	-0.111	-0.007***	0.014
RR * N	-0.180	-0.085***	0.022
RR * E	-0.113	-0.055***	0.059
RR * W	0.020	-0.044***	0.182***
RR * S-W	-0.039	-0.029***	0.108**
RR * C-E	-0.052	-0.020***	0.085*
RR * Med.	-0.039	-0.029***	0.107

*, ** and *** : significant respectively at 1%, 5% and 10%

We systematically find a negative composition effect for all rural areas in all regions, which confirms the over-representation of the most declining industries in rural areas. The geographical effect, though, is less systematically significant and positive as it appears in just 10 of the 21 sub-categories of rural area; and it is non significant (and so never negative) in any of the other cases. This effect never applies to the rural areas of the regions 'North', 'East' and 'Bassin Parisien'. These rural areas may be likened to the remote peripheral areas of big agglomerations (Paris in our case) for which the lack of

[7] We should have had 40 geographical areas but to compose areas with more than 10,000 jobs, the 'Ile-de-France' and 'Bassin Parisien' regions were grouped together for the three categories of predominantly rural areas.

geographical effect was noted earlier. Conversely, the increase in the share of industrial employment due to a significant geographical effect concerns all the rural categories in 'West' and 'Center-East', the rural areas with weak urban influences and the remote rural area in 'South-West', and the rural areas with weak urban influences on the Mediterranean Coast. It follows therefore that allowance for specific regional features does little to affect the results obtained before for rural areas.

Except for the periurban area of 'Ile-de-France' (which is congruent with the Paris periurban area), a significantly positive geographical effect is found in the periurban areas of all the other RPSAs. This result, including the exception of Paris, is consistent with the results obtained before. The composition effect, which has been seen to be positive on the fringes of the major urban centers and negative on the fringes of small centers, varies here with the urban composition of each RPSAs. It is significantly positive in 'Ile-de-France', in the other regions of 'Bassin Parisien' and on Mediterranean Coast (where Marseille and Nice are located). On the other hand, it is significantly negative in the regions 'North', 'East', and 'South-West' (despite the presence of large cities such as Lille, Bordeaux, or Strasbourg) and is non-significant in 'West' and 'Center-East', where large and small agglomerations coexist (cf. Map 1).

As with the analysis of the role of city size, it can be seen that the composition-sectoral effect in periurban areas generally goes in the same direction as observed in the urban centers of the same region. The sectoral structure of employment is thus favorable in Paris and in the Paris periurban area, in the other urban centers of 'Bassin Parisien' and of the 'Mediterranean Coast' as in their periurban areas. It is unfavorable in the cities of 'North' as in their periurban areas. While very slightly positive in the cities of 'Center-East' and 'West', it is non-significant on their fringes. Lastly, while non-significance in the cities of 'East' and 'South-West', it is negative in their periphery. It is as if the sectoral structure of the urban center (the favorable or unfavorable character of this structure in terms of changes in employment) also characterized the vast areas under its direct influence, that is its periurban area. These areas are therefore the industrial reflection of their urban center.

The relation with the regional urban structure is less clear cut with regard to the geographical effect of urban centers. Whereas the effect is negative in 'Ile-de-France' (*i.e.* Paris) as in the other cities of 'Bassin Parisien' and 'East' (where the industrial crisis was particularly severe), it is positive in 'West' (a region known for its dynamism) and non significant in all the other French cities.

To summarize, allowance for regional specificities does not undermine our results. The unfavorable character of the rural industrial structure is confirmed, which is often offset by specific geographical advantages. We also confirm the very clear geographical advantages provided by the periurban areas, whatever the sectoral structure of their employment. The favorable character of the urban sectoral structure is more refined. It concerns the big cities like Paris and Marseille; but it is more mitigated, or even reversed, in many other cities, particularly in the regions where small urban centers are dominant. Conversely, a direct link appears clearly between the sectoral structure of employment in urban centers and that of their periurban areas.

6. Summary and implications for future research

We performed a shift and share analysis of French employment data (1990–1999) using different levels of industrial and geographical division and two different definitions of the industrial sphere. We have shown that the increase in the share of rural industrial employment in national industrial employment may be due to geographical advantages specific to low-density areas and liable to attract any industrial sector. These 'rural' advantages are far from negligible because they offset preferentially rural location of firms belonging to the declining sectors. These geographical advantages also concern, and more massively so, the periurban areas (apart possibly from the Paris periurban area). Nonetheless, it is probably not the same geographical advantages that are expressed in the periurban areas and in the more remote rural areas. The former are characterized by a geographical position allowing them to benefit from advantages of urban agglomeration without supporting its full

costs; the latter are too remote from cities to be able to benefit directly from such advantages. Conversely, urban centers, notably large ones, are affected by important geographical disadvantages (to be related to the urban costs they incur), while the favorable character of the sectoral structure of their industrial employment fails to offset such local disadvantages.

These results suggest different ways if theoretical investigations. The first line of thinking concerns the basis of the sectoral distribution of industry between rural and urban areas. It has been shown that the growing industrial sectors are located preferentially in urban areas, whereas the more fragile industrial sectors are located rather in rural areas. This ties back in with the idea that the most innovative sectors, the ones that create most jobs and have more intensive demand for a highly skilled workforce, begin by locating in cities and then relocate in urban fringes or in more peripheral areas as the production processes become standardized. To account for this phenomenon, we can drawn on the theoretical frameworks of economic geography as developed by Krugman (1991) or by Ottaviano, Thisse, and Tabuchi (2002) as did Kilkenny (1998) or Duranton and Puga (2001).

A second important line of inquiry suggested by the results is to work on a more precise picture of the specific rural features favoring the dynamics of these low-density territories. It is thought that a rural location allows firms to exploit 'economies of small agglomeration' which are not found in urban settings. Without calling into question the existence of urban externalities that grow in intensity with the density of firms, this result tends to show that low-density areas may also be affected by such externalities or may be the site of externalities of another kind. There is always scope to investigate what these 'specifically rural advantages' are. Our findings also show that the net effects of agglomeration may become negative beyond a certain level as increased urban costs progressively offset the agglomeration economies.

While periurban areas are distinctive too because of the growth of their industrial employment related to specific advantages , these advantages are probably not the same kind as those found in rural areas. Naturally, the role of land rent comes to mind here. Industrial sectors attracted by urban areas (made up of urban centers and their periurban areas) may find an incentive to set up on the fringe of urban centers. Thus such areas offer non-negligible advantages in terms of land rents and their proximity to urban centers allows them to benefit from the advantages of agglomeration while avoiding its costs to some extent. This calls for an analysis of the decentralization around urban centers of manufacturing employment with an emphasis on the role of the land market, little work having been done in this field (Fujita *et al.*, 1997).

References

Berzeg K. (1978), The empirical content of shift-share analysis, *Journal of Regional Science*, 18: 463-469.

Bessy-Pietry P., M. Hilal and B. Schmitt (2001), Des évolutions démographiques rurales contrastées liées à la proximité et aux dynamiques urbaines : le cas de la France, *Espace, Populations, Sociétés*, 1-2: 19-36.

Bryden J. and R. Bollman (2000), Rural employment in industrialised countries, *Agricultural Economics*, 22: 185-197.

Champion A. (1989) *Counterurbanization*, London: Ed Arnold.

Combes P.-P. (2000), Economic structure and local growth: France, 1984-1993, *Journal of Urban Economics*, 47: 329-355.

Combes P.-P. and H. Overman (2003), The spatial distribution of economic activies in the European Union, *In* Henderson V. and J. Thisse (eds), *Handbook of Regional and Urban Economics* (vol. 4), forthcoming.

Delisle P. and F. Lainé (1998), Les transferts d'établissements contribuent au desserrement urbain, *Economie et Statistique*, 311: 91-106.

Duranton G. and D. Puga (2001), Nursery cities: urban diversity, process innovation and the life cycle of products, *American Economic Review*, 91(5), 1454-77.

Duranton G. and D. Puga (2003), Micro-foundations of urban agglomeration economies, *In* Henderson V. and J. Thisse (eds), *Handbook of Regional and Urban Economics* (vol. 4), forthcoming.

Esteban J. (2000), Regional convergence in Europe and the industry mix: a shift-share analysis, *Regional Science and Urban Economics*, 30: 353-364.

Fujita M. and J.-F. Thisse (2002), *Economics of agglomeration*, Cambridge (Ma): Cambridge University Press.

Fujita M., J.-F. Thisse and Y. Zénou (1997), On the endogenous formation of secondary employment centers in a city, *Journal of Urban Economics*, 41: 337-357.

Glaeser E., H. Kallal, J. Scheinkman and A. Shleifer (1992), Growth in cities, *Journal of Political Economy*, 100: 1126-1152.

Gramlich E. (1994), Infrastructure Investment: A Review essay, *Journal of Economic Litterature*, 32, 1176-1196.

Henderson V., A. Kuncoro and M. Turner (1995), Industrial development in cities, *Journal of Political Economy*, 103: 1067-1090.

Henry, M.S., B. Schmitt and V. Piguet. (2001), Spatial econometric models for simultaneous systems: Application to rural community growth in France, *International Regional Science Review*. 24(2): 171-193.

Holmes T. and J. Stevens (2003), Spatial distribution of economic activities in North America, *In* Henderson V. and J. Thisse (eds), *Handbook of Regional and Urban Economics* (vol. 4), forthcoming.

Jacquot A. and D. Rajaonarison, (1993), D'un recensement à un autre : la redistribution géographique des emplois entre 1975 et 1990, *Economie et Statistique*, 270: 23-35.

Jayet H. (1993), *Analyse spatiale quantitative*, Paris: Economica.

Kilkenny M. (1998), Transport costs and rural development, *Journal of Regional Science*, 38: 293-312.

Kim Y., D. Barkley and M. Henry (2000), Industry characteristics linked to establishment concentrations in nonmetropolitan areas, *Journal of Regional Science* 40(2): 231-259.

Knudsen D. and R. Barff (1991), Shift-Share analysis as a linear model, *Environment and Planning A* 23, 421-431.

Krugman P. (1991), Increasing returns and economic geography, *Journal of Political Economy*, 99: 483-499.

Mokyr J. (1995), Urbanization, technological progress and economic history, *In* H. Giersch (ed), *Urban Agglomeration and Economic Growth*. Berlin: Springer Verlag, 3-37.

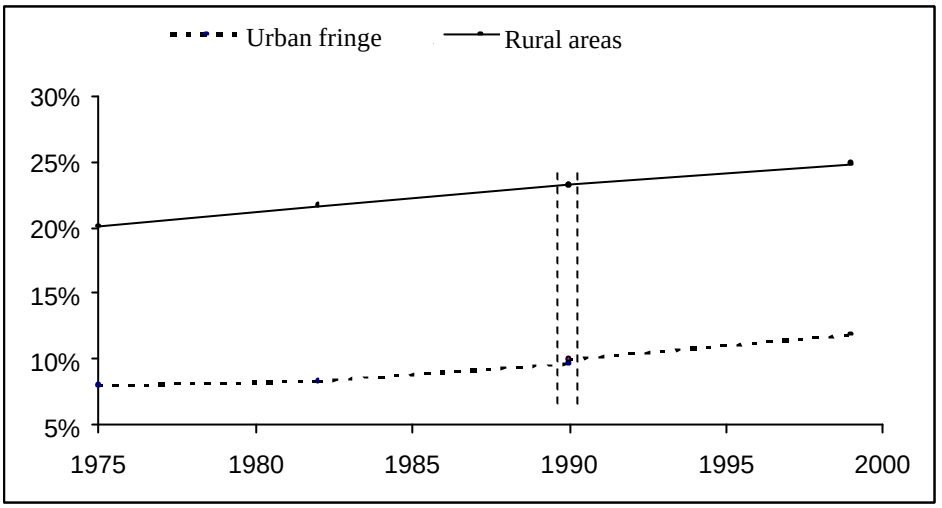
Ota M. and Fujita M. (1993). Communication technologies and spatial organization of multi-unit firms in metropolitan areas, *Regional Science and Urban Economics*, 23: 695-729.

Ottaviano G., Tabuchi and J.-F. Thisse (2002), Agglomeration and trade revisited, *International Economic Review*, 43: 101-127.

Schmitt B. and M. Henry (2000), Size and growth of employment centers in French labor market areas : consequences for rural population and employment, *Regional Science and Urban Economics*, 30: 1-21.

Schmitt B. and P. Perrier-Cornet (eds) (1998), *Les campagnes et leurs villes*, Paris: INSEE.

Appendix A. The change in the share of industrial employment located in urban fringe (or periurban areas) and rural areas



Sources: RP 1975, 1982 and 1990 (NAP) and RP 1990 and 1999 (NES).

Appendix B

Appendix B1. Sectoral classifications

NES16	NES36
Food product, beverage and tobacco	Food product, beverage and tobacco
Final goods industries	Dressing and leather Publishing, printing and reproduction of recorded media Pharmaceutical industry Household equipment
Automotive	Automotive
Equipment goods industries	Other transport equipment Mechanical equipment Electrical machinery and apparatus
Intermediate goods industries	Mining and quarrier Textiles Wood and papers Chemical, rubber and plastics products Basic metals Electrical and electric components
Energy	Fuel Water, gas and electricity
Business activities	Post and telecommunications Consultancy and others Renting without operator Research and development

Appendix B2. Labels of geographical areas and their abbreviation

URAZ5		RPSA	
UC	Urban centers	IdF	« Ile-de-France »
UF	Urban fringe or periurban areas	BP	« Bassin Parisien »
RIU	Rural under weak influence urban	GBP	Bassin Parisien whose IdF
RC	Rural centers	N	North
RR	Remote rural areas	E	East
Size of urban centers		W	West
S<20	UC with less than 20,000 jobs	S-W	South-West
S:20-100	UC with 20,000-100,000 jobs	C-E	Center-East
S>100	UC with more than 100,000 jobs	Med	Mediterranean Coast
Paris	UC of Paris		

Appendix C. Some characteristics on urban centers, urban fringe and rural areas

	Number of communes	Land area (%)	Population (N/1000)	Population (%)	Employment (N/1000)	Employment (%)
Urban centers	2,793	7.4	35,211	60.2	16,164	70.9
Urban fringe or Periurban areas	10,431	22.1	9,675	16.5	2,249	9.9
Rural under weak urban influence	8,887	23.8	5,305	9.1	1,401	6.1
Rural centers	3,528	9.6	3,284	5.6	1,310	5.7
Remote rural areas	10,926	37.1	5,039	8.6	1,676	7.4
Total	36,565	100.0	58,514	100.0	22,800	100.0

Sources: RP 1990 and 1999

Appendix D. Composition and geographical effects - period 1982-1990 (NAP40).

D1. Composition and geographical effect at URAZ5 level, 1982-1990

URAZ5	Growth rate	Comp. Effect	Geo. Effect
Urban centers	-0.129	0.005^{***}	-0.037^{***}
Periurban areas	0.0438	-0.005^{***}	0.146^{***}
Rur weak infl urb	-0.0492	-0.014^{***}	0.061^{***}
Rural centers	-0.0432	-0.017^{***}	0.070^{***}
Remote rural areas	-0.0435	-0.016^{***}	0.0699^{***}

D2. Composition and geographical effects at URAZ5*size of urban center level, 1982-1990

URAZ5*Size of center	Growth rate	Comp. effect	Geo. effect
UC * S<20	-0.098	-0.014^{***}	0.012
UC * S:20-100	-0.153	-0.027^{***}	-0.029^{***}
UC * S>100	-0.117	0.019^{***}	-0.040^{***}
UC * Paris	-0.131	0.046^{***}	-0.081^{***}
UF * S<20	0.055	-0.006^{*}	0.159^{***}
UF * S:20-100	0.020	-0.017^{***}	0.135^{***}
UF * S>100	0.103	2.10^{-6}	0.200^{***}
UF * Paris	0.003	0.008^{**}	0.092^{**}
RUI * S<20	-0.031	-0.010^{***}	0.076^{**}
RUI * S:20-100	-0.065	-0.026^{***}	0.058^{*}
RUI * S>100	-0.060	-0.003	0.039
RC * S<20	-0.053	-0.019^{***}	0.063^{**}
RC * S:20-100	-0.048	-0.019^{***}	0.067^{**}
RC * S>100	0.021	-0.017^{***}	0.136^{**}
RR * S<20	-0.044	-0.020^{***}	0.072^{***}
RR * S:20-100	-0.046	-0.021^{***}	0.071^{**}
RR * S>100	-0.020	-0.005	0.081

Nota Bene: There exists a small gap between the industrial classification for 1982 and 1990 in NAP 40 and the classification for 1990 and 1999 in NES36.

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