Journal of Urban Economics **47**, 329–355 (2000)
doi:10.1006/juec.1999.2143, available online at http://www.idealibrary.com on IDEAL®

Economic Structure and Local Growth: France, 1984–1993

Pierre-Philippe Combes[1]

CNRS and CERAS-Ecole Nationale des Ponts et Chaussées, 28, Rue des Saints-Pères, 75 007 Paris, France
E-mail: combes@enpc.fr

Received October 5, 1998; revised June 28, 1999

For 52 industry sectors and 42 services sectors, this paper tests how the local economic structure (local sectoral specialization and diversity, competition, average size of plants, and total employment density) affects the 1984–1993 employment growth of 341 local areas. These areas entirely and continuously cover the French territory. The impact of the local economic structure differs in industry and services. In industrial sectors, local total employment density, competition, and plant size always reduce local growth. Sectoral specialization and diversity have a negative impact on growth, but also increase the growth of a few sectors. Service sectors always exhibit negative specialization effects and positive diversity effects. Competition and plant size have a negative impact and density a positive one, but exceptions are observed for some sectors.

1. INTRODUCTION

There is an ongoing debate about the relative impact of urbanization and localization economies in the process of local economic development. When sectoral diversity matters for local growth, urbanization economies are prevalent, as suggested by Glaeser et al. [19] in their study of the U.S. cities between 1956 and 1987. By contrast, Henderson et al. [22] show evidence of a positive effect of specialization on urban growth, thus reflecting localization economies, between 1970 and 1987. They find evidence of urbanization economies only in new high-tech sectors. This paper contributes to this debate by studying the growth of French local areas. Further, it shows how additional variables characterizing the local eco-

[1] I greatly thank Jan Brueckner, Gilles Duranton, Gilles Saint-Paul, Bernard Salanié, Jacques-François Thisse, Mickaël Visser, Yves Zenou, two anonymous referees, and participants at the CEPR-NBER International Seminar in International Trade (Paris, May 1997) and the Western Regional Science Association annual meeting (Monterey, February 1998) for very useful comments. I also thank Emmanuel Duguet, Sylvie Lagarde, and Françoise Maurel for their critical help concerning data and econometrics. My Web site is at http://www.enpc.fr/ceras/combes.

0094-1190/00 $35.00

nomic structure also contribute to the explanation of development. Finally, some methodological points are clarified.

More precisely, local employment growth by sector is regressed on five variables. The first two are specialization and diversity as in Glaeser et al. [19] and Henderson et al. [22]. However, it is argued that other local economic variables have a significant impact on local growth. First, the size of the local economy, sometimes considered as part of urbanization economies, as, for instance, in Ó hUallacháin and Satterthwaite [28], determines the size of local markets as well as the supply of local public goods. However, it may also be the origin of negative externalities such as pollution or high land rents. Second, as suggested in industrial organization and recalled by Glaeser et al. [19], the location and growth of firms also depend on the intensity of competition on both local input and output markets. Lastly, the size of plants, a variable also considered by Glaeser et al. [19] and Ó hUallacháin and Satterthwaite [28], is used here as a surrogate to test whether local economies of scale are internal or external to plants. Unlike previous works, we simultaneously consider all these variables. This allows us to provide a broader perspective of the issues by comparing the impact of each of these variables.

Previous comparable papers have mainly concentrated on manufacturing sectors. However, it is well known that the share of industry in modern economies is declining. In this paper, we consider both industry and services; our dataset includes 52 industrial and 42 service sectors. One should keep in mind that the intensity of agglomeration forces may differ across industrial and service sectors. For instance, some of the latter are nontradable as they must be consumed where they are produced. Moreover, they might be also less subject to economies of scale. To the extent that services are also more diversified in their input consumption and in the sectors they sell to, it is reasonable to believe that they benefit more from diversity. More generally, we may expect the economic structure to have a different impact on local growth, depending on the sector. Our analysis confirms this assumption.

It is worth stressing that the results obtained in this paper may not be identical to those derived for the American economy. Indeed, economic geography models show the importance of factor mobility in agglomeration processes. Unlike the U.S., labor mobility is very low in European countries. Furthermore, the existence of substantial unemployment within the European Union might have a significant impact on firms' location strategies. All of these suggest that the agglomeration process, and, in particular, the role of the local economic environment, may vastly differ in Europe from what it is in the U.S. In this respect, the present paper is a first attempt to compare a European country (France) with the U.S. In addition, whereas American studies often focus on metropolitan areas, we use a set of 341 spatial entities (*zones d'emploi* "employment areas") that covers the whole territory of France. As a result, the possible econometric problem due to the selection of particular entities partially vanishes, while the scope of the study is enlarged to cope with nonmetropolitan areas. Finally, we propose some methodological innovations that, hopefully, help to clarify the debate on the causes of local development. These include the replacement of the sectoral local employment level by the total local employment level in the explanatory variables, the use of a Herfindhal index of competition, and the use of a generalized Tobit model in estimation.

A last point is worth mentioning. Previous studies often argue that the impact of the local economy on growth mainly goes through information spillovers. In Section 2, we show that alternative interpretations are also consistent with the tested reduced form. Section 3 presents the dataset and the econometric method. The results are given and interpreted in Section 4, while Section 5 concludes.

2. ECONOMIC STRUCTURE AND AGGLOMERATION FORCES

Let us begin by justifying the reduced form we estimate as

$$y_{z,s} = I + \alpha_1 \log(\text{spe}_{z,s}) + \alpha_2 \log(\text{div}_{z,s}) + \alpha_3 \log(\text{size}_{z,s})$$
$$\alpha_4 \log(\text{comp}_{z,s}) + \alpha_5 \log(\text{den}_z), \tag{1}$$

where $y_{z,s}$ is the local employment growth of sector s in zone z, I is an intercept, and $\text{spe}_{z,s}$, $\text{div}_{z,s}$, $\text{size}_{z,s}$, $\text{comp}_{z,s}$, and den_z are the explanatory variables corresponding respectively to specialization, diversity, average size of plants, competition, and total employment density. In this section, our first aim is to briefly present the two main families of agglomeration forces (information spillovers and market-based forces) that have been recently put forward to explain local development. We then provide a justification for using specification (1) by showing that all explanatory variables have an impact not only on information spillovers but also on market-based forces.

2.1. *Agglomeration Forces*

Fujita and Thisse [17] and Glaeser [18] provide recent surveys on agglomeration and dispersion forces.

Information Spillovers

Information spillovers arise when the following conditions are met. First, firms have different pieces of information, which they are able to exchange through the turnover of skilled labor and/or through face-to-face contacts.

These pieces of information bear on firms' organization, product demand (desired qualities, market locations), and input and/or output innovations. The expression "technological externality" is used in this last case. Second, distance is an impediment to the transmission of information. Indeed, even though communication technologies have been greatly improved, several recent studies, such as Jaffe [24], Acs et al. [3], Jaffe et al. [25], Audretsch and Feldman [5], or Anselin et al. [4], show that the diffusion of information and tacit knowledge across locations is far from being free. Consequently, local information spillovers are still relevant, and firms benefit from locating in the same place.

Market-based Forces

Whereas information spillovers correspond to pure externalities, other agglomeration forces operate directly through markets. Because of the coexistence of transportation costs and increasing returns, it is profitable for firms to be located close to large input and output markets. However, a high degree of competition for these products in these markets, by lowering output prices and increasing input prices, is a strong dispersion force. But this is not the end of the story. More competition also gives more incentives to suppliers and consumers to locate in the large area, thus increasing the size of the corresponding markets. Three families of models describe such spatial configurations: urban economics models, as initiated by Fujita and Ogawa [16], spatial competition in the spirit of Hotelling [23], and new economic geography inspired by Krugman [26]. Differences arise from the modelling of the physical substratum, from the nature of competition (perfect or imperfect, with or without product differentiation and strategic interactions), and from the fact that the setting is partial or general. Empirical studies aimed at validating these models are rare. This is mainly due to the difficulty in collecting good data at the micro-spatial level.

2.2. *Impact of the Economic Structure on Agglomeration Forces*

Like in previous comparable studies, the dataset used in this paper does not allow one to discriminate between the two types of externalities. This is not a major drawback here since the purpose is to determine which kind of local economic structure fosters economic growth, whatever agglomeration forces. In this section, we show how the explanatory variables introduced in specification (1) affect the two types of agglomeration forces.

Sectoral Specialization and Diversity

Localization economies imply that firms benefit from clustering with other firms in the same sector, whereas urbanization externalities imply inter-sectoral positive effects of agglomeration (see, e.g., Quigley [30]).

Regarding information spillovers, the innovations of a given sector mainly originate and diffuse from this very sector but also from other sectors. For example, improvement in electronics components increases the power of software. Conversely, the need for higher memory and speed capacities by software engineers gives electronics firms incentives to discover new technologies. If there is some uncertainty about the sector that is at the origin of innovation in another sector, high global diversity increases the probability of such a cross-fertilization of ideas. These impacts of specialization and diversity on local technological spillovers are detailed in Glaeser et al. [19]. Feldman and Audretsch [14] make one of the first attempts to directly test the impact of diversity (which is strong) and of specialization on the local rate of innovation.

However, this debate is also relevant for market-based forces. Abdel-Rahman and Fujita [2] show that the relative degree of internal and of inter-sectoral scale economies conditions the degree of urban diversity. In models based on homogenous inputs and outputs (for instance, under perfect competition as in the traditional trade theory or under imperfect competition *à la* Cournot, as in Combes [9]), local growth is associated with specialization. On the contrary, the use of the Dixit and Stiglitz [11] monopolistic competition model in urban economics[2] and in economic geography[3] yields a preference for diversity, inducing agglomeration. Uncertainty, on the quality of goods for instance, reinforces these effects as shown by Schulz and Stahl [32], with high diversity improving the quality of matching.

Size of the Local Economy

If rural as well as urban areas are considered, the size of the local economy also influences the intensity of agglomeration forces. This is an important explanation of the uneven distribution of activities in the U.S., as shown by Ciccone and Hall [8], and may be interpreted as another form of urbanization economies, as in Ó hUallacháin and Satterthwaite [28]. First, the level and quality of information exchanges in spillovers are sufficiently important only when the number of firms, and thus the potential complementarities, is high enough.

Second, the size of local markets greatly affects the firms' locational choices if transportation costs are non-zero. The locations of input and output markets for each sector are rarely available in datasets. However, sectoral effects being controlled by the specialization and diversity variables, the size of local markets is conditioned by the global size of the local economy and is measured here by total employment density. Moreover,

[2] See Abdel-Rahman [11], Fujita [15], and Rivera-Batiz [31].
[3] See Krugman [26], Krugman and Venables [27], and Puga [29].

this variable is relevant for some non-specialized markets, such as land: high density implies high land rent, which constitutes a dispersion force. Some local pure externalities, positive (such as the presence of local public goods) or negative (such as transportation congestion or pollution), also depend on the total size of local economy.

Local Competition

The positive effects of the size of local markets depend on the degree of competition in these markets. Due to strategic interactions, firms have incentives to locate at the periphery where competition is lowered, even though a more central location would allow them to attract more consumers. Different frameworks (product differentiation, uncertainty on the quality of goods) allow firms to relax price competition, thus leading them to choose more central locations (see Fujita and Thisse [17]).

The impact of competition on information spillovers is ambiguous, a fact which is not related to the spatial dimension. Indeed, Sutton [33] shows that empirical studies do not succeed in establishing that competition has a positive impact on innovations. Schumpeterian models underline the trade-off: high competition gives firms incentives to make important R & D investment, but, if the succession of innovations is too fast, returns from R & D are low, which reduces the amount of R & D and has in turn a negative impact on innovations. Since competition generates opposite effects on the level of local R & D and innovations, its effect is also indeterminate on local technological spillovers.

Average Plant Size

If scale economies are internal to plants, for instance, in the monopolistic competition models, large plants have lower average costs and benefit more from locating close to large markets. If scale economies are external to plants, in the endogenous growth model spirit, only the city size determines the degree of scale economies, large plants being penalized if internal returns are decreasing. For instance, at the country level, Caballero and Lyons [7], by comparing firms' and aggregate production functions, find very little evidence of internal economies of scale, whereas external ones exist for the four countries they study.

Concerning information spillovers, arguments in both directions can be presented. The size of the R & D department clearly increases with the size of plants. However, first, some empirical studies show that the efficiency of R & D decreases with the size. Second, small plants, which may not have an R & D department, are the most interested in technological spillovers and can even base their development on them, for instance, by encouraging the turnover of skilled labor at other firms.

As we have shown, all considered elements of the local economic structure may affect information spillovers and market-based forces, possibly in opposite directions. For a given family of externalities, their effects depend on the characteristics of production (e.g., the levels of transportation costs and scale economies), the degree of product differentiation, and the presence or absence of uncertainty. Depending on the sector, empirical studies such as this one show what the dominant effects are.

3. DATA AND ESTIMATION METHODOLOGY

In France, as is more generally the case in Europe, local data are scarce. Our study is based on 341 geographic units defined by the French National Institute of Statistics and Economic Studies (INSEE) and called *zones d'emploi* (ZEs, "employment areas"). These ZEs entirely and continuously cover the French territory, and thus include both urban and rural places. Their average area is 1570 km^2, which is fairly small (equivalent to a 40×40 kms square) but the standard-deviation is high (987 km^2). A ZE's definition is based on the observation of workers' daily migrations. This makes them economically more homogenous than administrative units, and it lowers some border effects.

We use a dataset on plants (*Enquête Structure des Emplois*, collected by INSEE), which includes all plants located in France that have more than 20 workers. It gives each plant's employment level between 1984 and 1993, the ZE where the plant is located, and its four-digit sector. We use INSEE's sectoral nomenclature (NAP 100) that aggregates sectors into 52 industrial sectors and 42 service sectors.

Some of the effects described above have a direct influence on output, but others only affect productivity. Local employment should vary in the same direction, but, if better productivity in a given place does not induce market-share gains, or if the substitutability between labor and capital is high, employment may decrease in a few specific cases. As in previous comparable studies, we hope this does not too much perturb the interpretations, since data on local output levels and capital stocks do not exist.

First, regressions are performed by pooling different sectors, as in Glaeser et al. [19]. They are computed on all industrial sectors, on the one hand, and on all services sectors, on the other hand, and are called "global regressions." Second, as in Ó hUallacháin and Satterthwaite [28] and Henderson et al. [22], regressions are computed on each sector separately. In order to avoid introducing a selectivity bias, all geographic units are kept, contrary to Glaeser et al. [19]. Moreover, each variable is normalized by the value it takes at the national level for the considered sector: this allows comparisons between sectors. For the same reason, Ellison and Glaeser [12] correct the spatial concentration index by the sectoral productive concentration. Surprisingly, Glaeser et al. [19] only normalize their specialization and competition variables, but not others.

The dependent variable is the difference between the employment growth of sector s in ZE z between 1984 and 1993 and the national employment growth of this sector in France during the same period,

$$y_{z,s} = \log\left(\frac{\text{emp}_{z,s,1993}}{\text{emp}_{z,s,1984}}\right) - \log\left(\frac{\text{emp}_{s,1993}}{\text{emp}_{s,1984}}\right),$$

where $\text{emp}_{z,s,t}$ and $\text{emp}_{s,t}$ ($t = 1984, 1993$) are employment levels in sector s at date t in ZE z and France, respectively. We do not want to explain why the growth of a sector in a given place is $x\%$, but why it is $y\%$ higher (or lower) in this place compared to the national level. In regressions on each sector, this normalization only changes the intercept, but this makes important differences in global regressions. It is worth noting that this variable can be interpreted in terms of employment density growth and that all other variables are implicitly normalized by land area (which cancels in the ratio form), except the one controlling for the size of the local economy. It is consequently controlled for differences in the ZEs' areas.

All explanatory variables are considered at the initial date, 1984. This is consistent with the observed lag between the emergence of agglomeration forces and their real impact on firms' relocation and on regional growth. Adding 1993 variables to the specification, as in Henderson et al. [22], makes it more difficult to interpret. All variables are taken in logarithms: the estimated parameters are their elasticities with respect to each variable, which makes them easily comparable.

The specialization index we consider is the ratio of the employment share of sector s in ZE z divided by this ratio at the national level,

$$\text{spe}_{z,s} = \frac{\text{emp}_{z,s}/\text{emp}_z}{\text{emp}_s/\text{emp}},$$

where emp_z and emp are the total employment and $\text{emp}_{z,s}$ and emp_s are the sectoral employment in ZE z and France, respectively.

Concerning diversity, we use, as in Henderson et al. [22], the inverse of an Herfindahl index of sectoral concentration based on the share of all sectors, except the one considered.[4] As previously, this variable is normal-

[4] See Encaoua and Jacquemin [13] for a discussion on concentration indexes. Ellison and Glaeser [12] also use Herfindahl indexes to study spatial concentration.

ized by the same variable computed at the French level,

$$\mathrm{div}_{z,s} = \frac{1 \Big/ \sum_{\substack{s'=1 \\ s' \neq s}}^{S} \left(\mathrm{emp}_{z,s'}/(\mathrm{emp}_z - \mathrm{emp}_{z,s})\right)^2}{1 \Big/ \sum_{\substack{s'=1 \\ s' \neq s}}^{S} \left(\mathrm{emp}_{s'}/\mathrm{emp} - \mathrm{emp}_s\right)^2},$$

where S is the total number of sectors. The numerator is maximum when all sectors except the one considered have the same size in the ZE. This indicator reflects the sectoral diversity faced by sector s in this zone and is therefore not necessarily negatively linked with the own local specialization of sector s. Note that these notions of specialization and diversity are conditional on the aggregation level implicit in the sectoral nomenclature.

We now tackle the problem of competition indicators. Glaeser el al. [19] consider that the number of firms per worker is a good proxy for competition. However, as in Ó hUallacháin and Satterthwaite [28], we interpret the inverse of this variable as the average size of plants located in ZE z, in order to test for internal economies of scale. It is normalized by the average size of plants in the sector in France,

$$\mathrm{size}_{z,s} = \frac{\mathrm{emp}_{z,s}/\mathrm{nbr}_{z,s}}{\mathrm{emp}_s/\mathrm{nbr}_s},$$

where $\mathrm{nbr}_{z,s}$ and nbr_s are the number of plants belonging to sector s in ZE z and France, respectively.

Competition is captured by the inverse of a local Herfindahl index of productive concentration. It is computed on the employment shares of the plants in the given sector belonging to the same ZE. It is also divided by the same indicator computed at the national level,

$$\mathrm{comp}_{z,s} = \frac{1 \Big/ \sum_{i \in z} \left(\mathrm{emp}_{z,s,i}/\mathrm{emp}_{z,s}\right)^2}{1 \Big/ \sum_{i} \left(\mathrm{emp}_{s,i}/\mathrm{emp}_s\right)^2},$$

where $\mathrm{emp}_{z,s,i}$ and $\mathrm{emp}_{s,i}$ are the employment of plant i belonging to sector s and located in ZE z and France, respectively.

Glaeser et al. [19], Ò hUallacháin and Satterthwaite [28], and Henderson, et al. [22] include in the explanatory variables the level of the local sectoral employment. However, Combes [10] shows that this strongly changes the interpretation of the specialization variable and leads to an overestimation of localization economies. Actually, the impact of the share of the sectoral employment in total employment, holding the level of the sectoral employment constant, is simply the inverse of the effect of the total employment. Thus, it cannot be interpreted as intrasectoral local externalities. The correct interpretation is obtained if the level of the sectoral employment is replaced by the level of the total employment in control variables. In this case, the specialization variable really captures the impact of the relative size of the sector in local employment. Moreover, the total employment variable, which reflects the size of the local economy, is easily interpreted, as described above. In order to simultaneously control for the differences in ZEs' areas, it is here more relevant to consider the total employment density of the ZE,

$$\mathrm{den}_z = \frac{\mathrm{emp}_z}{\mathrm{area}_z},$$

where area_z is the area of ZE z.

Because plants that are smaller than 20 workers are not in the dataset, sectoral employment in ZEs where there are only small plants is not observed. Because of this truncation, OLS estimates are biased. Moreover, the selection rule depends on an unknown random variable: a generalized Tobit methodology must thus be used. The methodology proposed by Heckman [20] first estimates a Probit model of a dummy variable which takes a value of 1 if sectoral employment is observed, 0 if not, as a function of the variables available for all locations. These variables are here an intercept, geographical dummies (Paris, Méditerrannée, Ile de France, Nord, and Est), and total employment density. This regression leads to an estimation of the Mills ratio, which is simply introduced as an extra explanatory variable in the initial model. OLS estimation now gives consistent but inefficient estimates. Therefore, we use the maximum likelihood estimate, which is efficient, of this generalized Tobit model. The likelihood maximization algorithm is initialized by the Heckman [20] estimate.[5] Note that Henderson et al. [22] also use a Tobit method because U.S. data are censored, at a much higher level (250 employees per sector and city).

4. RESULTS

As a background for the results, observe that whereas employment strongly decreases between 1984 and 1993 in industry (−15.4% on average over the ZEs), it increases in services (+10.1%) during the same period. Moreover, the spatial disparity of growth rates is high, with a standard

[5] More details are available on request.

error of 19.2% in industry and of 34.5% in services. In industry and services, respectively, the 10% deciles are −34.4% and −15.2% and the 90% deciles, 6.6% and 37.7%. Hence, local factors have a critical effect on growth in France.

Correlations between the explanatory variables are smaller than 0.2. Average size of plants and competition are not significantly correlated, which confirms that the first variable cannot be used as an inverse competition proxy. Specialization and diversity are only very slightly negatively correlated. Density is positively correlated with competition and diversity.

Exhaustive results are given in Table 1 (global regressions), Table 2 (industry), and Table 3 (services). Unless mentioned, we only focus on estimates that are significant at least at the 10% level. On the contrary, in Figs. 1 to 5, the elasticities are plotted, in white for industry and in black for services, according to whether they are significant or not, after having ranked the sectors from the lowest to the highest estimate.[6]

Density

Concerning global regressions, the elasticity is negative for industry and non-significant for services. No industrial sector presents a positive elasticity whereas it is negative for 15 of them, 11 elasticities being between −0.1 and −0.3. On the contrary, only 2 service sectors have a negative elasticity, and for 5 others, it is higher than 0.1. Many others are positive but non-significant. Figure 1 confirms the global opposition between the industry and service sectors, but also shows that elasticities can in some cases be positive for industry and negative for services, although non-significantly.

As mentioned above, because density favors information spillovers, the induced productivity gains can negatively affect employment. However, we think that the negative elasticities of density are obtained because congestion effects (high land-rent or congestion of local infrastructures) create negative externalities on employment growth in dense places. The positive effects of having an important local economy, due to either information spillovers or input and output markets size, are dominated in industry as in a few services sectors. This occurs in many traditional industrial sectors such as primary processing of steel, smelting works, metalworking, manufacture of machine tools, production of industrial equipment, or the automobile industry. A complementary effect works through some inputs that are fairly expensive to transport and are produced in non-dense and non-congested places: firms such as wood working and the furniture industry have an advantage in locating close to them. A similar explanation

[6] We only keep sectors which are observed in more than 25 ZEs.

TABLE 1
Global Regressions

	Industry	Services
Number of observations	17,732	14,322
Non-zero observations	6664	5842
Probit variables		
Intercept	0.444	0.724
	(0.027)	(0.033)
Dummy Paris	−1.579	−0.471
	(0.184)	(0.427)
Dummy Ile-de-France	−0.351	−0.350
	(0.038)	(0.054)
Dummy Méditerrannée	−0.276	0.146
	(0.030)	(0.040)
Dummy Nord and Est	−0.115	−0.249
	(0.024)	(0.033)
Density	0.302	0.387
	(0.009)	(0.012)
Tobit variables		
Intercept	0.185	−0.018
	(0.048)	(0.054)
Density	−0.161	−0.040
	(0.010)	(0.019)
Specialization	−0.088	−0.211
	(0.012)	(0.013)
Diversity	−0.051	0.058
	(0.015)	(0.017)
Competition	−0.030	−0.011
	(0.011)	(0.009)
Size	−0.154	−0.110
	(0.017)	(0.022)
Likelihood	−17,502.72	−14,576.87

Note. Logarithm is taken for all variables.

Standard-errors in brakets.

All variables significant at the 5% level, for Student or Wald tests, except for services, the dummy Paris, density, and competition.

Likelihood for the model with only the intercept: −18637.68 for industry, −15736.09 for services can be given for the working of grain and the manufacture of miscellaneous food products, although the transportation costs of inputs seem to be lower in these cases.

On the contrary, the positive effects of the size of the local economy significantly dominate in five services sectors: they are either non-tradable or susceptible to present fairly high transportation costs, such as the food and the industrial wholesale trades, hotel and restaurant services, road transport, and consulting. In high density places, the size of the markets where these goods are sold is larger. The need for direct contact in transactions may also be high in these services, as well as search and matching effects under imperfect information. These last results are consistent with those obtained by Ó hUallacháin and Satterthwaite [28].

Specialization

In most cases, no localization economies are found. In fact, a negative effect of specialization is often observed. In the global regressions, specialization negatively affects growth, slightly for industry and more for services. This is confirmed by the regressions on each sector: for 10 industrial sectors, the elasticities are lower than -0.1, whereas they are lower than -0.5 for 4 sectors of services and between -0.5 and -0.1 for 14 others. The minimum estimate for industry is reached by distribution of water and urban heating, which is comparable to a service activity. Figure 2 confirms that a wide majority of elasticities are negative, although not always significantly.

Explanations of the negative effect of specialization can hardly be found in the agglomeration forces presented above. However, the study of sectoral cycles at the national level may give some answers. Two groups of sectors emerge. In the first one, sectoral employment expands at the national level. This concerns the services of retail trade (food and specialized non-food), consulting, the services auxiliary to finance and insurance, and, lastly, education and social work market services. Three industrial sectors are also in this situation but they are related to growing services: the distribution of water and urban heating, the bakery industry, and the pharmaceutical industry. The negative specialization effect can be interpreted in terms of a product's life-cycle: products, and here more particularly services, first develop in a few places and then diffuse across space, which would correspond to the observed period.

On the contrary, in the second group of sectors, both more numerous and more traditional, sectoral employment decreases at the national level. An interpretation may be that high specialization implies lower flexibility and worse adaptability of products, technologies, and infrastructures when the sector declines, whereas low specialized ZEs are more able to reconvert their activities. In this group, many traditional industrial sectors can

TABLE 2
Sectoral Regressions—Industry

Sector	Dens.	Spe.	Div.	Comp.	Size	Obs.	Gro.
Gas and oil production	−0.038	−0.114*	−0.093	−0.012	0.066	39	−21.3
Distribution services of water and urban heating	−0.129**	−0.452***	0.237***	−0.080	−0.123	103	70.4
Metallurgy of iron and steel	0.144	−0.092	−0.170	−0.082	0.041	37	−49.7
Primary processing of steel	−0.078**	0.021	0.183	0.042	−0.217***	92	−38.9
Metallurgy, primary processing of non-ferrous metals	0.011	−0.021	−0.159	−0.331**	−0.119	88	−28.9
Production of miscellaneous ores	−0.001	−0.101	0.095	−0.517**	−0.107	45	−25.0
Production of construction and ceramic materials	0.067*	0.078	0.068	−0.214***	−0.254***	276	−28.2
Glass industry	0.090	0.166**	0.198*	−0.372***	−0.327***	103	−10.4
Basic chemical industry	−0.024	−0.140*	−0.088	0.010	−0.029	143	−14.2
Parachemical industry	−0.016	−0.063	0.156	−0.258**	−0.236**	161	−1.6
Pharmaceutical industry	0.040	−0.205**	0.037	−0.076	0.070	93	15.8
Smelting works	−0.094***	−0.017	0.031	−0.005	−0.105**	124	−24.7
Metalworking	−0.079**	−0.156***	−0.065	−0.047	−0.112	309	−8.5
Manufacture of agricultural machinery	−0.080	−0.230**	−0.287**	−0.098	−0.100	97	−46.1
Manufacture of machine tools	−0.224***	−0.103	−0.128	−0.266***	−0.267***	127	−30.3
Production of industrial equipment	−0.118***	−0.266***	−0.070	−0.016	0.070	260	−10.8
Manufacture of civil-engineering equipment	−0.106	0.036	0.120	−0.500***	−0.453***	148	−31.7
Manufacture of office machinery and computers	0.145	0.482**	0.386*	−0.779***	−0.949***	50	−5.7
Manufacture of electrical equipment	0.001	0.066	0.103	−0.184*	−0.354***	195	−18.0
Manufacture of electronic equipment	0.012	−0.095	0.100	−0.168	−0.330***	179	−19.1
Manufacture of household equipment	0.006	−0.006	−0.066	0.014	−0.074	58	−22.8

Automotive and other land transport industry	−0.159***	−0.091	0.023	−0.282***	−0.095	216	−25.0
Aeronautics	0.100	0.115	0.183	−0.467***	−0.271***	63	−12.0
Manufacture of precision equipment	0.072	0.039	−0.185	−0.304**	−0.437***	119	−13.6
Meat products industry	−0.087	0.031	−0.037	−0.162	−0.312***	222	7.0
Milk products industry	−0.005	−0.033	−0.109	−0.285***	−0.074	205	−23.8
Canned foods industry	−0.013	−0.180	−0.229	0.007	−0.170	99	9.9
Bakery industry	−0.096	−0.203***	−0.056	−0.341***	−0.045	120	6.4
Working of grain	−0.166***	−0.112	−0.233***	−0.179*	−0.178*	197	−15.8
Manufacture of miscellaneous food products	−0.126***	−0.123***	−0.168***	−0.065***	−0.019	132	−23.4
Manufacture of beverages and alcohol	−0.080	−0.088*	−0.066	−0.186*	−0.022	113	−18.4
Industry of textile	−0.129***	−0.007	0.114	−0.128	−0.268***	182	−37.5
Industry of leather	−0.050	−0.026	−0.013	−0.346***	−0.246*	99	−28.6
Industry of shoes	−0.031***	−0.040	−0.084	0.053**	−0.063	81	−41.6
Manufacture of wearing apparel and dressing	−0.017	0.001	−0.124*	−0.269***	−0.294***	232	−40.0
Working of wood	−0.110***	−0.123***	−0.180***	−0.075***	−0.002	261	−19.3
Industry of furniture	−0.164***	−0.128	−0.054	−0.262***	−0.131	208	−22.2
Industry of paper and pulp	−0.036	−0.130***	0.004	−0.117	0.014	207	−3.9
Printing, press, and publishing	0.059	0.030	0.009	−0.151***	−0.266***	223	−8.5
Rubber industry	−0.300***	−0.137	−0.264**	−0.241	−0.053	118	−22.5
Working of plastic	−0.231***	−0.085	0.081	−0.170**	−0.365***	232	24.2
Miscellaneous industries	0.044	0.159**	−0.106	−0.449***	−0.415***	179	−27.1
Construction	0.015	−0.238***	0.088***	0.022	−0.031	340	−13.7

Note. The number of observations and the sectoral national growth rate are given in columns "Obs." and "Gro."
***, **, *: significant at the 5%, 10%, and 15% levels, respectively.

TABLE 3
Sectoral Regressions—Services

Sector	Dens.	Spe.	Div.	Comp.	Size	Obs.	Gro.
Reprocessing	−0.116	−0.191*	0.039	−0.186	−0.120	75	−15.3
Food wholesale trade	0.008	−0.048	0.146**	−0.160***	−0.291***	275	−17.6
Non-food wholesale trade	0.130***	−0.184**	0.047	−0.105	−0.167	224	−7.4
Inter-industrial wholesale trade	0.158***	−0.243***	−0.019	−0.100*	0.022	285	−12.3
Middleman's business	0.090	−0.273**	0.313*	−0.381**	−0.139	82	−5.6
Food retail trade	−0.033	−0.422***	0.114***	−0.194***	−0.070	330	62.7
Specialized food retail trade	−0.048	−0.337***	0.009	−0.069***	−0.082	138	−75.0
Non-specialized non-food retail trade	0.085	−0.115	0.171	−0.211	0.015	208	−28.6
Specialized non-food retail trade	0.053	−0.772***	0.314***	0.076	0.640***	207	12.4
Repair and trade of motor vehicles	−0.018	−0.284***	0.003	−0.041	0.180**	313	−17.2
Miscellaneous repair	0.030	−0.039	0.170	−0.386**	−0.674***	39	3.7
Hotel and restaurant services	0.157***	−0.099	0.098	−0.104	−0.547***	223	10.5
Rail transport	0.011	−0.039	0.070	−0.035	0.114**	251	−23.6
Road transport	0.104***	−0.238***	0.068	−0.078	−0.464***	313	23.8
Supporting transport services and warehouses	0.024	−0.075	−0.184	−0.408	−0.581***	74	71.1
Auxiliary transport and travel agency services	0.059	−0.435***	0.050	0.119	−0.088	149	−8.9
Holdings	−0.065	−0.074	0.186	0.143***	0.382***	33	184.7

Consulting	0.134***	−0.370***	−0.061	0.113	0.014	267	14.2
Services auxiliary to finance and insurance	−0.027	−0.464	0.220	0.002	−0.013	33	48.3
Property developpers	0.136	0.039	0.312*	−0.169	−0.432*	72	−7.6
Renting of personal goods	0.134	0.035	−0.079	−0.398***	−0.535***	65	0.5
Property renting	−0.101	−0.429***	0.095	−0.004	0.261*	101	−0.9
Education services (market)	−0.100	−0.765***	0.034	0.390**	0.246	52	184.2
Research (market)	0.024	−0.124	0.631*	−0.483	−0.471**	52	158.0
Health services (market)	−0.055**	−0.221***	0.059	0.093**	0.048	296	−2.0
Social work services (market)	−0.231***	−0.638***	0.112*	0.143**	0.100	265	99.3
Cultural and sporting services (market)	0.078	−0.036	0.218	−0.104	−0.327*	91	30.4
Miscellaneous services (market)	−0.029	−0.632***	0.098	0.138**	0.337***	204	37.7
Insurance	0.073	−0.110	0.308***	−0.255**	−0.371***	112	−0.7
Financial services	0.033	−0.172***	0.207***	−0.029	0.076	244	−18.6
Pension funding and social security services	−0.006	−0.215***	0.127***	0.074	0.117*	161	−5.7
Education services (non-market)	0.017	−0.085	0.153***	−0.217***	−0.470***	233	−18.0
Social work services (non-market)	0.054	−0.195**	0.155*	−0.147*	−0.509***	221	−4.4
Cultural and sporting services (non-market)	0.057	−0.070	0.125	−0.241	−0.611***	40	85.3
Miscellaneous services (non-market)	0.003	−0.010	0.047	−0.511***	−0.721***	127	−44.8

Note. The number of observations and the sectoral national growth rate are given in columns “Obs.” and “Gro.”
***, **, *: significant at the 5%, 10%, and 15% levels, respectively.

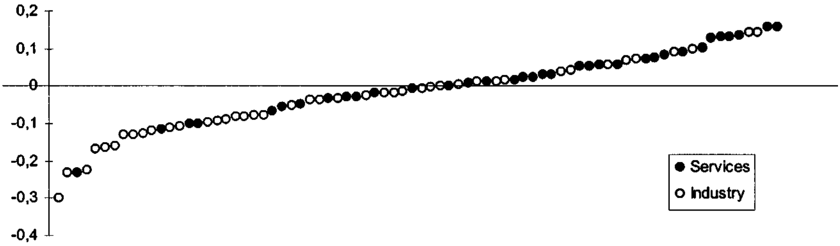

FIG. 1. Density elasticities.

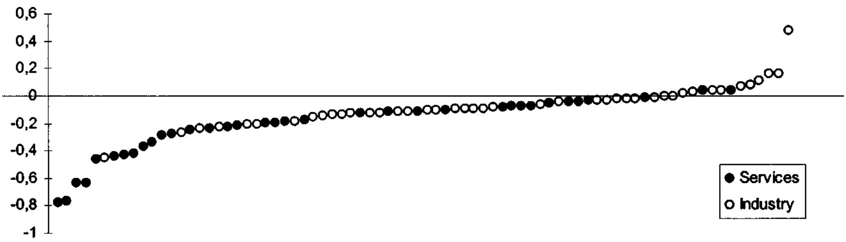

FIG. 2. Specialization elasticities.

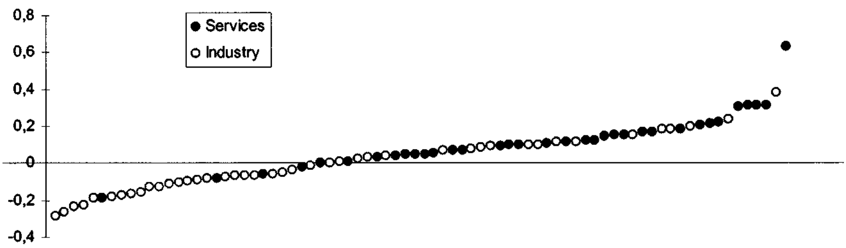

FIG. 3. Diversity elasticities.

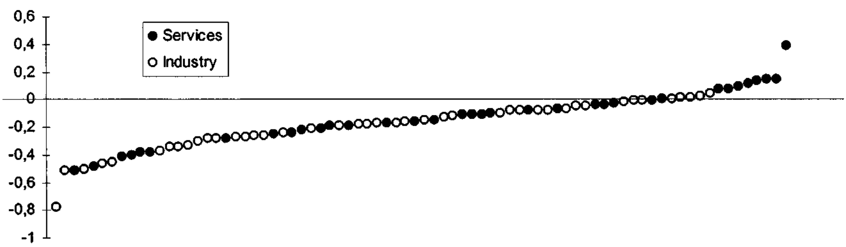

FIG. 4. Competition elasticities.

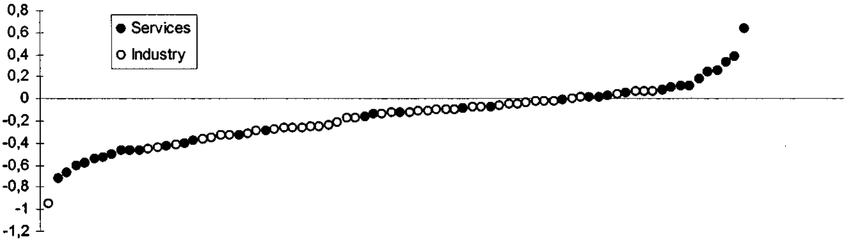

FIG. 5. Size elasticities.

be found, such as metalworking, the manufacture of agricultural machinery, the production of industrial equipment or the industries linked to wood (the wood, furniture, and paper and pulp industries), as well as some services, such as wholesale trade (non-food and inter-industrial), specialized food retail trade, the repair and trade of motor vehicles, financial services, and pension funding and social security services.

Thirteen sectors experience a positive effect of specialization, but no service sector has a significant positive elasticity for specialization, and the contrary is only observed in three industrial sectors. These economies of localization can be the result either of market-based effects (for instance, due to the sharing of specialized inputs) or information spillovers. Both of these interpretations seem to be particularly relevant for the glass industry, the manufacture of office machinery and computers, and, although the effect is strong but non-significant, aeronautics. The case of miscellaneous industry is harder to interpret, because it covers many different activities.

These results globally confirm for French industry and services the absence of intra-sectoral local externalities stated by Glaeser et al. [19] for the U.S. industry. On the contrary, all industrial sectors studied by Henderson et al. [22], traditional as well as high-tech, present this type of externality, whereas it is the case only for a few of ours. However, these authors simultaneously control for the sectoral employment level, which increases the probability of obtaining a positive elasticity for specialization, as shown by Combes [10] and recalled above. Lastly, the decrease in France of the spatial concentration may lead to the following conjecture: localization economies could be linked to the business cycle and would work asymmetrically, positive in growing periods but negative in recessions. A longer period of observation would be necessary to precisely test this conjecture.

Diversity

Urbanization economies are observed in global regressions for services whereas industry experiences a negative effect of diversity. Figure 3 confirms this contrast between the industrial and service sectors. Moreover, the diversity impact is lower, in absolute value and on average, than the specialization effect.

Diversity elasticity is higher than 0.3 for two service sectors (plus three others but non-significantly) and is between 0.1 and 0.3 for five others. This validates the intuitions of the monopolistic competition models with differentiated inputs and outputs. Indeed, in services, inputs are fairly diversified and outputs are not specific to given sectors or given types of consumers. Firms consequently benefit from facing a great variety of sectors located in the same place, because of both supply and demand linkages. This is confirmed by the frequent simultaneous positive effects of diversity and density. Such an interpretation may apply to five sectors of trade, although the effect is not always significant, and also to finance, insurance, and pension funding and social security services.[7] The distribution of water and urban heating, already compared above to a service, and construction are the only industrial sectors that present a significant positive elasticity. Urbanization economies due to knowledge spillovers between different sectors may also explain the positive, and fairly high although non-significant, effect of diversity for the manufacture of office machinery and computers, the manufacture of electrical equipment and the manufacture of electronic equipment, and for aeronautics.

No service sector has a significant negative elasticity for diversity, whereas it is lower than -0.1 for five industrial sectors. They also present a negative elasticity for density and are often linked to agriculture, for instance, the working of grain and wood, the manufacture of miscellaneous food products and agricultural machinery, and the rubber industry. Moreover, many traditional industries experience a negative but non-significant effect. In these cases, inputs are simultaneously highly specialized and costly to transport: they consequently do not benefit from diversity.

Thus, some evidence of urbanization externalities is found for services, and there is a presumption that they exist for a few high-tech industrial sectors. While these externalities emerge on average for all industries in Glaeser et al. [19], our results are consistent with Henderson et al. [22], who find urbanization economies for new industries but not for mature ones.

[7] As well as services auxiliary to finance and insurance, and to property developers, although the effect is strong but not significant.

Competition

Global regressions show that local competition has a negative effect on growth in industry and is not significant in services. The elasticity is lower than -0.3 for 10 industrial and 4 services sectors and between -0.3 and -0.1 for 9 industrial and 4 services sectors. This reflects the dispersive effect of price competition on outputs, provided that markets are sufficiently local and segmented, which is often the case in services. Good examples can be found in different wholesale and retail trades, the middleman's business, the renting of personal goods, and insurance. Moreover, this effect can be reinforced if some congestion on inputs also emerges. Higher competition between firms means higher land-rent or wages of skilled labor, which is not very mobile in France. In particular, if the sector declines, as in many traditional industrial sectors, this decreases the local firms' survival rate. The production of construction and ceramic materials, the manufacture of machine tools, civil-engineering equipment, and wearing apparel and dressing, the automobile industry, the milk products industry, and the working of plastic simultaneously experience a negative competitive effect and a decrease in national employment higher than 20%.

Competition has a positive effect in only five service sectors, which is never observed for industry. A first explanation may be the positive impact of competition on information spillovers. Uncertainty about the quality of goods may also generate high demand in highly competitive places due to improved matching: this certainly plays an important role in the holdings, health, social work, and education market services.[8]

Size

The plants' average size has a negative impact on growth in global regressions for both industry and services. Nine industrial and 12 services sectors present an elasticity lower than -0.3, and for 8 industrial and 1 services sectors, it is between -0.1 and -0.3. No industrial sector presents a positive elasticity, whereas this happens in 5 services sectors. Figure 5 shows that elasticities are lower in absolute value in industrial sectors than in services, these ones presenting either high or low elasticities.

The fact that size positively affects growth in very few sectors cannot be strictly interpreted as an absence of internal economies of scale since production functions are not really estimated. However, one could think that larger plants would grow faster in more sectors, in particular, in traditional industries. Sectors such as gas and oil production, the metallurgy of iron and steel, the basic chemical industry, the production of

[8] And in consulting and auxiliary transport and travel agency services: the effect is greater than 0.1, although not significant.

industrial equipment, or the manufacture of household equipment do not present a negative impact of size either. Internal economies of scale may not only explain the lower employment decrease of large plants in declining sectors, such as rail transport or repair and trade of motor vehicles, but also their faster growth in expanding sectors, such as miscellaneous services, specialized non-food retail trade, and holdings.[9]

The negative elasticities of size may simply reflect a firm's life-cycle effect: new firms are in general of small size and are able to grow faster, whereas, once they have reached their optimal size, their employment stops expanding. This is intuitive in services, such as hotel and restaurant services, road transport, supporting transport services and warehouses, and the research market services, which experience the lowest effects and which are simultaneously growing and diffusing across space. Another conclusion would be that information spillovers are more important for small firms: in industry, high-tech sectors such as the manufacture of office machinery, computers, electrical equipment, electronic equipment, and precision equipment are among the ones which experience the strongest effect. Moreover, adaptability and flexibility can be higher in small firms. This benefits the sectors in which technologies change very quickly and it saves employment in declining sectors, such as most industrial ones.

Glaeser et al. [19] interpret the negative elasticity of size as a positive effect of competition. However, the previous results show that competition has mostly a negative effect on employment. Recall also that no correlation exists between size and competition in the dataset. These results are globally consistent with those of Glaeser et al. [19] and Caballero and Lyons [7], but the interpretations, in the first case, and methodology, in the second one, completely differ. Ó hUallacháin and Satterthwaite [28] obtain a positive effect of plants' size in a greater number of sectors.

Short-Run Effects

Another interesting question is related to the delay with which the economic structure affects growth. Using panel data, Henderson [21] shows that the strongest effect of localization externalities arises after three or four years, whereas urbanization externalities show a lag of up to eight years. Since the number of years of our panel is too small, we cannot perform such a study. However, we now regress the annual growth rate (between years t and $t+1$) on the current economic structure (at date t). We pool all years between 1984 and 1992, and perform global regressions for industry and services, respectively. This reflects possible short-run

[9] To which could be added education services and social work services, although the effect is not significant.

effects, the previous regressions being interpreted as middle-run ones. The results are presented in Table 4.

It turns out that these effects are significantly smaller than the middle-run ones. Both for industry and services, no estimate which is significant in the short- and middle-run has a different sign in both cases. In this situation, the middle-run effect is roughly the sum of the short-run ones, and the economic structure influences growth in the same direction, whatever the horizon. Concerning services, the diversity effect, which is positive but small in the middle-run, is non-significant in the short-run. On the contrary, density and competition, which were non-significant in the middle-run in global regressions, now affect growth positively, as they do for some sectors in the middle-run. This confirms that these variables influence growth in a different way depending on the sector.

5. CONCLUSIONS

This study shows that the local economic structure significantly affects local employment growth. The separate regressions show that there are sharp differences between industrial and service sectors. Our interpretations include not only arguments based on information spillovers and market-based effects, but also the national evolution of the sector.

Industrial and services sectors react to density and diversity in an opposite way. In most cases, these factors favor local services employment growth, probably due to market-based effects arising from the local presence of large and diversified input and output markets and to possible inter-sectoral information spillovers. Thus, urbanization economies emerge in many services sectors. Density and diversity mainly slow down employment growth in industry, probably due to congestion effects increasing the costs of local inputs, such as land and local transportation.

In industry as in services, very few localization economies are found. This may be explained by the presence of an asymmetric effect, which remains to be tested: specialization would enhance local growth during expansion periods, but it would also favor employment decline during recessions, inducing adaptability problems. Concerning competition, the direct dispersive price effect dominates, in almost all sectors, except in a few services, possibly reflecting in this case positive agglomeration effects due to imperfect information. Lastly, this study shows that local externalities are generally external to plants.

For some sectors, our results differ from those observed in the U.S. It should, however, be recalled that our methodology concerning localization economies is more restrictive. Agglomeration mechanisms may differently work in the U.S. and France, which can be explained by differences in factor mobility. The period of study and the global evolution of the sector

TABLE 4
Annual Global Regressions

	Industry	Services
Number of observation	92,284	81,938
Non-zero observations	66,646	58,219
Probit variables		
Intercept	1.152	1.220
	(0.012)	(0.014)
Dummy Paris	− 0.928	0.127
	(0.079)	(0.250)
Dummy Ile-de-France	− 0.365	− 0.350
	(0.019)	(0.020)
Dummy Méditerrannée	− 0.254	− 0.105
	(0.015)	(0.015)
Dummy Nord and Est	− 0.139	− 0.154
	(0.012)	(0.013)
Density	0.223	0.276
	(0.004)	(0.005)
Tobit variables		
Intercept	− 0.134	0.030
	(0.008)	(0.009)
Density	− 0.021	0.014
	(0.002)	(0.002)
Specialization	− 0.033	− 0.062
	(0.002)	(0.003)
Diversity	− 0.026	− 0.002
	(0.001)	(0.001)
Competition	− 0.031	0.018
	(0.002)	(0.002)
Size	− 0.013	− 0.033
	(0.003)	(0.005)
Likelihood	− 75,012.04	− 80,934.45

Note. Logarithm is taken for all variables.

Standard-errors in brakets.

All variables significant at the 5% level, for Student or Wald tests, except for services, the dummies Paris and Méditerranée, and density.

Likelihood for the model with only the intercept: − 77,905.28 for industry, − 83,759.28 for services.

also influence the results: the effects are possibly asymmetric, or local externalities may just less influence local growth during some periods, as Bostic et al. [6] shows for the late 19th century in the U.S.

Although it would be important to deduce from our study some advice in terms of economic policy, our conclusions show the complexity of the problem: a local economic structure that is profitable in the short-run or for some sectors is not necessarily good in the middle- or long-run or for other sectors. For instance, many industrial sectors are in the paradoxical situation where neither specialization nor diversity enhances growth. Moreover, the magnitude of elasticities also greatly differs between sectors: no variable which policymakers might control exercises a systematically strong effect. Some aspects of the evolution of the geographical employment distribution can, however, be derived from our results. For instance, during this period and on average, industrial sectors work in favor of geographical convergence of the ZEs' total employment density, by growing more (or declining less) in non-dense places, whereas services expand more in dense and diversified ZEs. The negative effect of specialization on growth, both in industry and services, induces a convergence of the ZEs' employment sectoral composition.

This type of study could be improved by using longer data series and panel methodology, as in Henderson [21], and by considering some spatial autocorrelation of the effects. Moreover, a structural econometrics method based on recent economic geography or endogenous growth models would clarify what is really tested. It would, for instance, help to distinguish between productivity and output effects and between market-based effects and information spillovers.

REFERENCES

1. H. M. Abdel-Rahman, Product differentiation, monopolistic competition and city size, *Regional Science and Urban Economics*, **18**, 69–86 (1988).
2. H. M. Abdel-Rahman and M. Fujita, Specialization and diversification in a system of cities, *Journal of Urban Economics*, **33**, 189–222 (1993).
3. Z. Acs, D. B. Audretsch, and M. P. Feldman, Real effects of academic research: A comment, *American Economic Review*, **82**, 363–367 (1992).
4. L. Anselin, A. Varga, and Z. Acs, Local geographic spillovers between university research and high technology innovations, *Journal of Urban Economics*, **42**, 422–448 (1997).
5. D. B. Audretsch and M. P. Feldman, R & D spillovers and the geography of innovation and production, *American Economic Review*, **86**, 630–640 (1996).
6. R. Bostic, J. Gans, and S. Stern, Urban productivity and factor growth in the late nineteenth century, *Journal of Urban Economics*, **41**, 38–55 (1997).

7. R. Caballero and R. Lyons, Internal versus external economies in European industry, *European Economic Review*, **34**, 805–830 (1990).
8. A. Ciccone and R. Hall, Productivity and the density of economic activity, *American Economic Review*, **86**, 54–70 (1996).
9. P.-Ph. Combes, Industrial agglomeration under Cournot competition, *Annales d'Economie et de Statistique*, **45**, 161–182 (1997).
10. P.-Ph. Combes, "Marshall–Arrow–Romer externalities and city growth: A methodological note," CERAS Working Paper No. 99-06 (1999).
11. A. Dixit and J. Stiglitz, Monopolistic competition, and optimum product diversity, *American Economic Review*, **67**, 297–308 (1977).
12. G. Ellison and E. L. Glaeser, Geographic concentration in U.S. manufacturing industries: a dartboard approach, *Journal of Political Economy*, **105**, 889–927 (1997).
13. D. Encaoua and A. Jacquemin, Degree of monopoly, indices of concentration and threat of entry, *International Economic Review*, **21**, 87–105 (1980).
14. M. P. Feldman and D. B. Audretsch, Innovation in cities: Science-based diversity, specialization and localized competition, *European Economic Review*, **43**, 409–430 (1999).
15. M. Fujita, A monopolistic competition model of spatial agglomeration in urban economics, *Regional Science and Urban Economics*, **18**, 87–124 (1988).
16. M. Fujita and H. Ogawa, Multiple equilibria and structural transition on non-monocentric urban configurations, *Regional Science and Urban Economics*, **12**, 161–196 (1982).
17. M. Fujita and J.-F. Thisse, Economics of agglomeration, *Journal of the Japanese and International Economics*, **10**, 339–379 (1996).
18. E. L. Glaeser, Are cities dying?, *Journal of Economic Perspectives*, **12**, 139–160 (1998).
19. E. L. Glaeser, H. Kallal, J. Sheinkman, and A. Schleifer, Growth in cities, *Journal of Political Economy*, **100**, 1126–1152 (1992).
20. J. Heckman, Sample selection bias as a specification error, *Econometrica*, **47**, 153–161 (1979).
21. J. V. Henderson, Externalities and industrial development, *Journal of Urban Economics*, **42**, 449–470 (1997).
22. J. V. Henderson, A. Kuncoro, and M. Turner, Industrial development in cities, *Journal of Political Economy*, **103**, 1067–1090 (1995).
23. H. Hotelling, Stability in competition, *Economic Journal*, **39**, 41–57 (1929).
24. A. B. Jaffe, Real effects of academic research, *American Economic Review*, **79**, 957–970 (1989).
25. A. B. Jaffe, M. Trajtenberg, and R. Henderson, Geographic localization of knowledge spillovers as evidenced by patent citations, *Quarterly Journal of Economics*, **108**, 577–598 (1993).
26. P. Krugman, Increasing returns and economic geography, *Journal of Political Economy*, **99**, 483–499 (1991).
27. P. Krugman and A. Venables, Globalization and the inequality of nations, *Quarterly Journal of Economics*, **110**, 857–880 (1995).
28. B. Ó hUallacháin and M. Satterthwaite, Sectoral growth patterns at the metropolitan level: an evaluation of economic development incentives, *Journal of Urban Economics*, **31**, 25–58 (1992).
29. D. Puga, The rise and fall of regional inequalities, *European Economic Review*, **43**, 303–334 (1999).

30. J. Quigley, Urban diversity and economic growth, *Journal of Economic Perspectives*, **12**, 127–138 (1998).
31. F. Rivera-Batiz, Increasing returns, monopolistic competition, and agglomeration economies in consumption and production, *Regional Science and Urban Economics*, **18**, 125–153 (1988).
32. N. Schulz and K. Stahl, Do consumers search for the highest price? Equilibrium and monopolistic optimum in a differentiated products markets, *Rand Journal of Economics*, **27**, 542–562 (1996).
33. J. Sutton, Technology and market structure, *European Economic Review*, **40**, 511–530 (1996).