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Changes in the intra-metropolitan location of producer services in Ile-de-France (1978-1997) : do information technologies promote a more dispersed spatial pattern ?

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CHANGES IN THE INTRA-METROPOLITAN LOCATION OF PRODUCER SERVICES IN ILE-DE-FRANCE (1978-1997): DO INFORMATION TECHNOLOGIES PROMOTE A MORE DISPERSED SPATIAL PATTERN?*

Céline Boiteux-Orain et Rachel Guillain

Abstract

Because of their intensive need for face-to-face contacts, producer services have, historically, been found at the core of CBDs. However, it has been suggested that advances in information technologies could lead to the erosion of the CBD's economic base, rendering face-to-face contacts obsolete and enabling producer services to suburbanize. Although a considerable amount of empirical work has been done on the suburbanization of these activities in North-America, the same is not true of France. In this paper, we adopt an original methodology to study the role played by face-to-face contacts in the spatial distribution of producer services in the Ile-de-France region between 1978 and 1997. Our findings confirm that producer services did indeed suburbanize during the study period. Nevertheless, this suburbanization was multicentric, rather than scattered, suggesting that face-to-face contacts remain an important factor in the location of such services.

Résumé

Une raison traditionnellement avancée pour expliquer la localisation des services aux producteurs dans les CBD est leur fort besoin de contacts face à face. Néanmoins, ce pouvoir d'agglomération des contacts face à face pourrait être remis en cause par l'essor des technologies de la communication ce qui conduirait à une répartition plus uniforme de ces activités. Les centres villes ne seraient plus alors l'espace privilégié de localisation de ces activités et perdraient leur pouvoir d'organisation sur l'aire métropolitaine. Bien que le processus de suburbanisation ait fait l'objet de nombreuses études empiriques, ces dernières restent, à notre connaissance, peu nombreuses en France. Dans ce papier, nous proposons une méthode originale pour étudier le rôle des contacts face à face dans les choix de localisation des services aux producteurs dans la région Ile-de-France entre 1978 et 1997. Nos résultats confirment que les services aux producteurs ont effectivement connu une vague de suburbanisation mais que cette dernière conduit à la formation de nouvelles polarités plutôt qu'à leur dispersion au sein de l'aire métropolitaine. Ceci suggère, qu'en dépit des progrès dans les technologies de la communication, les contacts face à face restent un facteur important de localisation pour ces services.

Keywords: producer services; information technologies, monocentric and polycentric configurations; suburbanization.

JEL Classification: R12, R30

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INTRODUCTION

Advances in information technologies were expected to herald the impending demise of the urban core as the prime focus for information interaction (Webber, 1964; Kellerman, 1984; Down, 1985). The main arguments for this were that (i) with information technologies, an impressive mass of information can be reliably transmitted anywhere in real time (Graham, 1997); (ii) continued progress in information technologies would greatly reduce communication costs; and (iii) information technologies would replace face-to-face contacts (Gaspar and Glaeser, 1998).

'For the first time in history, it might be possible to locate on a mountain top and to maintain intimate, real-time, and realistic contact with business or other associates. All persons tapped into the global communication net would have ties approximating those used today in a given metropolitan region' (Webber, 1968, quoted in Moss, 1987, p. 535).

All else being equal, it was expected that economic activity would be more evenly distributed. Yet economic activity and more particularly information-dependent activities such as services and business administration continue to concentrate in cities (Sassen, 1991; Daniels, 1993). It seems, then, that the connections between the location of information-dependent activities and information technologies are more complex than was first thought. Face-to-face contacts still appear to be an agglomeration force for information-dependent activities. In other words, information technologies and face-to-face contacts cannot be considered as substitutes. This idea has received a great deal of empirical support in North America (Coffey, 1996; Coffey et al., 1996; Longcore and Rees, 1996; Leslie, 1997), yet few such studies have been conducted in France.

In this paper, we seek to further our understanding of the role played by new information technologies in the present-day distribution of information-dependent activities in Ile-de-France. More precisely, we use data on employment by place of work to investigate the changing spatial distribution of producer services sector employment in this metropolitan region between 1978 and 1997. We then seek to answer the questions: (1) do FIRE (Finance, Insurance and Real Estate) and business services decentralize, moving away from the CBD during the study period in greater numbers than activities that are less information-dependent? If so, (2) are they scattered across the entire metropolitan region or do they cluster rather in new employment poles in the suburbs alongside other activities? And finally, (3) do all the separate sectors of producer services display the same propensity to suburbanize?

To answer these questions, two complementary approaches are adopted. The spread of information-dependent activities (both overall and by separate sectors) over the period 1978-1997 is examined in terms of rings. However, this approach is not sufficient in itself. If the decentralization of employment in producer services takes the form of scatteration¹, then there has been a decline in the role of face-to-face contacts. Conversely, if high-order activities leave the CBD to form new employment poles in the periphery, the role of face-to-face contacts apparently remains an important location factor for such activities. Therefore, we also conduct an analysis in terms of employment poles to investigate these subsidiary questions.

Our results show that producer services are indeed suburbanizing in Ile-de-France. However, suburbanization is not synonymous with scatteration. It exhibits a subtle multicentric pattern with specialized centers forming outside the CBD. These results

¹ Scatteration may be defined as "a generalised dispersion of economic functions, as opposed to their concentration in employment centers" (Shearmur, Coffey, 2002, p.576).

suggest that face-to-face contacts may still be instrumental in explaining the urban pattern.

The next section reviews the literature about the impacts of new information technologies on the geography of economic activity. Then we describe the study area, data and methodology used in conducting our empirical study. The following two sections examine the changing spatial distribution of high-order service employment in Ile-de-France over the period 1978-1997. Then, we examine to what extent information facilities may reinforce this spatial distribution by highlighting the impact of fixed costs. In our final section, we summarize the main characteristics of suburbanization in Ile-de-France and discuss the effects of information exchanges on this process.

THE SPATIAL IMPACTS OF INFORMATION TECHNOLOGIES: A CONTROVERSIAL ISSUE

It is difficult to apprehend the effects of information technologies on the location of economic activities. Indeed, these technologies are still recent developments and their overall impact on the location choice of activities may take some time to work through.

Some authors claim that information technologies will bring about radical changes in spatial organization, much as the railroads or the automobile did in their time (Hohenberg and Lees, 1985; Rallet, 1999a). This is a realistic claim. First, information can be transmitted easily via information technologies between distant agents, thereby freeing economic agents from their proximity constraints. Second, economic activity is becoming increasingly information-based (Sassen, 1991; Castells, 1996).

The greatest spatial impact of information technologies will be on services and business activities, because these activities are information intensive. Indeed, they are based on complex decision-making processes, which renders them highly information-dependent. These activities are traditionally located in city centers because of their information requirements. Information exchanges have a strong non-market dimension and the benefits derived from information exchanges are similar to those derived from externalities (Jaffe, 1989; Feldman, 1994; Audretsch and Feldman, 1996; Fujita and Thisse, 2000; Guillain and Huriot, 2001). Moreover, distance is a barrier to the spread of information (Hägerstrand, 1965; Banerjee, 1993), and accordingly information exchanges generate spatial externalities. Because the information diffusion is spatially restricted, information-dependent activities are located close to each other.

Ogawa and Fujita's models (1980, 1982) explain the trade-off between the benefits derived from information externalities and the high costs of central location incurred by firms. They develop a model of firm-household interactions with information externalities. This model aims at determining the equilibrium configurations of a city where information exchanges between firms act as an agglomerative force. Opportunities for information exchange increase with the number of firms sharing the same location. Furthermore, the firms are assumed to have different information. Consequently, by facilitating a larger number of diversified contacts, geographic proximity ensures that agents can acquire a large quantity of varied information. Proximity between firms thus cuts their operating costs and boosts profits. Households simply have to move toward these firms to find work. However, the clustering of many firms within a single area pushes up land rent and commuting costs: these are the dispersion forces, which are disincentives to any further agglomeration by firms. At equilibrium, the distribution of firms and households exhibits patterns with one or more

centers formed by the agglomeration of firms. These patterns result from the balancing out of the two opposing forces.

Sekeris (1998) introduces two types of firm into this model: manufacturing activities and services. Services are assumed to be more sensitive to information externalities than manufacturing is. At equilibrium, services are more concentrated in the center(s). Thus, the more sensitive activities are to information externalities, the closer together they will locate.

By introducing information technologies into this reasoning, it can be argued that information-dependent activities will leave the high-rent city centers. Information technologies seem to weaken the proximity constraint on information exchanges. They also seem to provide the same advantage as city centers for efficient information exchanges without the economic, social and environmental diseconomies of urban concentration.

However, the recent literature on the spatial impact of information technologies is not so sure about this prediction. Indeed, the evidence is that some activities, especially producer services, still cluster in the city centers because their informational component acts as an agglomerative force despite advances in information technologies (Daniels, 1993; Bailly and Coffey, 1994; Coffey and Drolet, 1994; Sassen, 1991). In order to explain the links between information exchanges and localization and thus the spatial impact of information technologies, the specific character of the information has to be analyzed.

In short, two main types of information can be identified (Guillain and Huriot, 2001). 'Codified information', being systematic, repetitive and articulated can be transmitted easily and reliably by information technologies. 'Tacit information', by contrast, requires dialogue between parties and gradual clarification because it is highly personalized and contextualized (Foray and Lundwall, 1996).

The persistence of tacit information in the economy is one explanation for the continuing need for proximity in information exchanges. New advances in information technologies simply increase the opportunities for transmitting codified information over long distances but do not change the proximity constraint related to tacit information (Rallet, 1999b; Guillain and Huriot, 2001). Indeed, geographic proximity facilitates and enhances the understanding of tacit information for a number of reasons. First, there are more opportunities for exchanging information where there is a high-density of individuals. Next, proximity means that time spent arranging contacts can be saved, and therefore more interactions are possible. Finally, geographical proximity is conducive to multiple contacts and so induces other forms of proximity, more particularly relational proximity (Bouabdallah et al., 1996). With frequent encounters, individuals share the same culture, a common language and similar outlooks. Moreover, mutual confidence develops between agents, precluding opportunistic behavior (Arrow, 1974; Granovetter, 1985; Cohen and Levinthal, 1990; Pryke, 1991; Saxenian, 1994; Thrift, 1996). Proximity therefore allows improved transmission of information, more refined interpretation and consequently better use of that information (Guillain, 2000; Guillain and Huriot, 2001).

We set out to test the robustness of the second thesis about the impacts of information technologies in Ile-de-France through an empirical analysis of the distribution of employment.

STUDY AREA, DATA AND METHODOLOGY

With nearly 11 million inhabitants and approximately 5 million jobs, Ile-de-France is France's largest region. It represents 18.8% of the national population and produces 29% of the national GDP, so that GDP per inhabitant in this region exceeds the national average by 55%. The economy of Ile-de-France is largely oriented toward the service sector: 80% of regional employment is in this sector, compared with 72% nationwide (IAURIF, 2001). The region covers 12,000 square kilometers, which is 2.2% of the national land area. It comprises 1280 communes and the 20 districts of the City of Paris. Since 1964 the metropolitan region has been partitioned into eight departments: Paris, Seine-et-Marne, Yvelines, Essonne, Hauts-de-Seine, Seine-Saint-Denis, Val-de-Marne and Val-d'Oise.

We used two separate databases to conduct our empirical analysis. Our first source of data was the Population Censuses compiled by the French National Institute of Statistics and Economic Studies (INSEE) for the years 1975, 1982, 1990 and 1999. These data relate to the communal level. The second source of data was the 1978 and 1997 surveys conducted by INSEE, providing information on public- and private-sector employment by place of work. These employment data are classified according to the INSEE's industrial classification, NAP 600 ('Nomenclature des Activités Professionnelles') for 1978 and NAF 700 ('Nomenclature d'Activités Française') for 1997. These sector-based definitions were standardized to ensure that the two years of the study period could be reliably compared.

To examine the data in accordance with the objectives set out in the introduction, we adopted two approaches. The first was to analyze changes in the spatial distribution of employment during the 1978-1997 period by 'rings'. The Ile-de-France region was divided into three rings (see fig. 1) on the basis of the standard division: Paris, Petite Couronne² (our inner ring) and Grande Couronne³ (our outer ring).

[*Fig. 1 about here*]

The second approach was a method of identifying employment poles. The choice of such a method is somewhat problematic. Indeed, empirical literature on this subject suggests a whole battery of criteria for defining employment poles, the most common being total employment levels, employment density cut-offs, employment-to-population or employment-to-resident worker ratios, or any combination thereof (McDonald, 1987; Giuliano and Small, 1991; McDonald and Prather, 1994; Cervero and Wu, 1997; Forstall and Greene, 1997; Cervero et Wu, 1998; McMillen and McDonald, 1998; Bogart and Ferry, 1999; Shearmur and Coffey, 2000; Anderson and Bogart, 2001).

However, these criteria have mainly been tested on large North-American urban regions. When trying to apply them directly to the Ile-de-France, two main problems arise. First, unlike North-American cities, but like most European cities, the central part of the Ile-de-France area is characterized by a high concentration of both population and employment, so that standard employment-population indexes are not very useful. In particular, the use of such indexes in the Ile-de-France region entails excluding some sizeable employment areas, both in the central part of the metropolitan region and in the suburbs. Therefore, in order to identify areas with comparatively more jobs than inhabitants, we propose a new criterion, which we term an employment location

² Hauts-de-Seine, Seine-Saint-Denis and Val-de-Marne

³ Seine-et-Marne, Yvelines, Essonne and Val-d'Oise

quotient. This employment location quotient is defined as the ratio of the employment-population ratio of a given commune to the employment-population ratio of the department in which this commune is located. Thus, an employment location quotient of more than one indicates that the given commune has an employment-population ratio that exceeds that of the entire department, or, in other words, that this commune has a higher proportion of employment to population than do the communes of the department as a whole.

Second, a specific feature of this region is the presence of a 'megapole' of almost two million jobs, constituted by the City of Paris and its western and northern extensions into adjacent areas of the inner ring. To the best of our knowledge, two solutions have been proposed in the literature to tackle this problem. The first solution, used for example by McMillen and McDonald (1998) for the Chicago metropolitan area, consists in raising the minimum employment cut-off level for the giant center in order to divide it into a number of employment subcenters. An alternative solution, adopted by Bekouche and Vire (1998) for Ile-de-France, is to group the various spatial units of the large pole according to their economic profile. Insofar as any reasonable subdivision of the megapole requires the use of several cut-offs for minimum employment levels, we have opted for the second approach.

To account for these two specific features of the Ile-de-France region, we adopted a three-step procedure to determine employment concentrations.

First, we defined a suburban employment pole as *a suburban commune, or a set of adjacent suburban communes, concentrating at least 7,000 jobs and with an employment location quotient of more than unity.*

Second, using the methodology described above, the 20 districts of the City of Paris and the 15 inner communes of the megapole were grouped into employment poles according to their 1997 economic profile (Fig. 2 and Fig. 3).

[Fig. 2 and Fig. 3 about here]

Third, adapting an approach used by Shearmur and Coffey (2000), all the poles identified in the preceding steps were grouped into three main categories: central poles (poles containing at least one commune of 50,000 jobs); primary poles (poles in which one or more communes have a minimum of 15,000 jobs) and isolated poles (poles formed by a single commune containing at least 7,000 jobs). This three-step procedure was applied to the 1997 data and replicated for the 1978 data. It led to the identification of 34 employment poles (Table 1 and Fig. 4).

[Table 1 and Fig. 4 about here]

CHANGES IN THE GENERAL SPATIAL PATTERN IN ILE-DE-FRANCE, 1978-1997

In this section, our aim is to determine, by two means, whether new information technologies have made face-to-face contacts obsolete as the main factor in the location of high-order activities. We begin by analyzing whether employment in this sector has become more or less evenly distributed across the three rings defined in the previous section compared with less information-dependent activities. Next, we examine the sectoral composition of employment poles to determine whether producer services tend to disperse across the remainder of the region or to concentrate in suburban employment poles.

In order to conduct this part of our empirical analysis, we aggregated employment data into the nine following broad sectors: (1) Industry; (2) High Tech Industry; (3) Construction; (4) Transport, Utilities and Communications (TUC); (5) Wholesale trade; (6) Consumer Services (CS); (7) Finance, Insurance and Real Estate (FIRE); (8) Business Services (BS) and (9) Public Services (PS).

Table 2 summarizes changes in employment distribution across the rings for the nine sectoral groups under consideration.

[Table 2 about here]

Analysis based on the rings reveals that the 1978-1997 period was one of decentralization of employment from the heart of the region toward the suburban areas, and especially the outer ring. While Paris's share of total metropolitan employment fell from 41% to 32% between 1978 and 1997, the share of total metropolitan employment in the outer ring rose from 23% to 31%. This suburbanization of total employment led to a more uniform distribution of economic activity across the three parts of the Ile-de-France region at the end of the study period, with each ring containing about one third of total metropolitan employment.

However, this general spatial pattern varies for individual sectors. Over the 1978-1997 period, the process of suburbanization of extensive land-use activities (industry, high-tech industry, construction and wholesale trade) and population-service-oriented activities (consumer services and public services) largely benefited the outer ring. The former were pushed out to the periphery because this was the only area able to offer sufficient floor space at affordable prices for their large plants, whereas the latter moved out to the suburbs to serve the booming market that the increasing decentralization of population was steadily creating at that time.

Employment in information-dependent activities (FIRE services and business services) tended to spread to the inner ring, and slightly to the outer ring. Between 1978 and 1997, the inner ring's share of regional employment in these two sectors rose respectively from 16% to 28% and 26% to 39%. The corresponding figures for the outer ring were 7% to 12% and 14.5% to 23.5%. At the same time, the share of employment of the Paris metropolitan area fell from 77% to 60% in the FIRE services sector and from 60% to 37% in the business services sector. Thus, despite substantial losses in FIRE employment, Paris maintained its leadership for FIRE activity, but the inner ring overtook the region's central zone for business services.

One explanation for this spatial distribution of information-dependent activities could be that new information technologies have rendered them more footloose. However, the dynamics at work would only bear out this thesis if no new concentrations of information-dependent activities were observed in the suburban zones. Thus, further examination is required to determine to what extent the spatial pattern displays a dispersed or a polycentric form and to ascertain the role of producer services in this process.

As shown in table 3, the results of the identification of employment poles indicate that, in 1997, the 34 employment centers identified concentrated 69% of total regional employment, whereas only 31% was dispersed over the remainder of the Ile-de-France region. This suggests that the Ile-de-France region displays a polycentric spatial pattern rather than a dispersed spatial distribution of employment.

[Table 3 about here]

This concentration of employment in poles is even more pronounced for information-dependent activities than for the other seven sectors, as poles contained 87% of the region's total FIRE employment and 79% of total metropolitan business services employment at the end of the study period.

An interesting feature is that producer services employment concentrates in poles in general, but also in a number of selective poles. Indeed, although the share of total regional employment of the eight central employment poles was eroded between 1978 and 1997, those poles still concentrated 70% of total regional FIRE services employment and 56% of total regional business services employment in 1997. The respective figures for the 14 primary poles are 15% and 21%, and for the 12 isolated poles 2.4% and 1.7%. These results are consistent with those of Alvergne and Shearmur (1999) and Shearmur and Alvergne (2002) who used complementary indicators of concentration and dispersion for the Ile-de-France study. They also highlight the predominant role of the central part of Paris in producer services employment.

However, of all the central poles, only three of them, located west of Paris, but adjacent to the inner beltway surrounding Paris, increased their share of total regional employment in producer services, especially in business services: Issy-les-Moulineaux/Boulogne Billancourt (C6), Rueil/Suresnes/Nanterre (C7) and 'La Défense' (C8). Conversely, the five central Paris poles, including the CBD, saw their share of producer services total regional employment decline over the same period.

In addition to these central poles, three primary poles and one isolated pole, all located South of Paris, stand out as centers for business services: Ivry Pole (P12), 'La Plaine de Saclay' (P20), the 'Ville Nouvelle' of Saint-Quentin-en-Yvelines/Versailles (P21) and Plaisir (I34). Elsewhere, six primary poles and one isolated pole diversified their economic base, in receiving business services, but without so far emerging as business services centers: located North of Paris are La Plaine Saint-Denis (P9), Roissy airport (P18) and the 'Ville Nouvelle' of Cergy-Pontoise (P26); South of Paris are the 'Ville Nouvelle' Evry (P22), Etampes (I33), and Orly airport (P19); and finally, East of Paris are two employment poles belonging to the 'Ville Nouvelle' of Marne-la-Vallée, Noisy-le-Grand (P15) and Noisiel (I17).

All told, the results indicate that employment did indeed decentralize in the Ile-de-France region during the 1978-1997 period, and that producer services, and especially business services, acted a significant part in this process. As the suburbanization of these activities tended to reinforce a number of existing poles, this suggests that face-to-face contacts, inducing these information-dependent activities to locate together in close proximity, have not yet been supplanted by new information technologies. However, even if some suburban poles have attracted substantial business services employment, we cannot yet conclude that these poles necessarily emerge as substitutes for the CBD. The next logical step is to determine whether the business services found in these poles are similar to those found in the CBD.

SPATIAL DYNAMICS OF PRODUCER SERVICES, 1978-1997

In spite of the traditionally higher rents associated with a CBD location, one of the major reasons suggested in the recent literature for producer services agglomerating in such places is that clustering tends to minimize transaction costs. Specifically, the concentration of firms facilitates the gathering and the transmission of non-standardized

and highly complex information, and creates an information-rich environment (Cappellin, 1988; Romer, 1990; Saxenian, 1994). However, in the previous section, we found some evidence for the suburbanization of information-dependent activities during the 1978-1997 period in the Ile-de-France region and for new forms of polarization in which these activities play a central role. Thus, to understand these phenomena, we feel it is important not to consider the producer services sector as a homogenous group of activities. Indeed, the literature on producer services points out that the spatial behavior of these activities varies with the type of service relationship concerned (Daniels, 1993; Gadrey, 1994; Jouvaud, 1996).

Traditionally, the provision of services is divided into four separate stages (Vauthey, 1994): the design phase, the implementation phase, the delivery phase and the use phase. The phases during which the client and the service provider have to interact influence their need for proximity. This proximity constraint depends first of all on the service features. These characteristics include the duration of contact (service provided in part or completely at the client's location), the purpose of the contact (operational interactions involving a co-production relationship or contractual interactions involving a co-driving relationship) and its level of standardization (if the service is standardized, contact with the client occurs only during the delivery and use phases). Second, the proximity constraint also depends on the frequency of the need. In this case, the more often the client uses the service, the greater the proximity constraint.

However, client proximity is not the sole factor influencing the location of producer services. Another specific feature of this economic sector is the existence of important intra-sectoral links between its different components: more than 70% of producer services firms' intermediate purchases are other producer services (Jouvaud, 1996). This feature contributes in part to the spatial clustering of complementary producer services firms. So, it is interesting to analyze whether the suburbanization process of these activities has modified this spatial practice.

Our objective in this section is two-fold, then: first, we aim to examine whether differentiated spatial behaviors can be observed in the producer services sector. Secondly, we attempt to determine whether some specific clusters of producer services emerge in those employment poles that were identified in the previous section as containing a substantial concentration of these activities. In order to perform this part of our empirical analysis we elected to subdivide the FIRE and business service sectors into 16 employment categories: (1) Financial intermediaries (FI); (2) Insurance; (3) Insurance and Financial Auxiliaries (F&I Auxiliaries); (4) Real Estate; (5) IT Consultants; (6) Data Processing; (7) Engineering; (8) R&D; (9) Legal Services; (10) Accounting Services; (11) Opinion Polls; (12) Management Consulting; (13) Architecture; (14) Advertising; (15) Temporary Work and (16) Other producer services.

In order to identify differentiated spatial behavior of producer services activities, the respective sectoral specialization of the CBD, of Paris non-CBD locations and of the two suburban rings, in each of the 15 employment categories, were examined for 1997. We compared the location quotient computed for each employment category in each zone with that associated with the producer service sector as a whole. An area was specialized, therefore, in a producer services category if its location quotient exceeded that of all producer services (Table 4).

[Table 4 about here]

The results indicate that each zone is characterized by a specific cluster of producer services. The Paris CBD stands out as a privileged location for high-order activities, such as financial intermediaries, insurance, financial and insurance auxiliaries, legal services, accounting services, but also for advertising and temporary work. The Paris non-CBD areas specialize in financial intermediaries, insurance, R&D, legal services, accounting services, opinion polls, architecture, temporary work and other producer services. The inner ring stands out from the other locations in being specialized in IT consultants, data processing, engineering, opinion polls, management consulting, advertising and other producer services. Locations in the outer ring are more attractive for real estate, engineering, R&D, opinion polls, architecture, temporary work and other producer services. These observations suggest that suburban locations emerge as complementary opportunities for location rather than as substitutes for the central location. In particular, the Paris CBD maintains its leadership in hyper-management functions, whereas technical services (IT consultants, engineering, data processing and R&D) prefer suburban locations. The Paris non-CBD zones emerge as intermediate areas specializing in high-order services and more standard services.

Examination of employment pole specialization in producer services employment provides insight into this analysis by ring. The new geography of activities and employment in the Ile-de-France region is characterized both by a polarization of producer services in a small number of employment centers and by a different specialization of these centers. A clear diversification in the attraction of territories is observed in the Ile-de-France region, corresponding to specific functions of the metropolitan production system. First, some poles receive office-based high-order services functions, like financial intermediaries, insurance, insurance or financial auxiliaries, legal services, accounting services, management consulting or advertising. These functions are concentrated in the CBD and in a few nearby suburban communes in the West, that is in 'La Défense'. The westward spread of producer services from the CBD is also reported in previous studies of Ile-de-France (Bekouche and Vire, 1998; Alvergne Shearmur, 1999; Shearmur, Alvergne, 2002).

Nevertheless, this shift of some commanding functions toward the western part of the metropolitan region is not surprising, because it was encouraged by public policy. Indeed, all the office blocks built in Paris during the last 30 years have been located in Hauts-de-Seine, and especially in 'La Défense', in order to relieve congestion in central Paris. Thus, rather than suggesting a decline in the CBD's managerial economic role, this indicates an extension of office activities space requirements.

Second, certain other employment centers are business functional or managerial poles combining specializations in technical producer services (IT consultants, data processing and engineering) and productive functions, especially in the high-tech sector. An interesting feature is that the number of specialist technical producer services decreases with distance from Paris. Indeed, the Rueil/Nanterre/Suresnes and Issy-les-Moulineaux/Boulogne-Billancourt employment poles, surrounding the western part of Paris's inner beltway, and the 'Ivry' employment pole, adjacent to the southern part of Paris inner beltway, are specialized in three technical producer services: IT consultants, data processing and engineering. Two poles located farther out in the south-western part of the metropolitan region stand out as specialized centers in two technical producer activities: IT consultants and engineering. Finally, the two 'Villes Nouvelles' of Evry and Cergy-Pontoise are specialized exclusively in engineering.

Third, a number of other poles are reception poles for transport functions and the wholesale trade, like Roissy and Orly airports, which are specialized in other producer

services (security services, rental services, mailing services, packaging services, cleaning services, computer maintenance services...).

In fact, a more structured and more polarized employment geography emerged in 1997, indicating that face-to-face contacts, and thus tacit information, remain a key component in decisions about the location of producer services. However, as tacit and codified information are complementary in the workings of producer services, we can justifiably wonder about the impact of telecommunication facilities on current producer services concentrations.

SUPPLY IN TELECOMMUNICATION FACILITIES AND THE POSSIBLE STRENGTHENING OF THE EXISTING CENTERS

The distinction between tacit information and codified information is a key to understanding the persistence of the proximity constraint despite advances in information technologies. It also explains the suburbanization of standard services, which rely largely on codified information.

However, this simplification is not entirely satisfactory and does not capture all the consequences of information technologies for the spatial organization of activities. In fact, the two types of information are complementary. First, the complementarity is organizational. For example, when a project involves several partners, this collaboration implies several sequences of tacit and codified information exchange. Face-to-face contacts may be planned by phone or e-mail and those face-to-face contacts may be followed up by formal up-dates by phone, fax or e-mail (Gaspar and Glaeser, 1998).

Second, the complementarity is decisional (Guillain, 2000). The high-order services not only use tacit information but also codified information in order to reduce uncertainty. For example, firms look for macro-economic data about the economic climate, the market, economic policies, etc. This does not mean that tacit information is not important in decision-making. Indeed, in an increasingly complex economy, tacit information exchanges between agents may help in interpreting codified information. The financial market is a good example of this complementarity between the two types of information. An increasing number of agencies (like Reuters, Bloomberg, AP Dow Jones) now provide financial analyses, company accounts, economic reports, etc. A wealth of codified information is available for the financial institutes, but face-to-face contacts are still useful when it comes to interpreting this information. 'Its complexity and uncertainty, [...], has driven the denizens of the City toward having to construct a more and more structured space of face-to-face interaction/interpretation' (Thrift, 1996).

As a consequence, information-dependent activities locate in places where they can maximize the collection of tacit and codified information, that is, places with telecommunication equipment.

In Ile-de-France, firms have access to a well-developed network of telecommunication technologies. The territory is well covered and the network is modern with optical fibers allowing very high-volume information exchanges (IAURIF, 2001). First, this is because France Telecom was a state monopoly: the supply of telecommunication facilities was conducted in line with an equity-based strategy, that is to say France Telecom was compelled to satisfy demand from all potential users. Second, different programs in telecommunication research such as 'Francilienne des Télécommunications' and 'Réseau Recherche Ile-de-France', initiated by the

authorities, helped improve the quality of the network during the 1990s (IAURIF, 2001).

With the deregulation of the telecommunication market in 1998, a number of operators invested in Ile-de-France and this competition has resulted in uniform prices internationally (Rallet, 1999a). However, competition between operators could lead to a reinforcement of the polarization identified in section 4. Indeed, when we speak of low-cost information exchanges by information technologies over long distances, we are referring to variable costs not fixed costs. Telecommunication technologies use complex physical infrastructures including real estate, which implies large investments in capital and innovation.

In a competitive environment, the priority for the telecommunication operators is to make their investments profitable. They therefore concentrate their services in places of high demand (Moss, 1987; Sassen, 1991; Daniels, 1993; Graham and Marvin, 1996). Our data cannot capture this phenomenon but this tendency seems to be going on today: 40 operators hold licenses to offer services in Ile-de-France. However, supply seems to be limited to the 'Petite Couronne' and more specifically to the area around 'la Défense' (Rallet, 1999a; IAURIF, 2001.). This may lead to a lock-in process in the choice of localization because firms will always prefer places with modern telecommunication facilities, unless, for example, the authorities help operators to set-up in places where demand is lower by proposing joint investment projects.

CONCLUSION

Our study confirms that economic activity in the Paris metropolitan area is arranged in multiple centers, as it is in most cities in the industrialized world (Anas et al., 1998; Shearmur and Coffey, 2000).

Our aim was to determine whether this process was the result of advances in information technologies. It is clear that employment has decentralized from the CBD toward the suburbs. However, economic activity is not uniformly distributed throughout Ile-de-France. On the contrary, economic activity clusters in new employment poles, suggesting that face-to-face contacts are still important for information exchanges and remain a localization factor.

Analysis of the sectoral composition reveals that the poles are dissimilar, specializing in different economic activities, especially in the case of high-order services. The poles seem to be complements rather than substitutes. Three tendencies are identified:

First, the center of Paris and the pole of 'La Défense' mainly attract financial intermediaries, insurance, financial and insurance auxiliaries, legal services, accounting services, management consulting and advertising. However, the two poles are not strictly in competition with one another even if high-order services employment seems to have shifted from the center toward 'La Défense', which therefore appears to be the new CBD of Paris. Indeed, the center of Paris is more highly specialized in the provision of financial intermediaries, insurance, financial and insurance auxiliaries and legal services whereas 'La Défense' is more oriented toward the provision of accounting services, advertising and especially management consulting. So, management functions still cluster in the center of Paris and its immediate western fringe, although new employment poles have emerged.

Second, 'La Défense' differs from central Paris in that it specializes in the high-tech industry. This industry is concentrated in five major poles: in 'La Défense' and its

immediate vicinity (Rueil/Suresnes/Nanterre), in the 'Ville Nouvelle' of Saint-Quentin-en-Yvelines/Versailles, in 'La Plaine de Saclay' and in the Ivry pole, and to a lesser extent, in the 'Villes Nouvelles' of Cergy and Evry. Engineering and IT consultants seem to be attracted by this high-tech environment even if IT consultants are not found in Evry.

Third, the two airports are specialized in logistics (transport and wholesale trade) and in ordinary services (security services, cleaning services, rental services, mailing services, packaging services, computer maintenance). Roissy airport is characterized by the presence of temporary work agencies and management consultancies, which may be because Roissy is the newer of the airports and handles more traffic than Orly.

This particular distribution of high order services in different poles suggests that high order services are not a homogeneous sector with uniform needs of information, a point that is not considered in Ogawa and Fujita's models. As a consequence, not all services have incentives to be located in close geographic proximity to all the high order services. The geographical proximity between certain categories of high order services seems to be more important than their proximity to all producer services. For example, financial services are more sensitive to locations close to accounting and legal services than to engineering services because of strong informational complementarity between these activities and more frequent face-to-face contacts (IAURIF, 1998).

The fact that the poles are located close to the RER-SNCF lines and to the highways into the Ile-de-France reinforces this hypothesis. A similar situation is observed in North American cities (Coffey and Shearmur, 2000). A relative specialization of the centers may be considered with cluster of activities, which present strong informational complementarity and frequent face-to-face encounters. The activities located in any given center may maintain ties with other centers, owing to less important informational complementarity and reduced need for face-to-face contacts.

In this context, information technologies may play an indirect role in the localization of high order services. High order services will prefer centers with a good network of telecommunication facilities and with real estate infrastructures adapted to the installation of these telecommunication technologies (Longcore and Rees, 1996). The development of employment centers in 'La Défense' and in the 'Villes Nouvelles' may reflect this process. The two regional plans in 1965 and 1994, designed to reduce the excessive growth of Paris by proposing new office space in 'La Défense' and in the 'Villes Nouvelles', influenced the pattern of suburbanization in Ile-de-France. Today 'La Défense' and most of the 'Villes Nouvelles' appear to be dynamic centers, offering good quality office facilities. This further suggests that public policies may have an effect on urban structure, which Shearmur and Coffey (2000) claim account for the differences in the patterns observed in Canadian cities.

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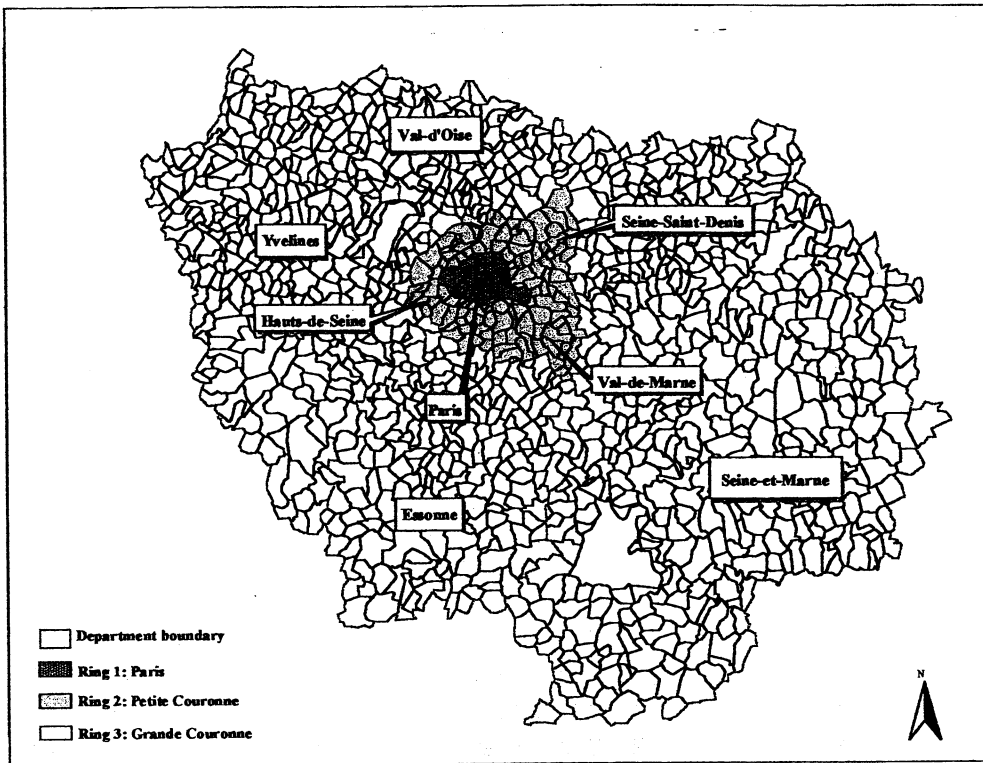


Fig. 1. Rings geography in Ile-de-France

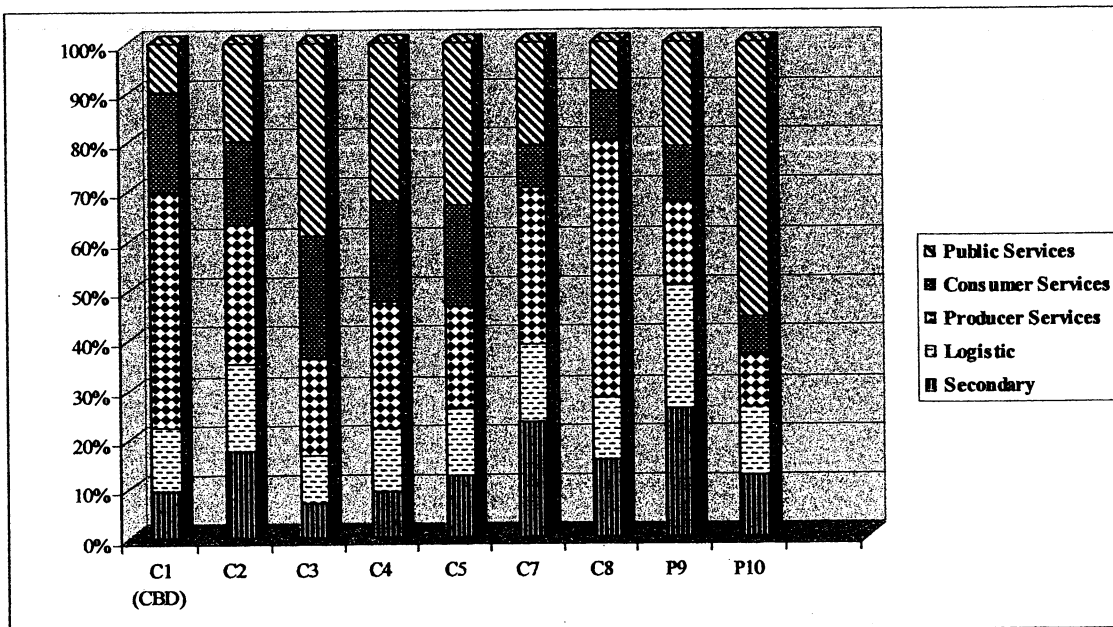


Fig. 2. Average economic profiles of the CBD poles

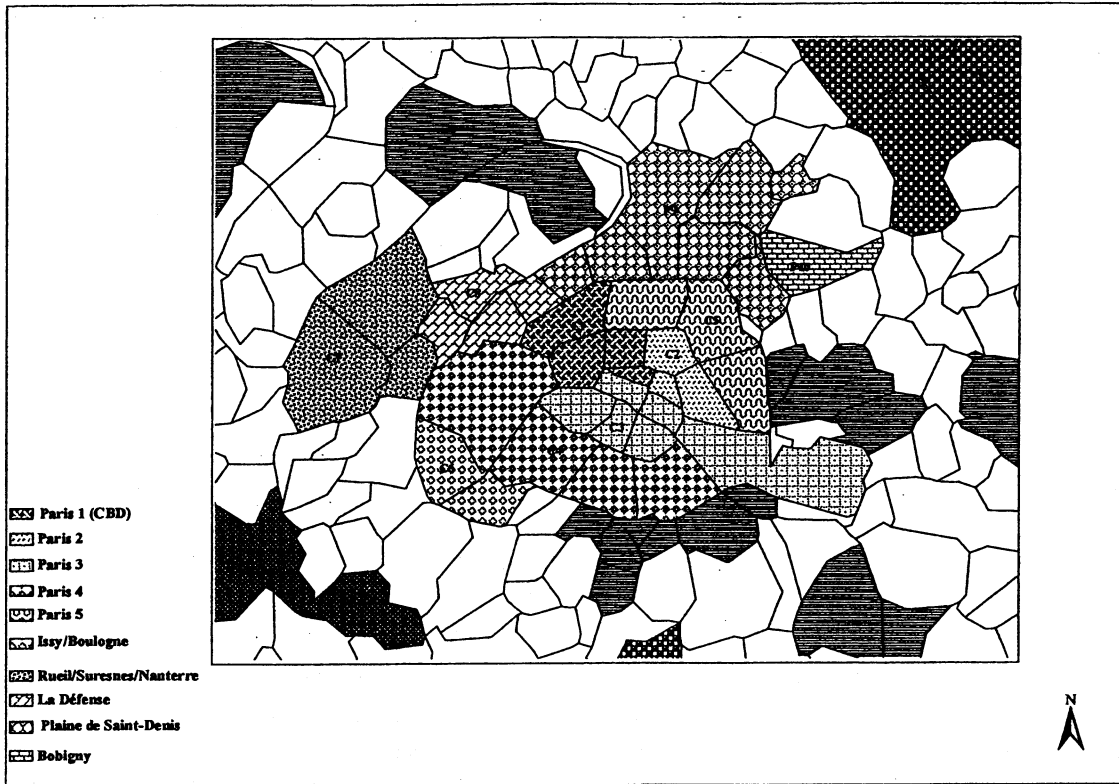


Fig. 3. Employment poles in Ile-de-France central part

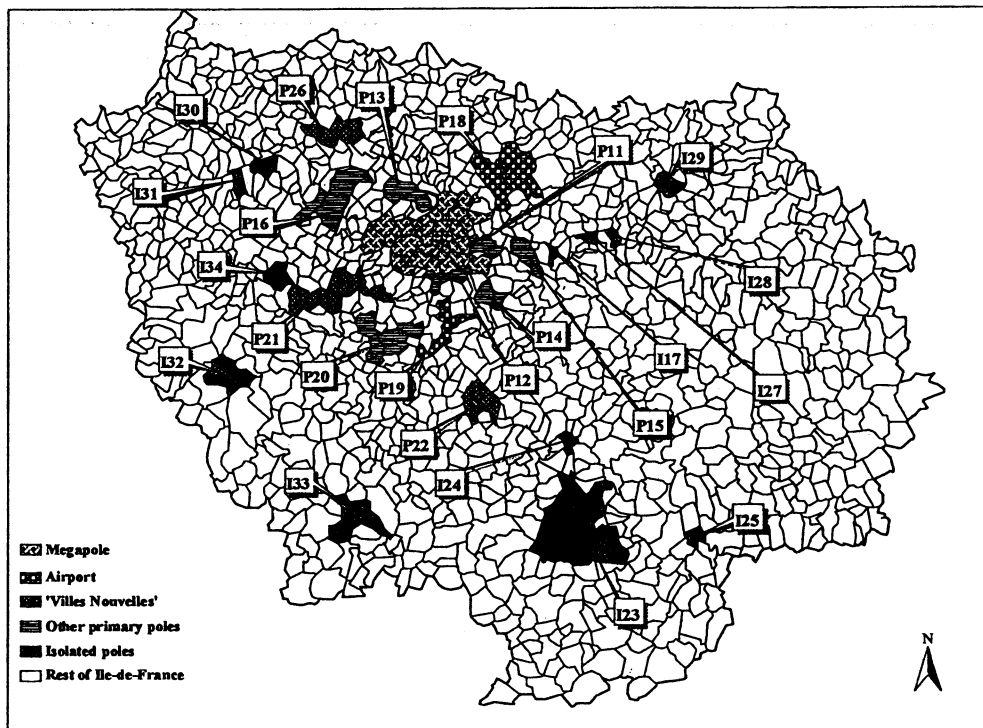


Fig. 4. Employment poles in Ile-de-France region

TABLE 1.—COMPOSITION OF EMPLOYMENT POLES IN TERMS OF COMMUNES AND DISTRICTS

Poles	Composition
C1	2è, 8è, 9è et 17è arrondissements de Paris (CBD)
C2	3è, 10è et 11è arrondissements de Paris
C3	1er, 4è, 5è, 6è, 7è et 12è arrondissements de Paris
C4	13è, 14è, 15è et 16è arrondissements de Paris
C5	18è, 19è et 20è arrondissements de Paris
C6	Issy-les-Moulineaux et Boulogne-Billancourt
C7	Rueil, Suresnes et Nanterre
C8	Neuilly, Levallois-Perret, Puteaux et Courbevoie
P9	Clichy, Le Bourget, La Courneuve, Pantin, Aubervilliers, St Denis et St Ouen
P10	Bobigny
P11	Bagnolet, Montreuil, et Fontenay-sous-Bois
P12	Charenton-le-Pont, Montrouge, Arcueil, Gentilly, Ivry, Kremlin-Bicêtre et Cachan
P13	Gennevilliers et Argenteuil
P14	Créteil et Bonneuil-sur-Marne
P15	Neuilly-sur-Marne et Noisy-le-Grand
P16	St Germain-en-Laye et Poissy
I17	Noisiel
P18	Tremblay-en-France, Roissy-en-France, Gonesse, Aulnay-sous-Bois et Villepinte
P19	Longjumeau, Morangis, Paray-Vieille-Poste, Rungis, Chevilly-la-Rue et Orly
P20	Les Ulis, Orsay, Villebon-sur-Yvette, Saclay, Palaiseau et Massy
P21	Trappes, Montigny-le-Bretonneux, Guyancourt, Versailles et Velizy-Villacoublay
P22	Courcouronnes, Evry, Corbeilles-Essonnes et Lisses
I23	Fontainebleau
I24	Melun
I25	Montereau-Fault-Yonne
P26	Cergy, Pontoise, et St Ouen l'Aumône
I27	Lagny-sur-Marne
I28	Chessy
I29	Meaux
I30	Les Mureaux
I31	Aubergenville
I32	Rambouillet
I33	Etampes
I34	Plaisir

TABLE 2.—CHANGES IN EMPLOYMENT SHARE BY RING IN NINE SECTORAL EMPLOYMENT CATEGORIES

	1978				1997			
	Paris	Inner ring	Outer ring	Total	Paris	Inner ring	Outer ring	Total
Industry	26.78%	41.84%	31.38%	100%	23.35%	34.10%	42.56%	100%
HT Industry	27.00%	48.49%	24.52%	100%	15.58%	42.03%	42.39%	100%
Construction	46.46%	33.47%	20.07%	100%	14.18%	44.73%	41.08%	100%
TUC	24.57%	45.77%	29.65%	100%	31.75%	38.85%	29.40%	100%
Wholesale	42.62%	38.65%	18.73%	100%	21.61%	44.67%	33.72%	100%
CS	47.44%	28.35%	24.21%	100%	41.18%	27.71%	31.11%	100%
FIRE	76.96%	16.05%	6.99%	100%	59.72%	28.06%	12.22%	100%
BS	59.89%	25.65%	14.46%	100%	37.02%	39.30%	23.67%	100%
PS	38.51%	33.78%	27.71%	100%	31.27%	34.53%	34.20%	100%
Total	41.14%	35.54%	23.32%	100%	32.40%	36.13%	31.47%	100%

TABLE 3.—REGIONAL EMPLOYMENT SHARE BY POLE

	Total central poles		Total primary poles		Total isolated poles		Rest of Ile-de-France		Total poles	
	1978	1997	1978	1997	1978	1997	1978	1997	1978	1997
Industry	41.13%	32.85%	25.70%	25.50%	6.26%	6.86%	26.91%	34.79%	73.09%	65.21%
HT Industry	39.65%	27.11%	25.07%	31.09%	2.11%	3.31%	33.17%	38.49%	66.83%	61.51%
Construction	55.65%	24.07%	26.12%	23.14%	1.60%	2.58%	16.63%	50.21%	83.37%	49.79%
TUC	34.99%	40.75%	21.75%	30.76%	2.56%	1.72%	40.70%	26.77%	59.30%	73.23%
Wholesale	49.32%	33.15%	23.42%	31.90%	1.46%	1.46%	25.79%	33.48%	74.21%	66.52%
CS	53.47%	47.63%	16.30%	17.08%	2.47%	3.55%	27.77%	31.75%	72.23%	68.25%
FIRE	82.48%	70.39%	7.50%	14.90%	1.34%	2.39%	8.68%	12.31%	91.32%	87.69%
BS	70.90%	56.01%	11.90%	21.39%	1.44%	1.70%	15.76%	20.90%	84.24%	79.09%
PS	44.00%	37.01%	20.44%	23.69%	3.5%	4.05%	32.07%	35.25%	67.93%	64.75%
Total	50.23%	42.86%	20.18%	23.43%	2.72%	3.06%	26.88%	30.65%	73.12%	69.35%

TABLE 4.— LOCATION QUOTIENTS BY ZONE IN 1997

	CBD	Paris non-CBD	Inner ring	Outer ring
FI	3,45	1,02	0,76	0,49
Insurance	4,22	1,06	0,80	0,18
F&I Auxiliaries	4,43	0,72	0,79	0,37
Real Estate	1,80	0,99	0,98	0,78
IT consultants	1,14	0,89	1,40	0,57
Data processing	0,94	0,86	1,56	0,47
Engineering	0,88	0,65	1,23	1,02
R&D	0,27	1,15	0,91	1,22
Legal services	3,25	1,45	0,49	0,56
Accounting services	2,57	1,06	0,91	0,57
Opinion polls	1,60	1,03	1,04	0,75
Management consulting	1,82	0,76	1,23	0,65
Architecture	0,94	2,00	0,66	0,69
Advertising	2,06	0,92	1,30	0,38
Temporary work	2,50	1,21	0,71	0,71
Other producer services	1,03	1,09	1,05	0,87
Total PS	1,99	0,99	1,02	0,67