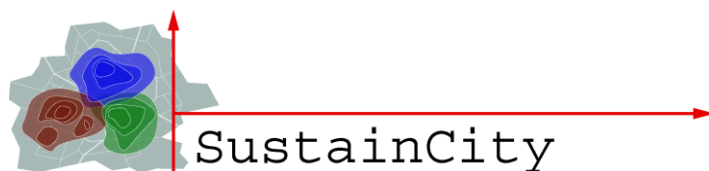

Working Paper 3.7

**Firmographics: Guideline for implementation in
UrbanSim and for estimation**

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Firmographics: Guideline for implementation in UrbanSim and for estimation

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Abstract

This working paper is a part of the SustainCity Project and focuses mainly on modeling firmographic events in Ile-de-France including the differences by sectors. A clear understanding of behavior of establishments over time is crucial in forecasting the development of the region, and related land use and transportation issues. The changes in business units affect the spatial distribution of jobs and economic activities in the urban areas. To describe the life cycle of the establishments, we propose threefold firmographic model which explains the disappearance, evolution and location choice of the business units. We also compute the creation rates across various activity sectors and all counties of Paris Region to get possibly the most detailed overview of changes of the business units.

Keywords

Firmography; Discrete choice models; Location choice; Spatial econometrics; Paris area

Preferred citation style

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Executive summary

Working Paper 3.7 *Firmographics: Guideline for implementation in UrbanSim and for estimation* is a part of the SustainCity Project and focuses mainly on modeling firmographic events in Ile-de-France including the differences by sectors. Paris Region is one of the most important metropolises in the world with 11.7 million inhabitants and over 5 million jobs (de Palma et al., 2005). A clear understanding of the behavior of establishments over time is crucial in forecasting the development of the region, and related land use and transportation issues. The changes in business units affect the spatial distribution of jobs and economic activities in the urban area. These processes are of great interest for both scientists and policy makers. Firmographic models, which we build, may provide a useful tool to develop policies which encourage sustainable economic growth and preserve social systems.

The term firmography, by analogy with demography, can be assigned to a fourfold model which includes establishment birth, its re/location, variation in the number of jobs within establishment, and its ultimate destruction. Consistently with available data, we propose some theoretical models which describe three stages of the establishments' life cycle: disappearance of the establishments, evolution of the workforce within the stable units and location of new establishments. To get an overview on the first stage of the establishment life cycle, the birth of the establishment, we compute the creation rates across eleven activity sectors for each county of Ile-de-France.

The Paris Case Study which concerns firmography may be divided into three main parts: the descriptive statistics of the employment data gathered at the level of establishment (ERE data source is used). The second stage consists in the estimation of the above mentioned firmographic models. In this stage, we use also other sources of the data: IAU-MOS which includes the information on the land use; Côtes Callon data on real estate prices; the information on accessibility to public transport and travel time data was obtained through MODUS; local population and workforce characteristics were gathered through INSEE. The data used for the estimation of the models are gathered at the *commune* level. The final stage of the Paris project (which is out of the scope of WP. 3.7) is the implementation of these new firmographic models from SAS to OPUS/UrbanSim.¹

Business life cycle can be analyzed at the level of firm or establishment. Within a firm, one or more local business establishments or plants can exist. The research is carried out at the estab-

¹ It is presented in Working Paper *Firmographics: Initial module for UrbanSimE*.

lishment level. The distribution of establishments is analyzed by different categories: size type (size of an establishment can be measured as a total number of employees of both genders. The majority of the establishments in Ile-de-France can be classified as micro establishments); activity sector (all the establishments are divided into eleven activity sector groups: Agriculture, Industry, Construction, Commerce, Transport, Financial activities, Real estate activities, Business services, Personal services, Education, health, social actions and Administration); governance type (there are three types of establishments in the ERE database: private, public and semi-public); and county (Paris Region is divided into eight *départements* which cover Paris city and the suburbs).

In the first part of the report (descriptive statistics of the employment data), we use the information about all the establishments registered in the ERE database. The initial and the final periods, year 1997 and 2001, are treated separately, and for each of them, we present a static picture of a situation in the market at a particular time. In 1997, 284,739 establishments are registered with the total number of employees equal to 4,721,162. In the final year, 292,999 establishments are registered in Ile-de-France where 5,163,515 employees work.

We examine the changes in the number of establishments created or destroyed through the processes that occur between two observation time points. Overall, the creation rate accounts for 41.1% and the destruction rate is equal to 39.4%.² Creation and destruction rates are computed also at the employment level. The increase in the number of employees between two analyzed periods is due to: (1) the creation of new establishments and (2) the growth of the existing ones. By analogy, the decrease in employment is caused by (3) closures of the establishments and (4) the shrinkage of the existing business units. Taking into consideration above mentioned events, we compute the creation and destruction rates for the workforce. We obtain the creation and destruction rates equal to 30.0% and 27.3%, respectively. We compute the creation and destruction rates also by different categories, such as: size-type of the establishment, activity sector and *département* where the establishment is located. Interestingly, when we look at the relative differences between the creation and destruction rates, we can observe that bigger establishments are more stable since this difference tends to increase with the establishment's size. From the creation and destruction rates computed across *départements* for each activity sector, we register an increasing trend in the number of establishments and employees in most of the sectors. Only in Industry sector and Agriculture, both number of institutions and workers fall down rather significantly. By looking also at the magnitude of the

² Creation rate is calculated as a number of establishments created after 1997 which still exist in 2001, to the total number of establishments in 2001. Destruction rate shows the percentage of the establishments which were destroyed after 1997 and were not in the market in 2001, to the total number of establishments in 1997.

changes, we can conclude that the greatest positive changes are noticed in Business services, Transport and Personal services.

In this report, we estimate firmographic models to understand which factors have the most significant influence on the establishments' behavior. We present three models with equations, short description of the variables used to run the models and the interpretation of the results.

We use the binary probit to model disappearance of the establishments. An establishment is considered as a "dead one," if it was in the market in the initial year and is not observed any more in the final year. The death of the institution is registered in two cases, when the establishment is closed and when it relocates.

We run log-linear regression models to describe the evolution of the number of employees within stable establishments. A stable establishment is an establishment which is observed in the market in both analyzed periods. The evolution model describes the growing or shrinking behavior of the establishment. Final workforce is a function of the initial workforce and the variables which represent the socio-economic characteristics of the population and employees living in the surrounding of the establishment.

We estimate the parameters of the location choice model for newly born units using multinomial logit model. Every establishment can choose a location from the set of all available locations in Ile-de-France. Therefore, the possible choice set is large. To deal with the problem of high number of alternatives, we propose to randomly sample a set of nine alternatives with a uniform distribution (McFadden, 1974, 1981). Each possible location has attached some utility. The establishment chooses a particular location if its expected utility is higher than all the expected utilities associated to other locations.

The variability of the disappearance of the establishments in Transport and Administration sectors is explained the most fully. Construction and Transport evolution models have the highest adjusted R^2 . The explanation of variability of the location choice is the highest for Construction and Industry sectors.

In the disappearance model, we can observe a growing chance of the survival with establishment's size. Low education has a very strong positive effect on the survival of establishments in Industry and Construction. On the other hand, well educated workers accelerate the evolution of the establishments in Business services and Real estate. Establishments tend to locate in the close proximity to population and establishments operating in the same sector (it is not the case only for Education, health, social actions sector). We can observe that children dis-

courage the establishments in Commerce and Personal services but attract the openings of new establishments in Education, health, social actions. Location in La Défense festinate only the evolution of the financial establishments. Paris itself has a strong, however mixed effect on the survival rate of establishments in general. Easy access to train and metro stations is a strong incentive for all types of establishments and this effect is stronger in the case of metro stations than trains. Increasing average travel time spent in the public transport has a negative effect on the location choice for all the establishments' types. Professional tax has a mixed but always significant effect on the establishment's disappearance and negative effect on the units' evolution, especially on those operating in Business services, Real estate and Commerce. Area available to meet new employment in a short run can be seen as an incentive when choosing a location in the market. Business establishments tend to locate close to the highways and the opposite phenomenon can be observed in the case of Personal services.

1 Introduction

Paris Region is one of the most important metropolises in the world, one of the engines of the global economy. It is Europe's most populated region. In the area equal to 2.2% of the whole surface of France, over 18% of the population of the country lives (11.7 million) creating GDP at the level of EUR 552,100 million³ which is almost one third of the GDP of France. Its GDP is the fifth-largest in the world, just before London, and after the urban areas of Tokyo, New York, Los Angeles and Chicago.⁴ Paris Region's economy is dynamic, innovative and competitive. Ile-de-France is Europe's biggest employment base with over 50% of French executives living in the area. Big fraction of senior professionals is due to the high density of company headquarters located in Paris Region.⁵ However, Paris Region economy is also diversified. Over 5 million jobs are distributed across the region. Ile-de-France is divided into eight counties (*départements*) and these into 1300 *communes* which cover Paris City and the suburbs. Very large differences in population density can be observed between Paris (25000/km²) and the outer periphery (1000/km²).

Based on the English experience of new towns, during the 1960s and 1980s, the French government created *villes nouvelles* on the outer ring of the Paris suburbs in order to multi-polarize the economy of the city (Combes et al., 2011). However, *villes nouvelles* experiment showed the limits of the policy of developing population centers since economic activities still remain in a large measure concentrated in the middle of the urban area of Paris Region, namely, Paris City and Hauts-de-Seine.

As discussed at the Round Table hosted at the OECD Meeting in December 2011, recent trends, between 1990 and 2006, show rapid growth on the periphery, yet many issues remain to be solved to improve the situation in the suburbs on the outer ring. The *Grand Paris* Project from 2011 aims to link major territorial development contracts (Confluence Seine-Oise, Est de la Seine-Saint-Denis, Est-parisien Cité Descartes, Gonesse Val de France, La Défense, Le Bourget, Plateau de Saclay, Roissy-Villepinte-Tremblay, Saint-Denis Pleyel and Biotechnologies Seine-Aval) in Ile-de-France and support their growth. The project is estimated to generate 1.5 million population and 1 million jobs by 2030 and costs around EUR 20 billion. Ex-

³ Source: INSEE, 2009.

⁴ PriceWaterhouseCoopers, "UK Economic Outlook, March 2007", p. 5. "Table 1.2 - Top 30 urban agglomeration GDP rankings in 2005 and illustrative projections to 2020 (using UN definitions and population estimates)."

⁵http://www.paris-region.com/ard/paris-region-economic-developpement-agency/paris-region-s-economy/the-key-success-factors/the-key-to-success-4315.kjsp?RH=ARD_EN.

periment *villes nouvelles* and the level of funds dedicated to the *Grand Paris* Project show that Paris Region is spatially unbalanced.

Working Paper 3.7 *Firmographics: Guideline for implementation in UrbanSim and for estimation* is a part of the SustainCity Project and focuses mainly on modeling firmographic events in Ile-de-France including the differences in the distribution of employment across space in various activity sectors. A good understanding of the establishment's behavior over time is important when one tries to forecast the development of the region. The changes in business units influence the spatial distribution of jobs and economic activities in the urban areas. Recently, both scientists and policy makers has shown a big interest in these processes. Firmographic models may be a useful tool to develop policies which encourage sustainable economic growth and preserve social systems.

Various studies attempt to indicate how different factors, such as labor accessibility, accessibility to population and potential or existing customers, land-use, real estate characteristics, economic sector and establishment's size affect the probability of all the stages of business life cycle.

To cover the most urgent issues in the firmographic field, we will proceed as follows: the first part of the paper (section 2) presents a theoretical background on location theory and New Economic Geography. In section 3, we describe the employment data. In this step, we use the information about all the establishments registered in the ERE database in 1997 and 2001. In the further steps of analyses, we show how to compute the creation and destruction rates at the level of establishment and employment (section 4) and we estimate the firmographic models (section 5). In the final part of the paper, we interpret the results and draw the conclusions.

2 Theoretical background

There is a long history of spatial analyses in economics. Modern location economics began with the contribution of an agronomist, von Thünen (1826), who developed an Agricultural Land Use Model to describe the relationships between production costs, market prices and the transport costs. In his model, agricultural land users maximize their productivity which depends on their distance from the market on the following assumptions: there are no influences on the isolated state; the state is flat (with no rivers or mountains) and surrounded by the unoccupied space; the climate and the quality of soil are the same across the state; and there are no roads. However, already in 1809, Ricardo introduced the Law of Rent, claiming that the rent of a land parcel equals to the economic advantage obtained by using the site in its most productive way, relative to the advantage from using marginal land for the same purpose, given the same inputs of labor and capital. This law is considered as a vitally important principle of economics with a number of implications.

In the very beginning of XX century, the focus was directed from the agricultural to the industrial sector. Weber (1909) formulated a Theory of Industrial Location stating that firms locate in a site of minimum transport and labor costs. When choosing a location, firm should analyze factors, such as: material index, labor (unskilled and highly skilled professionals) and agglomeration and deglomeration phenomena. According to Hotelling (1929), at equilibrium, two firms locate at the center of the demand segment (principle of minimum differentiation). He claims that it is rational for producers to make their products as similar as possible to each other. Vickrey (1964) and Salop (1979) proposed a circular model to study the impact of parameters (transportation cost, fixed or variable cost) on the number of firms and industry. More than two firms case can be treated in the Circular-City Model of Vickrey and Salop. Circular-city is symmetric at any point, so symmetric outcome exists for oligopoly. Thanks to this assumption, Vickrey-Salop Model becomes a useful tool for analyzing oligopoly markets. The Linear Spatial Model of Hotelling was later on extended also by many other authors. D'Aspremont et al. (1979) formulate Two-Stage Location-Price Model, where firms choose locations and then face price-setting competition. Within the framework of de Palma et al. (1985), products are differentiated and the individual choices are probabilistic, rather than deterministic as in the original Hotelling Model. Jehiel (1992) and Friedman and Thisse (1993) claim that firm chooses location and then price. Mai and Peng (1999) assume that firms can communicate and introduce cooperation between them in the form of information exchange.

Christaller's Central Place Theory (1933), developed more deeply by Lösch (1940), describes the spatial patterns of urbanization and explains why there is a hierarchy of urban centers. Hierarchy is explained by Heilbrun (1992) as "a systematic arrangement of the classes of an object." In the Central Place Theory, an economic center plays the role of an object. Theory explains relations between a central place, which is a place of higher order, and the lower order places. A central place is a settlement which provides services for the population who live in the surroundings. The services can be of high (specialized services, such as universities) or of low order (grocery shops). High order services make the lower order services locate around them, but not the other way round. However, due to the strict assumptions imposed by Christaller (the surface is flat, the population is evenly distributed, transportation costs are equal in all directions and proportional to distance, the consumers have similar purchasing power and that there is a perfect competition in the market), his model does not hold in reality.

Encouragement of Isard for economists, geographers, sociologists, land planners causes a further dynamic development of the theories of urban and regional phenomena. Isard is a founder of the field of Regional Science and work on the methods of regional analysis.

The stream of literature which deals with urban development models, in particular, transport-land-use interaction models was developed by Alonso (1964), Mills (1967) and Muth (1969). It has led to several monocentric and then polycentric models. Alonso (1964) formulates Spatial Equilibrium Model which was extended by Muth (1967) and Mills (1969). The main assumption of the AMM Model is that housing costs plus transport costs are constant across space. That is why we can observe decreasing prices with the distance to the city center. In other words, housing costs decline as transport costs rise with the distance to the city center. Their model successfully explains some urban landscape patterns. Later on, Henderson and Mitra (1994) add multiple employment centers to the AMM Model. Glaeser and Kahn (2001) claim that nowadays, employment tends to be located far from the old city center. In the areas characterized by centralized employment, the tendency of prices to fall with the distance to the city center is more significant.

Since 1990, there has been a bloom of theoretical and empirical work on the spatial aspect of the economy. The Nobel Prize in Economics awarded to Paul Krugman can be a confirmation of the importance of geographical analysis. The stream of literature initiated by Krugman (1991, 1999) is known as the New Economic Geography. NEG concentrates on uneven distribution of economic activity across space. With Venables, Fujita (1999) and many others, a new generation of models has emerged which are based on constant returns to scale and imperfect competition. It is worth mentioning also Duranton and Puga (2003) who study the

theoretical micro-foundations of urban agglomeration economies and compare different sources of agglomeration economies.

Preliminary models developed in the XIX century studied the location of agricultural production. The initial basic models seem to be too simple to be used to describe the location of firms in urban or regional areas. Also, they usually fail due to their numerous unrealistic assumptions. The focus of the models was firstly on the agricultural sector. Later on, the literature concentrated on the industrial sector, to cover finally the issues of the firms which belong to the third sector. The latest theories are quite sophisticated and capture complex interactions in the markets for land and transportation. We wish to develop an establishment location model in this paper. However, we wish to go one step further and estimate firmographic models which extend the standard location models.

3 Descriptive statistics of employment data

This working paper studies the interactions of the establishments and employment dynamics over time and across space. The changes in business units influence the spatial distribution of jobs and economic activities. Firmographic models may become a practical tool for policy makers who wish to support sustainable development of the region.

The initial steps in all kinds of analyses are collection and preparation of the data. We focus on the area of Ile-de-France. In the first part of the paper, which is the descriptive statistics of the employment data, we use the ERE data. To run the models, we use also other sources of the data. IAU-MOS is used to gather the information on the land use (distribution of parks, housing, offices, etc.). We collected Côtes Callon data on real estate prices. The information on accessibility to public transport, highways, and traffic pattern data (travel time data) was obtained through MODUS. Local population and workforce are described by various characteristics, such as socio-professional class, education level, age, financial situation. Socioeconomic data to analyze population structure and jobs evolution were gathered through INSEE. The data used for the estimation of the models are gathered at the *commune* level.

Business life cycle can be analyzed at the level of firms or establishments. Within a firm, one or more local business establishments or plants can exist (van Wissen, 2000). The research will be carried out at the establishment level. The distribution of the establishments will be analyzed by different categories: size type (section 3.1), activity sector (3.2 and 3.3), governance type (3.5) and *département* (3.6). The industry will be divided into eleven sectors, such as construction, services, commerce, education, and transportation.

This part of the working paper consists in the descriptive statistics of the employment data. In this step, we use the information about all the establishments registered in the employment database in 1997 and 2001. The initial and the final periods, year 1997 and 2001, are treated separately, and for each of them, we present a static picture of a situation in the market at a particular time. In 1997, 284,739 establishments are registered with the total number of employees equal to 4,721,162. In the final year, 292,999 establishments are registered in Ile-de-France where 5,163,515 employees work. The data for the year 1997 and 2001 are delivered in a separate data files. All together, there are 405,241 establishments whose behavior is analyzed. Among these, 112,242 establishments were destroyed (or not registered) after 1997, 120,502 establishments existed in 2001 but not in 1997 and 172,497 establishments survived from 1997 to at least 2001 (were present at both analyzed periods).

3.1 Distribution of establishments' size

Size of an establishment can be measured as a total number of employees of both genders. The number of establishments by their size which are registered in both analyzed periods (E2=1 if it is in the market in 2001 and E9=1 if the establishment is registered in 1997); the number of establishments which are registered only in one of these periods ((E2=1 and E9=0) if the establishment exists in 2001 but does not exist in 1997 or (E2=0 and E9=1) if the establishment exists in 1997 and does not survive until 2001) are presented in Table 1. Additionally, we compute the number of employees who work in these establishments. The fractions of establishments in each size category in 1997 and 2001 are presented in Figure 1.

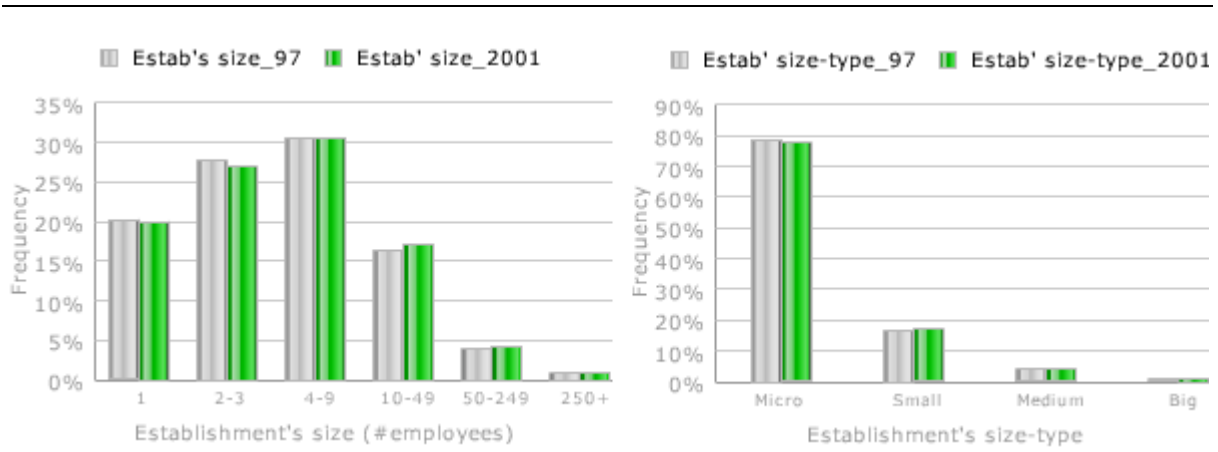
The majority of the establishments in Ile-de-France can be classified as micro establishments.⁶ In 2001, 77.55% of all the establishments hire 1-9 employees. In 1997, this percentage is similar and is equal to 77.61%. Small establishments (10-49 employees) account for 17.17% of all the establishments in 2001 (16.87% in 1997). There are around 4% of medium-sized units (50-249 employees) and less than 1% of big-sized establishments where 250 or more employees work.

Table 1 Distribution of establishments' size

Size type		0	1	2-3	4-9	10-49	50-249	250+	Ile-de-France
Establishment	E2=1 E9=1 (base 2001)	0	27417	44131	57090	33031	8713	2115	172497
	E2=1 E9=1 (base 1997)	60	27671	45683	57340	31726	8060	1957	172497
	E2=1 E9=0	5	31011	34930	32630	17271	3884	771	120502
	E2=0 E9=1	1091	29700	33054	29584	14999	3222	592	112242
Employment	E2=1 E9=1 (base 2001)	0	27417	107727	340194	694818	903727	1483690	3557573
	E2=1 E9=1 (base 1997)	0	27671	111658	339927	670767	833109	1398534	3381666
	E2=1 E9=0	0	31011	83639	189993	357028	390590	553681	1605942
	E2=0 E9=1	0	29700	78955	172811	311664	327074	419292	1339496

⁶ Terms: micro, small, medium-sized, etc. are normally used when we speak about the size of the enterprises. We will use these terms in the paper to describe the size-type of the establishments.

Figure 1 Distribution of establishments' size (measured as total number of employees in establishment) and distribution of establishments by type-size in 1997 and 2001



3.2 Number of establishments and employees across activity sectors

All the establishments are divided into eleven activity sector groups. The division is as follows:

- 1. Agriculture
- 2. Industry
- 3. Construction
- 4. Commerce
- 5. Transport
- 6. Financial activities
- 7. Real estate activities
- 8. Business services
- 9. Personal services
- 10. Education, health, social actions
- 11. Administration.

Sector Services (both business and personal) gathers over one third of all the establishments in both analyzed periods. In 2001, 32% of all the employees in Ile-de-France (30% in 1997) work in establishments that offer services. As can be seen in Table 2, sector Commerce gathers around one fourth of all the establishments in both analyzed periods. In 1997 and 2001, 13% of all the employees in Ile-de-France work in this sector. Next, Industry sector gathers 10%-11% of all the establishments where also around 13% of employees work. Very similar percentage of establishments and employees is classified into Education, health, social actions

sector. It is worth noticing that only 5% of all the establishments in the market belong to Administration sector. However, over 12% of workforce is registered in this sector. Agriculture is the least numerous sector, with less than 1% of establishments and less than 1% of employees appearing in the market. In the next part, we present some examples of activities in each sector.

To Agriculture sector, we can include: growing of cereals and vegetables; crop production; breeding sheep, goats, horses and pigs; hunting; fishing.

Industry sector includes over 300 various activities connected with mining, producing, manufacturing and processing different goods in general.

Activities in Construction sector are for instance: construction of individual houses, buildings, railways, undergrounds, pavements and telecommunication; electrical installation; gas and water installation; plastering; painting; renting of construction equipment.

Commerce can be represented by: retail sale and repair of motors and vehicles; retail sale and wholesale of fuel, metals, chemicals, machinery, industrial equipment; retail of furniture and household goods; retail sale and wholesale of textiles, clothing and footwear; retail sale and wholesale of food, flowers and animals; wholesale of electrical household appliances; wholesale of perfume, cosmetics and pharmaceuticals; wholesale of construction materials, sanitary equipment, computers, office equipment; retail sale of books, newspapers, watches, jewelry; supermarkets, hypermarkets and department stores; mail order catalogs; repair of footwear, leather, consumer electronic equipment, personal and household goods, watches and jewelry.

Transport activities are among others: rail transport; urban passenger transport; scheduled passenger transport by roads; taxis; hire of trucks with drivers; shipping; coastal transport; maritime and river services; airport services; cold storage.

Financial activities include banks; saving institutions; insurance companies; pension funds; administration of financial markets.

Real estate activities are: activities of real estate agents; rentals and sale of housing and lands; management of residential buildings.

To Business services sector belong: national post; telecommunication; radio and television transmission; short- and long-term rentals of land, water and air transport's means; rentals of machinery and construction equipment; rentals of office machinery, computers and their repair; data processing; research and development; photographic activities; advertising agen-

cies; cleaning activities; packing; translation; call centers; removal and treatment of household and water waste; organization of fairs and exhibitions.

Personal services are the following ones: tourist accommodation; restaurants; fast food restaurants; drinking places; nightclubs; film production; production of television and radio programs; artistic activities; news agencies; library management; management of sport facilities; laundry; coiffeur; beauty salons; spa.

Education, health and social actions sector gathers the establishments, such as primary, secondary, technical and high-schools; driving schools; hospitals; institutions which are involved in the medical and dental practice; veterinary activities; nursery; childcare; and homes for disabled and elder people.

Foreign affairs, defense, justice, police, social distribution of income, union trades, religious organizations, political organizations are included in Administration sector.

Table 2 Percentage of establishments and employees across sectors in 1997 and 2001

Sector name	Sec	Establishment		Employment	
		1997	2001	1997	2001
Agriculture	1	0.07%	0.05%	0.07%	0.30%
Industry	2	10.8%	9.8%	13.6%	12.5%
Construction	3	8.1%	8.5%	4.6%	4.4%
Commerce	4	24.2%	23.7%	13.3%	13.2%
Transport	5	3.1%	3.2%	5.4%	5.7%
Financial activities	6	3.5%	3.3%	5.2%	5.2%
Real estate activities	7	3.2%	3.3%	1.7%	1.5%
Business services	8	18.6%	19.9%	21.0%	22.8%
Personal services	9	14.8%	15.0%	8.6%	8.8%
Education, health, social a	10	8.9%	8.6%	14.4%	13.8%
Administration	11	4.8%	4.8%	12.4%	12.0%

Figure 2 Distribution of establishments across sectors in 1997 and 2001

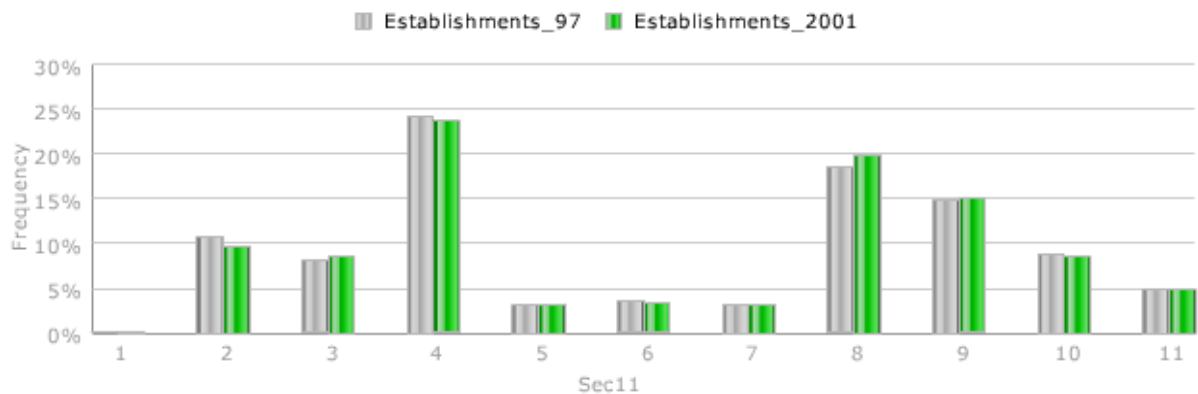
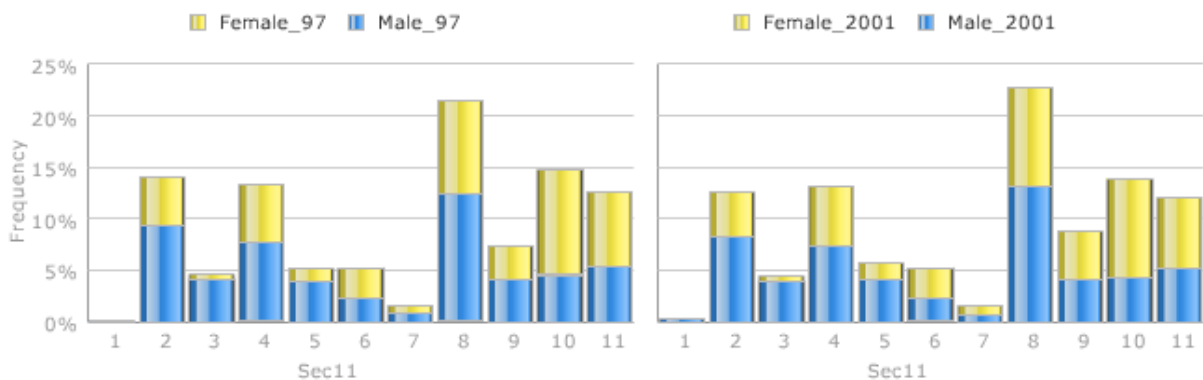


Figure 3 Distribution of employees by gender across sectors in 1997 and 2001



3.3 Male versus female worker

Sectors Commerce and Business services are the biggest as far as the number of establishments is concerned. However, also the number of employees should be taken into account. In Table 3, we present the number of male and female employees in each of eleven sectors for both analyzed periods, year 1997 and 2001. When the size of the establishment is measured as a number of employees, sector Business services turns out to be the most numerous. The establishments gathered in this sector hire the greatest number of employees of both genders which sums up to over one million people (1.027 million in 1997 and 1.173 million in 2001). Surprisingly, commerce is not at the first place any more when we look at the number of male and female workers registered in this sector. Number of employees in Education, health and social actions sector is greater than in Commerce sector and equals to over 700 thousands employees all together.

Some of the sectors are male dominated, whereas other sectors gather more female workers. In 2001, there is only one out of eleven sectors where markedly more women work. This would be sector 10, Education, health and social actions. In the sectors: Administration (sector 11), Financial activities (sector 6) and Real estate activities (sector 7), the percentage of female workers exceeds subtly the percentage of male workers. On the other hand, in the sectors, such as Agriculture (sector 1), Industry (sector 2), Construction (sector 3) and Transport (sector 5), the percentage of male employees is relatively high. From the ratios calculated in 1997 and 2001, one can notice that the discrepancy between the number of male and female employees seems to decline slightly (the ratio in 1997 is equal to 1.19 and the ratio in 2001 amounts to 1.16).

Table 3 Number of male and female employees across sectors in 1997 and 2001

Sector name	Sec	97		2001		Ratio 97	Ratio 2001
		Male	Female	Male	Female	Male/Female	Male/Female
Agriculture	1	1494	766	11897	3750	1.95	3.17
Industry	2	444938	221687	429474	216290	2.01	1.99
Construction	3	196757	21949	205615	23045	8.96	8.92
Commerce	4	363604	271865	378150	300953	1.34	1.26
Transport	5	183371	59995	211565	79708	3.06	2.65
Financial activities	6	110403	137672	119987	147345	0.80	0.81
Real estate activities	7	36064	38040	36537	42629	0.95	0.86
Business services	8	587773	439243	678532	494443	1.34	1.37
Personal services	9	199185	154905	212664	238590	1.29	0.89
Education, health, social a	10	216657	486290	218697	493439	0.45	0.44
Administration	11	254765	349036	264335	355432	0.73	0.74

3.4 Market concentration

The standard tools to measure market concentration are the concentration ratio and the Herfindahl index. The concentration of firms in a market is of interest to economists, business strategists and government agencies.

Concentration ratio, also called Gini coefficient, is based on the Lorenz curve. The concentration ratio is the percentage of the market share held by the largest firms in the market or in some particular activity sectors and shows the extent of market control of the largest firms. The concentration ratio for M largest firms in the market can be computed according to the following formula:

$$CR_m = \sum_{i=1}^M s_i, \quad (1)$$

where s_i is a market share of firm i in the market. Concentration ratio takes values from zero to one. Zero value indicates no concentration in the market and value equal to one stands for the total concentration.⁷

In accord with the formula:

$$HHI_m = \sum_{i=1}^M s_i^2 \quad (2)$$

(as above, s_i is a market share of i -th firm in the market), we can compute the Herfindahl index for M largest firms in the market. The HHI also ranges from 0 to 1. If it takes value zero, there are many small firms in the market and a perfect competition among them. If the Herfindahl index equals to one, there is a single monopolistic producer in the market. An increase of the HHI indicates a decrease in the competition and a growing market power.

Firstly, we take fifty largest establishments that operate in the market to compute the Herfindahl index for all the sectors together. It equals to 0.0088% in 1997 and increases to the level of 0.010% in 2001. Next, Herfindahl indexes are computed for each of eleven sectors for both analyzed periods. Fifty biggest establishments are taken into consideration for each activity sector. Relatively high is the concentration index for Agriculture. In 2001, the HHI for the first sector amounts to 12.47% (6.12% in 1997). The least concentrated sectors are Commerce, Business services and Construction. Almost perfect competition exists in these sectors since Herfindahl index is very close to 0% (0.011% – 0.037% in 1997 and 0.013% - 0.042% in 2001). In these three sectors, the size of establishments is the most evenly distributed comparing to the other sectors. The detailed results are gathered in Table 4.

Since the number of establishments in each sector varies significantly, we compute the Herfindahl indexes also for 0.5% of the establishments in each of the 11 sectors (taking 1%, 5%, 10% or any other fixed percentage does not change the results significantly). Market concentration indexes for the relative number of establishments are presented in the last two columns of Table 4. Even after taking some particular percentage of the establishments which exist in the market for each sector instead of taking a fixed number of the establishments to compute the sum, the ranking of the sectors by the value of the HHI is exactly the same. Still, Agriculture sector is characterized by the highest HHI and for the same three sectors as before, namely: Commerce, Business services and Construction, the index is the smallest and is very close to zero. For all the sectors except Agriculture, the value of HHI is smaller than 1%. Small indexes indicate a competitive market with no dominant players. If HHI is smaller than

⁷ Source: <http://www.businessdictionary.com/definition/gini-index.html>

0.15, the market is unconcentrated. If $0.15 \leq HHI \leq 0.25$, we have a moderately concentrated market and the value of HHI greater than 0.25 indicates a highly concentrated market.⁸ Thus, the results suggest that in Ile-de-France, the market is unconcentrated and there is almost perfect competition in all the sectors.

Table 4 Herfindahl indexes across sectors in 1997 and 2001 (for fixed number of establishments and relative number of establishments)

Sector name	Sec	Total #estab		HHI for 50 estab		0.5% estab		HHI for 0.5% estab	
		1997	2001	HHI_97	HHI_2001	1997	2001	HHI_97	HHI_2001
Agriculture	1	195	146	6.115%	12.468%	1	1	2.094%	5.561%
Personal services	9	42161	43919	0.580%	0.736%	211	220	0.585%	0.741%
Transport	5	8738	9345	0.479%	0.536%	44	47	0.475%	0.534%
Financial activities	6	10083	9747	0.302%	0.266%	50	49	0.265%	0.302%
Real estate activities	7	9065	9520	0.164%	0.181%	45	48	0.161%	0.180%
Administration	11	13735	14077	0.109%	0.097%	69	70	0.121%	0.107%
Industry	2	30777	28652	0.092%	0.088%	154	143	0.099%	0.104%
Education, health, social a	10	25344	25063	0.069%	0.080%	127	125	0.085%	0.096%
Construction	3	22913	24930	0.037%	0.042%	115	125	0.044%	0.049%
Business services	8	52884	58203	0.027%	0.019%	264	291	0.038%	0.030%
Commerce	4	68843	69394	0.011%	0.013%	344	347	0.017%	0.020%

3.5 Establishments by type of governance

There are three types of establishments in the ERE database: private, public and semi-public. In 1997, 95.63% of the analyzed establishments are private and 4.37% are public or semi-public. There is no data on the governance type of the establishments for 2001. However, when we look at the total number of employees, this fraction is utterly different. Overall, around 23% of all the employees are hired through the public (or semi-public) institutions. More interestingly, we can observe very high percentage of employees who work in the public establishments in Administration sector, Education, health, social actions sector and Agriculture. According to the available data, 80% of all the employees in Administration work in the public institutions. The fraction of workers in public establishments in Education, health and social actions sector exceeds the level of 60%. In Agriculture, this number is equal to 40%. On the other hand, the most privatized sectors are: Construction, Transport, Financial activities, Industry and Commerce, where less than 1% of the workforce belongs to the public sector.

⁸ <http://www.justice.gov/atr/public/guidelines/hmg-2010.html> 2010 Merger Guidelines § 5.3

Table 5 Fraction of employees hired in public (or semi-public) establishments in 1997

Sector name	% EMPL in public estab
Agriculture	40.4%
Industry	0.15%
Construction	0.003%
Commerce	0.14%
Transport	0.02%
Financial activities	0.11%
Real estate activities	13.5%
Business services	14.6%
Personal services	5.3%
Education, health, social a	63.5%
Administration	80.0%

3.6 Number of establishments and employees across counties of Paris Region

Paris Region, namely Ile-de-France Region, is one of the most important metropolises in the world. It is divided into eight counties (*départements*): 75 – Paris, 92 – Hauts-de-Seine, 93 – Seine-Saint-Denis, 94 – Val-de-Marne, 91 – Essonne, 78 – Yvelines, 95 – Val-d’Oise, 77 – Seine-et-Marne, which cover Paris City (2.23 million inhabitants) and the suburbs. Paris Region is Europe’s most populated region. In the area equal to just 2.2% (12,012 km²) of the whole surface of France, over 18% of the population of the country lives (11.7 million) creating almost one third of the GDP of France (de Palma et al., 2005). GDP for Paris Region reaches EUR 552,100 million with EUR 47,000 per inhabitant.⁹

Table 6 *Départements* of Ile-de-France

Dep	#communes	Population	Surface (km2)	#empl	
Paris	(75)	20	2211297	105.4	1788148
Hauts-de-Saine	(92)	36	1549619	175.6	930024
Seine-Saint-Denis	(93)	40	1506466	236.2	535221
Val-de-Marne	(94)	47	1310876	245	510703
Essonne	(91)	196	1205850	1804	432269
Yvelines	(78)	262	1406053	2284.4	545173
Val-d'Oise	(95)	185	1165397	1245.9	433614
Seine-et-Marne	(77)	514	1303702	5915.3	437185
Ile-de-France		1300	11659260	12011.8	5612337

Source: INSEE, CLAP 2010 (connaissance locale de l’appareil productif).

⁹ Source: INSEE, 2009.

In Paris (75), there are 20 *arrondissements* which are treated as *communes*. Hauts-de-Seine (92) *département* is a part of *Petite couronne*. 36 *communes* belong to *département* 92, with 1.54 million inhabitants. Next 40 *communes* with 1.55 million people are located in Seine-Saint-Denis (93) which also creates the area of *Petite couronne* (inter ring). The last *département* of *Petite couronne* is called Val-de-Marne (94), where 47 *communes* and 1.31 million inhabitants are located. The rest of *départements* are located in *Grande couronne* (outer ring). In Essonne (91), there are 196 *communes*, but still 1.21 million people live in this *département*. In Yvelines (78), there are 262 *communes* and 1.40 million inhabitants. Val-d'Oise (95) gathers 185 *communes* and 1.17 million people. In Seine-et-Marne (77), there are 514 *communes* where 1.30 million people live. The data are presented in Table 7. The pink area shown in Figure 4 is called Statistical Paris *unité urbaine communes* (urban *communes* of Paris Region).

Figure 4 Contour maps of Ile-de-France and its urban area

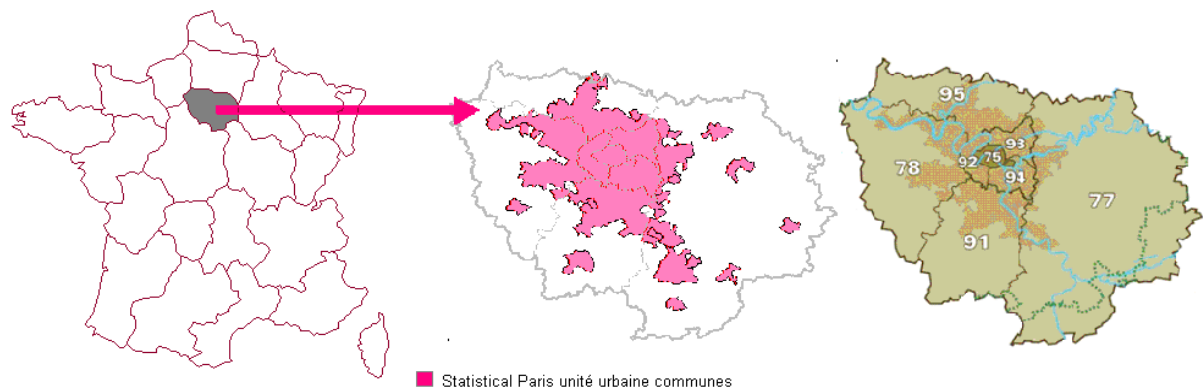


Table 7 Percentage of establishments and employees across *départements* computed as a total number of establishments (employees) in each *département* in relation to total number of establishments (employees) in 1997 and 2001

	Dep	75	92	94	93	78	91	95	77	Ile-de-France
Establishment	E2=1 E9=1(1_2001)	60539	20879	15797	15655	17015	13936	12389	16287	172497
	E2=1 E9=1(1_1997)	60539	20879	15797	15655	17015	13936	12389	16287	172497
	E2=1 E9=0 (2)	45036	15645	10492	11701	10846	8727	8200	9855	120502
	E2=0 E9=1 (3)	42372	14652	10192	11052	10121	8431	7371	8051	112242
#Est_97	1_1997+3	102911	35531	25989	26707	27136	22367	19760	24338	284739
#Est_2001	1_2001+2	105575	36524	26289	27356	27861	22663	20589	26142	292999
%Est_97		36.1%	12.5%	9.1%	9.4%	9.5%	7.9%	6.9%	8.6%	
%Est_2001		36.0%	12.5%	9.0%	9.3%	9.5%	7.7%	7.0%	8.9%	
Employment	E2=1 E9=1(4_2001)	1160331	575840	330908	341891	349373	277525	244655	277050	3557573
	E2=1 E9=1(4_1997)	1093437	542405	319999	328828	336523	267761	231017	261696	3381666
	E2=1 E9=0 (5)	516400	321194	127432	141155	150590	132299	110919	105953	1605942
	E2=0 E9=1 (6)	448417	263306	117338	121789	123823	107227	78180	79416	1339496
#Empl_97	4_1997+6	1541854	805711	437337	450617	460346	374988	309197	341112	4721162
#Empl_2001	4_2001+3	1676731	897034	458340	483046	499963	409824	355574	383003	5163515
%Empl_97		32.7%	17.1%	9.3%	9.5%	9.8%	7.9%	6.5%	7.2%	
%Empl_2001		32.5%	17.4%	8.9%	9.4%	9.7%	7.9%	6.9%	7.4%	

Figure 5 Distribution of establishments and employees across *départements* in 1997 and 2001

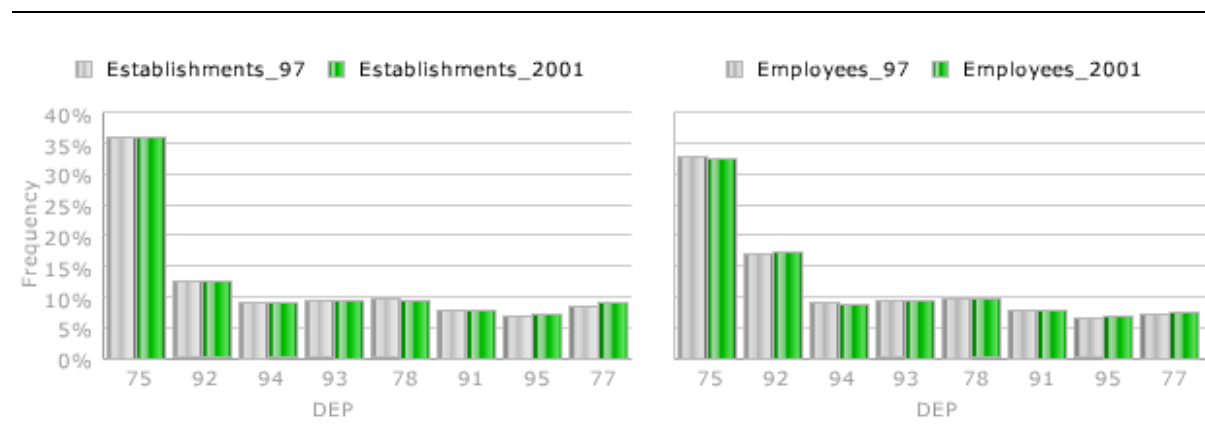
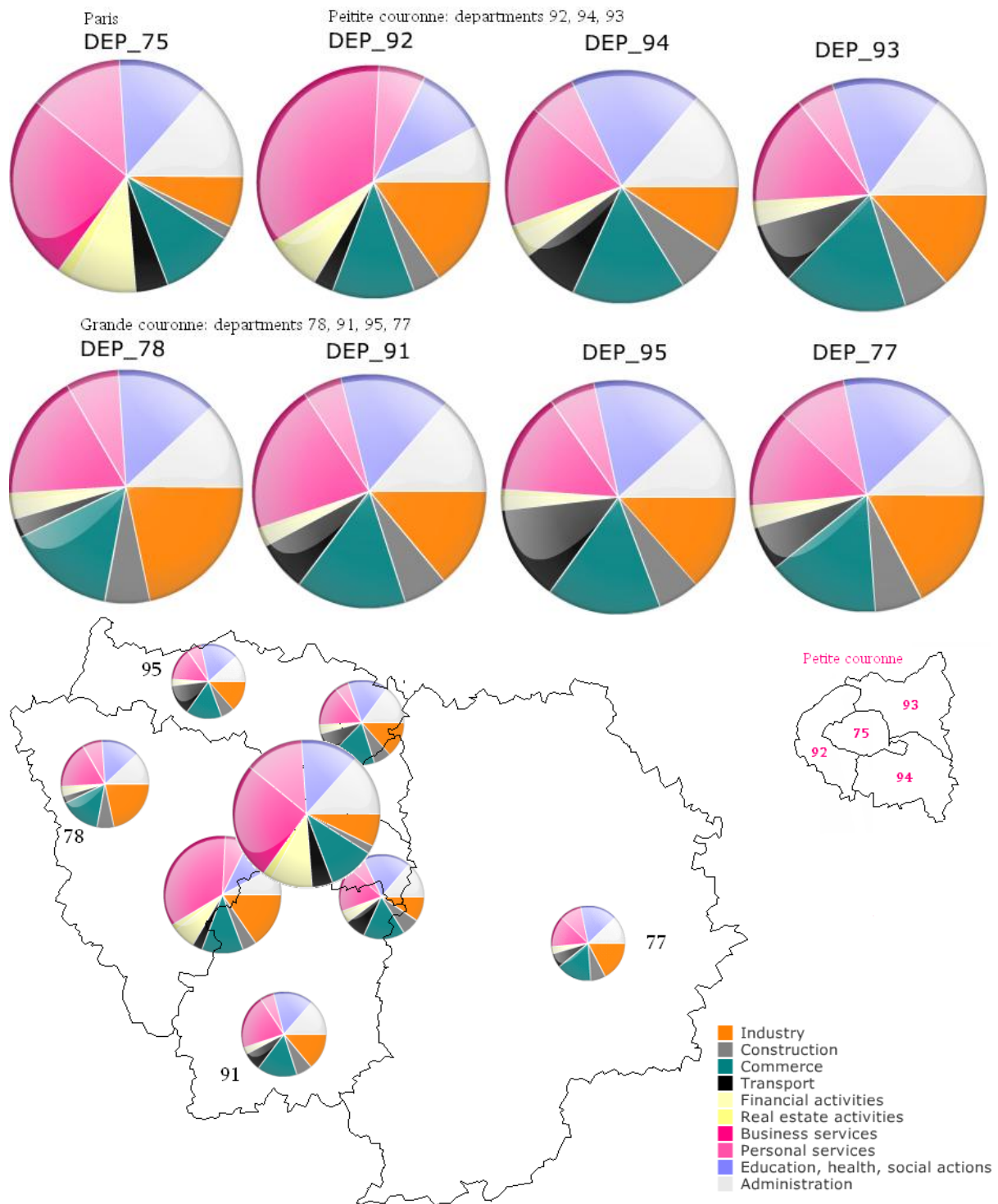


Table 8 Distribution of employees across *départements* and activity sectors in 2001

Dep	75	92	94	93	78	91	95	77
Agriculture	0.091%	0.004%	0.028%	0.005%	0.090%	0.038%	0.012%	0.097%
Industry	7.2%	15.5%	9.5%	13.5%	21.6%	13.9%	13.4%	17.2%
Construction	1.8%	3.8%	6.7%	6.5%	6.2%	6.1%	5.9%	6.6%
Commerce	10.1%	11.4%	15.7%	17.2%	14.9%	15.2%	15.6%	15.4%
Transport	4.5%	2.8%	8.0%	8.5%	2.7%	7.0%	13.3%	6.1%
Financial activities	9.2%	6.2%	3.1%	2.0%	2.3%	1.8%	1.8%	1.9%
Real estate activities	1.9%	1.7%	1.5%	1.4%	1.3%	0.8%	1.0%	1.1%
Business services	26.0%	34.4%	17.0%	15.5%	17.5%	20.8%	14.2%	13.6%
Personal services	13.1%	6.5%	6.4%	5.3%	7.4%	5.4%	6.4%	9.7%
Education, health, social a	12.6%	9.9%	18.3%	15.4%	14.1%	15.4%	16.8%	16.2%
Administration	13.4%	7.8%	13.8%	14.8%	11.9%	13.6%	11.6%	12.1%
%employees in DEP	32.5%	17.4%	8.9%	9.4%	9.7%	7.9%	6.9%	7.4%

It might be interesting to observe how the structure of employment changes with the distance to the center of Ile-de-France Region (Paris). The biggest percentage of employees working in Industry is located in *Grande couronne* and in *département* 92. Paris attracts relatively small number of people who belong to Construction sector. The patterns of employment in Construction do not differ much among the *départements*. Percentage of people working in Transport varies across the *départements* (2.7%-8.5%) and *département* 95 is characterized by the highest fraction of workforce in this sector (13.3%). Relatively high percentage of employees in Financial activities is located in Paris (9.2%) and *département* 92 (6.2%). In the rest of the *départements*, the fraction of employees working in Financial activities ranges from 1.8% to 3.1%. The percentage of people engaged in Real estate activities is low in all *départements* (0.8%-1.9%). On the other hand, the percentage of persons hired in the Business services is relatively high in the whole Ile-de-France and takes the highest value in *département* 92 (34.4%) and Paris (26%). There are no big differences in the fraction of workforce in Personal services, Education, health, social actions and Administration sectors. One can notice that Services and Financial and Real estate activities sum up to around 50% of all the employment hired in Paris and *département* 92.

Figure 6 Structure of employment across *départements* of Ile-de-France¹⁰



¹⁰ Overall, only 0.05% of all the employees is gathered in Agriculture sector (in 2001) which is the smallest one among all the eleven activity sectors. The fraction of employees hired in Agriculture sector is too small to be visible on the map.

4 Creation and destruction rates in selected sample

In this part of the working paper, we examine the changes in employment created or destroyed through the processes that occur between two observation time points, year 1997 and 2001. We will compute the creation and destruction rates at the level of establishment and employment. In this step of analysis, we use modified data files. Establishments with incorrect INSEE codes are excluded from our sample. In the process of “clearing” the database, we have to eliminate around 0.028% of the establishments which are present in the market in 1997 (81 establishments) and 0.033% business units which are registered in 2001 (97 establishments). Due to this data preparation, 2.11% of the employees in 1997 and 2.21% of the workers in 2001 are not taken into account in the further analyses.

Table 9 Total number of establishments and employees in 1997 and 2001 in full sample and reduced subsample. Creation and destruction rates (no category) and their formulas computed on reduced data set

	Full sample		Reduced sample		Loss of data	
	Estab	Empl	Estab	Empl	Estab	Empl
E2=1 E9=1 (1_01)	172497	3557573	172464	3538524	0.019%	0.538%
E2=1 E9=1 (1_97)	172497	3381666	172464	3362137	0.019%	0.581%
E2=1 E9=0 (2)	120502	1605942	120453	1513537	0.041%	6.105%
E2=0 E9=1 (3)	112242	1339496	112188	1261662	0.048%	6.169%
Total 1997=3+1_97	284739	4721162	284652	4623799	0.031%	2.106%
Total 2001=2+1_01	292999	5163515	292917	5052061	0.028%	2.206%
			Creation rate	2/(2+1_01) 41.1%	30.0%	
			Destruction rate	3/(3+1_97) 39.4%	27.3%	

Overall, the creation rate accounts for 41.1% and is calculated as a number of establishments created after 1997 which still exist in 2001, to the total number of establishments in 2001. Whereas, the destruction rate is equal to 39.4%, and shows the percentage of the establishments which were destroyed after 1997 and were not in the market in 2001, to the total number of establishments in 1997. Creation and destruction rates are computed also at the employment level. However, when computing the creation and destruction rates at the level of employment, one should carefully take the proper figures to do so. An increase in the number of employees between two analyzed periods is due to two events:

- the creation of the new establishments,
- the growth of the existing establishments.

By analogy, a decrease in employment is caused by:

- the closures of the establishments,
- the shrinkage of the existing business units.

Taking into consideration above mentioned events, we calculate the creation and destruction rates for the workforce using the formulas presented in Table 9. We obtain the creation and destruction rates equal to 30.0% and 27.3%, respectively.

Next, we calculate the creation and destruction rates by different categories:

- the size-type of the establishment,
- the activity sector and the *département* where the establishment is located.

Due to the growth or shrinkage of the establishment, the stable unit can change the size-type between two analyzed periods. We should also take it into account when computing the creation and destruction rates. The formulas and the results are presented in Table 10.

Table 10 Creation and destruction rates by size categories and their formulas at establishment and employment level (computed on reduced database)

	Size	0	1	2-3	4-9	10-49	50-249	250+	Ile-de-France ¹¹
Establishment	E2=1 E9=1 (1_01)	0	27414	44129	57086	33021	8711	2103	172464
	E2=1 E9=1 (1_97)	60	27670	45681	57338	31717	8050	1948	172464
	E2=1 E9=0 (2)	5	31007	34928	32622	17266	3876	749	120453
	E2=0 E9=1 (3)	1091	29693	33047	29584	14990	3215	574	112194
Creation	2/(2+1_2001)		53.1%	44.2%	36.4%	34.3%	30.8%	26.3%	41.1%
Destruction	3/(3+1_1997)		51.8%	42.0%	34.0%	32.1%	28.5%	22.8%	39.4%
Employment	E2=1 E9=1 (4_01)	0	27414	107723	340167	694569	903441	1465210	3538524
	E2=1 E9=1 (4_97)	0	27670	111652	339911	670521	831674	1380709	3362137
	E2=1 E9=0 (5)	0	31007	83634	189956	356911	389860	462169	1513537
	E2=0 E9=1 (6)	0	29693	78936	172811	311407	326313	342536	1261696
Creation	5/(5+4_2001)		53.1%	43.7%	35.8%	33.9%	30.1%	24.0%	30.0%
Destruction	6/(6+4_1997)		51.8%	41.4%	33.7%	31.7%	28.2%	19.9%	27.3%

The relative change in the number of all types of establishments between 1997 and 2001 is equal to 2.9%.¹² It differs by the size of the establishment. The relative change in the number of micro establishments (1-9 employees) is equal to 1.9%. For the establishments which hire 10-49 people (small establishments), the relative change accounts for 7.7%. For medium-sized establishments (50-249 employees) this number increases to 11.7%. For the biggest es-

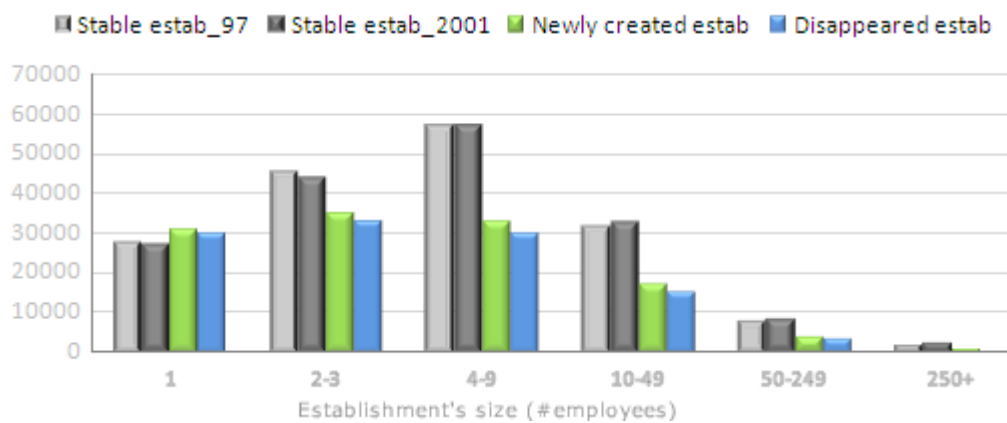
¹¹ If the establishment changes the size-type between two periods due to the evolution of the stable establishment, total number of stable establishments calculated on the base of year 1997 and 2001 should be the same.

¹² The relative change in the total number of establishments between 1997 and 2001 is calculated as $((2+1_{2001})-(3+1_{1997}))/((3+1_{1997}))$.

tablissements, where 250 or more employees work, the relative difference is higher than in the rest of the cases, and is equal to 13.1%. By looking at the level of the creation and destruction rate, we can notice that the figures are relatively higher for the smaller type-size of the establishments at both establishment and employment level. However, when we look at the relative differences between the creation and destruction rates, we can observe that the bigger establishments are more stable since the difference between creation and destruction rates tends to increase with the establishment size (Table 10).

From Figure 7, we can notice that the distribution of size of the disappeared and newly created establishments is approximately the same, but it differs from the distribution of size of the stable establishments, either measured by 1997 size or by 2001 size.

Figure 7 Distribution of stable (1997 as a computation base and 2001 as a base), newly created and disappeared establishments



Using the reduced data set, we compute the total number of establishments and the level of employment in 1997 and 2001 for each activity sector and the fraction of the business units and employees hired in these establishments that belong to a particular sector. Results are presented in Table 11.

Table 11 Percentage of establishments and employees across sectors in 1997 and 2001, computed on reduced data set

Sector name	Establishment				Employment				Avg #empl per estab	
	1997	%	2001	%	1997	%	2001	%	1997	2001
Agriculture	185	0.065%	133	0.046%	2137	0.046%	2691	0.053%	11.6	20.2
Industry	31002	10.8%	28652	9.8%	666625	14.4%	645764	12.8%	21.5	22.5
Construction	22872	8.0%	24930	8.6%	218706	4.7%	228660	4.5%	9.6	9.2
Commerce	69125	24.1%	69394	23.8%	635469	13.8%	679103	13.4%	9.2	9.8
Transport	8756	3.1%	9345	3.2%	243366	5.3%	291273	5.8%	27.8	31.2
Financial activities	10100	3.5%	9746	3.4%	248075	5.4%	265124	5.3%	24.6	27.2
Real estate activities	8720	3.1%	9520	3.3%	74104	1.6%	79166	1.6%	8.5	8.3
Business services	52630	18.4%	58192	20.0%	937460	20.3%	1171309	23.2%	17.8	20.1
Personal services	42175	15.3%	43902	14.5%	336979	7.3%	376261	7.5%	7.7	8.9
Education, health, social a	25346	8.9%	25057	8.6%	675758	14.6%	712049	14.1%	26.7	28.4
Administration	13716	4.8%	14043	4.8%	582194	12.6%	600652	11.9%	42.4	42.8
Total	284627		292914		4620873		5052052		16.1	17.3

Next, we compute the creation and destruction rates by each *département* treating separately all the activity sectors. The detailed results for year 1997 and 2001 across eleven activity sectors and eight *départements* of Paris Region are presented in Table 12 – Table 23. In the last column of each table, we show the results for Ile-de-France. Analyzed establishment may change the activity sector between two periods. According to the ERE database, it happens very rarely, however, the possible change should be also taken into account when computing the creation and destruction rates.

Table 12 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France by all activity sectors together

All sectors	Dep	75	92	94	93	78	91	95	77	Ile-de-France ¹³
Establishment	E2=1 E9=1 (1_01)	60531	20876	15794	15652	17010	13933	12385	16283	172464
	E2=1 E9=1 (1_97)	60519	20871	15792	15652	17010	13932	12381	16283	172440
	E2=1 E9=0 (2)	45015	15639	10486	11697	10843	8722	8197	9851	120450
	E2=0 E9=1 (3)	42359	14646	10184	11045	10115	8426	7368	8044	112187
Creation	2/(2+1_2001)	42.6%	42.8%	39.9%	42.8%	38.9%	38.5%	39.8%	37.7%	41.1%
Destruction	3/(3+1_1997)	41.2%	41.2%	39.2%	41.4%	37.3%	37.7%	37.3%	33.1%	39.4%
Employment	E2=1 E9=1 (4_01)	1154122	574745	326610	341486	347112	273701	244254	276494	3538524
	E2=1 E9=1 (4_97)	1078768	541122	318135	328579	334428	265804	230851	261426	3359113
	E2=1 E9=0 (5)	480617	307164	120833	137542	138559	125503	105980	97330	1513528
	E2=0 E9=1 (6)	418010	251498	111770	118598	113749	101877	74230	72028	1261760
Creation	5/(5+4_2001)	29.4%	34.8%	27.0%	28.7%	28.5%	31.4%	30.3%	26.0%	30.0%
Destruction	6/(6+4_1997)	27.9%	31.7%	26.0%	26.5%	25.4%	27.7%	24.3%	21.6%	27.3%

¹³ It may happen that a stable establishment changes the sector between two analyzed periods. However, the total number of stable establishments, calculated on the base of the year 1997 or 2001, should be equal for Paris Region). Slightly different magnitudes of (1_01) and (1_97) may suggest some inconsistency in the database.

Agriculture

In Agriculture sector, the destruction rate is greater than the creation rate at the establishment and employment level. To compare the variation in the changes in the numbers of establishments and employees across *départements* and sectors, we compute the coefficients of variation of creation and destruction rates on both measurement levels. The changes in the number of establishments and employees in Agriculture sector vary greatly between the *départements*, especially at the level of employment. It is also caused by small numbers of establishments and employees in each *département*. Agriculture sector is the smallest one among all the eleven activity sectors. Only 0.05% of all the establishments and 0.05% of all the employees are gathered in this sector in 2001 (0.07% establishments and 0.05% employees in 1997). On average, 20 persons are hired per establishment in 2001 (12 in 1997).

Table 13 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France in Agriculture sector

Agriculture	Dep	75	92	94	93	78	91	95	77	Ile-de-France
Establishment	E2=1 E9=1 (1_01)	17	5	4	2	13	7	6	14	68
	E2=1 E9=1 (1_97)	17	4	3	2	14	8	6	11	65
	E2=1 E9=0 (2)	12	6	1	2	11	5	7	21	65
	E2=0 E9=1 (3)	13	14	11	8	31	11	11	21	120
Creation	2/(2+1_2001)	41.4%	54.5%	20.0%	50.0%	45.8%	41.7%	53.8%	60.0%	48.9%
Destruction	3/(3+1_1997)	43.3%	77.8%	78.6%	80.0%	68.9%	57.9%	64.7%	65.6%	64.9%
Employment	E2=1 E9=1 (4_01)	1444	15	129	18	333	145	18	291	2393
	E2=1 E9=1 (4_97)	752	7	24	15	218	168	32	229	1445
	E2=1 E9=0 (5)	38	22	1	8	114	9	25	81	298
	E2=0 E9=1 (6)	111	36	17	22	149	19	194	144	692
Creation	5/(5+4_2001)	2.6%	59.5%	0.8%	30.8%	25.5%	5.8%	58.1%	21.8%	11.1%
Destruction	6/(6+4_1997)	12.9%	83.7%	41.5%	59.5%	40.6%	10.2%	85.8%	38.6%	32.4%

Industry

The creation and destruction rates in Industry sector vary between the *départements*, however, less when the rates are computed at the establishment level. At both measurement levels, the destruction rate exceeds the creation rate. The highest average number of workers is observed in the western part of Ile-de-France (*département* 92 and 78), the lowest in Paris. In Hauts-de-Seine, there are at an average, 45 employees in 2001 (40 in 1997) and in Yvelines, 42 employees in each establishment in 2001 (41 in 1997). In Paris, this number is around four times lower. Paris is characterized by the highest creation and destruction rates measured at the establishment level. *Départements* 92, Hauts-de-Seine, has the highest creation and destruction rates measured at the employment level. Overall, the average number of workers per establishment in Industry sector is equal to 23 in 2001 (22 in 1997).

Table 14 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France in Industry sector

Industry	Dep	75	92	94	93	78	91	95	77	Ile-de-France
Establishment	E2=1 E9=1 (1_01)	5736	2106	1724	2014	1610	1554	1499	2035	18278
	E2=1 E9=1 (1_97)	5814	2150	1750	2028	1633	1569	1504	2055	18503
	E2=1 E9=0 (2)	3717	1208	922	1189	805	773	797	963	10374
	E2=0 E9=1 (3)	4689	1470	1200	1434	956	889	911	950	12499
Creation	2/(2+1_2001)	39.3%	36.5%	34.8%	37.1%	33.3%	33.2%	34.7%	32.1%	36.2%
Destruction	3/(3+1_1997)	44.6%	40.6%	40.7%	41.4%	36.9%	36.2%	37.7%	31.6%	40.3%
Employment	E2=1 E9=1 (4_01)	81523	89161	32900	46103	75243	38253	36219	48283	447685
	E2=1 E9=1 (4_97)	78485	93870	33685	47468	73526	40089	34653	47567	449343
	E2=1 E9=0 (5)	38469	49412	10480	19308	32851	18643	11433	17483	198079
	E2=0 E9=1 (6)	45519	56196	14733	21600	29029	20456	12259	17490	217282
Creation	5/(5+4_2001)	32.1%	35.7%	24.2%	29.5%	30.4%	32.8%	24.0%	26.6%	30.7%
Destruction	6/(6+4_1997)	36.7%	37.4%	30.4%	31.3%	28.3%	33.8%	26.1%	26.9%	32.6%

Construction

As in Industry sector, the creation and destruction rates computed at the establishment level are the highest for Paris and the lowest for Saine-et-Marne (*département* 77). Overall, the creation rate is higher than the destruction rate. The average number of workers employed in Construction sector equals to 9 in 2001 (10 in 1997). In Paris, the average number of workers per establishment was the smallest (7 in 2001 and 8 in 1997) and in Hauts-de-Seine, the highest (15 in 2001 and 18 in 1997).

Table 15 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France in Construction sector

Construction	Dep	75	92	94	93	78	91	95	77	Ile-de-France
Establishment	E2=1 E9=1 (1_01)	1770	1204	1596	1692	1494	1365	1257	1851	12229
	E2=1 E9=1 (1_97)	1755	1201	1589	1699	1481	1354	1254	1855	12188
	E2=1 E9=0 (2)	2798	1156	1544	1819	1409	1275	1215	1485	12701
	E2=0 E9=1 (3)	2183	1056	1315	1617	1144	1207	1006	1156	10684
Creation	2/(2+1_2001)	61.3%	49.0%	49.2%	51.8%	48.5%	48.3%	49.2%	44.5%	50.9%
Destruction	3/(3+1_1997)	55.4%	46.8%	45.3%	48.8%	43.6%	47.1%	44.5%	38.4%	46.7%
Employment	E2=1 E9=1 (4_01)	16434	19339	19752	18292	16581	14004	13889	16959	135250
	E2=1 E9=1 (4_97)	16247	22434	18691	17137	14353	13287	13064	15105	130318
	E2=1 E9=0 (5)	13971	14914	10990	12976	14385	11021	7017	8136	93410
	E2=0 E9=1 (6)	14844	17914	9735	11680	9966	9489	6997	7763	88388
Creation	5/(5+4_2001)	45.9%	43.5%	35.7%	41.5%	46.5%	44.0%	33.6%	32.4%	40.9%
Destruction	6/(6+4_1997)	47.7%	44.4%	34.2%	40.5%	41.0%	41.7%	34.9%	33.9%	40.4%

Commerce

Commerce sector gathers the biggest number of establishments. On average, the creation rate outnumbers the destruction rate at the establishment and employment level. The average number of workers per establishment is the highest in *département* 92 (13 in 2001 and 12 in 1997) and the lowest in Paris (7 for both analyzed periods). Overall, the average number of employees per establishment in Commerce is equal to 10 in 2001 (9 in 1997).

Table 16 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France in Commerce sector

Commerce	Dep	75	92	94	93	78	91	95	77	Ile-de-France
Establishment	E2=1 E9=1 (1_01)	13498	4522	4256	4241	4114	3428	3063	3659	40781
	E2=1 E9=1 (1_97)	13589	4552	4270	4272	4147	3456	3089	3688	41063
	E2=1 E9=0 (2)	10004	3252	2691	3367	2692	2145	2069	2393	28613
	E2=0 E9=1 (3)	9738	3368	2876	3213	2710	2204	1991	1962	28062
Creation	2/(2+1_2001)	42.6%	41.8%	38.7%	44.3%	39.6%	38.5%	40.3%	39.5%	41.2%
Destruction	3/(3+1_1997)	41.7%	42.5%	40.2%	42.9%	39.5%	38.9%	39.2%	34.7%	40.6%
Employment	E2=1 E9=1 (4_01)	112384	62012	44494	53024	52031	41786	34476	39221	439428
	E2=1 E9=1 (4_97)	112549	56806	42984	51602	48478	41380	32444	38080	424323
	E2=1 E9=0 (5)	57797	40285	27289	30225	22481	20654	21096	19848	239675
	E2=0 E9=1 (6)	52753	35128	24879	27087	20235	18313	18150	14601	211146
Creation	5/(5+4_2001)	34.0%	39.4%	38.0%	36.3%	30.2%	33.1%	38.0%	33.6%	35.3%
Destruction	6/(6+4_1997)	31.9%	38.2%	36.7%	34.4%	29.4%	30.7%	35.9%	27.7%	33.2%

Transport

Transport sector gathers around 3% of all the establishments and 5-6% of employees in each of the analyzed periods. On average, the creation rate exceeds the destruction rate at both measurement levels in all the *départements* except Val-de-Marne (*département* 94) and Seine-Saint-Denis (*département* 93). There are markedly big differences in the creation and destruction rates at the level of employment across the *départements*. In three *départements* which belong to *Grande couronne*, namely Essonne, Val-d'Oise and Seine-et-Marne, the differences between the creation and destruction rates are relatively high. In Val'd-Oise, this difference reaches almost 30%. The average number of workers per establishment is equal to 28 in 1997, increases by three in 2001 and varies visibly across *départements* (ranges from 18 to 37 in 1997 and from 19 to 56 in 2001).

Table 17 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France in Transport sector

Transport	Dep	75	92	94	93	78	91	95	77	Ile-de-France
Establishment	E2=1 E9=1 (1_01)	1447	526	534	704	410	352	440	525	4938
	E2=1 E9=1 (1_97)	1447	527	537	710	419	352	436	528	4956
	E2=1 E9=0 (2)	1216	498	479	713	287	350	408	456	4407
	E2=0 E9=1 (3)	1138	407	447	597	264	306	339	302	3800
Creation	2/(2+1_2001)	45.7%	48.6%	47.3%	50.3%	41.2%	49.9%	48.1%	46.5%	47.2%
Destruction	3/(3+1_1997)	44.0%	43.6%	45.4%	45.7%	38.7%	46.5%	43.7%	36.4%	43.4%
Employment	E2=1 E9=1 (4_01)	63682	18702	29233	29120	10481	16953	26375	16516	211062
	E2=1 E9=1 (4_97)	63180	16291	26031	24346	10087	14539	21577	14338	190389
	E2=1 E9=0 (5)	12309	6319	7333	11803	2822	11691	20917	7017	80211
	E2=0 E9=1 (6)	11160	5420	10366	10402	2231	5326	4458	3614	52977
Creation	5/(5+4_2001)	16.2%	25.3%	20.1%	28.8%	21.2%	40.8%	44.2%	29.8%	27.5%
Destruction	6/(6+4_1997)	15.0%	25.0%	28.5%	29.9%	18.1%	26.8%	17.1%	20.1%	21.8%

Financial and Real estate activities

The sixth sector, Financial activities, gathers similar number of establishments and employees as Transport sector. On average, there are 27 people working in each establishment in 2001 (25 in 1997). This number varies markedly between the *départements*. The lowest number of workers is recorded in the *départements* of *Grande couronne* and the highest number in Paris and Hauts-de-Seine.

In Financial activities sector, the destruction rate for Ile-de-France exceeds the creation rate at the level of establishment. The creation rate is generally higher than the destruction rate at the employment level. These results are opposite for the Real estate activities sector. The levels of creation and destruction rates differ strongly across *départements* at the employment level. It is caused, among others, by the small number of employees in Real estate activities sector. Less than 2% of workers registered in Paris Region are hired in Real estate activities sector in both analyzed years. The average number of employees per establishment is equal to 8 in the initial and the final period. The biggest number of people working in the Financial and Real estate sectors is registered in Paris and Hauts-de-Saine.

Table 18 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France in Financial activities sector

Financial activities	Dep	75	92	94	93	78	91	95	77	Ile-de-France
Establishment	E2=1 E9=1 (1_01)	2845	872	531	489	634	471	408	431	6681
	E2=1 E9=1 (1_97)	2855	873	531	489	636	471	411	432	3843
	E2=1 E9=0 (2)	1511	447	213	198	213	164	148	171	3065
	E2=0 E9=1 (3)	1692	456	218	223	278	181	156	198	3402
Creation	2/(2+1_2001)	34.7%	33.9%	28.6%	28.8%	25.1%	25.8%	26.6%	28.4%	31.4%
Destruction	3/(3+1_1997)	37.2%	34.3%	29.1%	31.3%	30.4%	27.8%	27.5%	31.4%	47.0%
Employment	E2=1 E9=1 (4_01)	105619	29742	9327	6632	8389	6236	4791	5846	176582
	E2=1 E9=1 (4_97)	100611	28902	9865	6527	7806	5889	4002	5706	169308
	E2=1 E9=0 (5)	46863	26289	5066	2865	3202	1036	1700	1521	88542
	E2=0 E9=1 (6)	47592	16780	4819	2655	2809	1160	1800	1152	78767
Creation	5/(5+4_2001)	30.7%	46.9%	35.2%	30.2%	27.6%	14.2%	26.2%	20.6%	33.4%
Destruction	6/(6+4_1997)	32.1%	36.7%	32.8%	28.9%	26.5%	16.5%	31.0%	16.8%	31.8%

Table 19 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France in Real estate activities sector

Real estate activities	Dep	75	92	94	93	78	91	95	77	Ile-de-France
Establishment	E2=1 E9=1 (1_01)	2396	702	436	382	484	324	292	419	5435
	E2=1 E9=1 (1_97)	2273	658	397	350	450	305	278	379	5090
	E2=1 E9=0 (2)	1854	541	284	266	378	244	238	280	4085
	E2=0 E9=1 (3)	1585	414	259	190	376	223	168	415	3630
Creation	2/(2+1_2001)	43.6%	43.5%	39.4%	41.0%	43.9%	43.0%	44.9%	40.1%	42.9%
Destruction	3/(3+1_1997)	41.1%	38.6%	39.5%	35.2%	45.5%	42.2%	37.7%	52.3%	41.6%
Employment	E2=1 E9=1 (4_01)	20504	10535	5376	5461	3672	1910	2248	3468	53174
	E2=1 E9=1 (4_97)	19231	8174	4348	4858	2817	1786	1965	2774	45953
	E2=1 E9=0 (5)	12055	4865	1498	1391	2687	1400	1164	932	25992
	E2=0 E9=1 (6)	10691	4421	2524	1666	2837	2441	1379	2192	28151
Creation	5/(5+4_2001)	37.0%	31.6%	21.8%	20.3%	42.3%	42.3%	34.1%	21.2%	32.8%
Destruction	6/(6+4_1997)	35.7%	35.1%	36.7%	25.5%	50.2%	57.7%	41.2%	44.1%	38.0%

Business and Personal services

Business and personal services sectors gather over one third of all the establishments and similar percentage of employees in both analyzed periods. For both sectors and for all the *départements*, creation rate is always (except *département* 93) greater than the destruction rate at the establishment and employment level. The biggest number of establishments and employees working in these two sectors are situated in Paris and Hauts-de-Saine. On average, 20 people work in one establishment in Business sector in 2001 (18 in 1997) and 9 people are hired in Personal sector in 2001 (8 people in 1997).

Table 20 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France in Business services sector

Business ser- vices	Dep	75	92	94	93	78	91	95	77	Ile-de- France
Establishment	E2=1 E9=1 (1_01)	12795	4507	2184	1883	2458	1908	1552	1926	29213
	E2=1 E9=1 (1_97)	12715	4469	2175	1848	2445	1889	1537	1891	28969
	E2=1 E9=0 (2)	12902	5011	1965	1641	2437	1785	1421	1817	28979
	E2=0 E9=1 (3)	10882	4176	1660	1463	1893	1450	1072	1065	23661
Creation	2/(2+1_2001)	50.2%	52.6%	47.4%	46.6%	49.8%	48.3%	47.8%	48.5%	49.8%
Destruction	3/(3+1_1997)	46.1%	48.3%	43.3%	44.2%	43.6%	43.4%	41.1%	36.0%	45.0%
Employment	E2=1 E9=1 (4_01)	253823	176237	46294	45112	53567	46842	32357	30520	684752
	E2=1 E9=1 (4_97)	214488	147993	45471	41440	55316	44414	27423	25390	601935
	E2=1 E9=0 (5)	181340	132077	31610	29527	34085	38024	18228	21666	486557
	E2=0 E9=1 (6)	127677	88509	23511	21464	25430	25930	11234	11770	335525
Creation	5/(5+4_2001)	41.7%	42.8%	40.6%	39.6%	38.9%	44.8%	36.0%	41.5%	41.5%
Destruction	6/(6+4_1997)	37.3%	37.4%	34.1%	34.1%	31.5%	36.9%	29.1%	31.7%	35.8%

Table 21 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France in Personal services sector

Personal ser- vices	Dep	75	92	94	93	78	91	95	77	Ile-de- France
Establishment	E2=1 E9=1 (1_01)	11101	3219	2142	1984	2383	1864	1542	1983	26218
	E2=1 E9=1 (1_97)	11134	3224	2145	1982	2370	1865	1533	1994	26247
	E2=1 E9=0 (2)	7307	2344	1453	1595	1505	1086	1098	1296	17684
	E2=0 E9=1 (3)	6676	2122	1362	1446	1336	1027	949	1010	15928
Creation	2/(2+1_2001)	39.7%	42.1%	40.4%	44.6%	38.7%	36.8%	41.6%	39.5%	40.3%
Destruction	3/(3+1_1997)	37.5%	39.7%	38.8%	42.2%	36.0%	35.5%	38.2%	33.6%	37.8%
Employment	E2=1 E9=1 (4_01)	133334	28792	15735	14136	19642	12397	13802	25772	263610
	E2=1 E9=1 (4_97)	126001	27134	15259	13210	17795	11635	12350	23203	246587
	E2=1 E9=0 (5)	54814	16284	8067	8152	7779	5514	5624	6417	112651
	E2=0 E9=1 (6)	41952	13179	7310	7738	6380	5108	4611	4114	90392
Creation	5/(5+4_2001)	29.1%	36.1%	33.9%	36.6%	28.4%	30.8%	29.0%	19.9%	29.9%
Destruction	6/(6+4_1997)	25.0%	32.7%	32.4%	36.9%	26.4%	30.5%	27.2%	15.1%	26.8%

Education, health and social actions

Nine percent of establishments and over fourteen percent of employees belong to the 10th sector, Education, health and social actions. There are on average 28 people working in each establishment in 2001 and similar situation is observed in the year 1997, where the average number of employees per establishment is equal to 27. This number is smaller in the *départements* of Grande couronne (22-28 in 2001 and 20-26 in 1997) and higher for the *départements* situated in the closer neighborhood of Paris (30-36 in 2001 and 28-34 in 1997). There is no clear pattern in the level of creation and destruction rates between the *départements*. However, the differences between the *départements* are relatively not big. For the whole Ile-de-France area, the level of destruction rate is greater than the creation rate at the establishment level and the opposite situation is noticed at the employment level.

Table 22 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France in Education, health, and social actions sector

Education, health, social actions	Dep	75	92	94	93	78	91	95	77	Ile-de- France
Establishment	E2=1 E9=1 (1_01)	5148	2283	1770	1634	2342	1909	1637	2252	18975
	E2=1 E9=1 (1_97)	5151	2282	1763	1639	2350	1909	1634	2260	18988
	E2=1 E9=0 (2)	1934	707	589	538	676	509	501	628	6082
	E2=0 E9=1 (3)	2068	750	580	568	744	560	509	579	6358
Creation	2/(2+1_2001)	27.3%	23.6%	25.0%	24.8%	22.4%	21.1%	23.4%	21.8%	24.3%
Destruction	3/(3+1_1997)	28.6%	24.7%	24.8%	25.7%	24.0%	22.7%	23.8%	20.4%	25.1%
Employment	E2=1 E9=1 (4_01)	184981	81343	74040	64656	63297	55441	50468	53936	628162
	E2=1 E9=1 (4_97)	177732	78522	73139	61453	59254	51907	49366	52854	604227
	E2=1 E9=0 (5)	25928	7192	9707	9409	7014	7519	9119	7999	83887
	E2=0 E9=1 (6)	25260	6431	6950	5850	8510	7742	6351	4437	71531
Creation	5/(5+4_2001)	12.3%	8.1%	11.6%	12.7%	10.0%	11.9%	15.3%	12.9%	11.8%
Destruction	6/(6+4_1997)	12.4%	7.6%	8.7%	8.7%	12.6%	13.0%	11.4%	7.7%	10.6%

Administration

Départements Saine-Saint-Denis and Val-de-Marne are characterized by the highest average number of employees per establishment (*département* 93: 75 in 1997 and 71 in 2001; *département* 94: 63 in 1997 and 60 in 2001). The average level of the employees per business unit for Paris Region equals to 43 in 2001 and one employee less in the initial year. For all the *départements* except Paris and Seine-et-Marne, the creation rate outnumbers the destruction rate. The creation and destruction rates computed at the establishment level always take much higher values comparing to the results obtained at the employment level (similar effect can be noticed also in the case of Education, health, social actions sector). Around 12% of all the people who work in Paris Region dedicate their time to the work in Administration sector.

Table 23 Creation and destruction rates at establishment and employment level across *départements* of Ile-de-France in Administration sector

Administration	Dep	75	92	94	93	78	91	95	77	Ile-de- France
Establishment	E2=1 E9=1 (1_01)	3778	930	617	627	1068	751	689	1188	9648
	E2=1 E9=1 (1_97)	3769	931	632	633	1065	754	699	1190	9673
	E2=1 E9=0 (2)	1760	469	345	369	430	386	295	341	4395
	E2=0 E9=1 (3)	1695	413	256	286	383	368	256	386	4043
Creation	2/(2+1_2001)	31.8%	33.5%	35.9%	37.0%	28.7%	33.9%	30.0%	22.3%	31.3%
Destruction	3/(3+1_1997)	31.0%	30.7%	28.8%	31.1%	26.5%	32.8%	26.8%	24.5%	29.5%
Employment	E2=1 E9=1 (4_01)	180394	58867	49330	58932	43876	39734	29611	35682	496426
	E2=1 E9=1 (4_97)	169492	60989	48638	60523	44778	40710	33975	36180	495285
	E2=1 E9=0 (5)	37033	9505	8792	11878	11139	9992	9657	6230	104226
	E2=0 E9=1 (6)	40451	7484	6926	8434	6173	5893	6797	4751	86909
Creation	5/(5+4_2001)	17.0%	13.9%	15.1%	16.8%	20.2%	20.1%	24.6%	14.9%	17.4%
Destruction	6/(6+4_1997)	19.3%	10.9%	12.5%	12.2%	12.1%	12.6%	16.7%	11.6%	14.9%

In most of the activity sectors, one can observe an increasing trend in the number of establishments and employees. Only in Industry sector and Agriculture, both number of institutions and workers fall down rather significantly. By looking also at the magnitude of the changes, we can conclude that the greatest positive changes are noticed in Business services, Transport and Personal services. There are slightly more closures than establishments' openings in sectors Financial activities and Education, health and social actions. However, at the same time, we observe an increase in the number of workers in these two sectors. The opposite phenomenon is noticed in Real estate activities sector.

Table 24 Summary table of differences between creation and destruction rates at establishment and employment level across sectors and *départements* of Ile-de-France

Sector name	Dep	Paris	Petite couronne				Grande couronne				Ile-de-France
		75	92	94	93	78	91	95	77		
Agriculture	Estab	-2.0%	-23.2%	-58.6%	-30.0%	-23.1%	-16.2%	-10.9%	-5.6%	-16.0%	
	Empl	-10.3%	-24.3%	-40.7%	-28.7%	-15.1%	-4.3%	-27.7%	-16.8%	-21.3%	
Industry	Estab	-5.3%	-4.2%	-5.8%	-4.3%	-3.6%	-2.9%	-3.0%	0.5%	-4.1%	
	Empl	-4.6%	-1.8%	-6.3%	-1.8%	2.1%	-1.0%	-2.1%	-0.3%	-1.9%	
Construction	Estab	5.8%	2.2%	3.9%	3.0%	5.0%	1.2%	4.6%	6.1%	4.2%	
	Empl	-1.8%	-0.9%	1.5%	1.0%	5.5%	2.4%	-1.3%	-1.5%	0.4%	
Commerce	Estab	0.8%	-0.7%	-1.5%	1.3%	0.03%	-0.5%	1.1%	4.8%	0.6%	
	Empl	2.0%	1.2%	1.4%	1.9%	0.7%	2.4%	2.1%	5.9%	2.1%	
Transport	Estab	1.6%	5.1%	1.9%	4.6%	2.5%	3.4%	4.4%	10.1%	3.8%	
	Empl	1.2%	0.3%	-8.4%	-1.1%	3.1%	14.0%	27.1%	9.7%	5.8%	
Financial activities	Estab	-2.5%	-0.4%	-0.5%	-2.5%	-5.3%	-1.9%	-0.9%	-3.0%	-2.2%	
	Empl	-1.4%	10.2%	2.4%	1.3%	1.2%	-2.2%	-4.8%	3.8%	1.6%	
Real estate activities	Estab	2.5%	4.9%	-0.04%	5.9%	-1.7%	0.7%	7.2%	-12.2%	1.3%	
	Empl	1.3%	-3.5%	-14.9%	-5.2%	-7.9%	-15.5%	-7.1%	-23.0%	-5.2%	
Business services	Estab	4.1%	4.3%	4.1%	2.4%	6.1%	4.9%	6.7%	12.5%	4.8%	
	Empl	4.4%	5.4%	6.5%	5.4%	7.4%	7.9%	7.0%	9.8%	5.7%	
Personal services	Estab	2.2%	2.4%	1.6%	2.4%	2.7%	1.3%	3.4%	5.9%	2.5%	
	Empl	4.2%	3.4%	1.5%	-0.4%	2.0%	0.3%	1.8%	4.9%	3.1%	
Education, health, social a	Estab	-1.3%	-1.1%	0.2%	-1.0%	-1.6%	-1.6%	-0.3%	1.4%	-0.8%	
	Empl	-0.2%	0.6%	2.9%	4.0%	-2.6%	-1.0%	3.9%	5.2%	1.2%	
Administration	Estab	0.8%	2.8%	7.0%	5.9%	2.3%	1.2%	3.2%	-2.2%	1.8%	
	Empl	-2.2%	3.0%	2.7%	4.5%	8.1%	7.4%	7.9%	3.3%	2.4%	

5 Econometric models of firmography

5.1 Firmographic models: What may affect establishment's behavior?

The literature on the determinants of new establishment's formation and its ultimate destruction is quite ample (Johnson and Cathcart, 1979; Beesley and Hamilton, 1993; Hart and Scott, 1994; Garofoli, 1994; Audretsch, 1995; Love, 1996; Hannan et al., 1998; van Wissen, 2000; Maoh, 2005). However, there is not much done in the field of establishments' moving and growing behavior. Nor is the field of business units' survival deeply developed. This may seem very surprising since these topics are of great importance and various disciplines, such as geography, sociology, demographics or regional economics are interested in the establishment's behavior. One of the reasons may be the lack of suitable micro-level data. The assessments on the urban development process are also based on models using aggregated socio-economic data. However, due to the aggregate level of the data, models are not good enough to deal with the complex character and behavioral realism of the city development (Maoh and Kanaroglou, 2007). Researchers try to indicate what influences the establishments' behavior at all the stages of business life cycle.

5.1.1 Birth of business unit

There are many factors which influence the probability of the establishment's birth. Business births are due to two events: (1) business can split off or start operating in a new branch, (2) an individual can set an establishment. In the first case, economic prosperity, sector change, and government incentives affect the birth probability. A relatively easy access to capital also affects the birth probability (Maoh, 2005). In the case of the individual person starts a new business, his age, gender and education level are the most significant factors.

5.1.2 Evolution of workforce within establishment

In majority of the cases, new businesses are establishments with a small number of employees. Successfully created units can grow or decline. Establishment's growth can be measured in the number of employees or for instance, as a value of the total production. Nelson and Winter (1982) claim that the establishment's evolution depends mainly on its age, market determinants and investments in research and development. The changes in economic activity are especially common for young establishments which wish to find the niche in the market

(van Wissen, 2000). Cahuc and Zylberberg (2006) review the recent research in labor market concluding that two jobs are lost for every three created in growing industries and the opposite phenomenon is observed in the declining industries. Santarelli et al. (2006) present an overview of 72 empirical studies on the Gibrat's Law (Gibrat, 1931), the hypothesis that establishment's growth does not depend on the establishment initial size. The literature on the growth rate of establishments in U.S., Japan, Taiwan, U.K., Spain, Portugal, Italy, Greece, Netherlands, Germany, Sweden and more, shows that the Gibrat's Law may hold, be rejected or that the results are mixed depending on, among others, the area and the period taken into analysis, definition of the establishment size and the industry sector.

5.1.3 Relocation of business unit

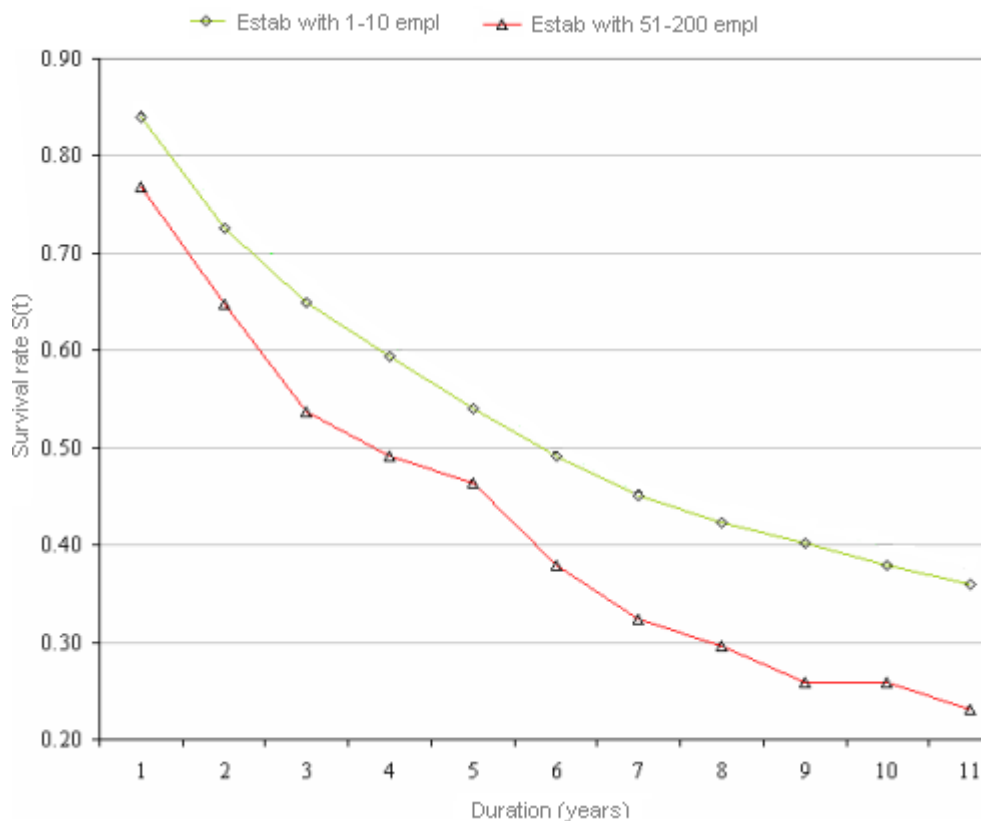
The business unit may also change its location. Generally, establishments prefer to stay in the current place and decide to change it only pushed by local deficiencies, due to location costs, accessibility problems or local policy (van Wissen, 2000). Brouwer et al., (2004) show that both internal (size, age and economic sector) and external factors (regions characteristics) have influence on the business mobility. Units that serve larger markets usually relocate with higher frequency (Brouwer et al., 2004; Dijk and Pollenbarg, 2000). Bodenmann and Axhausen (2008) claim that small establishments relocate relatively often and at relatively further distances. Young companies also behave this way. Maoh and Kanaroglou (2007) prove that establishments will move a longer distance as the competition in the local market increases. Kemper and Pellenbarg (1997) find that the establishment is born usually in the center of a large city, and if it successfully develops, very often, it moves to the suburbs or out of the city area.

5.1.4 Establishment's closure

The ultimate stage in the business life cycle is its closure. An establishment is considered as a "dead one," if it is registered in the market in the initial year of analysis and is not observed any more in the final year. There are many factors which may affect the probability of establishment's death. Economic sector, environmental conditions or change of unemployment rate (Love, 1996) may be recalled as examples. Also age and size of the establishment influence the decision whether to continue or close the business (Mata and Portugal, 1994; Audretsch and Mahmood, 1995). The probability of surviving increases with the establishment's age. This statement is called the "liability of newness" hypothesis (Stinchcombe, 1968). However, various studies cast doubt on its validity. Brüderl and Schüssler (1990) claim that the probability of death is the highest in the beginning of establishment's existence, and decreases only in the later stage. Ekamper (1996) proves that first 10 – 15 years are the most crucial for the

decision on the unit’s closure. After this age, there is no significant relation between age and the probability of exit. Hannan et al. (1998) find that age has an ambiguous effect on the establishment’s closure. Establishment’s size is an important determinant of its survival rate. Since closing a large company is not a trifling event and involves a relatively large amount of money, establishments of rather big sizes do anything possible not to close. A smaller death risk in the case of big establishments is called the “liability of size” hypothesis (van Wissen, 2000). In Figure 8, we present the change in the survival rate by business size according to Maoh and Kanaroglou (2005). The survival rate varies across economic sectors. The last finding is that innovative and progressive establishments are more liable to die (van Wissen, 2000).

Figure 8 Survival rate by business size



Source: Maoh and Kanaroglou (2005).

In this report, we estimate firmographic models to understand which factors significantly influence the establishments’ behavior (section 5.2.4 - 5.2.4). We concentrate on the unit’s disappearance from the market, its evolution and location. Selection of the variables that describe the characteristics of the establishment itself (such as industry sector and the size of the establishment) and the territorial characteristics (among others, land use types, transportation issues

or the socio-economic features of the population) has been made according to the economic relevance presented in the literature and the statistic availability.

5.1.5 Comments on firmographic models literature

Using the ERE database, we can confirm that the majority of the newly created establishments are micro units. 82% of the newly established businesses can be classified as micro ones, around 14% as small, 3% as medium and less than 1% as big units (Figure 9). We can also notice that the distribution of size of new establishments resembles the distribution of size of the closing units.

Figure 9 Newly created and disappeared establishments according to size and size-type

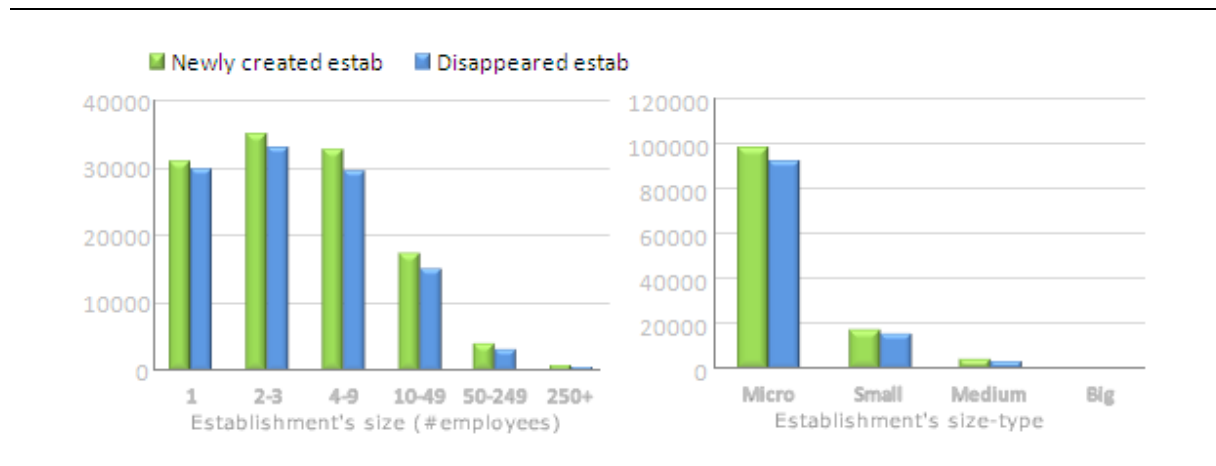
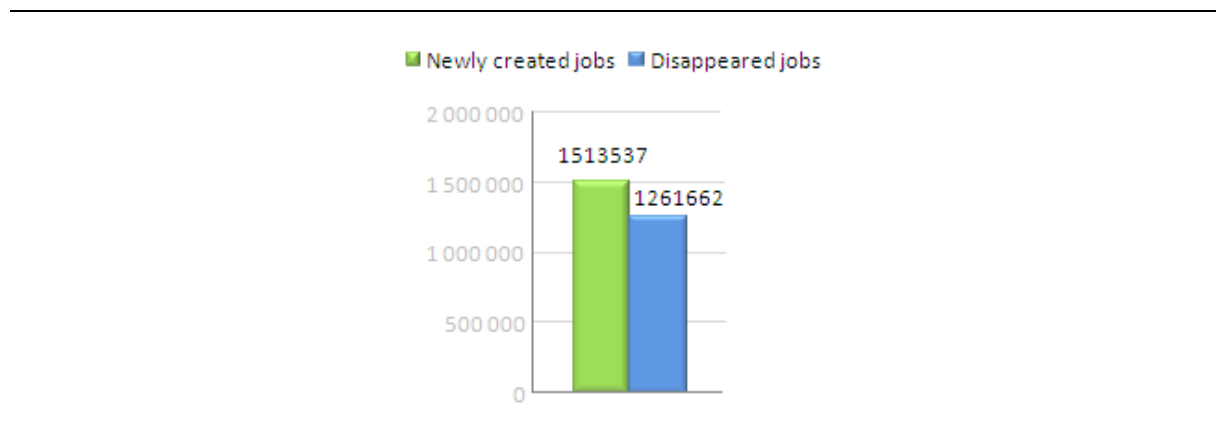


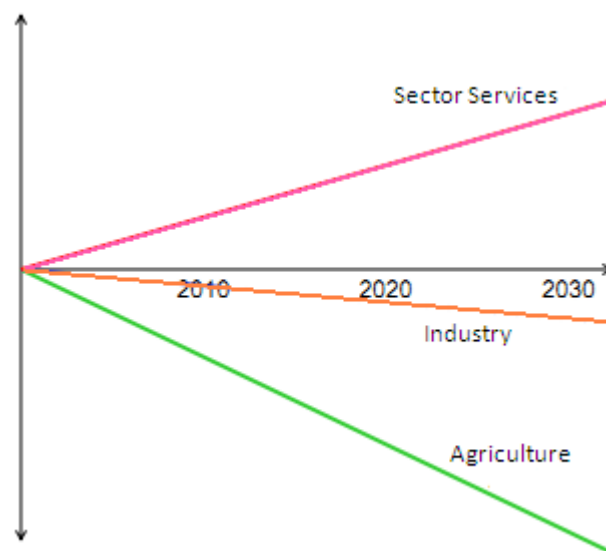
Figure 10 Total number of newly created and disappeared jobs



According to the employment data, the ratio of the total number of the created jobs to the total number of the disappeared jobs for all the sectors together is equal to 83.4% (Figure 10).

From the creation and destruction rates computed in section 2, we can conclude that the biggest number of jobs is created (between 1999 and 2001) in sectors: Transport, Business services and Personal services. On the other hand, in Agriculture and Industry sectors, we can observe a declining number of jobs. Moeckel (2005) obtains very similar results using the land-use transport model ILUMASS (integrated land-use modeling and transportation system simulation) to simulate the changes in employment across time for different activity sectors. We present his results in Figure 11.

Figure 11 Sectoral change: employment



Source: Moeckel (2005).

5.2 Discrete choice models

We use the binary probit to model disappearance of the establishments. We run the models which describe the evolution of the number of employees within the establishments. We try to model the growing and shrinking behavior of stable units using regression models. We estimate the parameters of the location choice model for newly born units using multinomial logit model.

In the next sub-sections, we present three models with equations, short description of the variables used to run the models and the interpretation of the results. The results of the estimations of each model are presented in Appendix, in Table 27 – Table 29.

5.2.1 Disappearance model

We model an establishment's death using binary probit model. The death of the institution is registered in two cases, when the establishment is closed but also when it relocates.

Consistently with the available data, we are not able to track the establishments when they move. For this reason, we do not model the relocation of the establishments. When the establishment moves, its id (SIRET code) is automatically changed so that there is no easy way to identify the "same" establishment before and after the move. The firm id (SIREN number) does not change but exploiting this information would imply too restrictive and unrealistic assumptions because of the possibility of multiple establishments for a given firm and the possibility that some of them disappear between 1997 and 2001. When the establishment changes the address, we consider this event as a death and a birth of a new establishment.

$$VL_e = \beta_s X_c + \gamma_s Y_e + \varepsilon_e \quad (3)$$

$$P(e \notin E^{2001}) = P(VL_e > 0) = P(\beta_s X_c + \gamma_s Y_e + \varepsilon_e > 0), \quad (4)$$

e - establishment present in the market in 1997

VL_e - value of leaving the market by the establishment e

ε_e - random part which measures the fragility of the establishment; $\varepsilon_e \sim N(0,1)$

X_c - *commune* characteristics

β_s - vector of coefficients which stand by the *commune* variables

Y_e - establishment's characteristics

γ_s - vector of coefficients which stand by the establishments characteristics

$P(e \notin E^{2001})$ - probability that the establishment is not in the market any more in 2001.

We check whether the following variables have a significant effect on the disappearance of the establishment:

- the initial size of the establishment,
- accessibility to population that have some particular socio-economic characteristics,
- local or regional accessibility measures, such as number of metro stations, average time for public transport and private vehicles,
- accessibility to labor (workforce from different socio-professional classes, workforce with different education levels),
- real estate prices.

5.2.2 Evolution model

To model the evolution of the stable establishments, thus the establishments which are observed in the market in both analyzed periods, we use regression model with the logarithmic value of the relative difference between establishment's size in the final period and the initial year as a dependent variable.

$$\ln\left(\frac{\tau_e^{2001}}{\tau_e^{1997}}\right) = const_s + \sum_{t \in T} \beta_{s,t} I_t + \sum_{t \in T} \gamma_{s,t} I_t (\tau_e^{1997} - \tau_t^{inf}) + \delta_s X_c + \varepsilon_e. \quad (5)$$

The log-linear regression, where the logarithmic value of the final establishment's size is used

$$\ln(\tau_e^{2001}) = const_s + \sum_{t \in T} \beta_{s,t} I_t + \sum_{t \in T} \gamma_{s,t} I_t (\tau_e^{1997} - \tau_t^{inf}) + \delta_s X_c + \varepsilon_e, \quad (6)$$

can be also proposed as an alternative. The evolution model describes the growing or shrinking behavior of the establishment. Final workforce is a function of the initial workforce and the variables which represent the socioeconomic characteristics of the population and employees living in the surrounding of the establishment.

I_t - size class indicator

t - size class

τ_e^{2001} -workforce (size) of the establishment in 2001

τ_e^{1997} - workforce (size) of the establishment in 1997

τ_t^{inf} - lower limit of each size class t

X_c - *commune* characteristics

δ_s - vector of coefficients which stand by the *commune* variables

ε_e - random perturbation.

To estimate the parameters in the evolution models, similar variables are used as in the disappearance models presented in the previous section.

5.2.3 Location choice model

We use multinomial logit model (McFadden, 1974, 1981) to study the location choice of the business units. The probability of a *commune* to be included in the choice set is proportional to the total number of employees in this particular *commune*.

$$P_i^e = \frac{\exp(V_i^e)}{\sum_{i=1}^I \exp(V_i^e)}, \quad (7)$$

$$P_j^e = C_j P_i^e = C_j \frac{\exp(V_i^e)}{\sum_{j=1}^J \sum_{i \in j} \exp(V_i^e)} = \frac{C_j \exp(V_i^e)}{\sum_{j=1}^J C_j \exp(V_j^e)} = \frac{\exp(V_i^e + \ln C_j)}{\sum_{j=1}^J \exp(V_j^e + \ln C_j)}, \quad (8)$$

P_i^e - probability that establishment e chooses location i ; $i \in I$

P_j^e - probability that establishment e chooses *commune* j

V_i^e - expected utility of choosing location i by the establishment e

J - number of *communes* in Ile-de-France

C_j - set of all available locations in *commune* j

I - set of all available locations in Ile-de-France.

Every establishment can choose a location from the set of all available locations in Ile-de-France open to a particular industry sector. Therefore, the possible choice set is large. To deal with the problem of high number of alternatives, we propose to randomly sample a set of nine alternatives with a uniform distribution. McFadden (1978) proves the consistence of the estimates of coefficients of a choice model when the random sample of alternatives is used. Each location i has attached some utility, V_i^e . The establishment chooses location i if the expected utility is higher than all the expected utilities associated to other locations. P_i^e is the probability of location i to be chosen by an establishment e . We assume that the set of possible locations is not observable, nor is the utility of each location. We represent the utility of each alternative as a summation of the systematic part and a random part:

$$V_i^e = v_i^e + \varepsilon_i^e, \quad (8)$$

where $v_i^e = \beta_i^e x$ is a function linear in parameters with x - vector of observable variables influencing the behavior of the establishment and β_i^e - vector of the estimates and ε_i^e is a random perturbation. We assume that all the locations which belong to a *commune* j have the same observable characteristics and give the same expected utility. Thus all the establishments in the same *commune* j have the same probability P_j^e to be chosen by the establishment.

These models address location behavior of units at the establishment level. We model only the location choice of new establishments. As was mentioned before, according to the way the employment database is built, there is no possible manner to distinguish between the real disappearance of the establishment and its relocation.

To avoid correlation between variables, de Bok (2004) and Sanders and de Bok (2004) propose to construct a variety of composed accessibility that describe the distances to the physical infrastructure, the accessibility to labor, the accessibility to the customers and suppliers. They suggest using as well a set of agglomeration variables to explore concentration or

deconcentration patterns. They use the information on the urban environment and they treat an average rental level in a particular territory as a proxy for the real estate quality. All the models presented by de Bok and Sanders are computed by establishment's size and by activity sector. Waddell and Ulfarsson (2002) confirm the significance of the real estate characteristics, the neighborhood characteristics, local and regional accessibility measures (access to employment, population and distance to highway, airport or central business districts) for the location models. Picard and Antoniou (2011) claim that commuting time is the most significant variable in explaining the location, much more important than variables which measure either accessibility or expected time commonly used in the location choice models.

In the location choice model, which we run, we take into consideration ten activity sectors (Agriculture sector is excluded) and we test the significance of the following variables:

- the local competition in the employment market and the employment density in each activity sector (local competition maps for each activity sector are presented in Appendix; maps were created in Quantum GIS),
- local and regional accessibility measures (variables indicating the distance to the national road, highways, travel time data, etc.),
- general characteristics of the region in which the establishment is being located,
- accessibility to population (financial situation of the households, the age of the head of the household, the presence of children in the household),
- real estate prices, treated as a proxy for the attractiveness of the area,
- land-use data.

To check the significance and the direction of the effects of the numbers of employees in each activity sector on another sector, we run linear regressions and compute the correlation matrix. These two steps can help to decide which variables can be used to run the location choice models. These results are presented in Table 25 and Table 26.

Table 25 Significance and direction of effects of numbers of employees in each activity sector on another according to regression models

Dependent variable	sec2	sec3	sec4	sec5	sec6	sec7	sec8	sec9	sec10	sec11
Industry				-	-					
Construction										
Commerce										
Transport										
Financial activities										
Real estate activities										
Business services										
Personal services										
Education, health, social a										
Administration										

- when the potentially significant variable has a negative effect on the total #employees;
 for the rest of the potentially significant variables, there is a positive effect of variable
 the highest relative significance
 other potentially significant variables

Table 26 Correlations between numbers of employees in each activity sector (green color stands for the possibly highest correlation, at least 70%)

Mean	496,74	175,89	522,39	224,06	203,94	60,90	901,01	289,43	547,73	462,04
Std	1540,83	449,50	1519,79	1294,28	1649,63	326,11	4143,63	1410,83	1792,38	1817,94
N	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
Sector name	sec 2	sec 3	sec 4	sec 5	sec 6	sec 7	sec 8	sec 9	sec 10	sec 11
Industry	1	0,74	0,83	0,34	0,56	0,67	0,78	0,62	0,58	0,60
Construction	0,74	1	0,73	0,37	0,34	0,51	0,63	0,49	0,65	0,59
Commerce	0,83	0,73	1	0,46	0,71	0,77	0,86	0,80	0,69	0,75
Transport	0,34	0,37	0,46	1	0,28	0,34	0,44	0,44	0,38	0,43
Financial activities	0,56	0,34	0,71	0,28	1	0,79	0,77	0,73	0,38	0,54
Real estate activities	0,67	0,51	0,77	0,34	0,79	1	0,88	0,83	0,59	0,68
Business services	0,78	0,63	0,86	0,44	0,77	0,88	1	0,83	0,64	0,70
Personal services	0,62	0,49	0,80	0,44	0,73	0,83	0,83	1	0,67	0,77
Education, health, social a	0,58	0,65	0,69	0,38	0,38	0,59	0,64	0,67	1	0,80
Administration	0,60	0,59	0,75	0,43	0,54	0,68	0,70	0,77	0,80	1

5.2.4 Interpretation of results of firmographic models

The variability of the disappearance of the establishments in Transport and Administration sectors is explained the most fully. Construction and Transport evolution models have the highest adjusted R². The explanation of variability of the location choice is the highest for Construction and Industry.

In the disappearance model, we can observe an increasing chance of survival with establishment's size.

Low education has a very strong positive effect on the survival of establishments in Industry and Construction. On the other hand, well educated workers accelerate the evolution of Business services and Real estate establishments.

We can observe that children discourage the establishments in Commerce and Personal services but attract the openings of new establishments in Education, health, social actions.

Establishments tend to locate in the close proximity to population. Establishments try to gather next to the establishments operating in the same sector (it is not the case only for Education, health, social actions sector). Moreover, industrial establishments try to choose the location near the establishments operating in the construction market, but it is not the case on the other way round. Industrial units locate also close to the establishments which belong to Commerce sector and avoid the ones in Business services. Establishments operating in Commerce try not to gather with the establishments in Industry and Financial activities. Financial institutions avoid Commerce and try to locate next to the units in Real estate. On the other hand, Business services are attracted by the Real estate market. Education, health, social actions are attracted to the financial establishments.

Location in La Défense festinates only the evolution of the financial establishments. Paris itself has a strong, however mixed effect on the survival rate of the establishments in general. Good access to train and metro is a strong incentive for all types of establishments. Easier access to the metro stations attracts the new establishments more significantly than the access to the train stations. Increasing average travel time spent in the public transport has a negative effect on the location choice for all the establishments' types.

Professional tax has a mixed but always significant effect on the establishment's disappearance and negative effect on the evolution of the units, especially on those operating in Business services, Real estate and Commerce.

Area available to meet new employment in a short run can be seen as an incentive when choosing a location to settle in the market. Business establishments tend to locate close to the highways and the opposite phenomenon can be observed in the case of Personal services.

As a great number of establishments have a workforce lower than 10. Instead of weighting the observations by the total number of employees in the establishment, we also estimate the firmographic models in two samples: (1) for the business units with the workforce lower or

equal to 10 and (2) for the units with the workforce greater than 10 up to 249. When we test the firmographic models, separately for these two cases, it turns out, that models for 10-249 employees are characterized by very small F-value and have very few significant variables. It may mean that we are not able to explain (with the variables used) the large establishments' behavior. In the simulation of the firmographic models, presented in Working Paper *Firmographics: Initial module for UrbanSimE*, the establishments with more than 249 employees are treated differently and are located exogenously in prefectures, large *communes* or close to large communes and in CDTs (territorial development contracts).

6 Conclusions

From the economical point of view as Ponsard (1990) claims, space is not neutral. In the section where we describe the ERE data, we highlight the fact that the distribution of establishments and employment vary strongly across the counties of Paris Region. The maps presented in Appendix show also very large differences in the employment density at the level of *commune*. Over 5 million jobs are distributed across the region with a high concentration of jobs in its central part. Much effort has been made recently to attract businesses to locate in the outer periphery of Ile-de-France, so far with not visible results however.

Paris Region is also diversified when we look at the distribution of establishments and jobs across the activity sectors. Sector Services (both business and personal) gathers over one third of all the establishments in both analyzed periods and similar fraction of employees. In Commerce, around one fourth of all the establishments are registered with 13% of all the employees in Ile-de-France. Next, Industry and Education, health, social actions sectors gather the biggest number of employees. We can also observe a slight decline in the discrepancy between the number of male and female employees registered in Ile-de-France between two analyzed periods.

In this report, we measure the size of an establishment as a total number of employees. The majority of the establishments in Ile-de-France, around 80% of all the establishments, is classified as micro units with less than 10 employees. We introduce also small (10-49 employees), medium-sized (50-249 employees) and big-sized units (more than 250 employees) to carry out the analyses.

Comparison of the estimation results of three firmographic models, disappearance, evolution and location models, show very big differences in the establishments' behavior across different activity sectors. However, after re-estimating all the models separately for different establishment's size-types, we can also draw the conclusion, that the behavior of the business unit depends on its size. With the variables that we use to run the models, the large establishments' behavior cannot be explained and different approach should be used to analyze the behavior of big-sized establishments.

As is shown in the paper, different factors affect three stages of establishment life cycle. The explanatory power of evolution and location choice models is not very high, but it is mainly due to the type of the model used and the way the dependent variable is created in the evolution model.

The final stage of the Paris Project, the implementation of these new firmographic models from SAS to OPUS/UrbanSim, is presented in *Firmographics: Initial module for UrbanSimE*.

7 References

- Alonso, W. (1964) *Location and Land Use*, Harvard University Press (Massachusetts).
- Audretsch, D. B. (1995) Innovation, growth and survival, *International Journal of Industrial Organization*, **13**, 441-457.
- Audretsch, D. B. and T. Mahmood (1995) New Firm Survival: New Results Using a Hazard Function, *The Review of Economics and Statistics*, **77**, 97-103.
- Beesley, M. E. and R. T. Hamilton (1993) Entry Propensity, the Supply of Entrants and the Spatial Distribution of Business Units, *Regional Studies*, **28**, 233-239.
- Berglund, E. and K. Brännäs (2001) Plants' entry and exit in Swedish municipalities, *The Annals of Regional Science*, **35**, 431-448.
- Bodenmann, B. R. and K. W. Axhausen (2008). Schweizer Unternehmen – quo vaditis? Firmendemographische Trends am Beispiel des Wirtschaftsraums St. Gallen, *Raumforschung und Raumordnung*, **66** (4) 318-332.
- Bodenmann, B. R. and K.W. Axhausen (2010) Synthesis report on the state of the art on firmographics, *SustainCity Working Paper 2.3*, Institute for Transport Planning and Systems (IVT), ETH Zurich.
- Brouwer, A., I. Mariotti and J. van Ommeren (2004) The firm relocation decision: An empirical investigation, *The Annals of Regional Science*, **38**, 335-347.
- Brüderl, J. and R. Schüssler (1990) Organizational Mortality: The Liabilities of Newness and Adolescence, *Administrative Science Quarterly*, **35**, 530-547.
- Cahuc, P. and A. Zylberberg (2006) *The Natural Survival of Work: Job Creation and Job Destruction in a Growing Economy*, MIT Press, Cambridge.
- Combes, P. P., M. Lafourcade, J.-F. Thisse and J.-C. Toutain (2011) The rise and fall of spatial inequalities in France: A long run perspective, *Explorations in Economic History*, **48**, 243-271.
- d'Aspremont, C., J. Gabszewicz and J.-F. Thisse (1979) On Hotelling's Stability in Competition, *Econometrica*, **47**, 1145-1150.

- de Bok, M. (2004) Explaining the location decision of moving firms using their mobility profile and the accessibility of locations, *ERSA conference papers ersa04p338*, *European Regional Science Association*.
- de Bok, M. and F. Sanders (2005) Firm Relocation and Accessibility of Locations Empirical Results from the Netherlands, *Transportation Research Record: Journal of the Transportation Research Board*, **1902**, 35-43.
- de Palma, A., V. Ginsburgh, Y. Y. Papageorgiou and J.-F. Thisse (1985) The principle of minimum differentiation holds under sufficient heterogeneity, *Econometrica*, **53**, 767-781.
- de Palma, A., K. Motamedi, N. Picard and P. Waddell (2005) A model of residential location choice with endogenous housing prices and traffic for Paris region. *European Transport\ Transporti Europei*, **31**, 67-82.
- Dixit, A. K. and J. E. Stiglitz (1977) Monopolistic Competition and Optimum Product Diversity, *American Economic Review*, **67**, 297-308.
- Duranton, G. and D. Puga (2003) Micro-Foundations of Urban Agglomeration Economies, *CEPR Discussion Paper* **4062**.
- Ekamper, P. (1996) Opheffing van bedrijfsvestigingen: Een sterftetafelbenadering (Dissolution of firms: a life table approach), *Planning, Methodiek en Toepassing*, **48**, 12-21.
- Friedman, J.M. and J.-F. Thisse (1993) Partial collusion fosters minimum product differentiation, *Rand Journal of Economics*, **24**, 631-645.
- Garofoli, G. (1994) New Firm Formation and Regional Development: The Italian Case, *Regional Studies*, **28**, 381-393.
- Gibrat, R. (1931) *Les Inégalités Économiques. Applications: Aux Inégalités des Richesses, à la Concentration des Entreprises, Aux Populations des Villes, Aux Statistiques des Familles, etc., d'une Loi Nouvelle: la Loi de l'Effet Proportionnel*, Paris: Sirey.
- Glaeser, E. L. and M. E. Kahn (2001) Decentralized Employment and the Transformation of the American City, *NBER Working Papers* **8117**, *National Bureau of Economic Research, Inc.*
- Hannan, M. T., G. R. Carroll, S. D. Dobrev and J. Han (1998) Organizational Mortality in European and American Automobile Industries. Part I: Revisiting the Effects of Age and Size, *European Sociological Review*, **14**, 279-302.

- Hannan, M. T., G. R. Carroll, S. D. Dobrev, J. Han and J. C. Torres (1998) Organizational Mortality in European and American Automobile Industries. Part I: Coupled Clocks, *European Sociological Review*, **14**, 303-313.
- Hart, M. and R. Scott (1994) Measuring the Effectiveness of Small Firm Policy: Some Lessons from Northern Ireland, *Regional Studies*, **28**, 849-858.
- Henderson, J.V. and A. Mitra (1996) The New Urban Landscape: Developers and Edge Cities, *Regional Science and Urban Economics*, **26**, 613-643.
- Heilbrun, J. (1992) Art and culture as central place functions, *Urban Studies*, **29**, 05-215.
- Hotelling, H. (1929) Stability in competition, *The Economic Journal*, **39**, 41-57.
- Isard, W. (1956) *Location and Space Economy*, MIT Press, Cambridge (Mass.).
- Jehiel, P. (1992) Product differentiation and price collusion, *International Journal of Industrial Organization*, **10**, 633-643.
- Johnson, P. S. and D. G. Cathcart (1979) New Manufacturing Firms and Regional Development: Some Evidence from the Northern Region, *Regional Studies*, **13**, 269-280.
- Kemper, N. J. and P. Pellenbarg (1997) De Randstad een hogedrukpan, *Economisch Statistische Berichten*, **82**, 508-512.
- Krugman, P. (1991) Increasing Returns and Economic Geography, *The Journal of Political Economy*, **99** (3) 483-499.
- Krugman, P. and A. J. Venables (1995) Globalization and the inequality of nations, *Quarterly Journal of Economics*, **110**, 857-880.
- Krugman, P., M. Fujita and A. J. Venables (1999) *The spatial economy. Cities, Regions and international trade*, Cambridge. MIT Press.
- Love, J. H. (1996) Entry and exit: a county-level analysis, *Applied Economics*, **28**, 441-451.
- Mai, C. and S. Peng (1999) Cooperation vs. Competition in a spatial model, *Regional Science and Urban Economics*, **29**, 463-472.
- Maoh, H. F. and P. S. Kanaroglou (2005) Agent-Based Firmographic Models: a Simulation Framework for the City of Hamilton, Proceedings of PROCESSUS Second International

al Colloquium on the Behavioural Foundations of Integrated Land-use and Transportation Models: Frameworks, Models and Applications. Toronto.

- Maoh, H. F. and P. S. Kanaroglou (2007) Business establishment mobility behavior in urban areas: a microanalytical model for the City of Hamilton in Ontario, Canada, *Journal of Geographical Systems*, **9** (3) 229-252.
- Mata, J. and P. Portugal (1994) Life duration of new firms, *The Journal of Industrial Economics*, **42**, 227-245.
- McFadden, D. (1974) Conditional Logit Analysis of Qualitative Choice Behavior, in Zarembka, P., ed., *Frontiers in Economics*, Academic Press: New York, 105-142.
- McFadden, D. (1978) An Application of Diagnostic Tests for the Independence from Irrelevant Alternatives Property of the Multinomial Logit Model, with Tye, W., Train, K., *Transportation Research Record: Forecasting Passenger and Freight Travel*, **637**, 39-46.
- McFadden, D. (1981) *Econometric Models of Probabilistic choice*, in Manski, C., McFadden, D., eds., *Structural Analysis of Discrete Data with Econometric Applications*, MIT Press: Cambridge, 198-272.
- Mills, E. S. (1967) An Aggregative Model of Resource Allocation in a Metropolitan Area, *American Econometric Review*, **57**, 197-210.
- Moeckel, R. (2005) Simulating Firmography, Fourth Oregon Symposium on Integrating Land Use and Transportation Models, Portland, Oregon, November 15-17.
- Muth, R. F. (1969) *Cities and housing: The spatial patterns of urban residential land use*, University of Chicago Press, Chicago.
- Nelson, R. R. and S. G. Winter (1982) *An Evolutionary Theory of Economic Change*, Cambridge (Massachusetts), London (England), The Belknap Press of Harvard University Press.
- Picard, N. and C. Antoniou (2011) Econometric guidance, *SustainCity Deliverable*, **5.1**, THEMA.
- Ponsard, C. (1990) L'analyse économique spatiale - observations méthodologiques, *Revue d'Economie Régionale et Urbaine*, **1**, 9-15.

- Porter, M. E. (1990) *The competitive advantage of nations*, Free Press, New York.
- Salop, S. C. (1979) Monopolistic Competition with Outside Goods, *Bell Journal of Economics*, **10**, 141-156.
- Santarelli, E., L. Klomp and A.R. Thurik (2006). Gibrat's Law: an overview of the empirical literature. In E. Santarelli (Ed.), *Entrepreneurship, Growth, and Innovation: the Dynamics of Firms and Industries*, New York: *Springer*, 41-73.
- Stinchcombe, A. L. (1968) Demography of organizations, *American Journal of Sociology*, **74**, 221- 229.
- van Dijk, J. and P. H. Pellenbarg (2000) Firm relocation decisions in The Netherlands: An ordered logit approach, *Papers in Regional Science*, **79** (2) 191-219.
- van Wissen, L. J. (2000) A micro-simulation model of firms: Applications of concepts of the demography of the firm, *Papers in Regional Science*, **79**, 111-134.
- Vickrey, W. S. (1969) Congestion theory and transport investment, *American Economic Review*, **59**, 251-261.
- Vickrey, W. S. (1964) *Microstatics*, Harcourt, Brace & World, Inc, New York.
- Waddell, P. and G. F. Ulfarsson (2003) Accessibility and Agglomeration: Discrete-Choice Models of Employment Location by Industry Sector, Paper presented at the 82nd Annual Meeting of the Transportation Research Board, Washington, D.C.

Appendix

Table 27 Disappearance models – results (t-Value given in the grey color below the parameter estimator; ***, **, * are 0.01, 0.05, 0.1 significance level, respectively)

	sector 1		sector 2		sector 3		sector 4		sector 5		sector 6		sector 7		sector 8		sector 9		sector 10		sector 11	
	Agriculture		Industry		Construct		Commerce		Transport		Financial a		Real estate a		Business ser		Personal ser		Ed, he, soc		Administr	
	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig
Intercept	4.293 7.63	***	-0.205 -3.51	***	0.810 26.81	***	-0.182 -2.71	***	-2.230 -23.67	***	-2.450 -20.28	***	1.294 7.49	***	-0.539 -12.40	***	-1.671 -22.43	***	2.481 35.07	***	-4.113 -51.40	***
Tot #empl in estab:2	-0.874 -3.07	***	-0.252 -10.10	***	-0.173 -7.32	***	-0.242 -17.82	***	-0.221 -4.73	***	-0.233 -5.27	***	-0.127 -3.57	***	-0.210 -13.47	***	-0.241 -14.61	***	-0.234 -10.70	***	-0.389 -11.96	***
Tot #empl in estab:3-5	-0.263 -0.91	***	-0.427 -17.99	***	-0.302 -13.38	***	-0.449 -34.44	***	-0.382 -8.66	***	-0.493 -12.19	***	-0.318 -9.35	***	-0.337 -22.58	***	-0.415 -26.01	***	-0.259 -11.56	***	-0.590 -18.48	***
Tot #empl in estab:6-9	-1.288 -4.30	***	-0.527 -22.66	***	-0.462 -20.44	***	-0.599 -45.36	***	-0.560 -13.07	***	-0.770 -19.77	***	-0.415 -11.69	***	-0.391 -25.95	***	-0.560 -34.26	***	-0.366 -16.03	***	-0.657 -21.04	***
Tot #empl in estab:10-19	-6.624 0.0005	***	-0.615 -26.71	***	-0.570 -24.78	***	-0.509 -37.49	***	-0.543 -12.83	***	-0.790 -20.85	***	-0.262 -6.95	***	-0.418 -27.73	***	-0.597 -35.11	***	-0.521 -24.35	***	-0.525 -17.93	***
Tot #empl in estab:20-49	-2.159 -7.23	***	-0.574 -25.98	***	-0.610 -27.91	***	-0.556 -43.01	***	-0.557 -13.79	***	-0.771 -20.50	***	-0.128 -3.72	***	-0.362 -26.05	***	-0.623 -38.60	***	-0.616 -33.86	***	-0.497 -18.80	***
Tot #empl in estab:50-99	-6.986 -7.12	***	-0.707 -30.78	***	-0.403 -16.35	***	-0.619 -43.79	***	-1.088 -26.12	***	-0.675 -17.83	***	-0.141 -3.76	***	-0.417 -29.18	***	-0.583 -30.73	***	-0.745 -40.81	***	-0.270 -10.19	***
Tot #empl in estab:100+	-0.831 -3.26	***	-0.863 -41.19	***	-0.353 -17.63	***	-0.534 -45.15	***	-1.163 -30.24	***	-0.627 -18.15	***	-0.098 -3.40	***	-0.524 -41.93	***	-0.735 -48.54	***	-0.818 -53.65	***	-0.637 -27.66	***
3-5 slope (3*tot97-3)	-0.765 -5.01	***	-0.040 -4.52	***	-0.101 -10.11	***	-0.070 -12.56	***	-0.030 -1.74	*	-0.088 -5.43	***	-0.051 -2.92	***	-0.040 -5.85	***	-0.057 -7.76	***	-0.052 -3.75	***	-0.066 -3.72	***
6-9 slope (6*tot97-6)	0.705 4.40	***	-0.009 -1.62	***	-0.042 -6.13	***	0.003 0.71	***	0.008 0.76	***	0.030 2.88	***	0.012 0.96	***	-0.033 -6.99	***	-0.051 -9.44	***	-0.028 -3.02	***	-0.001 -0.12	***
10-19 slope (10*tot97-10)	-0.329 0.0001	***	0.002 0.91	***	-0.014 -5.22	***	-0.010 -5.94	***	0.008 2.15	**	-0.003 -0.80	***	0.030 5.49	***	0.001 0.29	***	-0.013 -5.77	***	-0.011 -3.89	***	0.006 1.77	*
20-49 slope (20*tot97-20)	-0.024 -1.07	***	-0.007 -14.35	***	-0.002 -2.26	**	-0.002 -3.62	***	-0.009 -11.01	***	-0.002 -1.69	*	0.005 3.29	***	0.001 2.52	**	-0.007 -10.29	***	-0.006 -9.86	***	-0.008 -9.14	***
50-99 slope (50*tot97-50)	0.363 6.04	***	-0.001 -3.00	***	0.0001 0.20	***	0.002 5.93	***	0.012 19.77	***	0.0004 -0.57	***	0.008 7.96	***	0.001 2.86	***	-0.002 -3.76	***	-0.006 -15.18	***	-0.008 -16.05	***
100+ slope (100*tot97-100)	-0.025 -7.61	***	0.0002 136.30	***	-0.001 -40.17	***	-0.001 -66.85	***	0.0004 -74.08	***	0.0002 -75.27	***	-0.001 -25.38	***	0.0002 106.86	***	-0.001 -48.72	***	0.0003 -78.17	***	0.0005 128.59	***
%empl with primary educ	-0.373 -0.30	***	-1.582 -29.71	***	-0.566 -8.92	***	0.233 4.15	***	0.387 4.12	***												
%employ with educ: classes 6e-3e, CAP, BEP	1.836 3.29	***	0.143 4.95	***	-1.394 -38.23	***	-0.167 -5.45	***	0.457 8.11	***												
%empl with high school educ											5.057 26.14	***	0.493 2.36	**	0.018 0.29	***					3.652 44.00	***
%empl with superior educ											2.341 28.33	***	-1.985 -19.38	***	-0.097 -4.06	***					0.620 15.40	***
Ln(avg office price)			0.119 17.42	***			0.036 4.68	***			-0.109 -6.94	***	-0.156 -6.45	***	0.000 0.05	***	0.174 17.32	***	-0.200 -19.58	***	0.405 36.59	***
Population density (#people/ km2)*1000	0.064 3.77	***	0.009 31.83	***	-0.005 -10.17	***	0.010 32.49	***	0.001 1.68	*	-0.005 -10.79	***	-0.011 -13.47	***	0.011 46.16	***	0.002 5.37	***	0.004 9.23	***	-0.005 -12.64	***
%househ: members have no activity								***	-4.061 -42.62	***												
%househ with high income per person							-0.190 -3.32	***	4.525 38.67	***	0.458 6.80	***	0.804 8.36	***	0.726 30.40	***	0.127 1.52	***	-1.449 -21.48	***	-1.274 -33.62	***
%househ with low income per person							-0.203 -2.91	***	4.418 32.34	***							0.133 1.20	***	-1.460 -16.78	***		
Program Ville Nouvelle	-0.508 (-2.36)	**	-0.110 -17.04	***	-0.053 -4.87	***	0.076 11.01	***	-0.003 -0.17	***	-0.468 -25.53	***	0.449 17.92	***	0.009 1.48	***	0.105 8.76	***	0.191 22.93	***	0.196 21.45	***
La Défense											0.542 33.51	***	0.235 8.73	***	0.144 22.71	***					-0.365 -23.35	***
Paris	2.282 3.69	***	-0.248 -22.15	***	0.226 10.13	***	-0.431 -39.00	***	-0.611 -27.28	***	0.140 6.70	***	-0.121 -3.69	***	-0.050 -5.99	***	-0.538 -39.89	***	0.297 20.47	***	0.372 24.24	***
#SNCF&RER stations	-0.238 -4.47	***	-0.001 -0.62	***	-0.009 -5.97	***	0.000 -0.22	***	0.022 12.16	***	-0.016 -9.24	***	0.054 21.68	***	0.009 13.01	***	0.006 4.77	***	0.004 4.05	***	0.008 7.08	***
#metro&tram stations	-0.078 -2.96	***	0.004 8.07	***	-0.002 -2.02	**	0.011 23.87	***	0.021 21.46	***	-0.008 -10.33	***	-0.006 -4.63	***	-0.002 -4.98	***	0.019 35.22	***	0.002 4.34	***	-0.014 -27.01	***
Avg travel time for private vehicle (minute)	-0.028 -11.28	***	-0.005 -64.98	***	0.001 9.16	***	0.000 -4.48	***	-0.002 -10.75	***	-0.001 -5.05	***	0.002 7.93	***	0.000 2.57	**	0.000 -2.59	***	-0.003 -28.60	***	0.000 4.51	***
Avg travel time for public transport (minute)	-0.085 -7.81	***	-0.005 -17.77	***	-0.001 -1.89	*	0.004 14.82	***	0.013 33.70	***	0.031 38.49	***	0.031 29.99	***	0.008 32.72	***	0.004 10.90	***	-0.006 -14.26	***	0.004 8.51	***
Professional tax (by commune)			-0.001 -2.96	***	0.001 2.86	***	0.003 7.66	***	0.005 7.17	***	0.024 21.45	***	-0.040 -30.47	***	0.005 14.64	***	0.011 15.78	***	-0.017 -31.66	***	0.013 23.74	***

<i>R2</i>	0.9999	0.6597	0.2478	0.2210	0.9912	0.7904	0.4917	0.4469	0.3966	0.6622	0.9736
<i>LIKE 0 count</i> <i>(data used)</i>	120	12397	10672	28045	3790	3401	3280	23617	15905	6067	3747
<i>LIKE 0 tot weight (by</i> <i>tot97)</i>	692	217257	88369	211004	52935	78766	28147	335520	90392	71531	86745
<i>LIKE 1 count</i> <i>(data used)</i>	65	18490	12172	41050	4955	6698	5086	28950	26245	18969	9582
<i>LIKE 1 tot weight (by</i> <i>tot97)</i>	1445	449312	130266	424261	190381	169308	45947	601775	246587	604227	495121
<i>E2=0 E9=1 (3)</i> <i>(data read)</i>	120	12499	10684	28062	3800	3402	3630	23661	15928	6358	4043
<i>E2=1 E9=1 (1_1997)</i> <i>(data read)</i>	65	18503	12188	41063	4956	6698	5090	28969	26247	18988	9673

Table 28 Evolution models – results

Parameter	sector 1 Agriculture		sector 2 Industry		sector 3 Construct		sector 4 Commerce		sector 5 Transport		sector 6 Financial a		sector 7 Real estate a		sector 8 Business ser		sector 9 Personal ser		sector 10 Ed, he, soc		sector 11 Administr		
	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	Estim	Sig	
Intercept	0.165 1.59		0.545 3.49	***	0.449 9.96	***	0.439 4.12	***	0.759 7.47	***	0.397 1.63		0.578 2.23	**	0.480 3.59	***	0.158 1.56		0.286 2.30	**	0.282 4.28	***	
Tot #empl in estab:2			-0.299 -18.19	***	-0.248 -15.78	***	-0.234 -28.02	***	-0.286 -8.05	***	-0.221 -7.84	***	-0.197 -9.06	***	-0.219 -17.01	***	-0.252 -25.18	***	-0.162 -14.23	***	-0.215 -11.22	***	
Tot #empl in estab:3-5			-0.370 -22.85	***	-0.357 -22.19	***	-0.296 -35.21	***	-0.397 -11.30	***	-0.235 -8.91	***	-0.227 -10.26	***	-0.286 -21.62	***	-0.318 -30.92	***	-0.156 -11.42	***	-0.267 -13.19	***	
Tot #empl in estab:6-9			-0.435 -24.41	***	-0.413 -21.64	***	-0.354 -34.93	***	-0.517 -13.61	***	-0.266 -9.59	***	-0.312 -10.73	***	-0.329 -20.00	***	-0.335 -26.27	***	-0.114 -6.34	***	-0.277 -11.21	***	
Tot #empl in estab:10-19			-0.417 -20.79	***	-0.419 -17.78	***	-0.362 -26.58	***	-0.510 -11.49	***	-0.299 -9.77	***	-0.346 -8.08	***	-0.313 -15.13	***	-0.390 -22.97	***	-0.150 -7.66	***	-0.316 -11.00	***	
Tot #empl in estab:20-49			-0.431 -19.88	***	-0.377 -13.52	***	-0.374 -23.08	***	-0.558 -12.13	***	-0.357 -9.04	***	-0.311 -5.82	***	-0.289 -12.72	***	-0.299 -14.40	***	-0.136 -7.26	***	-0.376 -12.16	***	
Tot #empl in estab:50-99			-0.469 -13.11	***	-0.388 -6.01	***	-0.405 -13.22	***	-0.531 -7.82	***	-0.346 -5.42	***	-0.337 -3.66	***	-0.324 -8.75	***	-0.299 -6.57	***	-0.116 -4.57	***	-0.344 -7.13	***	
Tot #empl in estab:100+			-0.478 -20.50	***	-0.563 -13.19	***	-0.427 -16.93	***	-0.553 -12.61	***	-0.421 -11.12	***	-0.418 -6.64	***	-0.552 -23.37	***	-0.375 -9.95	***	-0.179 -10.65	***	-0.291 -11.84	***	
3-5 slope (3*tot97-3)			-0.020 -2.31	*	-0.016 -1.59		-0.027 -5.46	***	-0.029 -1.45		-0.025 -1.71	*	-0.051 -3.34	***	-0.017 -2.00	**	-0.008 -1.19		0.015 1.37		-0.011 -0.81		
6-9 slope (6*tot97-6)			0.006 0.83		-0.005 -0.60		-0.003 -0.57		0.008 0.49		-0.013 -1.08		-0.014 -0.92		-0.003 -0.44		-0.013 -2.11	**	-0.024 -2.59	***	-0.014 -1.16		
10-19 slope (10*tot97-10)			-0.003 -0.93		0.005 1.00		-0.003 -1.19		-0.008 -1.06		-0.009 -1.47		0.002 0.23		0.002 0.49		0.009 2.57	***	-0.004 -1.08		-0.003 -0.47		
20-49 slope (20*tot97-20)			-0.0002 -0.12		-0.004 -2.12	**	0.002 1.49		-0.001 -0.42		-0.001 -0.38		0.0002 0.05		-0.003 -2.22	**	-0.003 -2.04	**	-0.003 -2.16	**	0.001 0.63		
50-99 slope (50*tot97-50)			0.002 1.69	*	0.001 0.35		0.001 1.09		-0.001 -0.21		0.001 0.58		-0.007 -1.70	*	-0.002 -1.08		-0.006 -2.92	***	-0.003 -3.07	***	0.002 0.83		
100+ slope (100*tot97-100)			-0.0001 -1.68	*	-0.001 -7.52	***	0.000 0.39		0.00001 0.19		0.0001 -1.55		0.00002 0.09		0.0001 -1.50		0.00002 0.54		0.0000004 0.02		-0.0001 -2.74	***	
%empl with primary educ			-0.146 -1.63		-0.065 -0.83		-0.037 -0.52																
%empl with educ: classes 6e - 3e, CAP, BEP			-0.019 4.75	*	-0.020 -0.38		-0.015 -0.36																
% empl with high school educ					-0.070 -0.81		0.011 0.15		-0.233 -0.83		-0.258 -0.91		-0.134 -0.60		-0.202 -1.62						0.037 0.45		
%empl with superior educ								0.087 0.70		0.076 0.62		0.196 1.65	*	0.127 2.15	**						-0.094 -1.59		
Ln(avg office price)			-0.004 -0.22				0.007 0.55				-0.001 -0.03		-0.044 -1.24		0.009 0.51		0.014 1.01		-0.008 -0.44				
(Population density, #people/ km2)*1000			-0.002 -3.08	***	-0.001 -1.28		0.000 -4.31	***	-0.001 -0.97		-0.003 -2.57	***	0.001 0.89		0.0002 0.25		-0.0001 -0.26		0.0001 0.12		0.0002 0.22		
%househ.members have no activity			-0.203 -2.12	**			-0.420 -6.86	***	-0.539 -2.77	***	-0.154 -0.83		0.151 0.79		-0.594 -5.96	***	-0.084 -1.07		-0.215 -2.48	**	-0.157 -1.21		
%househ with high income per person			-0.103 -1.83	*			-0.083 -2.21	**	-0.108 -0.96		0.029 0.26		-0.206 -1.74	*	-0.104 -1.70	*	0.117 2.61	***	-0.012 -0.26		-0.002 -0.03		
La Défense							0.038 1.95	*	-0.050 -0.84		0.153 3.39	***	0.061 1.13				0.043 1.76	*	-0.020 -0.65		0.048 1.25		
Neighboring communes to Paris			-0.027 -1.74	*	0.017 0.93		0.002 0.16		0.013 0.38		0.013 0.45		-0.028 -0.87		0.019 1.16		0.015 1.09		-0.003 -0.21		0.002 0.07		
Program Ville Nouvelle			0.845 -2.20	***	0.028 1.56		0.033 1.77	*	0.009 0.78		-0.006 -0.16		0.006 0.18		0.054 1.41		0.003 0.13		0.030 1.85	*	-0.001 -0.04		0.003 0.10
Paris			-0.035 -1.14		-0.063 -1.45		-0.014 -0.71		0.033 0.57		0.093 1.70	*	-0.053 -0.91		-0.074 -2.44	**	0.048 1.99	**	0.005 0.17		0.028 0.71		
#SNCF&RER stations			-0.005 -2.57	***	-0.004 -1.71	*	-0.002 -1.96	**	0.001 0.28		-0.003 -0.88		-0.002 -0.52		0.002 0.90		-0.0004 -0.24		-0.001 -0.67		-0.001 -0.20		
#metro&tram stations			0.003 2.62	***	0.002 1.00		0.002 2.38	**	-0.002 -0.91		0.0004 -0.22		0.0003 0.19		0.001 1.44		-0.001 -1.64		-0.001 -0.71		0.00001 -0.01		
Avg travel time for public transport (minute)			-0.00003 -0.23		0.0001 -1.27		0.000 -1.06		-0.0004 -1.38		0.0003 -1.19		0.0005 1.79	*	0.0002 -1.43		-0.0001 -1.39		-0.00004 -0.39		-0.0001 -0.51		

Avg travel time for private vehicle (minute)		0.0000003 0.0004	0.001 0.81	- 0.0004 -0.93	-0.0001 -0.07	-0.002 -1.44	0.001 0.78	0.001 1.26	0.001 0.85	-0.0004 -0.55	0.0001 0.14
Professional tax (by commune)		-0.0004 -0.41	-0.001 -1.49	-0.001 * -1.75	-0.001 -0.38	0.0001 0.07	-0.003 * -1.88	-0.003 *** -3.03	-0.001 -1.26	-0.0005 -0.61	0.001 0.99
R2	0.0686	0.0592	0.0938	0.0647	0.0809	0.0433	0.0680	0.0432	0.0665	0.0241	0.0547
Coeff VAR	803.85	9370.57	667.66	2106.58	480.09	4967.31	1796.03	820.91	2104.00	1895.66	4125.21
ROOT MSE	0.8251	0.4917	0.4787	0.4657	0.5558	0.5020	0.4966	0.6142	0.4724	0.4713	0.5120
F Value	4.86	42.52	50.44	97.22	17.3	10.75	14.07	48.74	71.8	17.97	20.41
#observations read											
E2=1 E9=1 (I_2001)	68	18278	12229	40781	4938	6681	5435	29213	26218	18975	9648
#observations used	68	18264	12213	40769	4938	6681	5431	29194	26216	18956	9557

Table 29 Location choice models – results

	sector 2 Industry		sector 3 Construct		sector 4 Commerce		sector 5 Transport		sector 6 Financial a		sector 7 Real estate a		sector 8 Business ser		sector 9 Personal ser		sector 10 Ed, he, soc		sector 11 Administr		
	Estim	Sig.	Estim	Sig.	Estim	Sig.	Estim	Sig.	Estim	Sig.	Estim	Sig.	Estim	Sig.	Estim	Sig.	Estim	Sig.	Estim	Sig.	
Empl density in Industry (Emp2_97/Project99ST)*1000	0.036 8.32	***	0.012 -2.24	**	-0.012 -4.66	***							0.006 2.22	**							
Empl density in Construction	0.112 5.61	***	0.264 14.22	***	0.017 1.44												-	0.032 -1.17			
Empl density in Commerce	0.052 8.63	***	0.001 0.17		0.086 21.24	***			-0.028 -2.45	**											
Empl density in Transport							0.093 8.84	***													
Empl density in Financial activities					-0.013 -8.47	***			0.036 8.21	***								0.008 2.74	***		
Empl density in Real estate activities									0.122 5.01	***	0.233 7.18	***	0.046 3.75	***							
Empl density in Business services	-0.007 -2.83	***									-0.003 -0.77		0.014 6.77	***							
Empl density in Personal services											-0.010 -1.44				0.007 2.235	**				-	0.005 -0.82
Empl density in Education, health, social actions																	-	0.006 -0.89		0.010 1.53	
Empl density in Administration																	-	0.001 -0.13		0.018 3.38	***
Ln(total number of employees)	-0.786 -22.70	***	0.722 23.22	***	-0.785 -36.20	***	0.893 27.45	***	-0.056 -0.67		-0.500 -7.94	***	-0.619 -27.32	***	-0.607 22.291	***	0.665 14.20	***	0.587 12.21	***	
Population density (#people/km2)*1000	0.031 16.48	***	0.025 12.77	***	0.00001 10.66	***	0.031 11.17	***	-0.002 -0.43		0.015 4.32	***	0.008 6.99	***	0.019 10.678	***	0.021 6.30	***	0.000 4.73	***	
La Défense					-0.033 -0.66		0.100 0.86		0.010 0.08		-0.154 -1.18		-0.026 -0.65		-0.158 -2.556	**				0.073 -0.63	
Program Ville Nouvelle	-0.158 -3.27	***	0.267 -6.13	***	-0.201 -5.87	***	0.201 -2.94	***	-0.280 -2.82	***	-0.473 -5.32	***	-0.255 -7.02	***	-0.247 -5.291	***	0.440 -5.97	***	0.333 -4.56	***	
Distance to highway (km)	0.002 0.42		0.005 -1.09		0.002 0.57		0.004 0.43						-0.009 -2.29	**	0.011 2.618	***					
%empl with primary educ	3.128 7.73	***	4.678 13.11	***																	
%empl with educ: classes 6e-3e, CAP, BEP	1.211 5.23	***	2.206 10.65	***																	
%empl with high school educ									-2.054 -1.99	**	-1.529 -2.01	**	-0.536 -1.99	**							
%emp with superior educ									-1.946 -4.36	***	-2.129 -6.07	***	-0.660 -5.08	***							
%househ: members have no activity													-2.511 -10.77	***	0.352 0.510		4.376 3.40	***			
%househ with high income per person					2.931 10.82	***			1.588 3.84	***	2.201 6.36	***	4.041 13.51	***	2.020 5.383	***	3.671 6.21	***			
%househ with low income per person					4.635 13.50	***							4.021 10.34	***	3.828 7.904	***	3.776 4.95	***			
%househ where the head of the househ is at the age 35 or less					-2.051 -6.67	***									-0.703 -1.468		0.437 -0.58				
%househ where the head of the househ is at the age 55 or more					-1.699 -5.37	***									-1.067 -1.483		3.020 -2.41	**			
%househ with children 11 year old or less					-0.578 -1.88	*									-1.266 -2.801	***	2.484 3.50	***			
Ln(avg office price)					0.061 1.74	*			0.379 3.55	***	0.719 8.10	***	0.629 18.26	***	0.254 5.722	***	0.061 0.84		0.254 3.49	***	
Area available to meet a short term project	0.277 7.50	***	0.119 3.56	***	0.269 11.65	***	0.496 13.18	***	-0.357 -4.40	***	-0.027 -0.43		0.100 4.56	***	0.016 0.563		0.052 1.00		0.036 0.67		
#SNCF&RER stations	0.017 2.82	***	0.027 4.85	***	0.014 3.70	***	0.006 -0.64		0.052 4.23	***	0.029 2.87	***	0.023 6.09	***	0.027 5.931	***	0.040 4.98	***	0.020 2.20	**	

# metro&tram stations	0.032 *** 14.61	0.043 *** 18.73	0.031 *** 21.30	0.021 *** 6.37	0.011 ** 2.57	0.027 *** 7.62	0.023 *** 17.46	0.027 *** 15.100	0.039 *** 12.72	0.039 *** 11.70
Avg travel time for public transport (minute)	- 0.0004 -0.92	- 0.001 ** -2.29	- 0.0001 0.51	- 0.002 ** -2.19	- 0.0001 -0.08	- 0.0002 -0.22	- 0.0004 -1.27	- 0.0001 -0.272	- 0.001 0.97	- 0.001 * 1.74
Avg travel time for private vehicle (minute)	-0.003 * -1.72	0.020 *** - 11.00	-0.012 *** -10.22	0.009 *** 3.50	-0.019 *** -4.55	-0.026 *** -7.11	-0.017 *** -12.26	-0.019 *** - 11.451	0.026 *** - -9.53	0.017 *** - -5.40
Professional tax (by commune)		0.012 *** 6.10	-0.002 -1.33		0.013 ** 2.34	0.006 1.29	-0.006 *** -3.57	-0.002 -0.808		
%commune surface in Zone Franche Urbaine								-0.207 -0.878		

	sector 2 Industry	sector 3 Construct	sector 4 Commerce	sector 5 Transport	sector 6 Financial a	sector 7 Real es- tate a	sector 8 Business ser	sector 9 Personal ser	sector 10 Ed, he, soc	sector 11 Administr
<i>Dependent Variable</i>	decision	decision	decision	decision	decision	decision	decision	decision	decision	decision
<i>Number of Observations</i>	10374	12701	28613	4407	3065	4085	28979	17684	6082	4395
<i>Number of Cases</i>	103740	127010	286130	44070	30650	40850	289790	176840	60820	43950
<i>Log Likelihood</i>	-22151	-25169	-62654	-9517	-6643	-8821	-63746	-38912	-13086	-9662
<i>Maximum Absolute Gradient</i>	3.00E-07	9.99E-08	0.00138	3.7E-05	8.32E-06	0.00082	0.00094	0.00132	0.000053	9.53E-06
<i>Number of Iterations</i>	4	5	4	4	4	4	4	4	4	4
<i>Optimization Method</i>	Newton-Raphson									
<i>AIC</i>	44331	50368	125351	19055	13320	17676	127532	77864	26210	19350
<i>Schwarz Criterion</i>	44440	50480	125524	19125	13422	17783	127697	78020	26338	19433
<i>Measure</i>										
<i>2 * (LogL - LogL0)</i>	3472.6	8152.4	6458.8	1261.8	829.3	1170.4	5961.4	3472.6	1836.7	915.5
<i>- 2 * LogL0</i>	47774.0	58490.3	131767.7	20295.0	14114.8	18812.1	133453.2	47774.0	28008.6	20239.7
<i>R / (R+N)</i>	0.251	0.391	0.184	0.223	0.213	0.223	0.171	0.251	0.232	0.172
<i>1 - exp(-R/N)</i>	0.284	0.474	0.202	0.249	0.237	0.249	0.186	0.284	0.261	0.188
<i>(1-exp(-R/N)) / (1-exp(-U/N))</i>	0.287	0.478	0.204	0.251	0.239	0.252	0.188	0.287	0.263	0.190
<i>1 - (1-R/U)^(U/N)</i>	0.294	0.499	0.207	0.256	0.243	0.256	0.190	0.294	0.268	0.192
<i>1 - ((LogL-K)/LogL0)^(U/N)</i>										
<i>(-2/N*LogL0)</i>	0.291	0.498	0.205	0.252	0.234	0.249	0.189	0.291	0.263	0.187
<i>R / U</i>	0.0727	0.1394	0.0490	0.0622	0.0588	0.0622	0.0447	0.0727	0.0656	0.0452
<i>(R * (U+N)) / (U * (R+N))</i>	0.305	0.476	0.224	0.271	0.259	0.271	0.208	0.305	0.282	0.210

Figure 12 Employment density across activity sectors in 2001

