# Standards of living and segregation in twelve French metropolises

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**Abstract** – Urban public policies are required to reconcile targeted measures with more comprehensive measures promoting social diversity, and to arbitrate between conurbations, as well as neighbourhoods within conurbations. Localised data on tax and social income (*Filosofi*, Insee) are used to calculate segregation indicators to compare urban areas, their centre-cities, suburbs and outer suburbs; by developing a fairly simple typology, it becomes possible to map out the neighbourhoods, rich or poor, that most contribute to social disparities. This article presents the resulting analyses for twelve metropolises. The level of segregation in them is higher in the centre-cities and suburban areas than on the periphery. It is more marked for high living standards. Segregation is the most pronounced in the urban areas of Lille, Paris and Aix-Marseille, Strasbourg, Nantes) or in the suburbs (Paris, Lyon, Lille). These differences often stem from local urban history and housing policies.

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Reminder:

The opinions and analyses in this article are those of the author(s) and do not necessarily reflect their institution's or Insee's views.

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C ince the foundational work of the Chicago School in urban sociology in the 20s, the empirical study of the relationship between urbanisation, metropolises and segregation has developed considerably (Grafmeyer & Joseph, 1984). Recently, the OECD underscored that the economic growth of the large OECD conurbations in the United States and Europe has come along with high levels of inequalities in income, education, access to employment and heightened segregation (Brezzi et al., 2016; Musterd et al., 2017). The persistence of these inequalities and, in some cases, their increase is an obstacle to the inclusive growth called for by the OECD. As with pollution due to industrial activity and transport, they are referred to by economists as negative externalities of the metropolisation process. Some authors have suggested introducing segregation alongside concentration and urban sprawl as a feature of metropolisation (Buisson et al 2005; Lacour & Puisant, 1999; Sassen, 1991).

In France, the recent territorial reforms, in particular the 27 January 2014 Law for the Modernisation of Territorial Public Action and the Affirmation of Metropolitan Areas (MAPTAM law), give the metropolises decisive importance. A recent report by France Stratégie<sup>1</sup> on territorial dynamics and inequalities recommends making metropolises into the drivers of growth that would benefit all the regions (Dherbécourt & Le Hir, 2016). While the benefits to the metropolitan environment highlighted by the new geographic economy (Combes & Lafourcade, 2012), particularly in terms of labour productivity, continue to be debated by economists (Bouba-Olga & Grossetti, 2015), the growth of metropolises, whether in terms of number of inhabitants or active workers, is unquestioned (Creusat & Morel-Chevillet, 2015).

With the extension of the outer suburbs, the social composition of urban areas has changed perceptibly. The development of the outer suburbs, by enabling part of the urban population to become home-owners at the outskirts of cities, even though this often means extended commute times, planted the seeds for a sorting of the population across space and thus for spatial differentiation (Charlot *et al.*, 2009). Sometimes the result of circumstance, in particular, for populations who live in the farthest reaches of urban areas, this trend can also result from personal choice, in which case it gives rise to a phenomena of "clubbisation" (Charmes, 2011). Residents live in "clubbised" municipalities as members of a club premised on shared enjoyment of a social (high-quality population) and spatial (well-kept green spaces) environment. Lastly, the largest urban areas concentrate the most qualified jobs, which generally come along with high salaries. However, they are also home to the majority of the populations addressed by city policy, and thus over-represent both the highest and lowest standards of living, with notable local-level differences in the sharing between centre-cities, suburbs and outer suburbs.

To describe the spatial translations of these inequalities, the term urban segregation or socio-spatial segregation is used. This term ultimately made a place for itself in the French-language literature after lengthy debate due to the overly-present semantic connotations it carried, calling to mind ghettos or discrimination; alternative formulations such as "social division of space", or "social differentiation of urban territories" were, conversely, found to be too neutral. Here, the term "segregation" will be used to refer to the unequal distribution of social groups, approached using economic, demographic or social characteristics, between the districts of a city (Oberti & Préteceille, 2016; Baumont & Guillain, 2013). Segregation reflects the propensity of local situations to deviate from the average situation. The absence of segregation would result in a random distribution of the population across the space studied, resulting in similar spatial distributions for each of the social groups present (Verdugo, 2011). A consensus on the wording has now been reached in the French-language literature, in the economic as well as in the sociological approaches. Segregation refers in this context to a state of affairs and not to a willed separation.

Economic approaches to segregation are based on models from the urban economics, analysing the spatial organisation of the labour market in urban spaces where jobs are concentrated in the centre, a situation characteristic of most European cities. In this model, the unemployed or low-income households tend to settle in the most remote suburbs (L'Horty, 2015). These models provide an analytical framework that can be used to assess the effect of public policies, whether they pertain to transport costs,

<sup>1.</sup> France Stratégie (also the Commissariat Général à la stratégie et à la prospective - CGSP), is a body dedicated to reflection, expertise and consultation operating under the Prime Minister. Its main mandates include assessing public policies, anticipating challenges and changes, debating with multiple stakeholders and putting forth new solutions.

training, concentration of living spaces or social housing. Sociological approaches focus more on social rationale, institutional policies or the rationale of players that leads to urban segregation. They result historically from the research carried out by the Chicago School of Sociology in the 1920s. It was through these sociological studies that the main indicators for measuring segregation were built (Massey & Denton, 1988; Apparicio, 2000). The first studies, dealing with population breakdown based on ethno-racial criteria, contributed to the association between segregation, ghetto and discrimination.

In France, the empirical work on segregation has frequently drawn upon the Socio-Occupational Categories (SOCs hereafter) provided by census data: Debonneuil and Gollac (1978) for instance have characterised the spatial segregation of seven conurbations in Champagne and Picardie; others have proposed a social representation of the territory studying the changes in the social composition of the municipalities between 1982 and 1990 (Tabard, 1993; Chenu & Tabard, 1994), or combining analysis of neighbourhoods with a synoptic view at the level of the conurbation (Mansuy & Marpsat, 1991); meanwhile, successive censuses made it possible to study the development of segregation over time (Charlot et al., 2009). For the past few years, the statistical landscape has been modified by the availability of income data at a fine-grained territorial level: the localised income tax database (RFL), replaced from 2012 by the Localised Social and Fiscal Register (Filosofi) which now provides more comprehensive information on income, in that it matches up fiscal and social data, with a more accurate estimate of the benefits actually received at fine-grained local (sub-municipal) levels. Various empirical studies on spatial concentration and segregation have already used these income data, for example, to identify concentrations of poor neighbourhoods (Buisson et al., 2005; Bouzouina, 2007) or to analyse disparities in income (François et al., 2007) or "social sorting" (Tovar, 2011).

This article is based on data on local-level standards of living (see Box 1). The work carried out during the redefinition of priority neighbourhoods showed the standard of living to be the most relevant characteristic for summarily describing situations of social difficulty (Darriau *et al.*, 2014). These data are derived from the *Filosofi* register, which makes it possible to calculate the standard of living indicator for each tax household. The article extends from previous studies on income inequality (Floch, 2014; 2016) by putting the emphasis on spatial segregation.

Segregation is measured following a methodology set out in Dabet and Floch (2014), who drew upon the work of Reardon and Bischoff (2011a; 2011b). The latter also served as the foundation in recent OECD studies (Brezzi *et al.*, 2016). The proposed indicators, which take into account the overall distribution of income, were referred to as rank ordered segregation index data in the authors' initial work. They make it possible to go beyond the scope of extreme situations alone (Charlot *et al.*, 2009).

They will enable a comparative approach to segregation in twelve of France's main urban areas, at different territorial scales. Following on the MAPTAM law of 27 January 2014, which enshrined a list of 14 metropolitan areas<sup>2</sup>, the list of institutional metropolises has been swiftly changing and the "metropolitan" nature of some is sometimes disputed. Consequently, the reference for this work will be a list of 12 metropolises - Paris, Lyon, Marseille, Lille, Toulouse, Nice, Bordeaux, Nantes, Strasbourg, Rennes, Grenoble and Montpellier - based on an analysis of the relationship between the cities' size and their place in the ranking, referred to as the rank-size law (Brutel, 2011). The entire urban area, including urban and outer suburban areas, is taken into account, as opposed to only the urban unit made up of centre-city and the suburbs, as was the case in previous articles (Dabet & Floch, 2014; Floch, 2016). The development of outer suburban areas contributes to the segregation processes and the social sorting of populations.

The first part of the article, after a short review on income inequality and the respective concentrations of high and low incomes, relates to segregation in the various components of the urban area, centre-city, suburbs and outer suburbs. A distinct approach is used for the Paris suburbs. The indicators are computed using a gridded 500-metre-per-side mesh that makes it possible to take into account both the outer suburban areas and urban centres to

<sup>2.</sup> To which the city of Nancy was added on 1 July 2016. The following were included: 12 common-law metropolises (Bordeaux, Brest, Grenoble, Lille, Montpellier, Nancy, Nantes, Nantes, Nice, Rennes, Rouen, Strasbourg, Toulouse), 2 metropolises with special status (Grand Paris and Aix-Marseille) and 1 special-status municipality (Lyon). Seven other conurbations are expected to join this list of metropolises.

#### Box 1 – Data, mesh, scope

The 2012 Localised Social and Fiscal Register (Filosofi) was produced by matching the comprehensive tax data from the Directorate General of Public Finance (personal income tax statements) and data on social benefits from the main bodies responsible for managing those services (Cnaf, Cnav, CCMSA) (Aerts et al., 2015). It makes it possible to reconstruct gross disposable income including market income (wages, income from non-salaried activities), replacement income (retirement benefits and pensions, unemployment benefits, sickness benefits), property income and social benefits received (family benefits, minimum social benefits and housing benefits), with a more accurate estimate of the benefits actually received at fine-grained local (sub-municipal) levels than previously in the former localised tax income data (RFL). Net disposable income is determined by deducting income tax, housing tax, the general social contribution (CSG) and contribution to social debt repayment (CRDS).

- Standard of living is the net disposable income of the household divided by the number of consumption units (CUs). It is therefore the same for all individuals in a given household. The number of CUs is calculated using the OECD's equivalence scale: the first adult counts as 1, the other people over 14 years old as 0.5 and children under 14 years of age as 0.3. The scope covered is that of all ordinary tax households (i.e. excluding the homeless or those living in institutions).

- The matching with cadastral sources makes it possible to geographically locate the data by address and to calculate indicators on very fine meshes, without being dependent on administrative delineations.

- The indicators on segregation, concentration or social diversity were calculated using square blocks of 500 meters per side, referred to as neighbourhoods. This mesh, larger than that used in research on urban units (200 m side), makes it possible to get a first grasp of outer suburbs.

- The study covers a set of 12 large urban areas which will be referred to as metropolises. According to the 2010 urban area zoning rules, an area is composed of a central hub and most often of a periurban area. A division is an urban unit (a continuous built zone with

at least 2,000 inhabitants) with at least 10,000 jobs, in the case of large areas. The outer suburban area is defined as the set of municipalities or urban units, where at least 40% of the resident population has a job in the centre or in the municipalities gravitating toward it. When a large urban hub consists of multiple municipalities, the municipalities that comprise it are either the centre-city (more than 50% of the hub's population) or suburbs.

- We chose to limit ourselves to the metropolises defined by an analysis based on the relationship between the size of the city - defined by three variables, the size of its population, its number of jobs and the number of management jobs in metropolitan functions (i.e. design-research, intellectual services, inter-company trade, management and culture-leisure) - and its place in the rankings, referred to as the rank-size law (Brutel, 2011). This study brought out 12 cities and 29 urban areas as structuring the territory. This list of metropolises turns out to be almost identical to that set out in the first regulatory texts. It includes Paris, Lyon, Marseille-Aix-en-Provence, Toulouse, Lille, Bordeaux, Nice, Strasbourg, Grenoble, Rennes and Montpellier. Brest is not on the list. This set of cities shows good consistency: it comprises the top 11 urban areas in terms of size (as expressed in popu-lation numbers), Montpellier being in fifteenth position. The urban area of Paris has a population of the same order of magnitude as that of the total of the eleven other metropolises; and the suburbs of Paris alone exceed 8 million inhabitants. The role of Paris in concentrating activity and migratory phenomena is very specific. Numerous studies (Bourdeau-Lepage & Tovar 2015; François et al. 2007; Fleury et al. 2013) have been specifically dedicated to segregation in the Île-de-France region.

- Each metropolis has been partitioned into a centre-city, suburbs and outer suburbs, according to the criteria defined above. The respective weights of these three components vary greatly depending on the urban areas studied. The suburbs of Paris are partitioned based on the *départment* in which they are located, each of which has a population greater than that of many of the selected urban areas. The Paris outer urban area has not been separated.

a more detailed degree than the IRIS<sup>3</sup>. The 200-metre-per-side mesh, which is generally used in work on urban units, would have yielded too many neighbourhoods (each one a grid in the mesh) with low population figures in the outer suburbs that would have hurt the robustness of the analyses.

These indicators on the urban area, or some of its components, can then be used to draw comparisons between urban areas, but do neither provide information on the organisation of the urban area at the "neighbourhood" level (in this instance, each 500-metre-per-side square), nor on the way in which neighbourhoods with high standards of living, low standards of living and intermediate areas interlinked to

<sup>3.</sup> The municipalities with at least 10,000 inhabitants and most municipalities with 5,000 to 10,000 inhabitants are divided into Islets Grouped for Statistical Information (IRIS), areas defined by Insee for the purposes of the census. This principle of division, the foundational mesh used in distributed infra-municipal statistics, partitions the municipalities' respective territories into "neighbourhoods", the population of which is around 2,000 inhabitants.

form the urban fabric. In the second section, a typology of neighbourhoods based on the overall income distribution supplements this analysis of segregation and provides a mapping-based approach. The latter makes it possible to reason, in a highly empirical way, on social diversity, a generally ill-defined term (Epstein, 2013) even as public policy aims to promote it. The mapping provides a visual rendering of the spatial distribution of households with low versus high standards of living, and thus of "mixed" neighbourhoods versus neighbourhoods that contribute more to segregation.

Much of the statistical and sociological work on priority neighbourhoods tends to associate segregation with poverty. However, segregation can also result from residential choices made by households with a high standard of living, in an exclusive social grouping that some researchers sometimes refer to as *"l'entre-soi"* (Pinçon & Pinçon-Charlot, 1990; Préteceille, 2006). The indicators used in this article were designed to take into account all income levels, making it possible to understand the geographical separation that sets apart high incomes as well as low incomes.

In the final section, the results of these analyses are compared with those of previous studies based on segregation indicators calculated from the SOCs. These approaches make it possible to respond to some of the concerns at the heart of urban policies: establishing a hierarchy between conurbations (overall segregation indicators), and determining priority territories (analysis and mapping of neighbourhoods). This combination of the local and global also refers to the difficult conciliation of policies targeted at neighbourhoods and broader policies aimed at fostering social diversity and territorial cohesion. The analyses carried out show a convergence between approaches to "segregation", whether based on income or SOCs, and the "social diversity" approach based on neighbourhood typologies.

The article thus highlights significant differences between the 12 urban areas studied: the degree of segregation is greatest in Lille, Paris and Aix-Marseille. Segregation is less stark in outer suburbs than in suburbs and centre-cities. In most cases, segregation of higher standards of living is greater than for the lowest. The neighbourhood typology – based on a distribution of standards of living – by which mixed neighbourhoods are distinguished from neighbourhoods contributing more to

segregation is generally consistent with segregation indicators.

# Income levels, income inequalities and segregation

Do populations whose standards of living differ live in togetherness or in separation? Do social differences translate into spatial differences in location? These are the questions which segregation indicators are designed to objectively address. The absence of inequalities at the conurbation level trivially leads to the absence of segregation. However, segregation can be low in a very unequal city if the distribution of income is roughly the same in all neighbourhoods, or in a relatively egalitarian city in the event of high concentration of extreme standards of living in specific neighbourhoods.

Some results emerge from general background data (median standards of living, poverty rates, distribution of standards of living by decile) across the twelve urban areas studied (Appendix 1). In centre-cities, low standards of living are invariably over-represented, including in the wealthiest cities such as Paris and Lyon. The concurrent over-representation of the highest standards of living is frequent. The development of more attractive business activity, with high added value, generally leads to a certain social dualisation, due to the concurrent development of low-wage service activities. However, this is not a rule, as effectively illustrated by Lille, Marseille and Montpellier. In the suburbs of provincial urban areas across France, the over-representation of low standards of living is rare (although it does exist in Lille), while that of high standards of living is generally more marked than in centre-cities. The situation is more complex around Paris: the Hauts-de-Seine and Yvelines tend to be similar to Paris in terms of over-representation of high standards of living but tend to differ as regards the proportion of lower standards of living (François et al. 2007; Fleury et al., 2012). As to Seine-Saint-Denis, it has a very distinctive profile with very significant over-representation of low standards of living. In the outer suburban areas, except around Nice and Montpellier, low standards of living are under-represented.

According to the Massey and Denton classification (1988), the hierarchically-ranked segregation indicator belongs to the family of equality indicators, like all indices based on entropy, in the sense that it measures local differences in the distribution of standards of living. Designed to be calculated on ordinal variables, it is particularly suited to a continuous variable such as income or standard of living (Reardon & Bischoff, 2011a; 2011b). Taking into account all standards of living, this indicator offers good properties, compared to those based only on extreme situations (Dabet & Floch, 2014).

The principle of rank ordered index, detailed in Box 2, is based on a calculation of a series of Theil-Finizza indicators that offer the attractive property of being decomposable. The simplest expression of a Theil-Finizza indicator (using the case of two sub-populations) is as follows (Theil & Finizza, 1971):

$$H = \sum_{i=1}^{n} \frac{t_i}{TE(p)} \left[ E(p) - E(p_i) \right]$$

where  $E(p) = -[p \log_2(p) + (1-p)\log_2(1-p)]$ 

is an entropy indicator, p referring to the proportion of the first sub-population (that with the lowest standards of living) in the urban area, and  $p_i$  the proportion in neighbourhood *i*. T refers to the population of the urban area,  $t_i$ to the population of neighbourhood *i* and  $log_{2}$ the logarithm (base 2). In its initial version, this indicator calculated on two sub-populations was used in particular to understand the separation between managers and workers (Charlot et al., 2009) or comparing SOCs two by two (Madoré, 2015). The multigroup indices, the natural outcome of traditional indices, which make it possible to bring in all SOCs, or all standards of living, raise problems of composition invariance when modalities are permuted (Reardon & Firebaugh, 2002). In contrast, rank ordered segregation indices, which take into account all information, just like multigroup indices, are more interpretable as they introduce a hierarchy between modalities.

First of all, a two-modality variable is built: standard of living lower than  $r_1$  and standard of living above  $r_1$ . A first Theil-Finizza segregation indicator is calculated on the basis of this variable. Thereafter, thresholds  $r_2$ ,  $r_3$ ,... are varied along the distribution of standards of living, and a partial segregation indicator is calculated for each of them. Nine successive indicators are thus calculated based on national deciles of standards of living. This series of indicators first makes it possible to construct a curve illustrating the change in segregation along the standard of living scale. Then, using a weighting system (see Box 2), a composite indicator is calculated based on the series of indicators<sup>4</sup>. Figure I provides an example of a curve (series of partial indicators) and a summary index calculated on the Paris urban area.

#### Figure I Changes in partial indices and composite segregation index for the Paris urban area



Reading note: when the proportion of population with the lowest standard of living (in %) is equal to 20%, the basic index is equal to 0.12. The basic index at 20 % is calculated by taking 20% of the poorest population on the one hand , and 80% of the least poor on the other. The composite index, depicted by the red line, equal to 0.138, is a weighted average of the basic indices calculated according to the formula presented in box 2.

Scope: centre-city of the Paris urban unit

Source: Insee-DGFIP-Cnaf-Cnav-CCMSA, localised social and fiscal register (*Filosofi*) 2012; author's calculations.

These composite indicators and the partial indicators from which they are derived have been calculated for each metropolis, distinguishing between the centre-city, suburbs and outer suburbs (Table 1).

Segregation<sup>5</sup> is higher, in descending order, in the urban areas of Lille, Paris and Marseille, three of the five most highly-populated urban areas. They are followed by Lyon, Strasbourg, Grenoble and Montpellier, the other metropolises showing lower segregation indices.

These indicators, unlike those of Duncan and Duncan (1955) in particular, have no simple interpretation, and are interpreted more in terms of rank than level.

<sup>5.</sup> The values of the segregation indicators depend on the grid used. Given the same data, a smaller sized grid leads to an increase in the value of the indicators. Comparing the values of the segregation indicators obtained using the Filosofi 2012 data for a 500-metre mesh with those obtained using the RFL 2011 data with a 200-metre mesh shows a high correlation between the ranking levels, greater in the centre-cities than in the suburbs.

#### Box 2 – Rank-ordered segregation indices

The rank-ordered segregation index, based on the work of Reardon and Bischoff, presented in Dabet and Floch (2014) was proposed in order to study in particular segregation resulting from differences in income.

The first step is to provide a series of income levels  $r_{i_1}$  ...,  $r_{i_k}$ , ...,  $r_{i_k}$ . For each of the items in this series, a series of proportions  $p_{i_1}$ ...,  $p_{i_k}$ ...,  $p_{i_k}$  is associated where  $p_{i_k}$  refers to the proportion of the territory's population whose income per unit of consumption is less than  $r_{i_k}$ .

 $p_k = F(r_k) = \frac{1}{n} \sum_{i=1}^{n} 1_{y_i < r_k}$ , where F(.) is the income distribution function, *n* the number of basic grids in the territory.

For each of the p values, a Theil-Finizza type index is calculated, noted as  $H_{\nu}$  and based on entropy

$$H_k = \sum_{i=1}^n \frac{t_i}{TE(p_k)} \left[ E(p_k) - E(p_{ik}) \right]$$

derived from entropy indicators:

$$E(p_k) = -[p_k \log_2(p_k) + (1 - p_k) \log_2(1 - p_k)]$$
$$E(p_{ik}) = -[p_{ik} \log_2(p_{ik}) + (1 - p_{ik}) \log_2(1 - p_{ik})]$$

*T* represents the total population of the territory;  $t_i$  the population of the grid i.  $E(p_{ik})$  refers to the entropy calculated at the elementary grid level *i* for the population of the k-th quantile.  $E(p_k)$  refers to the entropy for the population of the K-th quantile of the territory.

The series of indicators  $(H_1, ..., H_k, ..., H_k)$ , which can be calculated for all income levels, makes it possible to build a segregation profile, showing whether the "segregation of the rich" or "segregation of the poor" predominates (figure I in the text).

The innovation of Reardon's and his various co-authors' work is to propose a way of combining these indicators to produce a global indicator H, by building a weighting system that is not a mere average of the indicators:

$$H = \sum_{k=1}^{K} w_k H_k$$

The fairly technical rationale for this is presented in Reardon and Bischoff (2011a; 2011b), and in simplified form in Dabet and Floch (2014). It is based on the search for a function with good properties, providing the maximum value when  $p_k$  is equal to 1/2, a value that aligns with the median income, and approaching 0 when  $p_k$  is equal to 0 or 1. The function put forth by Reardon and Bischoff displaying such properties is the entropy represented in the figure below, the value of *p* varying from 0 to 1, entropy *E(p)* being represented on the y-axis.

Segregation is less marked in the outer suburbs (Figure II). Only the Paris metropolis shows a level above 0.1. In eight of the metropolises, it is the territorial component that shows the least segregation. It is never the one where it is the highest. The highest values can be due to the

Graphical representation of the entropy function



As the partial indicator can be calculated for any value of p, the composite indicator will be stated in the form

$$H^{R} = \int_{0}^{1} \frac{E(p)}{\int_{0}^{1} E(q) dq} H(p) dp$$

and it will be possible to show that:

$$H^{R} = 2\ln(2)\int_{0}^{t} E(p)H(p)dp$$

The local weighting in p is:

$$\frac{E(p)}{\int\limits_{1}^{1} E(q) dq}$$

Wk

which is approached by:

$$=\frac{E(p_k)}{\sum_{j=1}^{K}E(p_j)}$$

Drawing from the work on the spatial decomposition of entropy-based indicators (Mora & Ruiz-Castillo, 2011), the indicator can be broken down into a hierarchicallyranked component and an intra-component:

$$H^{R} = \frac{\sum_{g=1}^{G} T_{g}}{T} \left| \frac{\int_{0}^{1} E(p) - E_{g}(p)}{\int_{0}^{1} E(p) dp} dp + H_{g}^{R} \right|$$

 $E_g$  refers to the entropy at the level of a territorial group,  $H_g^R$  the hierarchically-ranked segregation index within this group. The first part of equality is an "inter" component, while the is an "intra" component. This breakdown is used to study the breakdown of indicators using the centre city-suburb-outer suburb divide.

presence of small or medium-sized cities in the outer suburbs.

It is in suburbs that the indicators reach the highest levels, particularly in the Paris suburbs, with figures exceeding 0.16 in the Yvelines,

Urban area	Total		including			
		Centre-city	Suburbs	Outer suburbs		
Paris	0.138	0.077	0.142	0.113	8.4	
Lyon	0.117	0.066	0.146	0.093	2.6	
Aix-Marseille	0.134	0.135	0.105	0.076	12.6	
Toulouse	0.095	0.088	0.083	0.082	11.3	
Lille	0.143	0.108	0.151	0.067	7.2	
Bordeaux	0.096	0,094	0.099	0.068	5.1	
Nice	0.083	0,085	0.072	0.085	6.6	
Nantes	0.094	0,108	0.081	0.066	10.1	
Strasbourg	0.113	0,126	0.084	0.060	22.4	
Grenoble	0.109	0,067	0.121	0.093	6.5	
Rennes	0.089	0,090	0.086	0.065	14.8	
Montpellier	0.103	0,089	0.073	0.056	27.2	
		Paris subu	rbs			
Seine-et-Marne (77)			0.098			
Yvelines (78)			0.163			
Essonne (91)			0.138			
Hauts-de-Seine (92)			0.115			
Seine-Saint-Denis (93)			0.087			
Val-de-Marne (94)			0.102			
Val-d'Oise (95)			0.130			

 Table 1

 Composite indices of segregation in metropolitan urban areas and their territorial components

Reading note: in Montpellier, the segregation indices come out at 0.089, 0.073 and 0.056 in the centre-city, the suburbs and the outer suburbs, resulting in a value of 0.103 in the urban area. The "inter" component, which can be ascribed to the differences in segregation between centre-city, the suburbs and the outer suburbs, accounts for 27.2% of the value of the indicator calculated on the urban area. Scope: the 12 urban areas selected, Mainland France.

Sources: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (Filosofi) 2012; author's calculations.

a département where the median income is very high, but where social contrasts are very strong. However, in seven out of 11 metropolises (excluding Paris), the indices are higher in the centre-city than in the suburbs. Notwithstanding, in Lille and Lyon, which have both numerous high-priority neighbourhoods and high-income areas in the suburbs, the indices are particularly high. It is in Marseille that the centre-city's index is the highest. These differences between centre-cities and suburbs are very much in line with the policy deployed for housing. In the metropolises of Paris, Lille or Lyon, a large proportion of social housing was built in the suburbs. In Marseille, social housing is located more in the centre-city. This is also the case in cities such as Nantes, Rennes or Toulouse.

# Segregation of the poor, segregation of the rich

The socio-spatial segregation curve illustrates the way in which indices change along the standard of living scale. It indicates what prevails in segregation, whether of the poorest or the most affluent (Reardon & Bischoff, 2011a; 2011b). Three "stylized" curves showing change in segregation as a function of income can be seen (Figure III). They all show a high level of segregation of high-income populations. This finding, although already highlighted in a great deal of research, particularly on the Île-de-France region (Préteceille, 2006; Tovar, 2011; Madoré, 2015; Fleury *et al.*, 2012; François *et al.*, 2007) has not been readily taken

#### Figure II Variability of segregation indicators in metropolitan urban areas



Reading note: the plot-boxes make it possible to compare the level and variability of the indicators. The median is shown as a black line; the edges of the rectangle are the first and third quartile; the ends of the tabs are calculated using 1.5 times the interquartile space. Segregation is lower and less variable in the outer suburbs than in the suburbs or centre-cities.

Scope: the 12 urban areas selected, Mainland France.

Source: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (*Filosofi*) 2012; author's calculations.

up in public debate, as segregation is often associated with priority neighbourhoods.

The high segregation figures shown for high-income populations are also seen in United States cities. In all the conurbations with more than 500,000 inhabitants, the Theil indicators amounted respectively to 0.158 for the segregation of the poor and 0.195 for the rich (Reardon & Bischoff, 2011a; 2011b).

The asymmetry seen in the first two stylised curves (Figures III-A and III-B) comes from the virtual disappearance of the wealthiest households from the poorest neighbourhoods. In the centre-cities of all 12 metropolises, when more than 40% of households showed a standard of living below the first quintile, the median proportion of households with standard of living above the fourth quartile amounted to only 3.5%. The same cannot be said of the symmetrical situation (when more than 40% of households have income higher than the fourth quintile): the median proportion of households with the lowest standards of living is 10%. In other words, there are relatively more poor people in wealthy neighbourhoods than there are wealthy in poor neighbourhoods.

The first stylized curve (Figure III-A), the most frequent, shows an increase in segregation indices with the income up to a certain tier, followed by stability, then a sharp rise when reaching the highest standards of living. It is found in the majority of the *départements* of the Paris suburbs, and in the suburbs of the most highly-populated metropolises (Table 2). Half of the centre-cities align with this finding. It is absent from the outer suburbs, with the exception of Montpellier, and is associated with relatively higher levels of segregation, particularly in multiple *départements* of the Paris suburbs. In some cases, there is rather a slight decrease than a plateau.

The second stylized curve (Figure III-B) is also an increasing curve, albeit without the plateau found in the first. The fairly steady

#### Figure III Three stylised curves showing the change in segregation indices with standard of living



Note: the red line represents the associated composite index

Scope: the 12 urban areas selected, Mainland France.

Source: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (Filosofi) 2012; author's calculations.

increase reflects the fact that spatial separation is increasingly marked as income grows. What does this denote in practical terms? If the index increases from the 30% level to the 40% level, this means that the added population, which was found between 30 and 40%, is now geographically closer to the 0-30% than to the 40% or more. In other words, this reflects a tendency towards "separation" that is all the greater as the standard of living is higher. The centre-city Paris, where the level of segregation remains fairly low, shows a profile of this kind (see Table 2). Similar profiles, with a relatively low overall indicator, can be found in the centre-cities Lyon and Nice, with a higher indicator than in centre-cities Bordeaux, Lille and Grenoble. Three départements in the Paris suburbs can be identified as showing this configuration.

The last curve (Figure III-C) is characteristic of outer suburbs and reflects low segregation situations. High values can be seen for the segregation of both rich and poor, with a U-shaped profile. This curve is found in territories where high- and low-income populations are often under-represented (see Table 2), and as a result, the location of extreme income is spatialised in a distinct manner.

#### Size, inequalities and segregation

The connection between the size of the population and segregation becomes perceptible only if the scope of the urban units studied is extended. In the 29 urban areas found in the hierarchy after the 12 urban areas selected (Brutel, 2011), the segregation indices are lower and, most importantly, less dispersed (Figure IV). It is in these areas, however, that the highest values of the index are found. With a value of 0.151, the index is significantly higher in Mulhouse than in Lille. In Rouen, Le Havre and Amiens, the levels are close to those of Marseille. In the urban areas with lower population<sup>6</sup>, segregation is much less pronounced.

Of the 100 largest urban areas, segregation tends to increase with the size of the population. This finding was obtained in studies on tax income (Dabet & Floch, 2014) and SOCs (Charlot *et al.*, 2009), for instance. Looking at metropolises alone, the trend is not significant. This growing tendency toward segregation with the size of the urban complex is also observed in research on

6. Fifty-one urban areas, out of the top 100 by size, not taken into account in the two previous sets.

Level	Туре	Centre-city	Suburbs	Outer suburbs
	Intermediate plateau	Grenoble		Montpellier
Very low	Constant growth	Lyon	Montpellier, Nice	Aix-Marseille
	U-shaped profile			Bordeaux, Lille, Nantes, Strasbourg, Rennes
	Intermediate plateau	Rennes, Strasbourg, Toulouse		
Low	Constant growth	Nice, Paris	Seine-Saint-Denis	
	U-shaped profile		Nantes	Nice, Toulouse
	Intermediate plateau	Montpellier	Aix-Marseille, Bordeaux, Rennes, Seine-et-Marne	
High	Constant growth	Bordeaux, Lille	Val-de-Marne	
	U-shaped profile			Grenoble, Lyon
	Intermediate plateau	Aix-Marseille, Nantes	Essonne, Lille, Lyon, Val-d'Oise, Yvelines	
Very high	Constant growth	Strasbourg	Grenoble, Hauts-de-Seine	
	U-shaped profile			Paris

Table 2 Level and nature of segregation in metropolitan urban areas

Reading note: in Strasbourg, segregation is very strong and of the "Constant growth" type in the centre-city, low and "intermediate plateau" type in the suburbs, very low and with "U-shaped profile" in the outer suburbs. The three standard profiles are shown in Figure III. Scope: the 12 urban areas selected, Mainland France.

Sources: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (Filosofi) 2012; author's calculations.

large conurbations in other countries (Reardon & Bischoff, 2011; Brezzi *et al.*, 2015)

No significant link can be found, whether for metropolises or for a wider set of urban areas, between median income and the level of segregation (Dabet & Floch, 2014). This could be expected, since two territories with very different median income, but in which populations are evenly distributed, would have segregation indices of equal value.

In contrast, there is a (slight but significant) relationship between the inequality in income distribution measured by the Gini index and the segregation indices. This is observed for any territorial subgrouping (Figure V). This relationship is more pronounced when Paris centre-city is removed, with its combination of a low segregation and particularly marked income inequality. This situation can be explained by the low spatial concentration of the highest and lowest incomes. The spatial concentration index of the poor population in Paris centre-city is very low, and even lower as regards the populations with the highest standards of living. This low concentration explains why the gap between local entropies and overall entropy is low, hence the low values of the segregation index, despite high income inequality.

The share of segregation that can be attributed to differences between centre-city, suburbs and outer suburbs, measured by a breakdown of the rank ordered index (see Box 2) varies significantly depending on the metropolises. It is slightly higher than 20% only in Strasbourg and Montpellier. The hierarchy of segregation in the metropolises, derived from the hierarchically-ranked indices, in turn calculated using standards of living, is compatible with previous results (Charlot *et al.*, 2009) developed by comparing the spatialisation of managers and workers.

#### Spatialising inequalities

The segregation indicators are calculated based on a relatively fine-grained geographical matrix, but provide a metric relating to the entire urban area (or its components, centre-city, suburb and outer suburb). They indicate the extent of spatial segregation, enable comparisons between urban areas, but do not provide information on the neighbourhoods that contribute most to this separation of the populations, a decisive piece of information for the implementation of public policies. To understand inequalities by neighbourhood and endeavour to map them, we build, for each square, a standard of living

Figure IV Segregation indicators and urban hierarchy in metropolitan urban areas



Reading note: the box-plots make it possible to compare the level and variability of the indicators. The median is in black line; Ithe edges of the rectangle are the first and third quartile; the ends of the tabs are calculated using 1.5 times the interquartile space. The circles represent extreme values.

Scope: the 100 most populated urban areas, mainland France. Source: Insee-DGFIP-Cnaf-Cnav-CCMSA, localised social and fiscal register (*Filosofi*) 2012; author's calculations.

#### Figure V Relationship between inequality in living standards and segregation in metropolitan urban areas



Scope: the 12 urban areas selected, mainland France. Source: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (*Filosofi*) 2012; author's calculations. breakdown profile. More specifically, each 500-metre side square is described by the distribution of standards of living by national quintiles, which defines its "profile". Quintiles are preferred to deciles for questions of robustness (see breakdown by decile, Appendix 1).

Analysing these profiles makes it possible to propose a typology. "Standard profiles", in the form of histograms, have been defined based on exploratory research and knowledge of neighbourhoods. Each neighbourhood is connected up with the standard profile to which it is closest, proximity being defined by a distance between the square's profile and the "standard profile". This typology is based on a supervised classification, adapted from previous research carried out for the French *Observatoire national des Zones Urbaines Sensibles* – a National Observatory on sensitive urban areas – (Floch, 2012).

Five standard profiles have been selected for the analysis (Figure VI). Three of them are described as mixed, insofar as their profile differs little or moderately from the national distribution in quintiles. The first (in yellow on the maps) is close to a balanced distribution, with the numbers being substantially the same in each of the national quintiles on standard of living. In the other two mixed classes, there is a noticeable but limited difference compared with the balanced distribution, with a predominance depending on the high or low standards of living. In the "poor mixed" neighbourhoods, populations with low standard of living are over-represented, but those with a high standard of living are still present in substantial numbers. In "non-mixed poor" neighbourhoods, the over-representation of low standards of living is such that the higher standards of living are very little-represented. The "mixed rich" and "non-mixed rich" neighbourhoods are defined symmetrically.

This typology, by providing a standard characterisation of the neighbourhoods, enables a map-based analysis of the cities studied (for 4 of them, see Figure VII and for the 12 metropolises see Online Complement C1).

The maps in Figure VII make it possible to depict different types of spatial organisation. Depending on the circumstances, "non-mixed poor" pockets emerge in centre-cities (Rennes, Strasbourg) or in the suburbs (Paris, Lyon). In the outskirts of urban areas, the proportion of mixed-poor neighbourhoods often grows, the farther one moves out from the centre. However, this is not the case universally, and this tendency does not occur as regularly as what has been observed around Rennes (Floch, 2014).

At first sight, some cartographic results may seem surprising when compared to the segregation indices. In the centre-city of Paris, while the segregation index is low, the mapping shows a very high predominance of squares (neighbourhoods) referred to as non-mixed wealthy. This apparent paradox can be clarified only by mobilising another piece of information, namely spatial concentration (Appendix 2). Populations with extreme income show far less spatial concentration in Paris than in other centre-cities. In particular, populations with a high standard of living can be found in multiple neighbourhoods. Their share will not be the same everywhere, but will move away from the average situation – characterized by a high proportion of high standards of living – less than in many other cities, hence relatively low segregation. For comparison purposes, let us look at the Yvelines, where the "non-mixed rich" squares are also predominant, and where the overall distribution of standards of living is close to that of the centre-city Paris: the spatial concentration of the richest and the poorest is much more pronounced (see Appendix 2), with

Figure VI Profiles of the five non-mixed poor, mixed poor, mixed balanced, mixed rich, and non-mixed rich categories

Non-mixed poor	Mixed poor	Mixed balanced	Mixed rich	Non-mixed rich
S 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	S 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	R Q L D L L L L L L L L L L L L L	S P P P P P P P P P P P P P	G G G G G G G G G G G G G G G G G G G

Reading note: each histogram represents the distribution of the population according to the national standard of living quintiles



Figure VII An illustration of the typology in 5 classes of the neighbourhoods in Paris, Lyon, Strasbourg and Rennes metropolises

Note: the maps of the urban areas (left figures) have been constructed using a 500 m grid. The focus on the urban unit (figures on the right) is depicted using a grid of 200 m, but the data are smoothed with a radius of 500 m to provide a more readable representation. The messages illustrated by the figures on the right and left are consistent, despite a few small local differences. The boundaries of the centre-city in the urban unit are denoted by a black line. Scope: the 4 urban areas selected, Mainland France. Source: Insee-DGFIP-Cnaf-Cnav-CCMSA, localised social and fiscal register (*Filosofi*) 2012; author's calculations.

therefore more local situations diverging from the average value, hence a high value on the segregation index.

While public policies aim to foster social diversity, always invoked but often difficult to define (Epstein, 2013), statistical indicators such as concentration indicators or rank ordered segregation indices measure different types of segregation, de facto an absence or lack of socio-spatial diversity. The approach based on standard profiles offers a fairly empirical means of broaching social diversity and looking at how this empirical measure of social diversity can be compared with more theoretically grounded indicators.

The hierarchy derived from this approach to social diversity, and the hierarchy resulting from the rank ordered indices, reveal a negative relationship, which reflects a good consistency between the two approaches (Figure VIII).

For all metropolises in the provinces, the distribution of the population between the different types of neighbourhoods is almost the same in the outer suburbs as in the suburbs (Table 3). The centre-cities stand out for their larger share of "mixed balanced" neighbourhoods, at the expense of "mixed rich" neighbourhoods. The "non-mixed rich" are also found less frequently in the centre-cities.

The situation in the Paris urban area is very distinctive (Table 4). The neighbourhoods where the highest standards of living dominate encompass the majority of the population, as much in the centre-city as in the *départements* of Hauts-de-Seine and Yvelines. The situation in Seine-Saint-Denis is also particular. The "non-mixed poor" neighbourhoods comprise nearly 40% of the *département*'s population.

#### Figure VIII

Relationship between the rank of the urban area (calculated based on the proportion of the population living in mixed districts) and the rank of its segregation index



Scope: the 12 urban areas selected, Mainland France. Source: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (*Filosofi*) 2012; author's calculations.

Neighbourhoods where the concentration of populations with low standards of living is high are characterised by a very large share of social housing. This can be precisely seen from the Registry of social housing. The percentage of residents living in social housing is approximately 20% on average in all the metropolises. It is twice that figure in mixed areas with a low standard of living and three times higher in the poorest neighbourhoods.

The share of households living in social housing can vary quite widely depending on whether one considers the conurbation or the outer suburbs. In the outer suburbs, this percentage exceeds 10% only in Lyon and Paris. In the other metropolises, it is around 4%, except in Lille, Grenoble and Rennes, where it varies between

						In %		
Neighbourhoods	Non-mixed		Mixed					
	Poor	Poor	Balanced	Rich	Overall	Rich		
Centre-city	18.8	12.3	45.0	13.9	71.2	10.0		
Suburbs	9.7	12.6	32.3	24.4	69.3	21.0		
Outer suburbs	5.5	11.1	32.2	27.8	71.1	23.4		

Table 3 Territorial breakdown of the tax population by type of neighbourhood (excluding Paris)

Scope: the 11 provincial urban areas selected in mainland France.

1

Sources: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (Filosofi) 2012; author's calculations.

Neighbourhoods	Non-mixed		Mi	xed		Non-mixed
	Poor	Poor	Balanced	Rich	Overall	Rich
Centre-city	3.3	2.2	36.3	1.4	39.9	56.8
Suburbs	14.9	11.6	28.4	15.1	55.1	29.2
Seine-et-Marne (77)	6.9	10.6	40.1	24.5	75.2	17.9
Yvelines (78)	7.2	7.0	18.7	16.3	35.0	50.8
Essonne (91)	13.3	8.1	23.4	24.2	47.7	31.0
Hauts-de-Seine (92)	4.5	9.0	21.4	8.1	69.3	57.0
Seine-Saint-Denis (93)	39.4	16.0	33.8	8.4	58.2	2.4
Val-de-Marne (94)	8.4	15.2	35.6	15.6	66.4	25.2
Val d'Oise (95)	17.9	14.1	30.6	19.4	64.1	18.0
Outer suburbs	5.2	7.1	21.7	31.0	71.1	35.0
Urban area	11.5	9.3	28.8	15.0	53.1	35.3

Table 4	
Territorial breakdown of the population of tax households by type of neighbourhood	od in the Paris urban area

Reading note: in the urban area of Paris, 35.3% of residents live in non-mixed rich neighbourhoods. More specifically, the centre-city of Paris comprises 56.8% of non-mixed rich neighbourhoods and 36.3% of mixed-balanced neighbourhoods; Seine-Saint-Denis is composed 39.4% of poor non-mixed neighbourhoods and 16% of poor mixed neighbourhoods. Scope: urban area of Paris.

Sources: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (Filosofi) 2012; author's calculations.

7% and 9%. The proportion of social housing is very high in the Paris suburbs. Whatever the *département*, it exceeds 20% or even 30% in Val-de-Marne and Seine-Saint-Denis (37%). In the suburbs of provincial metropolises, the figures are not as high. These shares are greater than 20% in Lille, Lyon and Bordeaux. In Nice and Montpellier, they are under 10%. In all other areas, the proportion varies between 15% and 20%.

## Income and SOC: two convergent visions of urban segregation

The use of SOCs, by reasoned choice or in the absence of alternative data, has long been the norm in research on segregation (Tabard, 1993; Charlot *et al.*, 2009). The respective benefits of both approaches (income or SOC) are discussed by Oberti and Préteceille (2016). By way of comparison, a segregation calculation was produced using the SOCs collected for the Population Census of 2012. Its comparison with the segregation indicator derived from income data is limited in multiple respects. Firstly, the SOCs are derived from observations gathered over a five-year period, in municipalities with 10,000 inhabitants or more, drawing from a sample. As the Census is only partially geolocated<sup>7</sup>, it was not possible to use a grid mesh, and we used the IRIS, or the municipalities where there was no IRIS split. This mesh provides a smaller number of basic meshes and tends to give lower level segregation indicators.

Moreover, the SOCs are not explicitly rank ordered, but are so implicitly. A hierarchically-ranked series of modalities (non-qualified workers, retail service employees, skilled workers, other employees, intermediate professions, executives, business leaders and artisans) is thus defined from one-digit SOC. Only employees were separated, based on the two-digit nomenclature: retail service employees were added as an intermediate position between unskilled and qualified manual workers. This was done because many empirical studies show spatialisation proximities between unskilled manual workers and service employees. The de facto hierarchy structured as described is also reflected in the hierarchy in salary between the various SOCs (Dabet & Floch, 2014).

Across the scope of study, the segregation indicator based on SOCs was calculated using 2012

<sup>7.</sup> The Census is localised by address only in municipalities with 10,000 inhabitants and more.

data. Comparison with the hierarchy derived from the *Filosofi* database's segregation indicator shows very strong convergence. The six most segregated urban areas are the same in 2012 according to both measures: Paris tops the rankings with the measure based on the SOCs and Lille comes in second (Table 5). The only significant difference lies in Montpellier's move from seventh place in the ranking based on income to twelfth in the ranking based on SOCs. The convergence between the two indicators increases the value of the income approach, which enables multiple cartographic depictions because of the variable's continuity.

\* \*

Rank ordered segregation indices are now a benchmarking tool, as demonstrated by the work carried out by Brezzi *et al.* (2016) for the OECD. The findings derived from this study, given the differences in territorial breakdown and income measurement, are consistent with those of the OECD. Highlighting segregation at both ends of the standard of living scale is a contribution, as well as taking into account space relations between populations with the lowest and highest standards of living with those with intermediate standards of living. As was noted by many authors, in particular Oberti and Préteceille (2016) and Madoré (2015),

Table 5

Comparison of the two segregation measures in the 12 urban areas, based on SOCs or standards of living

Urban area	2012 SOCs (Rank)	2012 Standard of living (Rank)
Paris	1	2
Lyon	5	4
Marseille	3	3
Toulouse	9	9
Lille	2	1
Bordeaux	7	8
Nice	10	12
Nantes	8	10
Strasbourg	4	5
Grenoble	6	6
Rennes	11	11
Montpellier	12	7

Reading note: the urban area of Lille is the most segregated based on the standard of living; it ranks 2rd according to the SOC-based metric. The rank of Toulouse is stable according to both measures.

analyses need to take into account the entire urban territory and not be limited to so-called sensitive neighbourhoods.

The division of urban areas into centre-cities, suburbs and outer suburbs provides a framework for analysis, which in particular makes it possible to put the discourse on the suburbs into perspective, the situations being highly diverse and the segregation due to standard of living frequent in these territories. However, behind the same definition (continuity of the built environment), the morphology can be very different, and to take just one example, the suburbs of Rennes hardly bear a resemblance to those of Paris or Lyon. For this reason, more monographic analyses continue to be of great interest in explaining, based on the topography, the local urban history and housing renovation policies, how agglomerations that are apparently similar in terms of income distribution actually differ when it comes to segregation. The interpretation of segregation profiles, outlined here, probably needs to be explored in greater depth, based on more detailed local analyses. The typology, and the cartographic analysis it enables, provide a starting point for description that appears consistent with the segregation indicators. Localised data, often of administrative origin, on the housing stock, commercial equipment and public services would help to improve the analyses.

In the short and medium term, research should focus on two points in particular. The first would be to take housing characteristics into account (Madoré, 2015; Goffette-Nagot & Schaeffer, 2013). The second would be the evolutionary dimension. Our article's approach remains static. Research such as that of Charlot et al. (2009), Préteceille (2006), or Fleury et al. (2012) have analysed the evolution of segregation over time. Time will be needed before the *Filosofi* source offers enough perspective to make reliable comparisons based on rank ordered segregation indices and typologies, as socio-spatial segregation is a high-inertia phenomenon<sup>8</sup>. This is obviously a central question for public policies aimed at fostering social diversity. 

Scope: the 12 urban areas selected, Mainland France.

Sources: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (*Filosofi*), 2012, Insee, *Population Census*, 2012; author's calculations.

<sup>8.</sup> Calculations made based on localised tax income with a five-year variance show few differences in the hierarchically-ranked segregation indicators (Dabet & Floch, 2014). Of the twelve urban areas studied, variations are still below 3%, and the formal complexity of the indicators does not make it possible to provide significance thresholds on the results. The typologies make it possible to suggest a few avenues for future analysis building from Filosofi. The first is based on the evolution of neighbourhoods between the two dates; the second on the evolution of standards of living in each of the types of neighbourhoods. These indicators show lower inertia than the hierarchically-ranked indicators, but are also less robust.

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#### APPENDIX 1\_

#### INEQUALITIES AND DIFFERENCES IN INCOME STRUCTURE

The first results of *Filosofi* 2012 (Aerts *et al.*, 2015) bring out the weight of poverty in centre-cities in large urban areas. The median standard of living is €18,371, significantly lower than the national median (€19,786). Except for Paris, where the median standard of living is particularly high, and Lyon, the median standards of living in metropolitan centre-cities are lower than the national level. They tend to be higher than in smaller urban areas, but this is not always the case, particularly in the metropolitan areas of the Mediterranean coast (table A1).

The poverty rate is 19.5% in centre-cities, compared with 14.3% for the whole of mainland France. The rates are fairly variable. With the exception of Lyon, they are higher than at the national level. In Paris, the particularly high median standard of living comes along with a poverty rate of 16.2%.

The coexistence of populations with very different standards of living can be easily identified using the standard of living, obtained by breaking populations down into standard of living deciles, based on the references on mainland France. The over-representation of populations whose standard of living is lower than the first decile holds in all metropolitan areas. It can be low, as is the case in Lyon or Nantes, or more marked, as is the case in Lille, Marseille or Montpellier. This can be seen even in Paris, despite the particularly high level of the median living standard. It is a strong characteristic of urban areas to be home to a large population in percentage terms with a low standard of living, and metropolises are no exception to this rule.

The situation is less automatic when it comes to the highest standards of living. In the vast majority of cases, there is also an over-representation of households with a standard of living above the ninth national decile. For the centre-cities to which this applies, the result is a U-shaped profile, with an over-representation of extreme standards of living and under-representation of intermediate standards of living. This distribution, which can be seen in particular in Lyon, Toulouse, Bordeaux, Nantes, Rennes, Strasbourg and Grenoble, is characteristic of metropolises. It is exceptional in large urban non-metropolitan areas, in which only the over-representation of low income is found (Floch 2016). The profile of the centre-city Paris, with a J- rather than a U-shape, is distinctive. High standards of living are very prominent, as 42% of the population enjoys a standard of living above the 8th decile of standard of living and 30% higher than the 9th. It is the intermediate standards of living that are under-represented. In Marseille and Montpellier, high-income earners are under-represented in the city centre, the U-shaped profile is not found in Lille, where there is a larger proportion of households with low standards of living. What is never seen in metropolitan centre-cities is a collapse of populations with a high standard of living. The situation in Lille is very dif-

#### Table A1 Standard of living indicators

Urban area		Population		Media	n income (in	euros)	Poverty rate (as %)		
	Centre- city	Suburbs	Outer suburbs	Centre- city	Suburbs	Outer suburbs	Centre- city	Suburbs	Outer suburbs
Paris	2 131 222	7 691 539	1 799 834	26 015	22411	22 770	16.2	16.1	8.3
Lyon	451 605	1 079 153	629 839	21 197	20 768	20 828	14.1	13.6	9.1
Marseille	803 526	708 131	166 384	17 935	20 672	22 188	25.2	12.5	9.6
Toulouse	390 004	454 755	369 053	19 541	22 691	20 939	18.1	8.4	9.3
Lille	191 318	782 337	144 043	17 921	18 963	22 112	24.3	17.5	7.7
Bordeaux	211 419	606 445	303 363	19 436	20 981	20 184	16.2	10.2	10.2
Nice	353 539	609 974	58 819	18 753	20 625	20 035	19.7	13.2	12.6
Nantes	259 209	315 758	295 794	19 626	21 302	20 077	15.1	7.2	7.2
Strasbourg	233 930	174 910	313 060	18 669	21 400	22 540	22.3	12	6.4
Grenoble	142 845	339 493	179 181	19 528	21 419	22 067	17.9	9.9	6.8
Rennes	171 540	108 524	377 225	19 394	22 147	20 321	17.5	6.8	7.0
Montpellier	230 537	140 875	165 524	17 578	22 482	20 198	25.6	8.6	11.8
Seine-et Marne (77)		617 887			22 026			12.5	
Yvelines (78)		1 185 853		24 945		9.7			
Essonne (91)		1 042 311		22 970		13			
Hauts-de-Seine (92)		1 568 128		25 406		11.9			
Seine-Saint-Denis (93)		1 536 970		18 130		27			
Val-de-Marne (94)		1 326 305		22 067		15.4			
Val-d'Oise (95)		1 031 972			21 208			17.6	

Note: the numbers presented here may differ from those of the population census because, on the one hand, the data are those of 2012 and do not come, as in the census, of the cumulative total of five collections, and on the other hand the population taken into account is that of tax households. Households affected by a fatality type event in December of the previous year, households of persons with no fiscal autonomy (mainly student households), persons living in communities are not taken into account.

Scope: the 12 urban areas selected, Mainland France.

Sources: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (Filosofi) 2012; author's calculations.

ferent from that of other urban areas of Hauts de France, such as Douai-Lens, Béthune or Valenciennes (Floch, 2016)

With the exception of the Lille suburbs and Seine-Saint-Denis, median standards of living in the suburbs are higher, or even far higher than €20,000. They are particularly high in Toulouse, Montpellier and Rennes. Poverty rates are lower than those found in large non-mainland urban areas (Floch, 2016). In the suburbs of metropolises (with the exception of Lille), the first standard of living deciles are under-represented. This under-representation is significant in Toulouse, Nantes, Rennes, Montpellier, less so in Strasbourg, Marseille or Bordeaux. In Lille or Lyon, the profile reflects very prominent heterogeneities within the suburbs.

Within the Paris suburbs, the Hauts-de-Seine *département* has a profile almost identical to that of Paris, with a marked over-representation of high standards of living. The lowest, in contrast, are less present, and are even less prominent in the Yvelines *département*. Essonne and Val-de-Marne are close to the U-shaped metropolis profile, and Seine-et-Marne similar to the profile of well-off suburbs, with Val-d'Oise being in an intermediate position. Seine-Saint-Denis has a profile very different from that of other *départements* in the Île-de-France region, similar to that of certain cities in northern France.

At the national level, the profile of standards of living in outer suburbs is characterised by an under-representation of the extremes. In metropolitan areas, it is found in Lyon, Bordeaux, Nantes and Rennes. We often encounter a profile close to that of the well-off suburbs around Marseille, Toulouse or Lille. These differences can be explained by the greater or lesser possibilities for extending the outer suburbs. The national profile, showing an inverted U-shape, is mainly found in urban areas where there are no constraints (topographic or through presence of other urban areas nearby).

Outside Paris and Lyon, median standards of living are lower in the centre-city. However, depending on the case, the outer suburbs can be wealthier than the suburbs (Marseille, Lille, Strasbourg, Grenoble) or vice versa (Toulouse, Bordeaux, Nantes, Nice, Rennes, Montpellier). These differences in situation may be the result of differences in the history or topography of the conurbations studied.

Median income tends to depart from the standard, the further away from the city centre one moves. The Rennes urban area shows a very steady trend in income: quite high incomes in the centre-city, a marked drop in the inner boundary of the centre-city where the majority of priority neighbourhoods are located, a sharp rise in the districts of the suburbs of Rennes, and then a very regular decline in the outer suburbs.

The Rennes configuration is quite distinctive, both in the regularity of the drop in income and the isotropy of the phenomenon, which can be ascribed to the city's geographical position (relief, distance from other urban areas.). In the vast majority of conurbations selected, the drop as one moves out from the centre is nevertheless marked and lower standards of living can be seen on the maps at the outer edges of the urban areas.

The very high standards of living are concentrated in Paris' urban area (Figure A1). It is already home to more than one-third of the population with a standard of living higher than the ninth decile, whereas it accounts for just under 20% of tax households. The proportion exceeds 40% when it comes to the highest centile, and 50% when it comes to the millile. This situation is due to the concentration of very high wage incomes (Bouba-Olga & Grossetti, 2015)



Figure A1-a Standard of living profiles in metropolitan urban areas



Note: each chart shows the breakdown of the population in the territory by income decile (calculated on mainland France). The red line reflects

the distribution observed in mainland France. Reading note: in the centre-city Paris, 12.7% of the population is found in the 1<sup>st</sup> decile of standard of living (calculated on mainland France). Scope: the 12 urban areas selected, Mainland France. Source: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (*Filosofi*) 2012; author's calculations.

Val-d'Oise (95)



### Figure A1-b Standard of living profiles in the Paris suburbs

Seine-Saint-Denis (93)

Val-de-Marne (94) Note: each chart shows the breakdown of the population in the territory by income decile (calculated on mainland France). The red line reflects the distribution observed in mainland France.

Reading note: in Seine-et-Marne, 8.7% of the population is found in 1st decile of standard of living (calculated on mainland France). Scope: the *départements* of the Paris suburbs. Source: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (*Filosofi*) 2012; author's calculations

#### SPATIAL CONCENTRATION OF LOW AND HIGH STANDARDS OF LIVING

Spatial concentration is one of the dimensions identified by Massey and Denton (1988) in their foundational article on segregation indices. This indicator is not the most studied index and is not the central focus of this article. It can, however, be used to clarify situations and provide explanations for situations that can appear paradoxical (table A2).

The spatial concentration is calculated here for the poor (first two deciles of standard of living) and the rich (last two deciles). The indi-

cator is shown in Duncan and Duncan (1955) form. For the poor, it is expressed as follows:

$$ICP = 0.5 * \sum_{i=1}^{N} \left| \frac{p_i}{P} - \frac{s_i}{S} \right|$$

where *i* refers to the square (500-metre side),  $p_i$  to the number of poor, *P* to the total number of poor,  $s_i$  to the surface of the square and *S* the total surface area. It is between 0 and 1.

Table A2

	Centi	re-city	Sub	Suburbs		uburbs
	Poor	Rich	Poor	Rich	Poor	Rich
Paris	0.346	0.303	0.549	0.435	0.557	0.512
Lyon	0.346	0.387	0.672	0.474	0.549	0.479
Aix-Marseille	0.538	0.452	0.635	0.477	0.556	0.537
Toulouse	0.455	0.448	0.525	0.441	0.501	0.474
Lille	0.406	0.466	0.590	0.457	0.519	0.447
Bordeaux	0.428	0.394	0.562	0.470	0.453	0.456
Nice	0.594	0.500	0.604	0.425	0.462	0.463
Nantes	0.440	0.434	0.553	0.495	0.442	0.447
Strasbourg	0.462	0.467	0.552	0.389	0.473	0.451
Grenoble	0.358	0.394	0.612	0.470	0.464	0.479
Rennes	0.437	0.424	0.584	0.608	0.499	0.526
Montpellier	0.450	0.409	0.515	0.447	0.559	0.513
	•	Paris	suburbs			
Seine-et-Marne (77)				0.532	0.381	
Yvelines (78)				0.571	0.468	
Essonne (91)				0.574	0.372	
Hauts-de-Seine (92)				0.442	0.378	
Seine-Saint-Denis (93)				0.414	0.346	
Val-de-Marne (94)				0.446	0.374	
Val-d'Oise (95)				0.550	0.390	

Spatial and low-income spatial concentration in metropolitan urban areas

Sources: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (*Filosofi*) 2012; author's calculations.