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Regions and territories

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Henri Martin

Introduction
Regions and territories: Evolutions and changes

Pierre Veltz*

Abstract – This special issue deals with three topics that dominate the current public debate on the regions and territories of France: the architecture of territorial institutions; the supposed divergence between metropolitan and non-metropolitan areas; the impact of technological transformations and globalisation. On the first point, particular attention should be called to the weak theoretical foundations underpinning a very empirically run reform process. While the complexity of territorial organisational is not specific to France, the relatively limited powers granted to the local authorities is even more so. On the second point, the much publicized image of the "two France", contrasting that of metropolises and their globalised elites to that of the suburbs and the losers of globalisation, is disputed. If there is a social divide, it crosses through cities and territories. Lastly, with regard to the criss crossing effects of technological change and international trade, it is important to acknowledge the trends toward bi polarisation in qualifications, as well as to take into account the complexity of its spatial effects, in contrast to some popular misconceptions.

Keywords: territorial reforms, metropolisation, spatial inequalities, technological change, globalisation, polarisation of qualifications

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The journal's last special issue dedicated to "territorial disparities" dates back to 2008. In the decade that has since (nearly) elapsed, the face of France has significantly changed. And, perhaps even more so that the objective changes, the discussions and controversies about the territorial dynamics at work in our country have taken on new forms. The financial crisis that started in 2007 has changed the landscape, uncovering the great vulnerability of many territories of longstanding industrialisation, and marking, through an increasing number of often very sharp breaks with the past, what can be considered the end of a cycle initiated with "les Trentes Glorieuses", the period of thirty "glorious" years in France, between 1945 and 1973. In 2012, Laurent Davezies warned of the predictable scissor effect between this manufacturing crisis and the likely retraction of transfers that had long played an essential part in dampening and reducing inequalities between rich and poor regions (Davezies, 2012). At the same time, in contrast to the decline of old industrial capitals, the large cities, and in particular those of the West, thrived, attracting the bulk of job creation (in absolute volume terms, at least). The new emerging economy – let us recall that in 2008, the smartphone had not yet taken off, Amazon was a second-tier player, and Uber did not even exist – thus appeared to be accompanied by a "metropolisation", based on the resurgence of "agglomeration economies".

In this context of crisis and profound transformation, the recurring theme of how to reorganise the notoriously complex territorial weave took on a new dimension, in that it was now explicitly linked to economic development issues, and not only to efficient administration. In 2008, when Le Grand Paris was unveiled by President Sarkozy, it was presented as a way of asserting and strengthening the capital city's role as a locomotive to the national economy – a role which was recognised only then, and in a complete departure from the "Paris versus the French desert" model that had prevailed up to that point, wherein the city, seen as predatory, needed to be bridled and re-balanced in its development, even as the said model had, from the start, served as the DNA of regional planning *à la française*. The laws passed under President Hollande's five-year term (MAPTAM and NOTRe) also acknowledged the catalyst role of "metropolises" – even if this extended the list a little beyond what this term might mean in an international comparison. The downside of this decision soon became clear. Many members of Parliament, finding that too much was being done for these metropolises, and observing the growing difficulties faced by small and medium-sized towns, endorsed the idea of a dual France, a widening gap between France's globalised elites, entrenched in the hearts of big cities, and the France of the excluded, the forgotten of growth and modernization, that of the "outer urban" areas, as they were termed in the highly-successful books of Christophe Guilluy (Guilluy, 2014). In the eyes of many observers, the last electoral cycle, in fact, appeared to confirm this pattern of a two-track France, through highly mediatised maps, such as those of the Front National vote, to the point that this pattern is now considered by most commentators as almost self-evident.

In this brief narrative, mixing facts and common representations, not everything is false, but many points deserve discussion, nuance at least, and sometimes more radical disagreement. It is the role of researchers to challenge popular belief, and tirelessly contrast the complexity of reality with the power of media simplification. This special issue on "Regions and Territories", makes a useful contribution in this regard, by providing precise, substantiated and quantified analyses of France's territorial dynamics. These analyses sometimes confirm, but also often bring necessary perspective to, or even outright disprove the dominant thinking. As such, they should be of interest not only to readers wishing to gain a less schematic picture of the

current state and future of our country, but also to the public authorities, at all levels of government.

The purpose of this introduction is not to present these various contributions, let alone discuss them. As a counterpoint to the collection of texts herein, I would however like to share with readers a number of ideas, observations and hypotheses, around three major questions at the moment, which also form the backdrop of this journal issue. 1) What is the current status of our administrative organisation and the over-abundant stratification so often decried, yet which seems to mischievously grow even more complex each time an attempt is made to simplify it? 2) What of the overall dynamic, not only in inequalities but also in territorial synergies? Are there truly grounds for referring to a divergence between two France? 3) What can be said, lastly, about the dual impact of technological changes and globalisation on these dynamics and supposed divergence?

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The project of institutional reform of local authorities, which can also be read, at least partially, as the reorganisation project of a professional corporation (that of the elected officials) itself, seems fated to remain perpetually open. What are the salient events in this process over the past decade? Paris' reshaping of its own institutions, with the creation of the Grand Paris Metropolitan Area, a big intermunicipal structure, stands at midstream. The assertion of the "metropolises" has, in a sense, been more significant symbolically than technically, the only truly profound changes having been the merger between the department and the metropolitan area of Lyon and the "forceps delivery" of the Aix-Marseille-Provence metropolitan area. The announced abolishment of the departments, as always, ultimately came to naught. The grouping of regions, the unexpected reform initiated from the highest State levels, took players and observers by surprise. Paradoxically, it has restored some of the departments' powers, especially in the large heterogeneous complexes such as Grand Est region. The most important change, as has been the case since 2000, was the continuation and now-recognised implementation of intermunicipality (an authority grouping municipalities, and exercising the powers delegated by these municipalities) as a standard principle, an essential move, alongside which came a large wave of voluntary inter-municipal alliances.

One very striking point in these developments, when one steps back to see the larger picture, is the weakness or lack of theoretical foundations to underpin them. Empiricism reigns supreme, including from the legal standpoint (for example, there is little in the way of detailed reflection on the concept of subsidiarity, often invoked somewhat lazily, when in fact it raises, in our interconnected world, aporas that are highly difficult to overcome). In economics, reflections on the various forms of "decentralisation" remain under-developed. This topic has been discussed mostly, in a qualitative and descriptive manner, in other disciplines (political science, political sociology, management, history). To say the least, in France, the concepts stemming from the theories of "public choice" and "fiscal federalism", or from "positive political" theory, etc. go largely ignored by decision-makers. Consequently, local authorities have been grouped through successive waves of negotiation, governed by club-type thinking, sometimes having little to do with the requirements of functionality and, even less, of solidarity (Estèbe, 2008). Worthy of tribute is the empirical test of the "decentralisation theorem" applied to the dynamics of intermunicipal powers, presented here by **Quentin Frère and Lionel Védrine**, comparing economies of

size with the heterogeneous range of citizen preferences, though, in my opinion, this last notion is quite problematic. One of the major problems in the French situation is indeed that the choices relating to intermunicipalities, both in the definition of their boundaries and in the architecture of their powers, are made largely away from the eye of grassroots citizens, who know only their mayor and their municipality, and frequently are unaware of the now-predominant role played by the intermunicipal structure.

The complexity of the territorial organisation of powers is not specific to France. All developed countries complain of systems that have become impenetrable and generate excessive transaction costs. What is problematic in France is not so much the number of layers piled up as the relative weakness of each of these levels. In many areas, we are now a highly decentralised country, but with weak local powers! When it comes to urban planning and land rights, municipalities have a decisive influence in decision-making. However, they are often insufficiently equipped in financial and, above all, human resources to deal with these tasks. This also applies to many intermunicipalities. This combination of considerable theoretical powers with limited practical capacities then frequently translates into blocking powers, as opposed to initiative-taking ones. The regions are a good example of this contrast. The very precise and useful study published by **Kim Antunez, Brigitte Baccaïni, Marianne Gueris and Ronan Ysebaert** on the new regions born in 2016 shows that French regions now have demographic (and economic) bearing comparable to those of the German *Länder*. Their resource levels, however, are not comparable. As a result, the "economic" powers now granted to the French regions are in no way similar to the striking force wielded by the said *Länder*. In passing, questions can be raised as to the urgency and rationale behind this regional reform. The economies of scale that might be derived from these are unclear, given the regions' powers. As for citizens' preferences, they appear to have hardly been taken into account. It is therefore not certain that this reform is a good illustration of Oates' "optimal decentralisation" theorem, central to Frère and Védrine's study. Time will tell...

One of the major problems in the French architecture of local powers is thus a deficit in democracy. This applies primarily to the intermunicipalities, whether metropolises or low-density areas. These groupings have made it possible to bring closer together the various levels of public management of the inhabitants' actual living spaces, geographical living areas and geographical residential areas. And almost all observers agree on the positive nature of this development. However, these are second-tier structures, and relatively obscure to citizens. The reform enabling them to elect their presidents by direct universal suffrage is constantly being postponed. And we can make the hypothesis that this deficiency translates into lower legitimacy and therefore less impact for the local executive power (though we would obviously like to be able test this analysis). It can be measured *a contrario* when the conurbation power is strongly embodied.

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As far as the underpinning geographical and social processes are concerned, the dominant figure in the public debate is now, as stated above, that of the opposition between France of the cities and that of the "outer urban" areas, downgraded to varying extents. What should we make of this? Is France really on the way to major divergence, such as the one described convincingly by Moretti or Giannone for the

United States (Moretti, 2013; Giannone, 2017) – not to mention the growing gulf between metropolitan and non-metropolitan regions in many emerging countries?

With regard, first of all, to the actuality and extent of metropolisation in France, a controversy recently opposed various economists, including Laurent Davezies, against other researchers, who in particular questioned the idea of the "over-productivity" of metropolises, exceedingly dependent on local GDP calculation rules (Bouba-Olga & Grossetti, 2015). Bouba-Olga also pointed out that, in relative value terms (in particular, the trend in employment), some small and medium-size towns outstrip metropolises, even the most dynamic ones. Nonetheless, it cannot be disputed that the trend in employment has been much more favourable in metropolitan areas, which rebounded better after the 2008/2009 crisis. This applies to employment in general, but even more to salaried employment in the private sector. Between 2008 and 2016, private salaried employment grew by 3.7% in the first 15 metropolises labelled as such (Greater Paris included), as compared with 0.2% across the rest of the nation (AdCF, 2017). However, this process is all the more remarkable as it is not self-evident. During past crises, especially after 1993, the Paris metropolis suffered more, in terms of GDP and employment, than the rest of the country. It is therefore tempting to see in this reversal a sign of a new pattern of territorialisation of growth. The majority of economists saw in this an illustration of the increasing role of "agglomeration economies". The whole problem lies in determining what this term covers. In general, economists invoke the greater efficiency born when powers are combined, crossed and blended on a massive scale amongst themselves (see, for example, Combes & Gobillon, 2015; Combes *et al*., 2015, 2016). As far as I am concerned, without denying this aspect, I would also highlight other factors, such as the reduction in uncertainty and the greater flexibility availed to firms and households (especially two-income) by the large size of metropolitan labour markets. It would be interesting to test these as well as others complementary hypotheses (metropolis hub function, behavioural ratchet effects among young people who have come to engage in university study). Be that as it may, Bouba-Olga (2017) is correct to highlight the diversity of possible development paths, which are probably less dependent than what is claimed on size effects in a small country such as France, where infrastructures and skills are widely distributed and accessible across a large part of the territory.

At the other end of the spectrum, all the data, and even a simple visit to many of the territories far from metropolitan influence centres, reveal the existence of downward spirals and even dereliction, as much across vast areas as in more local employment pools. Writers, often, in fact, tell of this better than do researchers (Kauffmann, 2013). I have already referred to the success enjoyed by Christophe Guilluy, as much in public opinion as with decision-makers. These theories have the merit of calling attention to the highly precarious socio-economic situations found in a so-called "grassroots" France, by offering a reminder that the suburban neighbourhoods referred to as troubled do not have a monopoly on precariousness. However, the image of "two France" is, in my opinion, far too simplistic to be true.

First of all, it should be noted that, while certain metropolises are faring well, this is far from being the case universally. The dynamic enjoyed by cities in the West and Southwest of France is not shared by counterparts in the East (Lille, Strasbourg, Nancy, Grenoble, Nice). The Île-de-France urban area itself does not stand out as a particularly brilliant performer, part of its development potential having clearly shifted to cities located one, two or three hours away by high-speed train, which beckon

in particular to households with the much more favourable cost to quality of life ratio in the provinces. The growth surplus in these major cities does not, moreover, create huge gaps with the rest of the country, if we consider stocks rather than flows: in terms of private-sector employment between 2008 and 2016, the change in relative weight of the 15 metropolises relative to the country as a whole can hardly be called lightning-fast (+1.3 percentage point). It is true that this count does not include the suburban areas located outside the strict boundaries of the metropolises, which are the big winners in the recent growth process. As for the non-metropolitan territories, in the France of middle-size towns and small burgs, those of low-density areas – which are no longer truly rural, so similar their lifestyles and activity structures to those of high-density urban France – their trajectories are surprisingly diverse. They include territories in extreme difficulty, concentrated above all in the North-East quarter of the nation, but also many dynamic employment and living areas. Some of these low-density areas, especially along the diagonal that extends from the Belgian border to the Massif Central appear to be locked in traps from which it will be difficult to emerge, despite the shock absorbers represented by social transfers, without a massive and specific show of solidarity by the national community – especially as many of these territories seem to be have been hit by a double penalty: the industrial crisis combined with lack of attractiveness, in these times of residential heliotropism. However, there are also areas of low-density population, whether continuous or discontinuous, that are doing well. Overall, incidentally, the 2008 issue of the journal already noted the reduction in income gaps (on average) between the suburban and rural areas and urban hubs (with the exception of Île de France) (Behaghel, 2008).

Secondly, it is essential to bear in mind that, if there is a social gap, it crosses all the metropolitan and non-metropolitan spaces, whether dense or sparsely populated. Antunez *et al.*, in their article, offer the reminder that France's regions have relatively similar profiles (even more so, understandably, since the recent merging), and that inequalities are more internal than external. This is consistent with the long-term trend of growth in local inequalities, internal to conurbations and local territories, against the backdrop of relative homogenisation at national level, the latter explained in particular by the extensive public and private redistribution mechanisms that irrigate our country. Broadly speaking, the closer in we zoom, the greater the inequalities. In this respect, the contribution of **Jean-Michel Floch** on inequalities and segregation in twelve metropolises, using the *Filosofi* data register and its matched tax and social income on the scale of a very fine geographical mesh, is very telling. Its purpose is to illustrate the complexity and variety of patterns in inequality, social diversity and segregation in our major cities. However, the article also offers a reminder that if these cities, and the Parisian conurbation first and foremost, are experiencing unparalleled concentrations of wealthy residents, entrenched in their citadels of "*entre-soi*", they are also characterised, including in the heart of the conurbations, by an over-representation of poor households. At the country level, low-income households are thus over-represented in metropolis cities, particularly in Marseille, Lille, Montpellier and even Paris. Overall, the poverty rate[1] is, moreover, much higher in cities than in the countryside and the large cities' working-class districts remain by far the primary poverty-stricken areas. Far from forming the homogeneous space of the "new elite" and "winners of globalisation", metropolises are composite spaces in which very diverse life paths and work trajectories co-exist. It would also be appreciable to be able to draw upon analysis as fine-grained as that used in Floch's contribution on the rest of the territory, or at least a sample of low-density areas.

1. *Reflecting the proportion of households with standard of living under 60% of the median standard of living.*

The "two France" discourse therefore does not stand up to analysis. First of all, there are far more than two France: there are multiple, and very diverse, France. Secondly, it could also be asserted that there is only one France, run-through by all kinds of flows, marked by multiple divisions but also brought together by a national solidarity that remains strong. Comparative studies show that France, much less unequal in terms of income and wealth than the United States or Great Britain (World Inequality Report, 2018) is also less unequal geographically. Even the infamous correlation between votes for political extremes (the Front National, in particular) and the divide between metropolises and outer urban areas does not withstand in-depth analysis (Gilli *et al.*, 2017).

In terms of public policy, the implications are clear. Rather than opposing territories against one another, or even specialising policies by demographic segment (yesterday the metropolises, now the average-sized cities), effort should be focused on uncovering, affirming and strengthening anything that contributes to de facto solidarity between metropolises and other territories. Many studies have begun exploring multiple forms of interaction between metropolises and surrounding territories, highlighting quite varied dynamics (Davezies & Talandier, 2015; Levratto *et al.*, 2017). An additional step could be taken, distinguishing between agglomerated cities in the strictest sense, and a more diffuse movement of "shared metropolisation", which can in reality be found across a very large expanse of the country (in terms of population, if not surface area). This shift manifests both in the convergence of lifestyles and consumption patterns and through an inter-metropolitan network functioning pattern, which is superimposed on the local functionning of living and employment areas, gradually driving our country to operate as a developing distributed metropolis (Veltz, 2012). To defend this thesis is not to describe a France where all is well, and where social divides have miraculously dissipated. It does, however, imply refusing to consider that these social divisions, which are real, simply coincide with geographical lines.

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This binary narrative of geography just outlined is often associated, in the dominant discourse, with another opposition: that of the "winners" and "losers" of globalisation. Our age is one of general and diffuse anxiety on the future of jobs, and therefore territories, in the face of the concurrent advances in robotisation and economic openness, which could gradually undermine the economic foundations of the existence of middle classes and speed up, through the bipolarisation of qualifications, the advent of an "hourglass society". This third question, specifically that of the changes in employment, qualifications and their impacts on the territories, is by far the most complex, as it requires moving beyond description to understand the causes and dynamics of the processes involved. How can we disentangle the roles of factors as intertwined in their outcomes and interdependent in their causes as technical change (in essence, the differential automation of tasks) and the internationalisation of value chains (in essence, the substitution effects linked to so-called international trade)? It is well known that economists are far from being in agreement on these issues and that there are multiple controversies outstanding. Moreover, there is much more empirical research in the United States (whose situation is only partially comparable to ours) than in France. Of particular interest to readers should be the courageous work of **Pauline Charnoz and Michael Orand**, testing the hypothesis of a specific effect of computerisation and automation on the erosion of routine tasks connected with mid-spectrum qualifications and wages, and of **Hugues Jennequin, Luis**

Miotti and El Mouhoub Mouhoud, who propose to build a vulnerability indicator to the risks of offshoring, based on a sectoral typology.

The observed polarisation of qualifications at both ends of the wage and diploma ranges, and the connection between this polarisation and technical change, in the spirit of the current research on so-called Skills-Biased Technical Change, now appears to have firmly taken hold, even though it continues to be sometimes disputed. The study by Charnoz and Orand published in this issue confirms that France is not immune to this polarisation. Based on the methodology proposed by Autor and Dorn (2013), it converges with other recent studies, such as that of Harrigan *et al.* (2016) conducted on panel data. In fact, over the course of the last two decades, managers and unskilled employees have been the main drivers of job development in the territories (Bisault, 2017). It remains to be seen in detail how this impacts the overall dynamics of our national territory. In principle, polarisation reinforces metropolisation, as a result of the concentration of high qualifications in large cities, in consulting companies, engineering centres and decision-making hubs. However, it is also reflected in an increase in demand for skilled jobs in non-metropolitan zones, including in factories undergoing modernisation, creating tensions that the current upturn in manufacturing activity (end-2017) illustrate to perfection, with many employers complaining about not finding the workforce they need, including in high-unemployment regions.

This highlights a fundamental difference between the period of growth of the so-called "Glorious Thirty", which was able to re-channel young people (boys and girls) relatively smoothly, from the artisan and peasant worlds into industry and later into services, and the current period. In the decades following the war, the skills step-up from the old world into the new world was low, and the transition was achievable without great geographical mobility, as industry came to meet its new labour supply halfway, leaving the major cities for rural areas, particularly in the Greater Paris Area. Today, the transformation is far more difficult to absorb, as the skills leap to be accomplished is much greater, and the geographical gap is increasing. The only way to regulate these tensions is thus through an increase in skills, supported by a massive training effort and/or geographical mobility. However, the latter remains relatively low overall (although it is increasing slightly in younger generations), as the last article in the issue reminds us, that of **Henri Martin**, who presents a very interesting typology of migratory pathways and sequences. Above all, it remains particularly difficult for those least endowed with financial and cultural resources, a situation which, by its very existence, exacerbates the sense of dead-end or even of abandonment in some territories, which are both particularly hard-hit by the ongoing transformations, and particularly ill-equipped to deal with them.

These technological shifts, it should be said in passing, are all too often presented as resulting from a kind of mechanical fate, whereas they depend mainly on firms' organisational choices, as these can opt for varying degrees of automation, in accordance with specific economic and social parameters that vary by country, or even by site. As for their macroeconomic effects, they depend first and foremost on the social sharing of productivity gains and therefore on the more or less unequal distribution. They also combine closely with the effects of globalisation, the international opening up of markets and productive systems. And that's where matters become truly complex.

First of all, it is important to reiterate that "offshoring", in the sense that the public understands it – i.e. the decision to shut down all or part of a French site to produce the same thing elsewhere, at lower costs – is only a very minor aspect of the shifts observed, as evidenced clearly by different research findings cited by Jennequin *et al.* (Aubert & Sillard, 2005; Fontagné & D'Isanto 2013). "Offshoring" is most often the result of complex recomposition movements within the value chains, where the aim to be closer to the markets served, build channels specially to do so, or gain flexibility play a generally greater part than the search for low labour costs. Moreover, fastest growing international trade is not that in low-skilled labour intensive sectors, as the most widespread image of globalisation would have it, but that in trade of technology-intensive products. The internationalisation of large corporations that continue to drive our economy (in particular by outsourcing) was thus motivated primarily by the conquest of foreign markets. This question of the impacts of internationalisation, and in particular the rise of emerging countries and China, is probably the one where the divergence between experts' views and those of the general public is the greatest. For quite some time, economic orthodoxy even considered this factor negligible in the rise of unemployment and pressure on wages. Things changed as highly fragmented transnational value chains began to be considered as these, without doubt, directly put workers from developed countries in competition with workers from the South. They also changed with the realisation that this competition was not exercised in an undifferentiated manner on large and homogenous national economies, but on specific job pools, creating local shocks that are difficult to absorb for the reasons already discussed above (unemployment traps, rigidity of qualifications, low mobility). A recent study by Clément Malgouyres using the Autor *et al.* method in their pioneering research on the impact of trade with China in the United States (Autor *et al.*, 2013), estimates job losses in France resulting from Chinese imports at 14,000 for the period 1995-2001 and 73,000 for the period 2001-2007 – this in the manufacturing industry, in addition to which, undoubtedly, come greater losses in the induced service sectors (Malgouyres, 2016). These figures remain, clearly, very far from those of unemployment. They are by no means negligible, however, especially if geographical concentration is taken into account.

Still on the subject of "offshoring" – it would be preferable, in my view, to steer clear of the term, so laden it is with ambiguities and misconceptions – it should also be recalled that our economy's good health depends, first and foremost, on the percentage of "offshorable" jobs, precisely, that is exposed to international competition, these jobs being on average more productive and better paid than jobs not exposed to such competition. It would be interesting in this regard to compare and contrast the analysis proposed by Jennequin *et al.* with the research done by Frocrain and Giraud (2016) based on a distinction between "nomadic jobs" and "sedentary jobs" (or, in another version: "exposed" and "sheltered"), the former being those that are tradable beyond borders, while the latter are those that compete only with co-localised jobs. While the methods are, admittedly, very different, they are also complementary. Jennequin *et al.*'s study published here is limited to the manufacturing sector and is part of a typology consisting of four large groups, with the vulnerability index being constructed based on the relationship between changes in employment and import. Frocrain and Giraud's approach defines the sectors exposed based on a geographical analysis of the dispersion of jobs across the territory, working from the idea that the greater the dispersion, close to that of the population, the more likely the jobs are to be sedentary. One of the surprises of this approach was to highlight a high proportion of service jobs amongst exposed jobs, a finding consistent with the growing proportion of services in international trade and transnational value chains. The main

outcome is that the exposed jobs category has both fallen into the minority and is declining: it receded from 30% to 26.8% of total employment between 1999 and 2013 in France. The protected sector is, conversely, the real driver of employment. This is reassuring in a sense, when seen from the viewpoint of offshoring risk, but is also worrisome from the point of view of the country's overall competitiveness. Once again, public policies must be able to play on multiple fronts: jump-starting competitiveness, by increasing the number of jobs exposed, improving the quality of sedentary jobs, and better anticipating local crises, so as to better manage them. Easier said than done!

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France, like all developed countries, is engaged in a series of transitions (globalisation, digitisation, financialization, behavioural changes, emergence of new energy, food, agricultural, health and education models), the consistency of which we are struggling to grasp. The resulting broken narratives, generally laden with worry, are unable to re-combine to form an all-encompassing narrative. Yet evidently, all of these changes are interlinked and global trajectories are emerging, different from those of other countries, even those closest to France. In these trajectories, the territories are not merely passive areas within which social, economic and cultural changes are planned. They are players in their own right. Their local triggers and their overall configurations shape national dynamics. For example, the broad distinction between the London region and the rest of Great Britain, which weighed heavily on *Brexit*, is not found in France, which is arguably protected from this type of divide by the ring of dynamic metropolises that interconnect the territory. In another illustration, the density of Germany's urban meshing, and the existence there of a horizontal network of large, relatively complementary and specialised cities – in contrast to the French, more vertical, less specialised network – and the stronger territorial anchoring of firms, including larger ones, are all closely intertwined with the German economy's form of competitiveness. Incidentally, these distinctive specificities in the territorial model, passed down by history, and which can also be found in Italy and Spain, are one of the challenges of European construction. Our policy makers have gradually come to understand that sectoral policies ("industrial" policy, vocational training, education and health) could not ignore this territorial dimension – even if the idea of the universal norm continues to strongly permeate our thinking. To understand this systemic dimension and beneficially inform public decision-making, economists, statisticians, quantification specialists in general, sociologists, policy-makers and geographers must work together, coming down from their respective ivory towers. The undertakings ahead are vast. Allow me to discuss two of them in closing.

The first pertains to the categories which we use to classify and read the world. The so-called founding distinction in our economic world view, between "industry" and "services", must now be put to serious questioning (see notably Crozet & Millet, 2014; Fontagné *et al.*, 2014). I put forward the idea of the transition to a "hyper-industrial" society (Veltz, 2017), first of all to resolutely reject the idea of a post-industrial society, but also and above all to duly take note of the following two-fold fact: 1) firms and players in the two major activity sectors (secondary and tertiary) are showing increasing interpenetration, 2) via platforms and new business models, the economy as a whole, the manufacturing sector included, is tending toward a "service" identity, with value creation now focused on a fine-tuned understanding of usages and experiences. The market economy – which, it should be mentioned in passing, is hybridising more and more with non-market economy – increasingly

appears to be a moving continuum rather than a set of clearly-separated sectors. At stake here is not just that another statistical and accounting view of things. It is also, first and foremost, that of public policies that must now take this continuum into account. To take just one example, the lack of competitiveness in our industry cannot be understood by limiting comparisons to the manufacturing field alone, as our exports of physical goods consist of at least one-third services purchased on national soil. Lastly, in these industry-digital-services continuums, new forms of division of labour as well as cooperation between densely-populated metropolitan areas and their very densely-populated outer urban areas, could emerge, given that the manufacturing industry today is found primarily outside of metropolitan areas (but could partially come back to them with smaller, "own" units) while market services and upstream technological supports are located mainly in large cities. Similarly, new forms of power generation, power supply and various eco-system services (recycling, in particular) could serve as the foundation for unprecedented synergies between the two types of spaces.

The second challenge lies in the transition from an analysis focused on stocks and localised data, to one centred on flows, exchanges and relationships between places. The facts show beyond dispute that, apart from data on daily migration and data (still sparse) on residential migration and individual life pathways, quantitative data on flows and exchanges remain meagre. However, our territory, whether local, national or international, is less and less representable as a set of juxtaposed entities or Matryoshka dolls charmingly nesting within one another. It is a world in which scales are telescoping each other, where the Paris or Lyon hinterland is found in Shenzhen, Boston or Amsterdam as much as and sometimes more than in the nearby provinces. The great leap forward in connectivity is the central phenomenon. It does not eliminate proximity effects, but rearranges them within more complex structures, the topology of which no longer follows topography. We are entering a world of hubs and interwoven networks on which available data remain highly-fragmented, and above all qualitative. The work carried out by geographers, bringing out the relational aspects of urban systems (Berroir *et al.*, 2017) would deserve to be greatly amplified and carried to new ground by economists. Clearly, this is something to feed future issues of *Economie et statistique / Economics and Statistics*, which could be entitled "Territories of flows vs. the territories of places" or "France and Europe as systems of relations and exchanges". □

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Disparities and territorial discontinuities in France with its new regions: A multiscalar and multidimensional interpretation

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Abstract – Since 1 January 2016, the 22 French metropolitan regions have merged to form 13 new regions. The deployment of public policies in these regions with enhanced areas of jurisdiction leads us to wonder about the way in which the merger leads to the reduction of territorial disparities or not. We analyse these disparities using five sociodemographic indicators. Several geographical levels are mobilised: the European Nomenclature of Territorial Units for Statistics (NUTS) and the French employment zones. The main characteristics of the new regions in a national and European context are highlighted using statistical and spatial data analysis methods. Inter-regional contrasts are relatively low in France, in comparison with those prevailing in other European States. The main discontinuities are found between countries rather than between regions within a country. At the national level, some merged regions appear relatively homogeneous (Nouvelle-Aquitaine, Bourgogne-Franche-Comté and Normandie) compared to others more contrasted (Hauts-de-France, Occitanie, Auvergne-Rhône-Alpes and Grand Est). The main territorial discontinuities are observed within the same regions and not between them.

JEL Classification: C21, C81, R11
Keywords: Territories, cohesion, Europe, territorial discontinuities, territorial disparities, territorial reform, new regions, spatial analysis

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The former French regional perimeter, effective from 1972 to 2015, finds its origin with Serge Antoine, a young technocrat of the *Cour des Comptes*, who was entrusted by the State, in 1956, with the project for dividing the regions. In the aftermath of the Second World War, France indeed questioned the relevance of its administrative map, which had become somewhat archaic (the *département* was designed in the aftermath of the revolution to allow residents to perform a round trip to their county town in one day of travel by horse). This is how this geography enthusiast proposed a division based on geographical and statistical criteria (minimum threshold of a million inhabitants per region, telephone links between large cities etc.), respecting, nonetheless, existing departmental limits. With the exception of Corse, which was detached from the Provence-Alpes-Côte d'Azur region in 1972, the division proposed by Serge Antoine, formalised by two decrees in 1959 and 1960, was maintained up to the end of 2015.

In 2015, the territorial reform initiated by the Government[1] transformed French territorial architecture again. France is composed of a superposition of administrative levels: *communes*, *EPCI* (inter-municipal authorities), *départements* and regions. It implies, according to the designers of the reform, political areas of jurisdiction and funding to be shared, but often also redundancies and therefore a loss of public money. Thus, while reinforcing the role of the inter-municipal authorities as of 1 January 2016, the reform substituted the 22 existing metropolitan regions with 13 regions, with 7 of them coming from the merger of the regions without modification of the départements which constitute them and increasing their areas of jurisdiction at the same time (Figure I). The Act

1. Via Law no. 2015-29 of 16 January 2015 relating to the demarcation of the regions, the regional and departmental elections and Law no. 2015-991 of 7 August 2015 on the new territorial organisation of the Republic (NOTRe)

Figure I
The new French regional map

Coverage: metropolitan France.
Sources: Insee.

of 2 March 1982 had endowed the regions with the general area of jurisdiction clause, which granted a certain power of initiative outside of the areas of intervention specifically provided for by the law. After being removed in 2010 and then reinstated in 2014, this clause was finally abolished by the New Territorial Organisation of the Republic (NOTRe) law for the regions as well as for the départements.

These two levels can therefore no longer intervene in all areas of public action and the region is now endowed with exclusive areas of jurisdiction (economic development, management of European programmes, education/training, land planning, equality of its territories, environment and the management of transport) which are action levers, in particular to limit territorial inequalities. In the field of transport, with respect to non-urban services, school transport, access to the French islands or construction, the regions have thus become solely competent, in place of the départements, while the development and operation of public bus stations continue to be the département's responsibility. In addition to the transfers of areas of jurisdiction in the transport field, the region becomes the territorial authority responsible for economic development on its territory, and no longer just the leading authority for this area of jurisdiction, as was the case before the reform[2]. The region is now solely responsible for the development of two major forward-looking schemes: the regional economic development, innovation and internationalisation plan (SRDEII)[3] and a new regional spatial planning, sustainable development and territorial equality plan[4] (SRADDET).

The motivations for merging regions were, however, much more than in the 1950s, political and economic than geographical or statistical. It was, above all "to *endow the French regions with a critical size which would allow them to exercise, at the relevant scale, the strategic areas of jurisdiction which are assigned to them, to compete with comparable authorities in Europe and to achieve efficiency gains"* and so to decrease public expenditure (cf. the draft law on regional delimitation, regional and departmental elections, and amending the electoral calendar, 17 June 2014). If the mitigation of disparities between territories could also be a motivation for the legislator, the scientific reflexions carried out on this subject have been, for the most part, *a posteriori* and this criterion was not explicitly taken into account in the choice of the new regions (Jouen, 2015; Amabile *et al*., 2015; Brière & Koumarianos, 2015). It is important, however, to document the effects of the merger on the accentuation or, on the contrary, the mitigation of inter- and intra-regional inequalities, as these questions cover issues related to the strengthening of public policies at the regional level.

In this article, the territorial impacts of the merger of regions are studied by using several sociodemographic indicators. The specificity of this analysis lies, furthermore, in the mobilisation of several geographical levels of the European Nomenclature of Territorial Units for Statistics (NUTS) and the intra-regional zoning of the French employment zones. It is in this sense that we can speak of a multiscalar and multidimensional interpretation of territorial disparities.

At the European level, it appears that the new regions, the future French NUTS 1 regions, show a rather modest demographic weight compared to the other NUTS 1 regions, while the merger of the regions has resulted in the mitigation of inter-regional contrasts that were already rather moderate before the reform, in comparison with the situation of other European States.

At the national level, the former regions having merged into a same new region might be relatively similar (this is the case, for example, with Nouvelle-Aquitaine) or, on the contrary, very different (this is the case, for example, with Hauts-de-France). The disparities –i.e. the differences between territories– and the territorial discontinuities –i.e. the gaps assessed as the most significant between neighbouring territories– appear stronger within the same regions rather than between regions, often with a strong heterogeneity between employment zones in a same region and strong territorial breaks within the same regions.

In a first part, this article will seek to put the new regions in the European context, within all of the regions constituting the 28 countries

2. During the constitutional revision of 2003, in article 72 it was recorded that "no territorial authority may exercise administrative supervision over another one". However, it was added: "However, when the exercise of an area of jurisdiction requires the cooperation of a number of territorial authorities, the law may authorise one of them or one of their groupings to organise the terms of their collective action". This is how an authority may organise the terms of collective action: it is then the leader.

3. Previously the regional economic development plan (SRDE).

4. For more details, refer to http://regions-france.org/observatoire-politiques-regionales/

of the EU. The aim will be to compare the magnitude of the disparities between French regions with the situation in other Member States. The second part will analyse, at national level, the effects on territorial disparities and discontinuities of the regional reorganisation linked to the change from 22 metropolitan regions to 13.

The new French regions in the European context: a modest demographic weight and moderate regional contrasts

The reform of the territorial map has often been justified by external and European arguments (Jouen, 2015): in particular, the French regions being smaller than their European counterparts (notably the German *Länder*) would not reach the sufficient critical size for international competition. In this context, we will consider the positioning of the new regions in the hierarchy of European regions and we will seek to assess the impact of the new perimeters on the measurement of French inter-regional contrasts, compared to those at play in the other European countries. These investigations require first to specify how the new regions fit into the NUTS nomenclature.

The new French regions, by doubling their population, become future NUTS 1 European regions

At European level, the harmonised definition of the "region", the cornerstone of community statistics, is based on the Nomenclature of Territorial Units for Statistics (NUTS). This nomenclature comes in four levels, from NUTS 0 corresponding to the State as a whole, up to NUTS 3 level, the smallest level[5]. The Member States of the European Union are invited to propose territorial levels following two normative principles (Eurostat, 2016):

- *Principle 1: the NUTS regulation defines the minimum and maximum population thresholds for the size of the NUTS regions*. This rule aims to make the regions comparable, as far as possible. For the NUTS 2 regions, which is the privileged level for EU regional policy, the average population of the units must be between 800,000 and 3 million inhabitants, whereas for the NUTS 1 regions, these thresholds vary between 3 and 7 million[6]. There can only be exceptions to these thresholds for geographic, socioeconomic, historical or particular cultural reasons.

- *Principle 2: the NUTS favours administrative regions (...) existing in the Member States*. For the implementation of public policies, it seems to be more coherent to manage European funds at the level of regions which actually have expertise in territorial development, rather than at the level of regions which would only be statistical constructions[7].

This evolving nomenclature (2003, 2006, 2010 and 2013 versions) changes according to the territorial reforms undertaken by the Member States, which therefore raises the issue of the choice of the right level for the new French regions in the NUTS nomenclature[8]. Indeed, the reform has important consequences on the population of the regions, which can be seen by comparing their European neighbours (Figures II-A and II-B). At NUTS 2 level, notwithstanding the particular case of the smallest states where the NUTS 2 regions are confused with national boundaries, the 22 regions in metropolitan France were already among the most populated areas in Europe, with an average of 2.5 million inhabitants (2.9 million without the overseas départements – the DOM), just behind Italy (2.9 million), and in front of other large States such as Poland (2.4 million), Germany (2.1 million), or even the United Kingdom (1.6 million). These comparisons are not, however, free from the effects of *MAUP (modifiable*

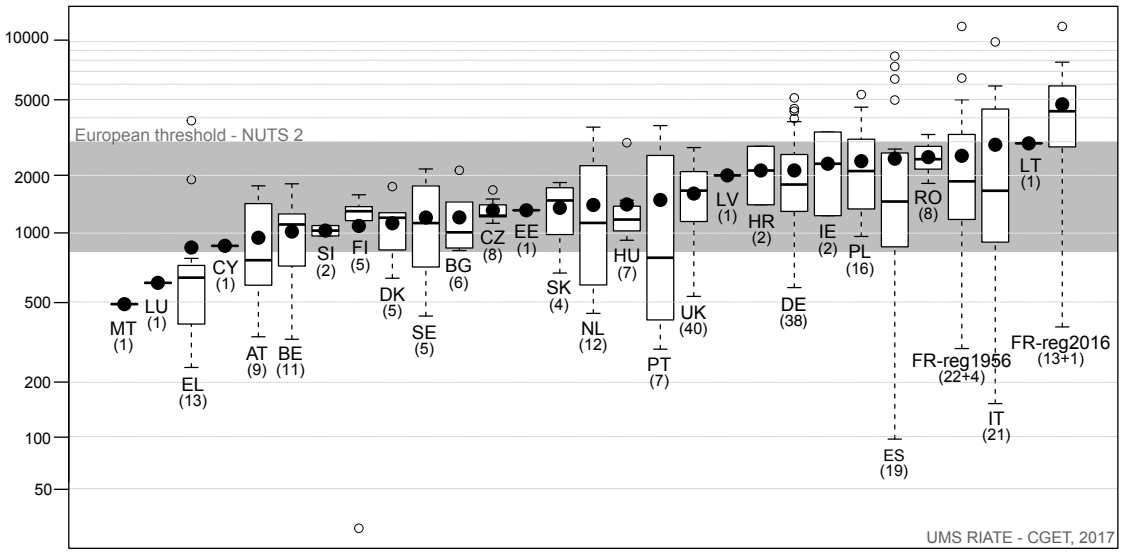
5. In some smaller countries, however, such as Luxembourg and the Baltic countries, the NUTS nomenclature does not take into account intra-national division and the smallest levels overlap with those of the State.

6. However, even within these intervals, there may be strong demographic heterogeneity: some regions may be heavily populated areas, due to the presence of large metropolitan centres, while at the other extreme, some regions have very little population, due to the existence of special laws within their countries (this is particularly the case of the Åland Islands in Finland, of Corse in France or of Sardinia in Italy), specific situations of enclaves (Ceuta and Melilla in Spain) or distant peripheries (the French overseas territories).

7. However, this preferred level of regional policy (NUTS 2) does not correspond to the management levels among the States. For example, because of considerable financial stakes related to this policy, some Member States have chosen a regional geographical level that maximizes the chances of falling within the eligibility thresholds of the European Union cohesion policy. One of the best-known cases is that of Ireland (Lagendijk, 2005): as this country was preparing to lose its regional grant at the start of the 2000s, abruptly moving from the "disadvantaged" statistical class to the "privileged" class, the initiative was taken to divide its territory into two parts - a poor north and a rich south - whose boundaries are completely disconnected from the three historical regions in Ireland (Connacht, Leinster, Munster).

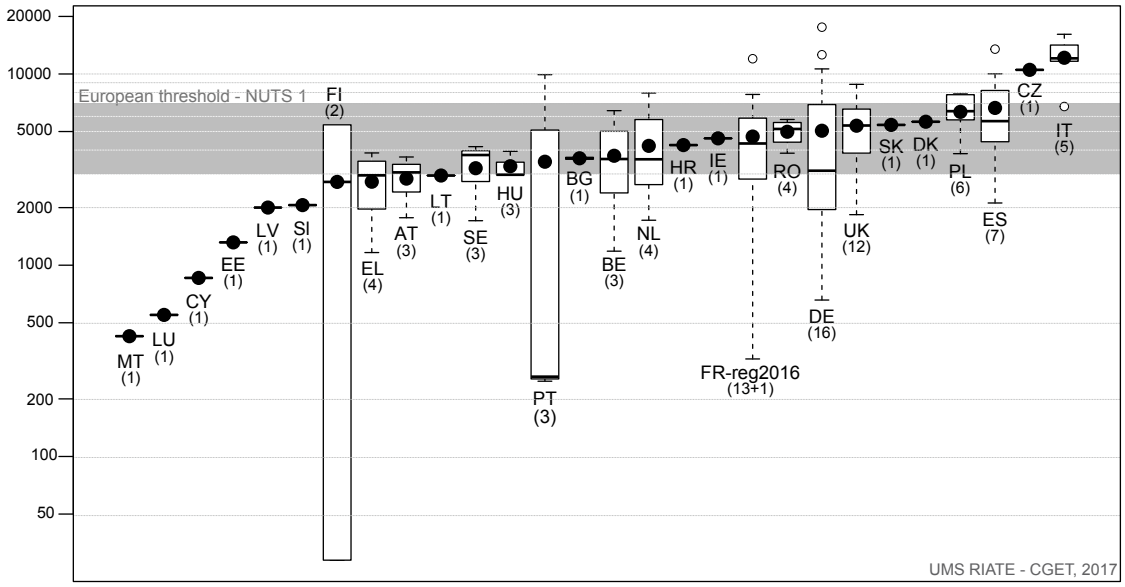
8. Up to now in France, the four NUTS levels have corresponded to the national territory (NUTS 0), to a division into 9 ZEATs (study and territorial development zones, NUTS 1), to 22 regions + 4 DOMs (NUTS 2) until 2011 and then 5 DOMs with the addition of Mayotte, and finally to the départements (NUTS 3).

Figure II-A
Weight of the European NUTS 2 according to the population criterion (2014)



Note: The figure represents, for each of the EU Member States, different parameters of the distribution of regional populations at NUTS 2 level. The bottom side of the box represents the first quartile (Q1), and the top side, the third quartile (Q3). The horizontal line inside the box is the median and the black circle is the mean. The vertical dashed lines extend to the minimum and the maximum values of the data set, as long as these values are not outliers. A value is considered as an outlier (white circle) if it is less than Q1-(Q3-Q1) or greater than Q3+(Q3-Q1). The shaded area corresponds to the demographic thresholds of the NUTS nomenclature in question. The number in brackets gives the number of NUTS in the Member State in question. The 28 Member States are: Belgium (BE), Bulgaria (BG), Czech Republic (CZ), Denmark (DK), Germany (DE), Estonia (EE), Ireland (IE), Greece (EL), Spain (ES), France (FR), Croatia (HR), Italy (IT), Cyprus (CY), Latvia (LV), Lithuania (LT), Luxembourg (LU), Hungary (HU), Malta (MT), the Netherlands (NL), Austria (AT), Poland (PL), Portugal (PT), Romania (RO), Slovenia (SI), Slovakia (SK), Finland (FI), Sweden (SE) and the United Kingdom (UK). For France, FR-reg1956 refers to the former French regions (22 in metropolitan France and 4 overseas, excluding Mayotte) and FR-reg2016 to the future NUTS 1 regions which correspond to the 13 new metropolitan regions in force since 2016 and an entity that brings together all the overseas ones, which are placed on the figure for comparison purposes. Nomenclature of NUTS 2 (version 2013) statistical territorial units of the EU28.
Reading note: Austria (AT) has 9 NUTS 2 regions (9 *Länder*). The average population of NUTS 2 regions in Austria is 945,000 inhabitants; the median population is 722,000 inhabitants. Half of the NUTS 2 regions have between 534,000 and 1,426,000 inhabitants (interquartile interval).
Sources: Eurostat, 2016.

Figure II-B
Weight of the European NUTS 1 according to the population criterion (2014)



Note: The figure represents, for each of the EU Member States, different parameters of the distribution of regional populations at NUTS 1 level. Nomenclature of NUTS 1 (version 2013) statistical territorial units of the EU28.
Reading note: Austria (AT) has 3 NUTS 1 regions. The average population of NUTS 1 regions in Austria is 2,836,000 inhabitants; the median population is 3,057,000 inhabitants. Half of the NUTS 1 regions have between 2,414,000 and 3,368,000 inhabitants (interquartile interval).
Sources: Eurostat, 2016.

areal unit problem) that is, the effects of scale and zoning related to the influence of spatial breakdown (Openshaw, 1984; appendix) as is illustrated in the case of the United Kingdom where several NUTS 2 regions correspond to urban districts (especially for London, divided into three districts). The new regional breakdown and mergers cause the French regions to move into NUTS 1 category. In fact, the new French regions have 4.7 million inhabitants on average (4.9 million excluding the overseas territories). Among the merged regions, only Bourgogne-Franche-Comté and Normandie, with respectively 2.8 and 3.3 million inhabitants, are relatively small compared to all of the NUTS 1 regions. Most of the new regions have between 5 and 6 million inhabitants, which puts them, for example, at the level of the *Land* of Hesse (Frankfurt), the East of England region and the West Midlands region in the United Kingdom, or even capital city regions such as that of Madrid. As for the Auvergne-Rhône-Alpes region (7.8 million), its size (in terms of population) is similar to that of large regions such as London (8.5 million), West Netherlands (7.9 million), or Poludniowy, which brings together Silesia and Lesser Poland, of which Krakow is the administrative capital (7.9 million).

The new French regions will be the future NUTS 1 regions from 2018 (replacing the ZEATs[9]), while the NUTS 2 regions will still correspond to the former regions[10], but will no longer have any administrative meaning. Compared to the most populated NUTS 1 regions of the other European States, the new French regions are in last place (Spain 6.6 million, Poland 6.3 million, United Kingdom 5.4 million, Germany 5 million). However, this relatively modest weight can be nuanced when comparing the future French NUTS 1 regions on the first intra-national level of territorial management, which corresponds, according to the States, to NUTS 1 or NUTS 2. The new French regions are closer then, in terms of population, to the German *Länder* (NUTS 1), while being a long way ahead of the Spanish communities (NUTS 2), the Italian regions (NUTS 2) or even the Polish *voivodships* (NUTS 2), which have, on average, between 2.4 and 2.8 million inhabitants. Similar observations could be drawn from comparing the GDPs.

Thus, according to a political-institutional approach, the future French NUTS 1 regions could be, taking into account their expanded areas of jurisdiction, compared to the NUTS 2 regions when the latter correspond to the first trans-national territorial management level[11] (Jouen, 2015).

The sociodemographic profile of the new regions in the European context: a relative smoothing out of inter-regional contrasts

Beyond the issues relating to the demographic weight of the French regions, one may ask what the impact of the new regional perimeters is on the sociodemographic profiles of the regions. Five sociodemographic indicators (the population density, the youth index, the employment rate of 25-64-year-olds, the median standard of living and the change in the number of employed persons since the crisis of 2008, see appendix) have been adopted to assess the impact of these restructurings on the classification of regions, both in relation to other European regions and in relation to the old French regions having merged. In fact, the sociodemographic indicators highlight the current and upcoming issues in a territory as well as the economic indicators. Here, we have also sought to complement the work already conducted on territorial cohesion in an economic perspective (Amabile *et al*., 2015a; 2015b), by including indicators often used to describe the social and demographic situation of territories in terms of degree of urbanisation, standard of living, age and labour market participation the inhabitants.[12]

As mentioned earlier, the choice of the relevant levels of the nomenclature to carry out the European comparisons is not self-evident. In this article, a statistical criterion of comparable demographic size will be favoured, rather than a politico-institutional criterion leading to selecting zones with comparable areas of jurisdiction. We will therefore directly draw on the logic of Eurostat's nomenclature (comparison at the NUTS 1 level).

Table 1 presents the respective rankings of the seven regions resulting from the merger (NUTS 1) and sixteen former regions that

9. The ZEATs (Zones d'études et d'émangement du territoire) are territorial units created in 1967 by Insee and Datar. There are 8 of them in metropolitan France.
10. The regions which have not merged simultaneously belong to NUTS 1 and NUTS 2 levels in the nomenclature. The overseas regions (Guadeloupe, French Guiana, Martinique, Mayotte and Réunion) constitute a single entity at NUTS 1, called the "outermost regions", each of which is always a region at NUTS 2 level (and at NUTS 3 level).
11. These geographical administrative management levels fall within the traditions and varied designs of the regionalisation processes depending on the different European Member States (Marcou, 1999; Lagendijk, 2005).
12. For more details on the choice of indicators, refer to appendix.

comprise them (NUTS 2), according to the five indicators chosen. This ranking is expressed using standardised rankings from 0 (the most unfavourable situations) to 100 (the most favourable situations)[13], so as to allow a direct comparison of the relative positions of regions within groupings of unequal size (103 NUTS 1 and 276 NUTS 2). Well-known traits of the positioning of the French regions in Europe can be found: they are rather poorly placed in terms of the employment rate (ranks 17 to 55, with this last value meaning that 55% of European regions have employment rate that are less favourable than the highest French region), quite favoured in terms of standards of living (ranks 48 to 74), while the demographic situation (21 to 81) and the recent change in employment (28 to 72) present results that are significantly more mixed from one region to another. From a more thorough analysis of each merged region (table 1 and Figure III), four profiles are identified and compared to other European regions:

The **Auvergne-Rhône-Alpes** region stands out with a very favourable situation on all of the indicators; the new region's profile is essentially

13. The rankings have been standardised: they correspond to the absolute value of the rank compared to the total number of observations (103 in the nomenclature of the new regions (NUTS 1), 276 in the nomenclature of the former regions (NUTS 2)), multiplied by 100.

Table 1
European positioning of the 7 new regions (NUTS 1) compared to the 16 former regions having merged (NUTS 2)

	Median standard of living	Population density	Youth index	Employment rate (25-64 years old)	Change in employment since 2008
Hauts-de-France	**48**	**63**	**81**	**16**	**36**
FR22 - Picardie	57	38	64	26	22
FR30 - Nord-Pas-de-Calais	42	76	84	17	42
Occitanie	**60**	**26**	**55**	**32**	**63**
FR62 - Midi-Pyrénées	65	19	58	50	52
FR81 - Languedoc-Roussillon	50	38	49	19	82
Grand Est	**62**	**36**	**56**	**33**	**28**
FR21 - Champagne-Ardenne	55	12	52	21	17
FR41 - Lorraine	55	37	49	26	28
FR42 - Alsace	65	67	66	55	33
Normandie	**66**	**45**	**48**	**39**	**31**
FR23 - Haute-Normandie	63	54	62	32	41
FR25 - Basse-Normandie	63	29	36	43	20
Nouvelle-Aquitaine	**68**	**22**	**21**	**48**	**54**
FR53 - Poitou-Charentes	65	22	16	40	35
FR61 - Aquitaine	63	28	44	47	75
FR63 - Limousin	65	10	12	52	22
Bourgogne-Franche-Comté	**69**	**13**	**29**	**44**	**46**
FR26 – Bourgogne	68	12	20	41	37
FR43 - Franche-Comté	63	23	52	43	55
Auvergne-Rhône-Alpes	**74**	**46**	**73**	**55**	**72**
FR71 - Rhône-Alpes	71	53	81	55	79
FR72 – Auvergne	72	12	23	42	39

Note: precise definition of the indicators in appendix; ranking using standardised ranks (corresponding to the absolute value of the rank compared to the total number of observations (103 in the nomenclature of the new regions (NUTS 1), 275 in the nomenclature of the former regions (NUTS 2)), multiplied by 100.
0 - Worst situation (0% of units below the value of the territorial unit in its nomenclature)
100 - Best situation (100% of the units below the value of the territorial unit in its nomenclature).
Reading note: the youth index of the new Hauts-de-France region reached 81, which means that 81% of European Regions (using the NUTS 1 nomenclature) are less "young"; the index of the former Nord-Pas-de-Calais region stood at 84, which placed this region in an even more favourable European position (using the NUTS 2 classification).
Coverage: former French regions having merged and new regions.
Sources: Eurostat, 2017.

modelled on that of the former Rhône-Alpes region, that demographic weight is predominant in the merged whole (82% of the new region's population). At the national level, the Auvergne-Rhône-Alpes region is therefore placed in the second rank of the new regions in terms of median standard of living (€19,320), after the Île-de-France region, thanks in particular to the presence of the Lyon metropolitan area and its location on the French border. Its employment growth is also higher than the national average. At the European level, the standard of living (rank 74), the recent change in employment (rank 72) and the youth index (rank 73) place the region in the first quarter of the most favoured NUTS 1 regions. This profile is quite similar, for example, to that of the South-West of England, and to a lesser degree, the Saar and the North-East of Italy, with these two regions being nevertheless much less favoured in terms of demographic situation or job creation dynamics.

Nouvelle-Aquitaine and **Occitanie** have a fairly favourable profile and are distinguished in particular by a positive change in employment (rank 54 and 63 respectively) and the inhabitants' relatively high standard of living (68 and 60 respectively), even if the median standard of living is lower in Occitanie (€ 17,910, which is lower than the average for metropolitan France) and closer to the profile of West Netherlands or of Thuringia in Germany. The situations in the two regions are, however, more differentiated in terms of the age structure and the employment rate. In Nouvelle-Aquitaine, where there are, on average, 79 young people aged between 15 and 24 for 100 people aged between 54 and 65, the profile is strongly marked by the ageing of the population in Poitou-Charentes and in Limousin, which are among the 15% of the least young regions in European. If according to the standard of living and employment indicators, Nouvelle-Aquitaine shares many traits with Scotland, taking into account its ageing demographic structure, it is closer to central Poland (Lodz region) or western Hungary (Transdanubia). As for Occitanie, its situation for the labour market appears particular, close to the **PACA region** in France or to the vast central region of Italy (from Lazio to Tuscany), where the positive change in employment is combined with a slightly unfavourable employment rate (70.1%).

Grand Est and **Normandie** are characterised by quite high levels of living standard (ranks 62 and 66), close to those observed in the Berlin and Brandenburg regions, and a fairly median demographic profile on the European scale (ranks 56 and 48). They share relatively important difficulties in terms of employment (ranks for employment rate of 34 and 39, 28 and 31 for change in employment), even if the situation on the labour market is significantly better in Grand Est thanks to the former Alsace region, whereas the former Champagne-Ardenne and Lorraine regions face the difficulties of being formerly highly industrial regions. **Bourgogne-Franche-Comté**, although more favoured in terms of standard of living, is close to this profile on the labour market, but it is characterised by a more ageing demographic structure, just like North-East Italy. Similarly, by their favourable situations on the labour market and their average demographic situations, the unchanged **Bretagne** and **Pays de la Loire** regions are relatively close to the new Grand Est region.

Finally, **Hauts-de-France** appears to be both the poorest French region (standard of living rank: 48, median standard of living of € 16,820), the least favoured in terms of employment (rank 17 for a rate of employment of 65% and rank 36 for change in employment, because of the rapid decay of the supply of jobs in Picardie, at a rate of – 1.0% per year), but also the youngest (rank 81, i.e. as many young people aged between 15 and 24 as people aged between 55 and 64), thus reflecting the essential characteristics of the Nord-Pas-de-Calais region. This profile is fairly close to that of Wales, or even the East Netherlands, even if the employment rate is higher by almost 10 points in these regions.

Two metropolitan regions which have not changed scope display very specific characteristics. **Île-de-France** displays a favourable labour market (rank 69 for the employment rate of 75.9% and rank 93 for the standard of living of €22,600) and a relatively young population (rank 92). However, with a – 0.1% average annual change in employment over the 2008-2015 period (rank 49), it is not, from this point of view, one of the most favoured regions in Europe and is overtaken, notably, by the Auvergne-Rhône-Alpes (+ 0.6%) and the Occitanie (+ 0.4%) regions. **Corse**, the second atypical region, presents both a very low rate of employment (rank 10, 61.5%) and a very pronounced decline in employment since the economic crisis (rank 4, – 3.2%) according to the data provided by Eurostat, which do not correspond to those published by Insee.

Through the reorganisation of this classification, the disadvantaged profiles of certain

former regions (Picardie, Auvergne, …) tend to be mitigated, while the favourable position of several of them (Rhône-Alpes, Aquitaine, …) tends to be slightly eroded. These developments suggest that there has been a certain smoothing out of inter-regional contrasts as a result of the territorial reform, encouraging to assess more thoroughly the impact of the mergers on the magnitude of regional disparities in France, compared to the other European States.

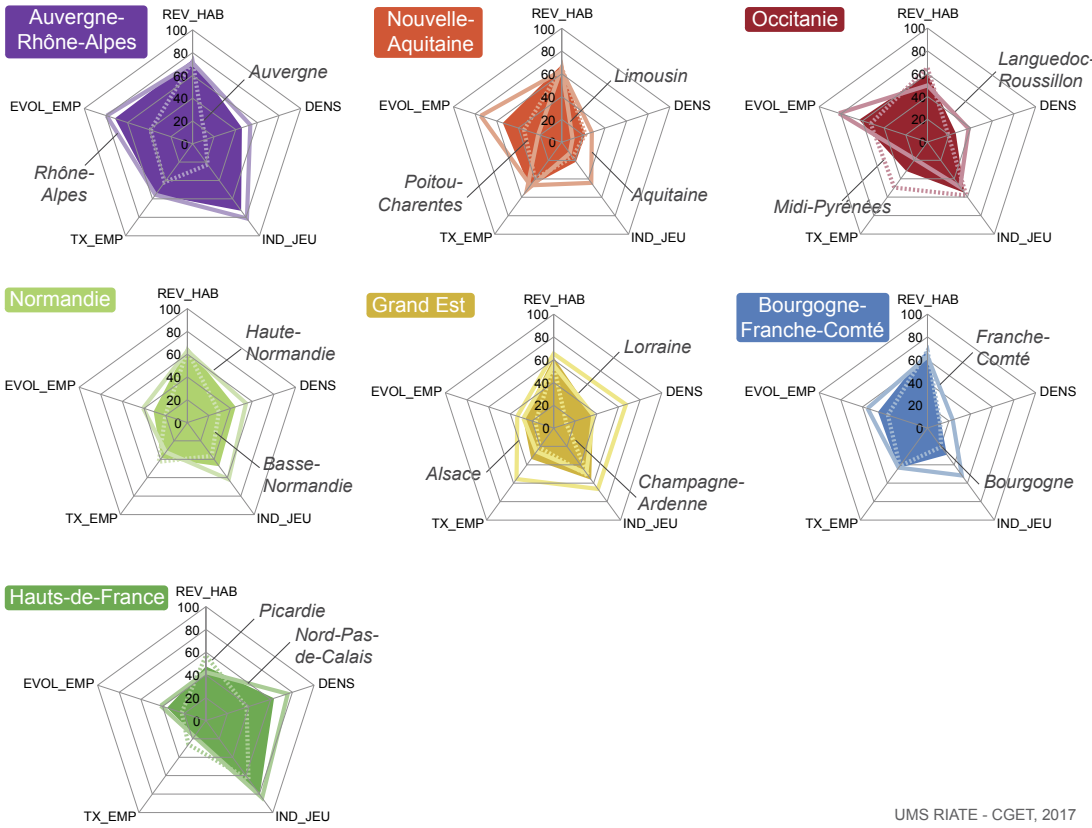
A relative homogeneity of French regions compared to the other European regions

How do the mergers alter the relative position of France in terms of internal heterogeneity compared to the other European States? Here, the comparison is restricted to States which have sufficient regional entities for the measurement of inter-regional inequalities to be relevant[14].

For the record, it should be remembered first of all that at the NUTS 2 level, it is in metropolitan France that the inter-regional contrasts are the weakest. This is especially true for the differences in median standards of living (coefficient of variation[15] of 0.06), despite the magnitude of the inequalities observed at the two extremes (median standards of living 40% higher in Île-de-France compared to Nord-Pas-de-Calais and Languedoc-Roussillon), which brings the French regions close to the German (c.v. of 0.09, with Upper Bavaria being 45% richer than Mecklenburg), but clearly distinguishes them from that of other States: in Spain, for example, the inter-regional contrasts in standard of living are very high (c.v. of 0.17, standard of living 75% higher in the Basque Country compared to

14. Only the States with more than 10 NUTS 2 or 5 NUTS 1 regions are included in this comparison. In addition, for France, the overseas territories are not taken into account.
15. Coefficient of variation defined by the ratio of the standard deviation to the mean; it increases with the variances; written as c.v. in the rest of the article.

Figure III
Socio-demographic profiles of the 7 new regions (NUTS 1) and of the merged 16 former regions (NUTS 2) in the European context



Note: the standardised rank of the NUTS 1 (103 territorial units) or NUTS 2 (275 territorial units) regions is represented (method detailed in the note to table 1). The five income indicators: REV/HAB (net disposable income per capita in 2013, which corresponds to the standard of living), DENS (density of population in 2015), IND_JEU (youth index in 2015), TX_EMP (employment rate of 25-64-year olds in 2015), EVOL_EMP (change in employment 2008-2015) (appendix 1).
Coverage: former French regions having merged and new regions.
Sources: Eurostat, 2017.

Estremadura), the same as in Italy (c.v. of 0.18, standard of living 75% higher in Lombardy than in Calabria) or to a lesser degree in the United Kingdom (c.v. of 0.15, once the three London districts are combined). Among all of the indicators, it is for the youth index that the dispersion of the values between the French regions is the strongest (c.v. of 0.12), but it remains low in relation to other European countries, with the index ranging from 70 in Limousin to 120 in Île-de-France, whereas the c.v. reaches, for example, 0.18 in the United Kingdom, 0.19 in Germany and 0.26 in Spain. In terms of the employment rate, the situation is particularly homogeneous (c.v. of 0.05), especially when compared to Italy (c.v. of 0.16) and Spain (c.v. of 0.10), while in Germany, the regional indicators are of the same order of magnitude as in France (c.v. of 0.03).

The change to NUTS 1 maintains this relative homogeneity in France. The statistical dispersion of the standard of living still appears to be the lowest there (c.v. of 0.07, standard of living in Île-de-France higher by 34% than in Hauts-de-France), followed by Germany (c.v. of 0.10, gap of 34% between the *Land* of Hamburg and Bavaria on the one hand, and that of Mecklenburg on the other hand), the United Kingdom (c.v. of 0.14, 57% between the Greater London region and Northern Ireland), Spain (c.v. of 0.17, 60% between the Madrid region and Andalusia) and Italy (0.19, 60% between the North-west and the South). As regards the youth index, at NUTS 1 level, the contrasts are significantly attenuated in France (c.v. of 0.10), while in the other States, moving from NUTS 2 to NUTS 1 tends to accentuate the demographic disparities, as is the case in Germany (c.v. 0.25, with indices setting the very old Mecklenburg and Brandenburg against Baden Württemberg and especially the Land of Hamburg).

In total, inter-regional contrasts appear to be especially low in France compared to the other major European States. The change to NUTS 1 has barely altered this finding and sometimes even strengthens it, as is the case for the youth index. The mapping of the greatest inter-regional territorial discontinuities, i.e. the largest gaps measured between neighbouring regions, illustrates it in another way (Figure IV). Furthermore, it invites one to question the relationship between the largest discontinuities and the localisation of international borders. The use of a territorial auto-correlation index allows measuring this effect of national affiliation more precisely (Box1). For the standard of living indicator, the territorial auto-correlation coefficient which is positive and close to 1 (0.78) shows that the main discontinuities are located at the borders of States and not at the level of regional intra-national limits. In other words, there is indeed a strong effect of national belonging, with regions of a same State being, on average, more similar between themselves, in terms of standard of living, than are the regions of different States, even if this effect is, for a large part, influenced by the very high differentials in standard of living observed at the western borders of the former socialist bloc countries. In France, the main discontinuities occur in Île-de-France on the one hand, and between Grand Est and Luxembourg and the neighbouring German *Länder* on the other hand. For the youth indicator, this territorial auto-correlation coefficient is positive but low (0.09); this time, the international borders effect is only slightly more marked than that of the intra-national borders. At the European level, it is the pronounced ageing of the former GDR (excluding Berlin) which marks the greatest discontinuity with the neighbouring regions, whereas in France, most of the demographic discontinuities correspond to "internal" regional limits in the most urbanised regions.

Strong territorial disparities within the thirteen new metropolitan regions

The change from 22 to 13 metropolitan regions on 1 January 2016 raises the question of a potential change in inter-regional differences. Does the creation of the new regions result from the amalgamation of similar or different regions?

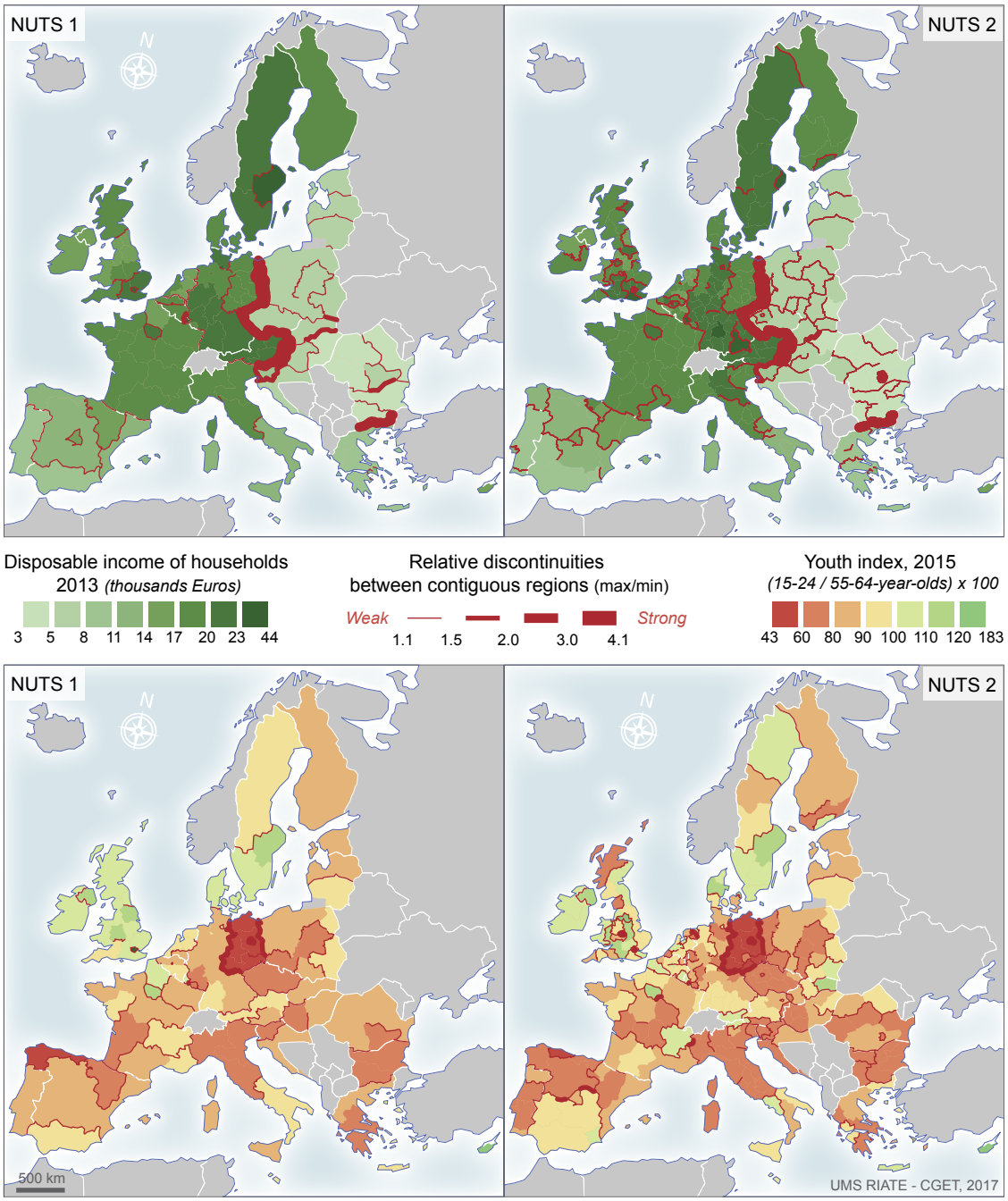
The extent of the disparities between territories depends very heavily on the indicators as well as the degree of precision of the zoning. This is the reason why we will use not only the different dimensions already used in the previous part (demographic situation, situation on the labour market and change in employment), but also several levels of analysis (employment zones in addition to the new and former regions).

Do the new regions result from the merger of former similar regions?

Measurement of the similarities and differences between the former regions

In order to summarise the proximities between regions, a Principal Component Analysis (PCA)

Figure IV
Main regional discontinuities according to the standard of living and the youth index



Note: The relative discontinuities correspond to the ratio between the maximum value and the minimum value of the indicator in question by pair of contiguous regions. These charts do not show the greatest relative discontinuities (max/min > 1.1). European Nomenclature of Territorial Units for Statistics NUTS 1 and NUTS 2, excluding outermost regions.
Reading note: the former French regions have been positioned with regard to the NUTS 2 nomenclature (2013 version) of the EU28. This nomenclature includes 275 territorial units. The new French regions have been positioned with regard to the NUTS 1 nomenclature (2013 version) of the EU28. The former NUTS 1 French regions (ZEAT in the 2013 version of the classification) have been replaced by the new French regions; the new French regions will officially integrate NUTS level 1 in 2018. This classification that has been reconstituted for the article includes 103 territorial units.
Sources: Eurostat, 2017.

has been carried out on the former metropolitan regions according to the same five indicators mentioned previously. As Île-de-France is an extreme statistical individual for most of these indicators, it has been placed as a supplementary individual. The new regions are also positioned as supplementary individuals.

We have identified two main axes of differentiation which contribute to 73% of the total

Box 1 – **Calculation of the territorial autocorrelation index**

For a given variable X, the territorial autocorrelation index measures the average dissimilarity $(Xi - Xj)^2$ for pairs of regions *I* and *J* of the same territorial affiliation (here, the countries of the European Union) (DS(Intra)), and for the pairs of regions *I* and *J* with a different territorial affiliation (DS(Inter)) (Grasland, 2001).

The territorial autocorrelation coefficient corresponds to:

$$G = 1 - DS(Intra) / DS(Inter)$$

- If the territorial autocorrelation coefficient G is positive, two regions of the same EU Member State are more similar to each other than two regions of two separate Member States;

- If the territorial autocorrelation coefficient G is negative, two regions of the same EU Member State are less similar to each other than two regions of two separate Member States;

- If the territorial autocorrelation coefficient G is zero, two regions of the same EU Member State are neither more nor less similar to each other than two regions of two separate Member States.

inertia (Figure V). The first axis contrasts the former regions where the situation on the labour market is favourable (employment rate of 25-64-year-olds and high levels of median standard of living) with those where it is less so. The second axis, which is slightly less discriminating, contrasts dense and young territories with more rural and ageing regions. The change in employment is used as a third factor of spatial differentiation.

A calculation of distances between regions on the mark on Figure V (cf. Table 2) points out that the former regions which have been merged are not necessarily the most similar ones. The average distance between two former regions having merged (2.67) is even higher than the average distance between two former regions, whether they have merged or not (2.35).

While some merged regions show similarities, as is the case in Nouvelle-Aquitaine, Bourgogne-Franche-Comté and Normandie, the former regions comprising Hauts-de-France, Occitanie, Auvergne-Rhône-Alpes or Grand Est are very heterogeneous. The results presented below can be further detailed through other studies carried out on the subject, using other indicators and levels of analysis (Amabile *et al*., 2015; Brière & Koumarianos, 2015). The regional values of the five indicators in the article are represented in appendix.

Proximities between merged regions…

Nouvelle-Aquitaine is the new region which appears to be the most homogeneous (lowest distance between the former regions) even if the former Aquitaine differs slightly from the other two merged regions by its better situation on the labour market and, in particular, higher standard of living. The two former regions that make up Bourgogne-Franche-Comté are also relatively close to one another. The demographic

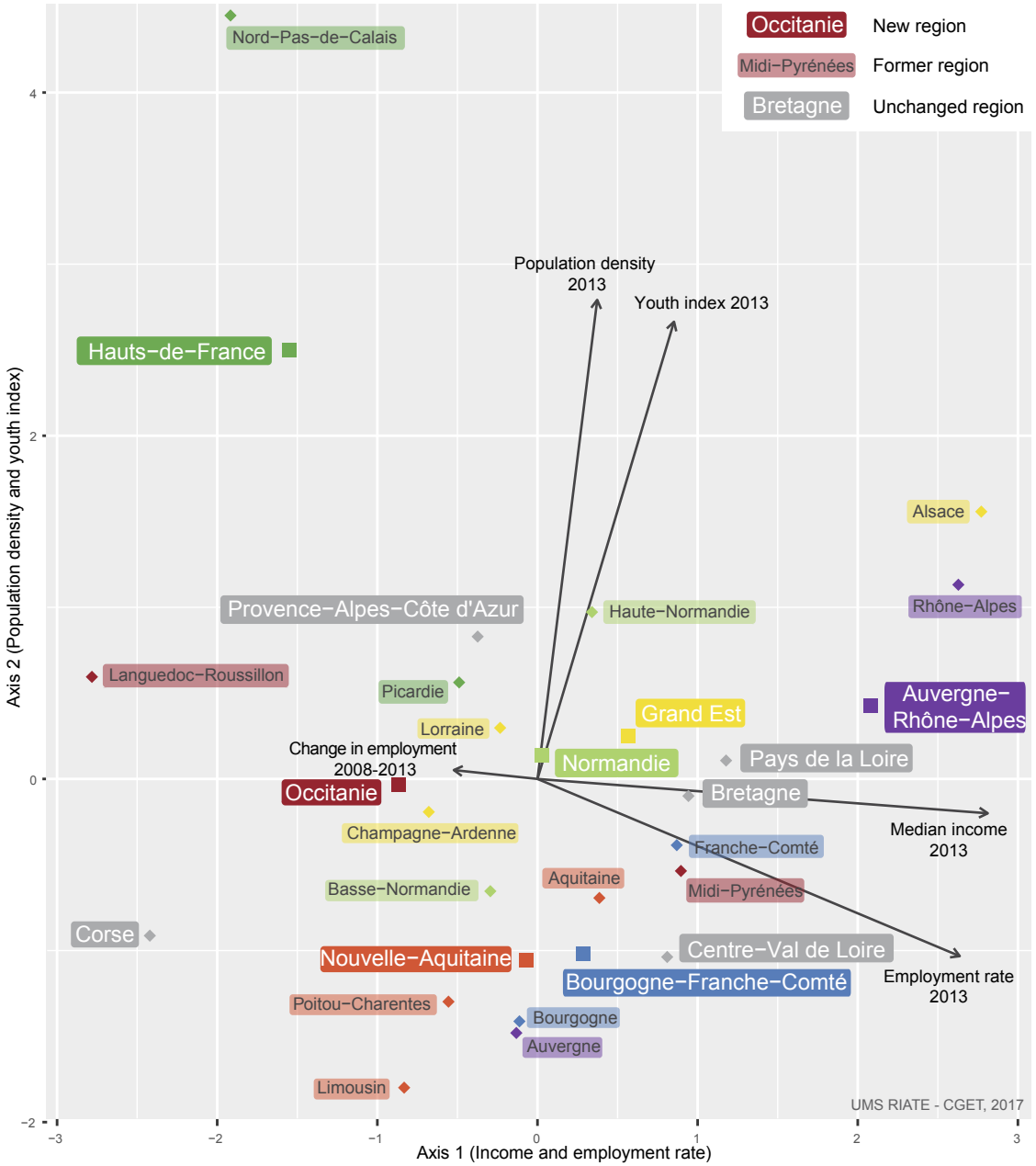
Table 2
Statistical proximity between the former French metropolitan regions having merged

Regions	Average distances between two former regions
Nouvelle-Aquitaine	1.11
Bourgogne-Franche-Comté	1.42
Normandie	1.75
Grand Est	2.60
Auvergne-Rhône-Alpes	3.80
Occitanie	3.85
Hauts-de-France	4.14
Average of average distances between the former regions having merged	*2.67*
Average distances between two former regions (merged or not)	*2.35*

Note: For each new region, the average distance between the former regions that compose it is calculated with the Euclidean distances observed between the different points of the system of axes on Figure V. A small distance corresponds to great proximity between the regions and vice versa.
Coverage: former and new regions in metropolitan France.
Sources: Insee, *RP* 2008-2013, *FiLoSoFi* 2012.

situation is roughly the same between these two fairly rural regions. The median employment rate and standards of living in the former regions forming Bourgogne-Franche-Comté are also relatively little contrasted, being close to the national average. Employment is in decline in Bourgogne (– 2.6%) as in Franche-Comté (– 2.4%). The situation on the labour market of the two former Normandie regions is balanced between a higher standards of living Haute-Normandie (€19,490 versus €18,900) and a Basse-Normandie with a higher employment rate of 25-64-year-olds (70.5% versus 69.6%). However, Basse-Normandie, which is mainly rural, has a less favourable demographic dynamic than its neighbour which benefits from its proximity to Île-de-France. There is also a great proximity between Haute-Normandie

Figure V
Statistical proximity of the French metropolitan regions according to five sociodemographic variables



Note: This figure represents the first factorial plan of the ACP on the former metropolitan regions (excluding Île-de-France) according to the five variables considered. The former regions have been projected in a new system of axes with two dimensions and the variables of the correlation circle have been superimposed on it (the new regions have been placed as supplementary individuals). The entities belonging to a same new region have been coloured in the same range of colours.
Coverage: former and new regions in metropolitan France (excluding Île-de-France).
Sources: Insee, *RP* 2008-2013, *FiLoSoFi* 2012.

and Basse-Normandie concerning the fall in the number of jobs (– 1.5% and – 1.4% respectively).

… but especially dissimilarities

If the Grand Est region brings together three relatively homogeneous former regions from the point of view of the age structure (the youth index varies from 90 for the Champagne-Ardenne and Lorraine regions to 96 for the Alsace region), Alsace is clearly distinguished from the other two by a significantly higher density (225 inhab/km² versus 52 for Champagne-Ardenne and 100 for Lorraine). Furthermore, Alsace figures among the leading former regions in terms of the median standard of living. On the other hand, the number of jobs has declined since the crisis in the three former regions of Grand Est, the decline being particularly marked in Champagne-Ardenne and Lorraine, which are industrial regions. In Occitanie, the disparities concerning these indicators, in particular the employment rate and the median standards of living, are strong between the former regions of Languedoc-Roussillon and Midi-Pyrénées, largely to the detriment of Languedoc-Roussillon. In addition, the Midi-Pyrénées region is more rural than its neighbour. However, two points bring the two former regions closer –the structure by age group and the employment dynamic, which has resisted the crisis very well, because of their strongly tertiary orientation.

Within the Hauts-de-France region, it is the demographic contrast which prevails with a Nord-Pas-de-Calais region three times more densely populated than Picardie (328 inhab/km² versus 99 inhab/km²) but also younger. On the contrary, the situation on the labour market is slightly more favourable in Picardie, which benefits from its proximity to Île-de-France; the median standard of living is also higher (€ 18,940 versus € 17,700) although lower compared to the French average. The contrast is very clear between the aged and very sparsely populated Auvergne region, which has an average situation on the labour market and the Rhône-Alpes region which presents opposite characteristics (high standards of living and employment rates, strong employment growth, younger population, high density).

This analysis of sociodemographic disparities within the new regions only takes into account the former regional perimeters. However, even within the former regions, there are significant spatial differences: for example, between metropolitan centres, their suburbs and isolated areas or even between the border or littoral strips and the interior of the regions. These areas of intra-regional importance may, in particular, explain the positioning of certain regions compared to other ones: the weight of the metropolitan centre of Lille compared to the city of Amiens certainly has a lot of importance in the positioning of the Nord-Pas-de-Calais region compared to Picardie or even the border situation of Franche-Comté very certainly has an impact on its positioning in relation to Bourgogne. That is why, in the next part, we refine our study by analysing disparities within regions.

Strong heterogeneity of the territories within the same regions: an analysis of territorial disparities at the level of employment zones

In order to identify the continuities and changes that exist within former and new regions, we are now focusing on the functional geographic level of employment zones (description in appendix), which is indeed adapted to intra-regional studies, including on local labour markets. The regional administrative level is used to discuss the results in relation to the article's key question.

Some groups of homogeneous territories independent of regional perimeters

A Hierarchical Cluster Analysis (HCA) , carried out from the three synthetic indices chosen (demographic situation, situation on the labour market and change in employment, see Box 2), allows identifying five profiles[16] (cf. Table 3; Figure VI and online complement C3) whose spatial configurations reinforce the analyses already carried out[17].

All regions, with the exception of Corse and Île-de-France, contain employment zones belonging to at least three different profiles, including the regions resulting from the merger of similar former regions:The 'D- M- E'

16. This typology in only five classes does not, however, reflect the entirety of the differences between employment zones since it explains 21% of the total inertia. To explain the entirety of the inertia, as many classes as employment zones should be created, which would not have any benefit for demonstration purposes.

17. Refer, in particular, to the thematic fact sheets on 'youth', 'location of jobs' and 'cohesion' in the fourth report from the Observatoire des Territoires entitled "Quality of life, residents, territories" (2015) as well as its fifth report entitled "Employment and Territories" (2017).

profile[18] (96 employment zones) characterises the employment zones in an unfavourable position for the three indicators used in the analysis and in particular, for change in employment. The territories included in this profile are rural overall and for the most part located on the diagonal ranging from the Meuse (Grand Est) to the Corrèze (Nouvelle-Aquitaine) départements as well as to the west of Ile-de France.

• The 'D+ M-- E--' profile (20 employment zones) corresponds to the employment zones which, like the previous profile, suffer from a very unfavourable situation in terms of the employment dynamics and the labour market, but which are fairly densely populated and young. This category represents more than half of the employment zones of Hauts-de-France (particularly in the former Nord-Pas-de-Calais) but is also present in the Grand Est region and in the former Languedoc-Roussillon region.

• The 'D- M- E+' profile (89 employment zones) corresponds to the average profile, is slightly unfavourable in terms of demography and the labour market, but has a small growth in

18. The classes have been named according to the following model: each synthetic index is summarised by a letter (D for demographic situation, M for situation on the employment market and E for change in employment) followed by a sign showing whether the synthetic index is very favourable (++), favourable (+) unfavourable (-) or very unfavourable (--).

Box 2 – **Calculation of synthetic indices (demography, employment market and employment change) and of the multi-criteria discontinuities between employment zones**

Synthetic indices

In order to simplify the analysis and classification of employment zones (EZ), we have created three synthetic indices corresponding to the three areas of spatial differentiation highlighted earlier at the regional level, which are also very discriminating at the employment zone level. For example, the demographic synthetic index corresponds to the standardised sum (centred reduced) of the population density and the youth index, once they have been standardised (Table A).

Table A
Construction of the synthetic indices: an example of the demographic index

ZE	Youth index	Population density	Standardised youth index	Standardised population density	Demographic index	Synthetic demographic index
Mâcon	77.1	93.7	– 0.11	– 0.14	– 0.25	– 0.15
Tergnier	81.3	148.7	0.10	– 0.05	0.05	0.03
Bourges	76.2	53.1	– 0.15	– 0.21	– 0.36	– 0.22
Lille	153.0	1214.9	3.67	1.73	5.39	3.33

Three synthetic indices are thus calculated: the synthetic demographic index, a second one on the situation on the employment market (from standard of living indicators and the employment rate of 25-64-year-olds) and a last one on employment trends since 2008.

Multi-criteria discontinuities between employment zones

The construction of a multi-criteria discontinuity indicator follows the following process, after the calculation of the synthetic indices:

Extraction of contiguous employment zones. Here, the analysis focuses on the contiguous employment zones. For the needs of the analysis, they are attached to the region to which they belong. As some employment zones are sometimes attached to several regions, they have been assigned to the region in which the maximum population is located (underlined below): Mont-de-Marsan (Aquitaine/Midi-Pyrénées), Alençon (Basse-Normandie/Pays-de-la-Loire), Cosne-Clamecy (Bourgogne/Centre), Mâcon (Bourgogne/Rhône-Alpes), Nogent-le-Rotrou (Basse-Normandie/Centre), Vallée-de-Bresle (Picardie/Haute-Normandie), Roissy-sud-Picardie (Île-de-France/Picardie), Brive-la-Gaillarde (Limousin/Midi-Pyrénées), Avignon (PACA/Languedoc-Roussillon, Saint-Etienne (Rhône-Alpes/Auvergne), Toulouse (Midi-Pyrénées/Languedoc-Roussillon).

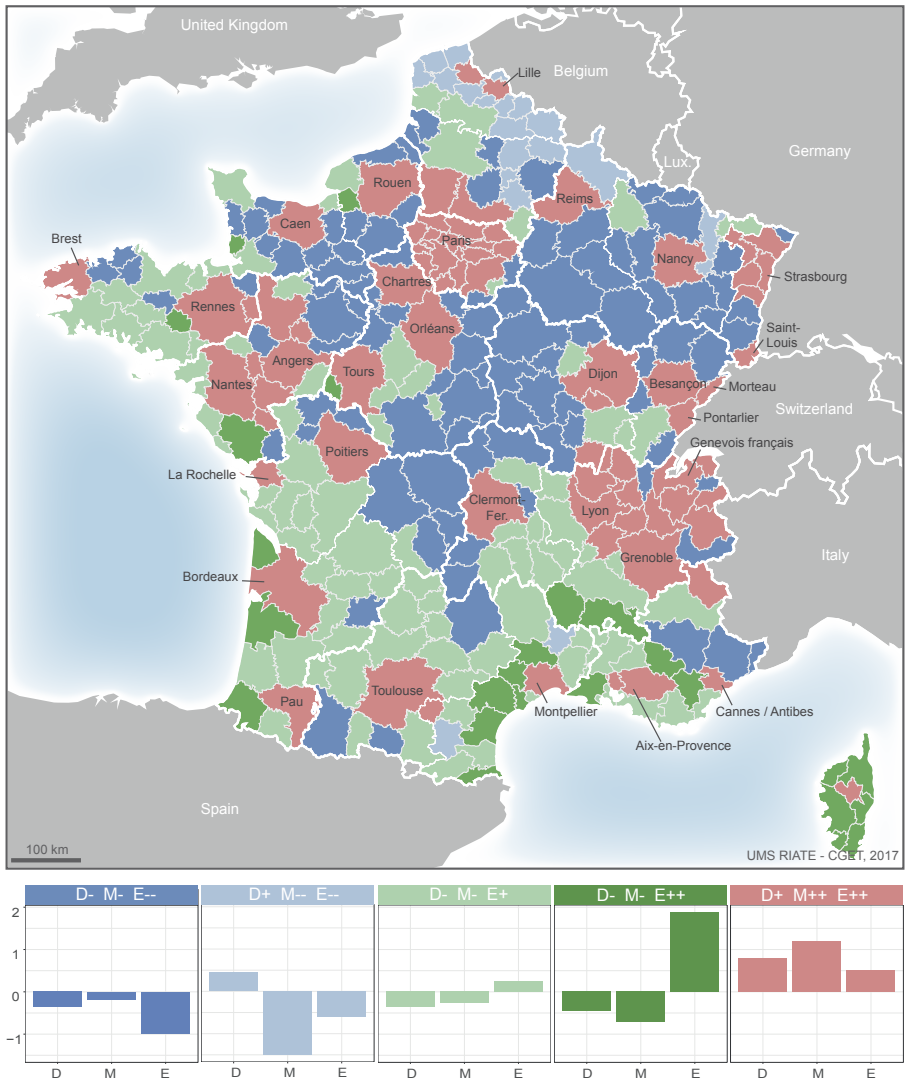
Calculation of the discontinuities for each pair of contiguous employment zones (803 pairs). For each of the three standardised variables considered at the end of the extraction, the calculation of the absolute value of the difference between the values of contiguous employment zone pairs enables the variance and thus the discontinuity between the two employment zones in question to be quantified (example of the synthetic demographic index case in Table B). The calculation of the average of the three absolute values of the discontinuities observed mapped in Figure VII enables the magnitude of the discontinuities observed on the three criteria in question to be approximated. ➔

Box 2 (contd.)

Table B
Calculation of the discontinuities between two neighbouring employment zones: the example of the synthetic demographic index

EZ 1	Synthetic demographic index (EZ 1)	EZ 2	Synthetic demographic index (EZ 2)	Demographic discontinuity index of the pair (EZ 1, EZ 2)
Mâcon	– 0.15	Le Creusot-Montceau	– 0.57	abs(– 0.15 + 0.57) = 0.42
Tergnier	0.03	Soissons	– 0.02	abs(0.03 + 0.02) = 0.05
Bourges	– 0.22	Saint-Armand-Montrond	– 1.00	abs(– 0.22 + 1) = 0.78
Lille	3.33	Douai	0.90	abs(3.33 - 0.9) = 2.43

Figure VI
Hierarchical Cluster Analysis of the demographic dimensions, employment market and change in employment in the employment zones



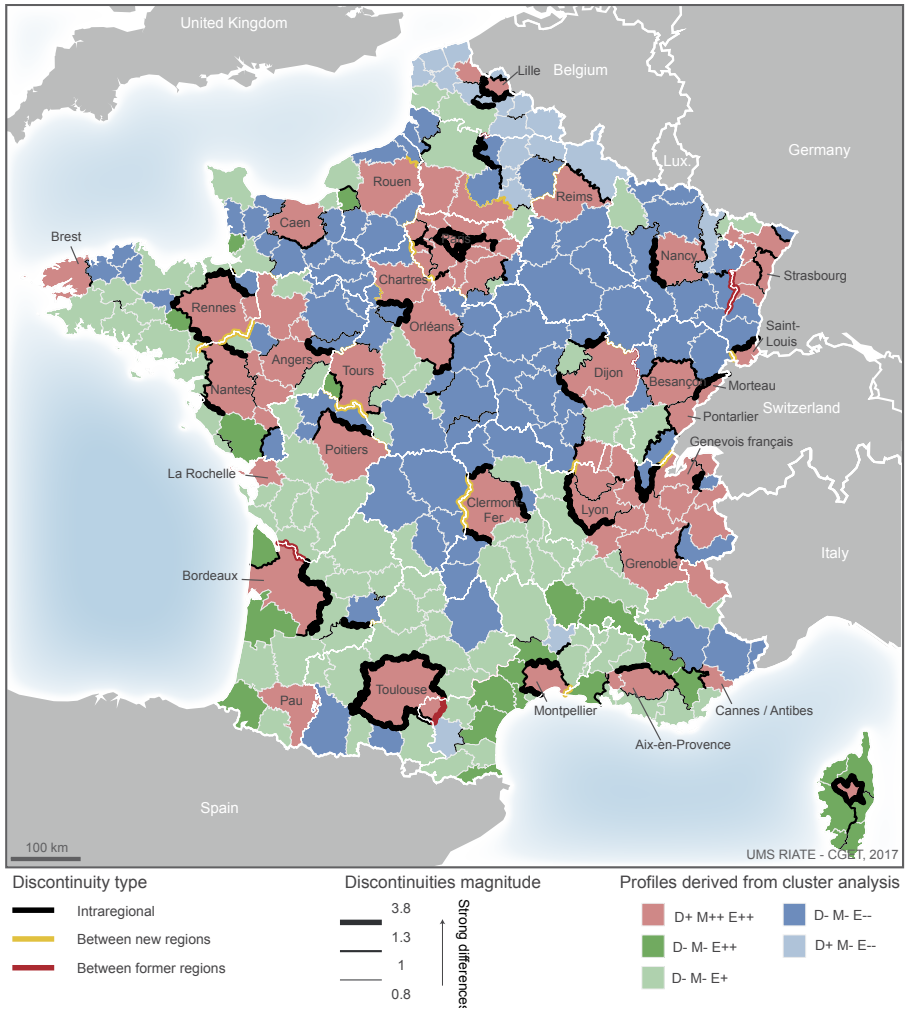
Note: the classes have been named according to the following model: each synthetic index is summarised by a letter (D for demographic situation, M for situation on the employment market and E for change in employment) followed by a sign showing whether the synthetic index is very favourable (++), favourable (+) unfavourable (-) or very unfavourable (--). The graph represents the average of the standardised synthetic indices of the employment zones of each class.
Coverage: employment zones in metropolitan France.
Sources: Insee, *RP* 2008-2013, *FiLoSoFi* 2012.

Table 3
Profiles of the 5 Hierarchical Cluster Analysis classes

Classes	Population density	Youth index	Employment rate (%) (25-64 years old)	Median of the median standard of living (in €)[(1)]	Change in employment since 2008 (%)
D- M- E--	61	76	69.5	18 665	– 3.9
D+ M-- E--	197	93	62.9	17 320	– 2.7
D- M- E+	86	77	68.4	18 750	0.5
D- M- E++	63	70	67.2	18 101	5.7
D++ M++ E+	220	112	74.3	20 582	2.1
Metropolitan France	117	94	71.3	18 901	0.7

(1) Due to the non-availability of individual data, the median standard of living is not calculated on the whole of the class, but corresponds to the median of the median standard of living in all employment zones in each class.
Coverage: employment zones in metropolitan France.
Sources: Insee, *RP* 2008-2013, *FiLoSoFi* 2012.

Figure VII
Intra- and inter-regional territorial breaks



Note: The methodology describing the construction of the territorial discontinuity indicator is detailed in box 3 and the different profiles coming from the cluster analysis are described in Figure VI.
Coverage: Employment zones in metropolitan France.
Sources: Insee, *RP* 2008-2013, *FiLoSoFi* 2012.

employment. This class' employment zones are located mainly in the south and the west of the country, slightly more densely populated than those of the 'D- M- E--' class described above, they tend to be located in the periphery of areas of urban employment, also in regions where this profile is not a majority (Rennes, Nantes, Angers, Toulouse…).

• The 'D- M- E++' profile (25 employment zones) characterises the employment zones in which the population is more rural, for which the synthetic demographic indices and the situation on the labour market are quite unfavourable, but which are experiencing very considerable growth in employment. These areas belong to the French countryside having experienced a resurgence of attractiveness in recent years. They are mostly in Corse and in Occitanie, particularly on the Mediterranean boundary of the Languedoc-Roussillon region, but also in a few employment zones of the ocean coastline.

• The 'D++ M++ E+' profile (74 employment zones) corresponds to very favourable indicators on all dimensions. The change in employment has also been favourable, but in smaller proportions than for the previous indicators. This profile is particularly present in Île-de-France, as well as in the former regions of Rhône-Alpes and Alsace, thanks to Strasbourg, but also to its cross-border areas (Haguenau, Saint-Louis…) also present in Franche-Comté (Morteau and Pontarlier) and which explain its position which is slightly better than that of Bourgogne. This type of employment zone is, however, also present in all the other regions.

The main territorial changes are observed at an intra-regional level

In order to represent the main territorial changes existing between the contiguous employment zones in metropolitan France (Figure VII), a multi-criteria analysis of territorial discontinuities was conducted (see Box 2 for details on the methodology).

As predicted in the previous classification, the main territorial changes at the level of employment zones can be seen in the heart of the former and new regions[19]. The average of the multi-criteria territorial discontinuities (Table 4) is indeed slightly higher within the regions than across regions (0.77 versus 0.66). In addition, the regional redistribution has no noticeable effect on the spatial configuration of these territorial discontinuities, with the average of the inter-regional discontinuities remaining broadly unchanged.

The territorial changes are particularly strong within regions themselves, in particular between urban employment zones and their periphery. In fact, all the employment zones having the maximum discontinuity within each new region contain large metropolitan centres, apart from near the Oyonnax/French Geneva border in Auvergne-Rhône-Alpes and the Corte/Ghisonaccia border in Corse (Table 5).

19. However, it is necessary to recall that these conclusions are only valid for the indicators considered with the geographical area of employment zones.

Table 4
Synthesis of multi-criteria discontinuity values by territorial affiliation type (former/new regions and intra/inter-regional)

		Value of discontinuities			
	Type	Average	Standard deviation	Min	Max
Former regions (22)	Intra-	0.77	0.51	0.04	3.79
	Inter-	0.66	0.44	0.08	2.59
New regions (13)	Intra-	0.76	0.51	0.04	3.79
		0.66	0. 44	0.08	2.50

Note: The methodology describing the construction of the territorial discontinuity indicator is detailed in box 3.
Reading note: the territorial discontinuities between employment zones are, on average, higher when they are located within a same region (average of the coefficient equals to 0.77 for the old regions and 0.76 for the new ones) than when they belong to two different regions (average of the coefficient equals to 0.66, for the former and the new regions).
Coverage: employment zones in metropolitan France.
Sources: Insee, *RP* 2008-2013, *FiLoSoFi* 2012.

Some multi-criteria discontinuities between employment zones belonging to two former regions having merged are also particularly high (Table 6). This is the case between the employment zones of Toulouse (Midi-Pyrénées) and Limoux or Carcassonne (Languedoc-Roussillon) and, to a lesser extent, for Saint-Dié-des-Vosges (Lorraine) and Molsheim-Obernai and Sélestat (Alsace). The results clearly show the multi-polarisation of certain new regions (Dijon-Besançon, Nancy-Metz-Strasbourg, etc.).

The observation of these strong local discontinuities raises additional issues in some new regions in terms of the treatment of internal territorial disparities, located in specific geographic perimeters: mainly around one or several metropolitan centres, but also in areas with specific issues, such as cross-border territories.

From the observation of disparities between territories to territorial cohesion

Regarding the sociodemographic indicators used in this article, the French regions are rather poorly placed in terms of the employment rate, quite favoured in terms of the standard of living, while the demographic situation and the recent change in employment shows more mixed results from one region to the next. However, the inter-regional contrasts appear relatively small in France in comparison with other EU

Table 5
Maximum discontinuities within the new regions

New region	Employment zone pair	Discontinuity
Île-de-France	Roissy - Sud Picardie / Paris	3.79
Auvergne-Rhône-Alpes	Oyonnax / Le Genevois Français	2.51
Occitanie	Toulouse / Saint-Girons	2.38
Hauts-de-France	Lille / Béthune - Bruay	2.18
Corse	Corte / Ghisonaccia - Aléria	2.14
Bourgogne-Franche-Comté	Dijon / Le Morvan	1.87
Nouvelle-Aquitaine	Bordeaux / Marmande	1.76
Bretagne	Loudéac / Rennes	1.70
Grand Est	Nancy / Saint-Dié-des-Vosges	1.68
Pays de la Loire	Nantes / Challans	1.56
Centre-Val de Loire	Vierzon / Orléans	1.54
PACA	Aix-en-Provence / Cavaillon - Apt	1.40
Normandie	Caen / Flers	1.29

Note: The methodology describing the construction of the territorial discontinuity indicator is detailed in box 3. Only the intra-regional discontinuities have been taken into account here.
Reading note: Discontinuity is at its maximum between the employment zone of Roissy-Sud Picardie and that of Paris.
Coverage: employment zones in metropolitan France.
Sources: Insee, *RP* 2008-2013, *FiLoSoFi* 2012.

Table 6
Maximum discontinuities between the former merged regions

Former region 1	Employment zone 1	Former region 2	Employment zone 2	Discontinuity
Midi-Pyrénées	Toulouse	Languedoc-Roussillon	Limoux	2.59
Midi-Pyrénées	Toulouse	Languedoc-Roussillon	Carcassonne	1.90
Lorraine	Saint-Dié-des-Vosges	Alsace	Molsheim - Obernai	1.80
Aquitaine	Bordeaux	Poitou-Charentes	Jonzac - Barbezieux-Saint-Hilaire	1.60
Lorraine	Saint-Dié-des-Vosges	Alsace	Sélestat	1.52

Note: The methodology describing the construction of the territorial discontinuity indicator is detailed in Box 2.
Reading note: within the new Occitanie region, there is a very strong discontinuity between the Toulouse and Limoux employment zones, which each belong to a different former region (respectively Midi-Pyrénées and Languedoc-Roussillon).
Coverage: employment zones in metropolitan France.
Sources: Insee, *RP* 2008-2013, *FiLoSoFi* 2012.

member States –such as Spain, Italy or the United Kingdom– that are at NUTS 2 (former French regions) or NUTS 1 (new regions) level. More generally, the main discontinuities are found more across member States than between regions of the same State. For the standard of living indicator, it is firstly the western borders of the former socialist bloc countries which are showing a considerable discontinuity. For the youth indicator, the effect of international borders is less marked: it is the pronounced ageing of the former GDR which constitutes the greatest discontinuity with neighbouring regions.

In metropolitan France, there is the reverse phenomenon: the main territorial changes are observed within the same regions, in particular between employment zones, both in their former as well as their new perimeter, and not between them. The Hierarchical Cluster Analysis (HCA) has identified five profiles of employment zones which are distinguished according to their demographic situation, their situation on the labour market and the change in employment. Thus, although there is a relative proximity according to these indicators between the former regions that make up Nouvelle-Aquitaine, Bourgogne-Franche-Comté and Normandie, each region, either in its former or in its new perimeter, is composed of territories with very specific sociodemographic characteristics: metropolitan areas *versus* rural or suburban territories, residential areas *versus* industrial areas, cross-border territories or coastlines *versus* interior territories…

It is possible that the same analyses, conducted with other types of indicators, in particular with a more macro-economic than sociodemographic view, and using other territorial levels of analysis, lead to other results. The objective here is to provide research avenues, in particular in terms of methodology, that allow territorial disparities to be observed and analysed within and between the new regions, without exhausting the subject.

Taking into account the diversity of territories within each of the regions is an indispensable tool for the European policy of territorial cohesion[20] (Jouen, 2015; Green Paper on territorial cohesion, 2008; Territorial Agenda of the European Union 2020, 2011). Indeed, this policy encourages the integrated development of territories in order to reduce inequalities between citizens related to their belonging to such or such an area,: it involves considering the territory outside of its administrative boundaries and thinking of it on a coherent and functional scale while analysing the territorial specificities according to several dimensions (economic but also social, environmental…).

The territorial cohesion policy also encourages the cooperation and coordination of different levels of governance (from the local to the European level), and more widely the interdependencies between territories that allow territorial policies to be conducted effectively, by promoting, for example, the dissemination of the growth of dynamic territories toward those of a more residential nature (Amabile *et al*., 2015).

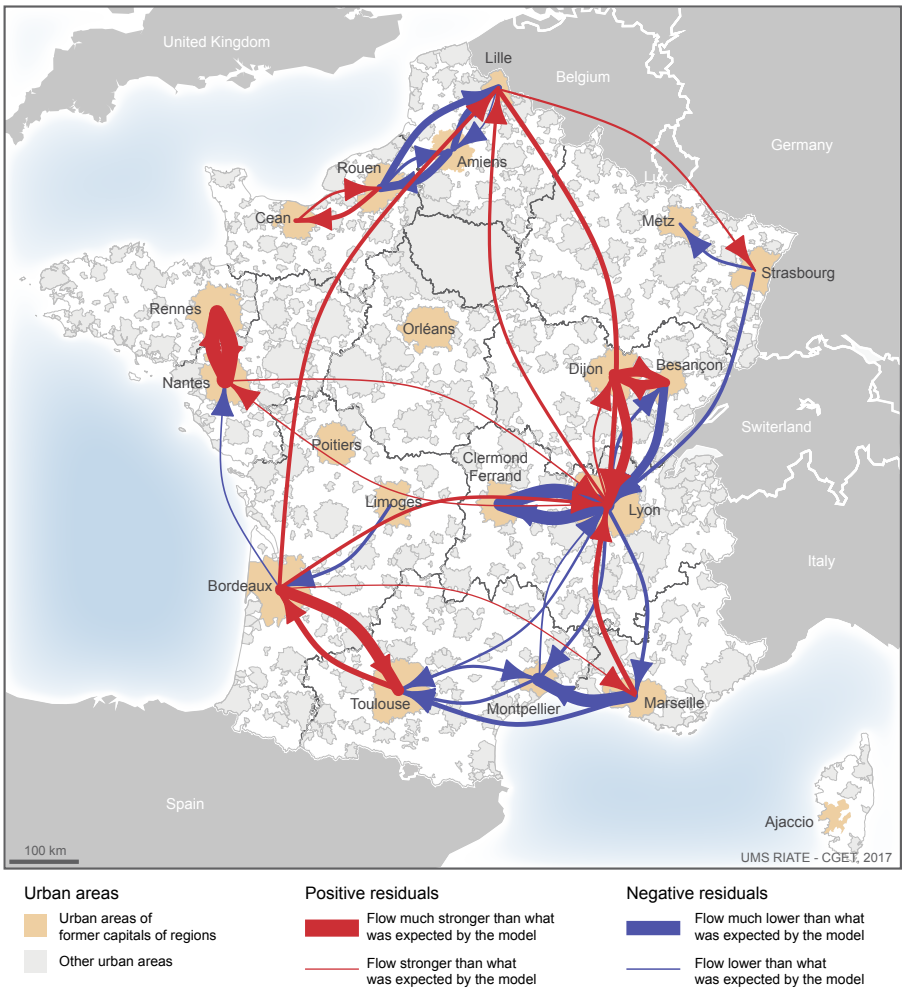
In order to take into account these interdependencies between territories, several methodological avenues could be considered to extend the conclusions of this contribution. The analysis of the spatial organisation of population flows (Figure VIII) is part of this since it shows –by isolating the effects of the population mass of urban areas of the former regional capitals and of the geographical distance that separates them– that there are commuting flows that are bigger than expected, in both directions, between some former regional capitals, Rennes and Nantes, Bordeaux and Toulouse, Lyon and Dijon, pairs which have not been repeated in the same new regions. Conversely, the flows between Lyon and Clermont-Ferrand, for example, are under-represented, while these two cities now belong to the same region. These first graphical outputs deserve to be explored further (change over time, accuracy of the granularity of the indicator thanks to an approach by age or by socioprofessional categories) or even extended thanks to other indicators such as, for example, the financial links between territories.

* *
*

The French territorial reform of 2015 was not intended, in its initial objectives, to respond to the European ambition of territorial cohesion, which would have involved taking into account the diversity of the territories by getting away from the administrative borders of départements and regions and to rely more on the analysis of the interdependencies between territories. However, territorial cohesion policies do not advise on the ideal method to adopt to create the "optimal" regional perimeters. Must

20. Since 2013, territorial cohesion has been part of the European cohesion policy following the signature of the Treaty of Lisbon and the Europe 2020 strategy.

Figure VIII
Residual home-to-work flows (excluding the distance and mass effects) between the former regional capitals



Note: This figure is created with a gravity model and uses the zoning into urban areas (group of municipalities consisting of an urban centre with a suburban periphery whose inhabitants work in the urban area). The importance of a home-to-work flow F_{ij} from an urban area i to an urban area j is modelled as being proportional to the distance between the centroid of the two urban areas (D_{ij}) and to the labour force of i (P_i) and j (P_j). $F_{ij} = k.P_i.P_j / D_{ij}\ \alpha$, with k and α positive parameters to be estimated. It is therefore possible to estimate, by a linear regression (with the hypothesis that the residuals follow a Poisson distribution), a theoretical flow f_{ij}* estimated between the urban area i and the urban area j and to deduce the residuals of the regression (f_{ij} - f_{ij}*) from it. Thus, a high residual will correspond to a bigger flow than provided by the model given the number of active people in i and j and the distance that separated them. On the contrary, a negative residual will correspond to a weaker relationship than expected.
Coverage: urban areas of the former regional capitals in metropolitan France.
Sources: Insee, *RP* (2013).

we create regions with internal homogeneity or, on the contrary, encourage intra-regional diversity (cf. Online complement C4)? While the first option facilitates the implementation of regional policies in homogeneous territories in drawing regional boundaries at the level of the main territorial breaks, the second one has the advantage of bringing together complementary territories within each region, thus encouraging their connection.

Finally, the merger of the regions, which is nearly three years old (Law of 16 January 2015), has changed the relative positions of the French regions among the European regions and rebalanced their weight at the national level. The deployment of public policies on these new territories with enhanced areas of jurisdiction, as well as the preparation, implementation and monitoring of new regional schemes (SRDEII, Regional economic development, innovation and internationalisation plan, and SRADDET, Regional spatial planning, sustainable development and territorial equality plan) will probably have multiple impacts, including on territorial disparities, which will need to be evaluated over the next few years, relying on work comparing different angles of analysis and geographic scales and by highlighting the specific issues at stake in each region. □

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APPENDIX

THE USE OF MULTIPLE INDICATORS AND GEOGRAPHICAL SCALES IN ORDER TO STUDY TERRITORIAL DISPARITIES

Five indicators to understand the territories

The five indicators used in the article to compare the magnitude of regional contrasts in France and in Europe are described below. We have provided their data sources in square brackets. For a reason of availability of data for the geographical level adapted, the source differs depending on whether the data is produced at a French (employment zones) or European (NUTS 2, NUTS 1) level.

Purely economic indicators, such as GDP, for example, have been put aside for several reasons. First of all, as was particularly pointed out by the Commission on the Measurement of Economic Performance and Social Progress (Stiglitz *et al.*, 2009), sociodemographic indicators (ageing, income…) all show the current and future issues in a territory as well as the economic indicators do. In effect, GDP is centred on production, market and monetary consumption and only, therefore, takes certain activities into account and ignores the effects of productivism on social life and environment. Then, we have sought to complement the work already achieved, dealing with the territorial cohesion in economic terms (Amabile *et al.*, 2015), by expanding the analysis to other indicators. Finally, the economic indicators do not always have a meaning at the intra-regional scale (they are, moreover, for some, such as GDP, not producted), whereas a standard of living indicator lets you better identify the specific local features, in particular in terms of cross-border territories.

The employment rate [France: Insee, RP 2013; EU: Eurostat, 2017 on 2015 data] compares the number of people in employment to the number of labour force in a given age group. A high employment rate may correspond to a low unemployment rate and/or to a high activity rate in the territory. We have restricted the employment rate to the 25-64 years-old age group to remove young people, for whom the indicator is difficult to interpret, from the field. A high employment rate of young people can correspond to a place where unemployment is low, but also to a territory where the activity rate of young people is high, due to a low number of these young people in the territory continuing their studies.

The change in employment [France: Insee, *RP* 2008-2013; EU: Eurostat, 2017 on 2008-2015 data] measures the change in the number of employed personssince the crisis (between 2008 and 2013 for the French analyses and between 2008 and 2015 for the European analyses). This indicator provides information on the dynamism of local employment.

The median standard of living [France: Insee, *FiLoSoFi* 2012; EU: Eurostat, 2017 on 2013 data] used for the French analyses corresponds to the median disposable income of the household divided by the number of consumer units. It includes income from work, assets, transfers from other households and social benefits (retirement, unemployment…) net of taxes. For the European analyses, the indicator used is the net disposable income of households (compared to the number of inhabitants) which corresponds to the total gross disposable income (income from work, private incomes derived from investments and property, transfers between households, as well as all social transfers collected in cash, including old age pensions) from which social security contributions and income tax are deducted. This indicator approaches the population's standard of living; it is linked indirectly to the situation of the labour market in the territory.

The youth index [France: Insee, *RP* 2013; EU: Eurostat, 2017 on 2015 data] corresponds here to the comparison of the number of people aged between 15 and 24 to the number of people aged between 55 and 64. This indicator provides information on the demographic structure of the territory but also on the potential for the renewal of the labour force in the ten years to come (excluding residential migration).

Population density [France: Insee, *RP* 2013; EU: Eurostat, 2017 on 2015 data] provides information on the more or less urban character of territories. It summarises, in a single indicator, a large number of sociodemographic phenomena to which it is correlated (access to equipment and services, employment dynamism, youth of the population).

Three zones to analyse the disparities on multiple scales

Following the analyses to be conducted, different reference zones have been used to increase the geographical granularity. The use of different spatial divisions significantly affects the results of statistical treatment or the visual of a map, a phenomenon that geographers call the MAUP effect (*Modifiable Areal Unit Problem*). In order to interpret the different scales of statistical discontinuities present in the territories, different geographical areas, adapted to the studied phenomenon, will be used.

For analyses in this article, three geographical areas were selected: a functional zoning (defined by statistical criteria) called employment zones defined below and the administrative zoning of the former and new french regions:

- **Employment zones:** an employment zone is a geographical area within which most of the labour force resides and works, and in which establishments may find most of the manpower necessary for the jobs offered. The division into 321 employment zones (metropolitan France and overseas départements) based on the commuting flows of the workforce. This zoning has the advantage of constituting a partition of the territory adapted to the intra-regional studies, in particular on local labour markets.

- **The NUTS 2 regions:** the former French regions have been positioned with regard to the NUTS 2 nomenclature (2013 version) of the EU28. This classification includes 276 territorial units.

- **The NUTS 1 regions:** the new French regions have been positioned with regard to the NUTS 1 nomenclature (2013 version) of the EU28. The former NUTS 1 French regions (ZEAT in the 2013 version of the nomenclature) have been replaced by the new French regions. The new French regions will officially integrate NUTS 1 nomenclature in 2018. This nomenclature includes 103 territorial units.

Does the decentralisation theorem apply to the French local governments? An empirical test on intermunicipal competences

Quentin Frère* and Lionel Védrine**

Abstract – As a key component of territorial governance in Europe, intermunicipality offers municipalities the opportunity to exercise and collectively fund some local public goods or services. In accordance with the decentralisation theorem, the choice made by municipalities to transfer some competences to the intermunicipal level ought to be based on a trade-off between economies of size and the cost of spatial heterogeneity of citizens' preferences. In order to empirically test this assertion, a *probit* model is estimated focusing on those French intermunicipalities with own fiscal powers, looking specifically at 10 various competences. Four main results are highlighted: (*i*) the heterogeneity of citizens' preferences is holding back the transfer of competences from municipalities to the intermunicipal level; (*ii*) economies of size and the need to coordinate local public choices predetermine certain competences to be exercised at intermunicipal level; (*iii*) intermunicipalities made up of small municipalities are more likely to be entrusted with certain competences; (*iv*) the decision to transfer competences to the intermunicipal level is influenced by the decisions made by neighbouring intermunicipalities.

JEL Classification: C25, H11, H41
Keywords: intermunicipal cooperation, decentralisation theorem, economies of size, heterogeneity of preferences

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Translated from « Le théorème de la décentralisation s'applique-t-il aux collectivités locales françaises ? Un test empirique sur les compétences intercommunales »

In the early 1980s, Act I of Decentralisation marks the beginning of a period of profound reorganisation within the French public sector. Powers are transferred from the central government to municipalities, *départements* and regions, which consequently became the third level of territorial authority. One of the challenges of drawing governors closer to the governed is getting public policies to take better account of the spatial heterogeneity of citizens' preferences (Tiebout, 1956). This idea hinges on Tocqueville's analysis (1836, p. 265), who already observed that "in larger centralised nations, the legislature is bound to give laws a uniform character which disregards the diversity of places and mores."

Furthermore, following the failure of policies encouraging the merging of municipalities (the law of 16 July 1971 on municipality mergers and consolidations), the government promotes intermunicipal cooperation (laws of 6 February 1992 and 12 July 1999; certain provisions of the law of 13 August 2004). Far from being a step backwards, intermunicipal cooperation appears to be complementary to decentralisation. It offers municipalities the opportunity to exercise and collectively fund some local public goods or services (called hereafter "competences"), whose range has been extended through decentralisation. Today, intermunicipality is a key level of territorial governance in France and most European countries, where decentralisation and intermunicipal cooperation have been developed in tandem (Frère & Paty, 2014). Also, as Hulst and Van Montfort attest (2007, p. 8): "[…] intergovernmental cooperation involving municipalities is a phenomenon that is present in all Western European countries. In some countries it has a long history, in others it is a relatively recent development; it varies in terms of its extent, significance and form, but is never completely absent". The most widespread model of cooperation in Europe is a form of intermunicipality that combines public and private bodies working together to exercise and fund numerous local competences. This is what is known as multi-purpose, associative intermunicipality (CDLR, 2007). Its creation respects municipalities' volunteerism, even though it remains more or less regulated by the central government. This is the case in Italy, where municipalities in mountainous regions must cooperate within a *comunità montana*. Likewise, while certain competences must be entrusted to these associative intermunicipal bodies[1], it is generally left to the member municipalities to make a collective decision as to which competence(s) they wish to transfer to such bodies.

In France, the country's intense municipal fragmentation (36,700 municipalities in 2012[2], half of which with populations of 500 inhabitants or fewer) has seen a specific and highly integrated form of cooperation emerge —namely "federative" intermunicipality— a system in which intermunicipalities have their own fiscal powers. These include the *Communautés de communes*, *Communautés d'agglomération*, *Communautés urbaines*, *Métropoles* and *Syndicats d'agglomération nouvelle*. The consolidation of such public entities for intermunicipality cooperation (*Établissements publics de coopération intercommunale*, EPCIs) with their own fiscal powers was made mandatory by the Territorial Authorities Reform Act (RCT law) of 16 December 2010, such that currently in 2017 nearly 100% of French municipalities[3] fall under an EPCI with its own fiscal powers. Conversely, municipalities still benefit from a great deal of leeway in terms of which competences they wish to transfer to their intermunicipality, despite the new obligations laid down by the Law on the New Territorial Organisation of the Republic (NOTRe) of 7 August 2015[4]. As such, the flexibility inherent to intermunicipal cooperation enables the principle of bottom-up subsidiarity to be applied on a case-by-case basis.

Intermunicipal cooperation translates into a local, limited-scope movement[5] that centralises decision-making at the local level. Consequently, according to the optimal decentralisation theorem proposed by Oates (1972), and in accordance with the logic of the Tiebout model (1956), municipalities' decision to

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1. For example, Swiss cantons can legally force municipalities to cooperate in a specific jurisdictional area (CDLR, 2007).

2. More precisely, 36,680 from 2000 to 2011 to the nearest one or two, followed by 36,700 in 2012 as a result of Mayotte's integration into the overseas departments.

3. With the exception of four single-municipality islands (île d'Yeu, île de Bréhat, île de Sein and île d'Ouessant).

4. The NOTRe Act provides for additional compulsory transfers of powers from member municipalities to Communautés de communes *and* Communautés d'agglomération*, including powers over economic development, tourism promotion, urban planning (development of local planning plans), planning, maintenance and management of traveller halting sites (in 2017), management of aquatic areas and flood prevention (in 2018), water and sanitation (in 2020) and household waste collection and treatment (in 2020).*

5. Unlike municipalities, intermunicipalities do not have a general purpose. Instead, they have a remit that is exclusively limited to those powers which are transferred to them (functional speciality principle), exercised only within the area designated by their perimeters (principle of territorial speciality).

cooperate for a given competence ought to be based on a trade-off between economies of size and the cost of the spatial heterogeneity of citizens' preferences.

By studying the cooperation choices of municipalities with respect to specific competences, this article offers an original empirical test of the decentralisation theorem. Indeed, while some analyses of specific intermunicipalities have identified the logic and strategies applied by local public actors[6], few studies have sought to establish global statistical relationships between measurable municipalities' and intermunicipalities' characteristics and the competences transferred. Frinault and Le Saout (2011) emphasised that some rural territories –consisting of small municipalities– are, for budgetary reasons, more inclined than others to engage in policies involving the sharing or transferring of social welfare competences to the intermunicipality. Frère *et al.* (2011) demonstrated the presence of a zoo effect of sorts within EPCIs with own fiscal powers in France. The zoo effect, initially observed by Schmandt and Stephens (1960) in the municipalities of Milwaukee County and later modelled by Oates (1988), is based on the idea that there are significant indivisibilities in respect of many local public goods (such as zoos), leading that the community must reach a certain minimum size in order to be able to provide them. Local public goods therefore increase with the size of local authorities, in both quantity and diversity. Applied to French intermunicipalities, the zoo effect provides an explanation as to why EPCIs with larger populations tend to exercise more competences. This article is not interested in the total number of transferred competences: rather it considers each competence taken individually. It is then the decision of municipalities to transfer certain competences (and not others) to the EPCI that is being studied and not the extent of the intermunicipalities' competences.

With regard to competences falling within the scope of public works, LeRoux and Carr (2007) also demonstrate through a similar approach that the decision of the Michigan municipalities to cooperate or not was based on a number of factors, in addition to the cost characteristics of the competence and the resulting economies of scale. They included the economic and fiscal resources available to the municipalities, the level and distribution of their populations, as well as their surface area. However, the context of the Michigan municipalities seems far removed from that of French municipalities. In the case of France, Emond (2015) examines the optional competences of social welfare[7] exercised at the intermunicipal level. These competences exhibit two specific features: economies of size are negligible and they benefit a minority of the population, which does not fund them through local taxes. Hence, by estimating a spatial probit model on the French EPCIs data, the decision to transfer this type of competences to the intermunicipal level appears to be driven by key strategic interactions exhibiting mimetic behaviour: the decision to transfer voluntary social competences to an EPCI is not based solely on the characteristics of its constituent municipalities, but also on whether or not these competences have been adopted by neighbouring EPCIs.

By way of contrast, this study draws on the decentralisation theorem to explain municipalities' cooperation choices. Following a presentation of the theoretical arguments relating to such choices in the literature, particular attention is paid to the extent of intra-municipal heterogeneity of citizens' preferences. A spatial *probit* model is then constructed on the basis of the propositions identified in the first section, then estimated with a view to identifying the determinants of municipalities' cooperation choices for 10 various competences. This work is based on 2012's data, which is the most recent year before the full impact of the Territorial Authorities Reform Act (RCT, enacted 16 December 2010) began to produce its effects. Indeed, the RCT's key feature is its strengthening of the role of prefect by potentially modifying the cooperative behaviour of municipalities. Finally, we suggest avenues for future research.

The decentralisation theorem applied to intermunicipal cooperation

By cooperating, municipalities transfer some of their powers to the intermunicipal level, thus

6. For example, Frinault and Le Saout (2011) argue that it is politically more costly for a mayor to transfer powers connected with citizens' associations (sport, social welfare) — which would see his or her direct interaction with the electorate reduced — than it is to transfer purely technical skills (waste management). Desage (2012) presents examples in which officially transferred skills have remained de facto *the function of mayors. Gallez (2014) emphasises the importance of personal commitment with respect to elected representatives, as well as that of political leadership games whether between various local players or between them and the central powers.*

7. The study focused especially on the following powers: Voluntary Social Assistance, the Intermunicipal Centre for Social Welfare, Urban and Local Development and Economic and Social Inclusion, as well as Healthcare Activities (medical or social and cultural)

creating a centralisation movement of public decision-making. Following the optimal decentralisation theorem (Oates, 1972), then, any decision by municipalities to cooperate indicates a trade-off between the cost of the spatial heterogeneity of citizens' preferences and the benefits of economies of size. On one hand, when a given competence is entrusted to the municipalities, they each benefit from a significant degree of discretionary power in exercising it. Thus, each municipality can determine every characteristic of the various local public goods in line with the preferences of its citizens. On the other hand, when decision-making is centralised at the intermunicipal level, the subsequent collective decision cannot respond quite as well to the heterogeneity of preferences across the different member municipalities' citizens (see Box 1). Citizens see their preferences less well-represented in the intermunicipal collective decision, which incurs a significant social cost. Generally speaking, the cost of the spatial heterogeneity of citizens' preferences constitutes a key element in the formation of social groups (Alesina & Spolaore, 1997; 2005) and social enclaving is therefore rational behaviour in this context.

Municipalities would then have an interest in cooperating in priority with neighbouring communities that have populations with preferences similar to their own, thus minimising the cost of collective decision-making. As a result, this intermunicipal heterogeneity of citizens' preferences may also affect upon the level of integration within the intermunicipality. Essentially, the more an intermunicipality includes municipalities consisting of citizens with heterogeneous preferences, the higher the cost of collective decision-making and member municipalities will therefore be less inclined to transfer their competences to the intermunicipal level, *ceteris paribus*.

Proposition 1. *Intermunicipal heterogeneity of citizens' preferences is slowing down the transfer of competences to the intermunicipal level.*

Box 1 – **Intermunicipal cooperation and cost of spatial heterogeneity of citizens' preferences**

Let us consider three municipalities (A, B and C) which, for a given local public good *g*, must choose a characteristic between option *x* and option *y* (expressed respectively as g_x and g_y). In making its decision, each municipality relies on the preferences of its citizens and respects the choice of the majority.

Thus, for municipality *i* (for *i* = A, B, C), we have:

$$g^i = \begin{cases} g_x \text{ if } n_x^i > n_y^i \\ g_y \text{ otherwise} \end{cases} \quad (1)$$

where n_x^i and n_y^i designate, respectively, the number of citizens N^i of municipality *i*, in favour of option *x* and option *y* of the local public good *g*, such that $n_x^i + n_y^i = N^i$. Let us examine the following two cases:

Case 1

In municipality A, as in B, all citizens are in favour of option *x*, while all citizens of municipality C are in favour of the option *y*. As such, municipalities A and B will opt for option *x* ($g^A = g_x$ and $g^B = g_x$) whereas C will opt for option *y* ($g^C = g_y$). In this case, the public decision takes full account of citizens' preferences: all citizens see their preferences fulfilled.

However, if the three municipalities decide to cooperate and transfer local public good *g* to the EPCI, the situation will be different. Depending on the population of each municipality —as well as the internal functioning of the EPCI and the negotiating powers of each municipality within the community council— the public good provided by the EPCI g^{A+B+C} may adopt characteristic *x* as easily as it might characteristic *y*. But in both cases, part of the population will not be in line with the collective choice of the EPCI (n^C if $g^{A+B+C} = g_x$, or $n^A + n^B$ if $g^{A+B+C} = g_y$). Thus, by centralising decision-making, the EPCI is less able to take into account the spatial heterogeneity of citizens' preferences.

Case 2

In each municipality, some citizens are in favour of option *x*, while others are in favour of option *y*. Consequently, each municipality opts for the characteristic that satisfies the majority of its citizens (equation 1). Let us posit $n_x^i > n_y^i$ for *i* = *A*, *B*, *C*. According to equation 1, each municipality will opt for option *x* and the population $n_y^A + n_y^B + n_y^C$ will not be in line with the choice of their respective municipality.

If the three municipalities decide to cooperate and transfer local public good *g* to the EPCI, then the situation will be the same. In fact, where each municipality opts separately for option *x*, the EPCI will uphold this choice. Public good *g* will be provided with characteristic *x* and the population $n_y^A + n_y^B + n_y^C$ will not be in line with the EPCI's choice, as was already the case without cooperation.

These two examples illustrate that it is only intermunicipal heterogeneity of citizen preferences —as opposed to intra-municipal heterogeneity— that constitutes a source of democratic inefficiency of the intermunicipality in comparison to the municipality.

On the other hand, centralisation also has certain advantages of its own, the most attractive of which being the potential for generating economies of scale. Indeed, in the presence of significant fixed production costs and low variable costs, it is possible to reduce the average production cost of a local public good by increasing its production scale. It was with this in mind that the first intermunicipal associations were created in France. While the duties entrusted to EPCIs are now much broader, controlling public spending and optimising government policy-making remain major objectives.

However, in the context of intermunicipal cooperation, it would be more appropriate to talk about economies of size instead of economies of scale. Indeed, cooperation has two distinct effects on the average production cost of a local public good: (*i*) by increasing the production scale, the average cost varies downwards in the case of economies of scale, or upwards in the case of diseconomies of scale; (*ii*) by sharing numerous costs (fixed generation costs, organisational or administrative costs, decision-making costs, etc.), which are then no longer shouldered by each municipality individually but by the whole, cooperation makes it possible to reduce the total production cost – and thus the average cost – of the good. Intermunicipal cooperation can thus make it possible to achieve economies of size, even in the presence of diseconomies of scale (see Box 2).

Thus it is understood that the greater the economies of size, depending on a public good's cost structure (see Box 2), the greater the extent to which cooperation can reduce its average cost of generation and the bigger the incentive for municipalities to cooperate with one another, *ceteris paribus*.

Proposition 2. *By determining the full extent of the economies of size that can be achieved through cooperation, the cost structure for supplying a given local public good or service plays a key role in deciding whether or not to transfer its production to the intermunicipal level.*

Furthermore, economies of scale have an indirect effect on demand for local public goods: the zoo effect (Oates, 1988). Some indivisible and weakly rival goods –such as stadia, theatres or zoos– may be too expensive for citizens living in smaller municipalities: the amount that everyone should pay to fund their construction exceeds their *willingness to pay*. Intermunicipal cooperation may provide them a solution: since the total production cost of the good is borne by a larger population, the per capita cost decreases and citizens' demand can thus be met. We know that the larger the population consolidated within

Box 2 – **Intermunicipal cooperation and economies of size**

Consider two municipalities (A and B) that must fund the production of a given local public good. The total cost of generating the public good (TC) consists of a positive fixed cost of production (FC) and a variable cost (*VC*), which is positive and increases commensurately with the population N_i of the municipality *i* (*i* = A, B).

Thus, without cooperation, each municipality *i* bears the total cost of production:

$$TC(N_i) = FC + VC(N_i) \quad (2)$$

And if the two municipalities cooperate, they will subsequently bear the total production cost collectively:

$$TC(N_A + N_B) = FC + VC(N_A + N_B) \quad (3)$$

Deducing therefrom, intermunicipal cooperation will enable them to generate economies of size if and only if:

$$TC(N_A) + TC(N_B) > TC(N_A + N_B) \quad (4)$$

$$\Leftrightarrow FC + VC(N_A) + VC(N_B) - VC(N_A + N_B) > 0 \quad (5)$$

By definition, however, economies of scale appear in the production of the public good if and only if:

$$VC(N_A) + VC(N_B) - VC(N_A + N_B) > 0 \quad (6)$$

On the contrary, if this condition is not respected, diseconomies of scale appear in the production of the public good.

Yet if Equation 6 holds, then it means Equation 5 also holds since, in theory, the fixed cost of production is positive. In other words, if economies of scale are at work, this will necessarily translate into significant savings and thus cooperation will reduce the overall production cost of the public good. More generally, however, Equation 5 holds as soon as *FC* is greater than $VC(N_A + N_B) - VC(N_A) - VC(N_B)$, even where Equation 6 does not hold. In other words, intermunicipal cooperation can generate economies of size —even in the presence of diseconomies of scale— provided that this excess cost is offset by the fixed costs that are shared.

Finally, one can deduce from Equation 5 that the economies of size achieved by way of cooperation are all the more significant given that: (*i*) the fixed costs of production are high, (*ii*) the second derivative of variable costs is low.

the intermunicipality, the greater the economies of size and the greater the incentive for the municipalities to cooperate, *ceteris paribus*.

Proposition 3. *In the presence of economies of size, the larger the population of the intermunicipality, the more member municipalities are willing to transfer their competences to the intermunicipal level.*

Moreover, this zoo effect may have the following indirect consequence. The smaller a municipality, the less able it is to fund a large number of highly indivisible public goods on its own. It then has no alternative but to cooperate with its neighbours to fund their production collectively. Consequently, the greater the number of small municipalities consolidated within a given intermunicipality, the more likely they are to transfer their competences to the intermunicipal level, *ceteris paribus*.

Proposition 4. *As an indirect consequence of the zoo effect, intermunicipalities are more readily entrusted with competences when they consist of smaller municipalities.*

Finally, let us keep in mind that cooperation has other non-negligible advantages (Frère & Paty, 2014). Indeed, intermunicipal cooperation also helps to improve the quality of local public goods and services, to promote horizontal equalisation and to internalise various external effects. For instance, where the provision of a public good is entrusted to municipalities, spillover effects (or other externalities) may begin to show and local public policies, which are highly interdependent, may suffer from a lack of coordination. Yet these various external effects can prevent the local public sector from functioning properly, both in terms of the level of public expenditure and the tax rates adopted.

Thus if we apply the decentralisation theorem to intermunicipal cooperation, municipalities' decision to cooperate and transfer competences to the intermunicipal level appears to be the result of a delicate trade-off between advantages and disadvantages, at the core of which is the cost of the spatial heterogeneity of citizens' preferences and the benefits of economies of size. In the rest of the article, an empirical approach is implemented in order to test these various propositions in the case of France. We must first measure the heterogeneity of citizens' preferences, a focal point of the decentralisation theorem but difficult to address empirically.

Measuring territorial heterogeneity

The heterogeneity of citizens' preferences is thus likely to play a key role in municipalities' choice of cooperation. However, since there is no empirical measurement for these preferences, (a) proxy variable(s) based on the economic and social composition of the populations studied is(are) commonly used. The implicit assumption is as follows: citizens have different preferences depending on their income, socioprofessional category, education level, employment/unemployment status, age or even gender (Bergstrom & Goodman, 1973). By calculating a heterogeneity index for each of these variables, the heterogeneity of citizens' preferences is thus measured indirectly. However, since these variables are closely correlated with one other, typically only a limited number of them are used in empirical studies. Moreover, as we have seen before, the spatial heterogeneity of citizens' preferences may express itself in relation to any one characteristic of local public goods. It can therefore seem reductionist to approximate this multidimensional heterogeneity using two or three sociodemographic variables, supposedly encompassing the full diversity of citizens' preferences (Gross, 1995). In order to avoid this shortcoming, we propose the use of a principal component analysis (PCA) to construct a composite indicator of preferences heterogeneity on the basis of 15 sociodemographic variables. This approach has three stages.

First, observable variables must be constructed allowing for an approximation of the citizens' preferences for each French municipality. To this end, we use Insee data on the population census of 2012 (see Box 3). 15 variables were eventually selected; they characterise each municipality in terms of population structure (proportion of the population aged under 15, 15-29, 75 and over; the percentage of the total population who are men, as well as the number of people per household), socioprofessional composition (proportion of the working population who are agricultural workers, craftsmen, associate professionals, managers), and standard of living (median income, unemployment rate).

Second, heterogeneity indices are calculated using these 15 variables. More precisely, these are indices of intra-community heterogeneity, i.e. the heterogeneity between municipalities within the same intermunicipality. For each variable, a Gini index was calculated at the intermunicipal level. Its value tends towards 0 in a situation of perfect equity (e.g. the

unemployment rate is identical in all member municipalities), and towards 1 in a situation of maximum inequity (e.g. all the unemployed are located in a single member municipality).

Third, a PCA is conducted over these 15 Gini indices in order to construct a composite indicator of preference heterogeneity derived from the principal components of the analysis (Hosseini & Kaneko, 2011). The first two components of this PCA explain 60.2% of the total sample variance. According to the correlations circle (Figure I), most variables are correlated with the first component: it explains 49.1% of the sample variance, compared with 11.1% for the second component. By way of contrast, the second component is closely correlated to the Gini indices calculated on the basis of household size, median income and the proportion of agricultural workers in the active population. Lastly, the Gini index calculated for the share of the population over 75 years of age is located far from the circle and is not aligned with any of the axes: it is poorly explained by these two components.

In order to improve the quality of our synthetic indicators, we might consider two solutions. The first would consist of adding another principal component, which would automatically increase the explained variance. However, the percentage of the variance explained by the third component is low and its eigenvalue is less than one. A second solution is preferred: it consists of conducting two PCAs in parallel, distinguishing between demographic variables on the one hand and socioeconomic variables related to employment (education level, socio-professional category (SPC) and standard of living) on the other hand (see appendix, Figures AI and AII for the correlation circles). The percentage of the variance explained by for the first two components is improved, reaching 72.2% for the demographic variables and 67.9% for the employment variables.

Having now these two sets of synthetic indicators that indirectly measure intermunicipal heterogeneity of citizens' preferences, we construct an econometric model in order to identify the major empirical trends influencing municipalities' cooperation choices.

The econometric model

On the basis of the decentralisation theorem as applied to intermunicipal cooperation and the resulting set of propositions, we define three variables of interest on which any collective decision to transfer competences to the intermunicipal level depends: the heterogeneity of citizens' preferences h_X, the intermunicipality's total population n_X as well as the average population of its member municipalities $\overline{n}_X$.

This decision can be calculated using a *probit* model, with D_X^g equal to 1 when there is a decision to transfer competences g to the intermunicipal level, such as:

Box 3 – **Data**

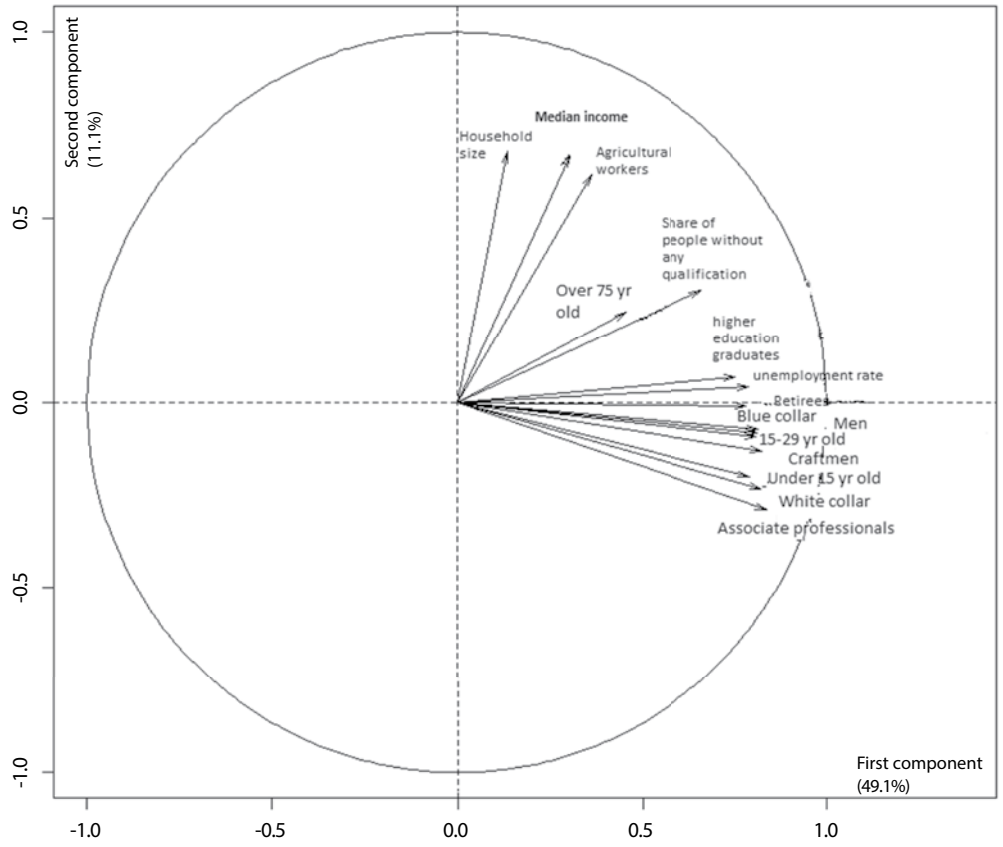
The data used at the municipal level are drawn mainly from the Insee population census of 1 January 2012, with the exception of per capita financial wealth potential, which was provided by the DGCL, and the per capita median income, which was taken from *FiLoSoFi* data (social and fiscal localized incomes) provided by the DGFIP and Insee. However, because of the lack of data available for 2012, we have used 2013's financial wealth potential information.

We chose to work on the basis of 2012's data, which is the most recent year before the full force of the Territorial Authorities Reform Act (enacted 16 December 2010) began to operate. Indeed, this Reform Act marks a major turning point in the development of intermunicipalities with individual fiscal powers in France. The role of prefect is considerably reinforced, with the aim to streamline the intermunicipal map, thereby reducing the decision-making power of individual municipalities'cooperation choices.

These municipal variables are then calculated at the intermunicipal level on the basis of the perimeters of intermunicipalities with their own fiscal powers as of 1 January 2012 published by the DGCL. They consolidate all of the *Communautés de communes*, *Communautés d'agglomération*, *Communautés urbaines* and *Syndicats d'agglomération nouvelle* (*Métropoles* being more recent). However, in the perspective of the spatial approach of the model, geographically isolated intermunicipalities have been excluded from the scope of the study. This includes intermunicipalities in overseas departments and regions, as well as those in Corsica. Our data sample therefore comprises 2,543 intermunicipalities with their own fiscal powers.

Finally, the position of intermunicipalities on the urban-rural gradient was determined based on Insee-Datar's Urban Area Zoning data (ZAU 2010). The list of powers exercised by each intermunicipality is based on the DGCL's national intermunicipality database (*Banatic*).

Figure I
Circle of correlations for all Gini indices relating to the various different sociodemographic variables – Principal Components Analysis



Reading note: associated with a point of contact (0.72; 0) in the first factorial plan, the Gini index for the portion of the intermunicipality's population who are retired has a correlation of 0.72 with the first main component and a zero correlation with the second main component. In other words, 0.72% of its variance is captured by the first component, with the second caputuring nothing.
Scope: 2543 EPCIs with own taxation powers (as of 1 January 2012) in Metropolitan France (Corsica excepted).
Sources: Insee, *Census* 2012; authors' calculations.

$$P_X^g = P\left(D_X^g = 1 \middle| h_X, n_X, \overline{n}_X, z_X\right) = \Phi\left(\beta_0^g + \beta_1^g h_X + \beta_2^g n_X + \beta_3^g \overline{n}_X + \beta_4^g z_X\right) \quad (7)$$

where $\Phi(\cdot)$ corresponds to the distribution function of the standard normal distribution law, z_X is the vector of control variables and β^g specify the parameters to be estimated for competence *g*.

More specifically, h_X is the column vector composed of the principal components constructed in the previous section, i.e. alternatively the first two principal components of the PCA conducted for the 15 variables ($CP1_X^{tot}$ et $CP2_X^{tot}$); or the first two principal components of the two PCAs conducted in parallel, one for the demographic variables ($CP1_X^{demo}$ and $CP2_X^{demo}$) and the other for the employment variables ($CP1_X^{emp}$ and $CP2_X^{emp}$).

According to Proposition 1, these variables are expected to have a negative impact on P_X^g – the greater the intermunicipal heterogeneity of citizens' preferences, the higher the cost of collective decision-making and the lower the likelihood of municipalities transferring their competences to the intermunicipal level (Tiebout, 1956). Conversely, Proposition 3 suggests that, in the presence of economies of size, the population of intermunicipality n_X has a positive impact on P_X^g, i.e. the larger the population of the intermunicipality, the lower the average production cost and the greater the financial incentive for municipalities to cooperate. Finally, in accordance with Proposition 4, the average population of the member municipalities of intermunicipality $\overline{n}_X$ would have a negative impact on P_X^g, i.e. the smaller the municipality, the less able it is to produce public good *g* using its own resources and the more

dependent it is on the intermunicipality to which it must transfer the relevant competence in order to ensure that *g* is provided to its citizens. This is what is known as the indirect zoo effect.

In addition, vector z_X is composed of nine control variables aimed to define context variability between the different EPCIs in our sample. The sole purpose of introducing these variables into the model is to set some characteristics of the intermunicipalities likely to affect the relationship between each of our variables of interest (spatial heterogeneity of preferences, size of the intermunicipality and average size of the municipalities comprising the intermunicipality) and the transfer of competences. The expected sign of the relationship between the transfer of competences and these variables is a priori unknown.

A Herfindahl-Hirschman index measures the municipal concentration of per capita financial wealth potential within the intermunicipality. It is calculated on the basis of the per capita financial wealth potential of the member municipalities and such that:

$$HHI_X^{pc\_fi\_wealth\_pot} = \sum_{x \in X} \left(\frac{pc\_fi\_wealth\_pot_x}{\sum_{x \in X} pc\_fi\_wealth\_pot_x} \right)^2 \quad (8)$$

Where $pc\_fi\_wealth\_pot_x$ corresponds to municipality *x* of intermunicipality *X*'s per capita financial wealth potential, or its fiscal potential[8] plus the fixed portion of the DGF subsidy[9].

Thus, the value of $HHI_X^{pc\_fi\_wealth\_pot}$ varies between $1/n_X$, i.e. when each member municipality has the same financial wealth potential per inhabitant, and 1 when a single member municipality holds all the financial wealth potential in the intermunicipality. The sign of the associated coefficient is expected to be negative: a higher concentration of financial wealth potential per capita reduces the likelihood that public good g will be transferred to the intermunicipal level. In fact, a high index $HHI_X^{pc\_fi\_wealth\_pot}$ illustrates an asymmetric situation in the level of per capita financial wealth potential of the various member municipalities. Relatively rich municipalities (per capita) may then fear that they will become net funding providers for intermunicipality activities and will tend to hold back the transfer of cost-intensive competences. However, the presence of a small number of dominant municipalities can also facilitate collective decision-making, thus facilitating the transfer of competences. In such cases, the sign of the associated coefficient would be positive.

Unemployment rate of the intermunicipality ($Unemployment\_rate_X$). The expected sign for this variable is undetermined. Actually, since intermunicipal cooperation is perceived as a potential solution to certain local imbalances in the labour market, then municipalities would tend to entrust key competences to the intermunicipal level when the unemployment rate is high. However, municipalities may also prefer to retain their decision-making power in respect of such electorally significant competences and thus maintain a direct relationship with their citizens.

Median income of the intermunicipality's citizens ($Median\_income_X$). Standard of living is an important factor when it comes to understanding the diversity of citizens' preferences with respect to public goods. Assuming that local public goods are normal goods, their demand should grow with citizens' incomes. Therefore, if the intermunicipality is better able to respond to this new demand, the transfer of competences should be more pronounced. If that is not the case, the result would be the opposite.

Percentage of the intermunicipality's population aged below 15 years (Pct_b15_X) and over 75 years (Pct_o75_X). Once again, the expected sign for these two variables remains unknown a priori. On the one hand, if a community has a large share of young and old people in its population, it can then be assumed that the member municipalities will tend to transfer specific competences in order to satisfy their high demand for local public goods. Thus, they would benefit from the potential advantages of cooperation. On the other hand, however, the member municipalities might also prefer to retain the exercise of these competences for electoral concerns.

Surface area of the intermunicipality in square kilometres ($Surface\_area_X$). By determining the full extent of economies of size, production costs play a decisive role in municipalities' cooperation choices (Proposition 2). Yet many competences are, by their very nature, sensitive to network effects. These include the maintenance of roads, water treatment and distribution and energy production and distribution. Thus, the larger the area of a given intermunicipality,

*8. Fiscal potential corresponds to the amount of tax revenues that a municipality would receive if its four gross local tax bases (territorial economic contribution (*contribution économique territoriale*), housing tax (*taxe d'habitation*), property tax on built and non-built land (*taxes sur le foncier bâti et non bâti*)) were levied at the average national rates calculated for all French municipalities.*

*9. The DGF (*dotation globale de fonctionnement*) is the main subsidy paid by the central government to local to municipalities.*

the more costly it will be to introduce a collective sanitation system (assuming similar population sizes). With regard to such competences, cooperation would therefore become less attractive for municipalities as the surface area of the intermunicipality increases. We expect communities' $Surface\_area_X$ to have a negative impact on P_X^g, particularly with regard to competences that are sensitive to network effects.

Intermunicipality's legal status (CU_CA_X), a dummy variable that takes the value 1 for *Communautés urbaines* or *Communautés d'agglomération*, and the value 0 otherwise. These legal statuses produce significant variations between intermunicipalities, both in terms of minimum population thresholds to be achieved as well as mandatory, voluntary or optional competences. In fact, depending on an intermunicipality's legal status, it is required to exercise a minimum amount of competences belonging to specific jurisdictions[10]. Thus, these are mandatory jurisdictions as opposed to specifically-defined competences, otherwise they would have to be exercised by 100% of intermunicipalities (see Box 4, Figure A).

Type of area on which the intermunicipality is established. The typology of Insee-Datar's Urban Area Zoning (ZAU 2010) partitions the territory into three main types of spaces from which we draw three dummy variables: large urban areas ($Large\_area_X$), other areas ($Small\_average\_area_X$), other multipolarised municipalities and isolated municipalities ($Rural\_isolated_X$). Since this typology is determined at the municipal level, a given intermunicipality is designated by the type of area that corresponds to that of the majority of its member municipalities. Our model including a constant, $Large\_area_X$ is excluded from the estimations.

The quality of model 7's estimation is assessed by two statistics: the percentage of correct predictions and the log-likelihood that takes an increasingly higher value as the model's explanatory power grows. We also test for spatial autocorrelation by comparing, with a likelihood ratio test, the non-spatial model and the autoregressive spatial model (SAR). The model to be estimated then becomes:

$$P_X^g = \Phi\Big(\beta_0^g + \beta_1^g h_X + \beta_2^g n_X + \beta_3^g \overline{n}_X + \beta_4^g z_X + \rho^g \sum_{Y \neq X} w_{XY} P_Y^g\Big) \quad (9)$$

with w_{XY} the element of the spatial weighting matrix (W) describing the neighbourhood relationship between intermunicipalities X and Y. The definition of neighbourhood here is contiguity: two intermunicipalities are considered to be neighbours if they have a common border. Finally, the elements of the spatial weighting matrix (W) are row standardised[11]. This SAR model is estimated using the maximum likelihood method proposed by McMillen (1992).

Results

First of all, the estimations of models (7) and (9) show that the results are unaffected by the specification adopted with regard to the heterogeneity of preferences. Thus, only those results obtained using the two principal components of the two PCAs conducted in parallel ($CP1_X^{demo}$, $CP2_X^{demo}$, $CP1_X^{emp}$ and $CP2_X^{emp}$) are presented here[12]. The results of the estimations of model 7 are displayed in Tables 1, 2 and 3. Four main results emerge:

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10. For example, a Communauté d'agglomération *must exercise at least one competence connected to urban governance, which is not the case for a* Communauté de communes.

11. If an EPCI has n *contiguous neighbours, the weighting assigned to each will be 1/n. By standardising the spatial weighting matrix (W), the neighbourhood impact is not artificially affected by the administrative breakdown that determines the number of contiguous neighbours for each EPCI.*

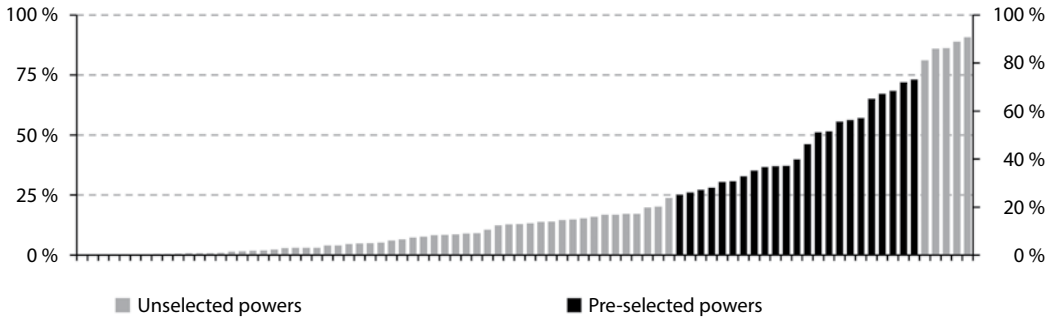
12. The results of estimates obtained using the two main components of the PCAs conducted for all Gini indices ($CP1_X^{tot}$ and $CP2_X^{tot}$) are available on request.

Box 4 – **Choice of competences studied**

The DGCL's national intermunicipality database (*Banatic*) lists the competences exercised by each intermunicipality out of a selection of 84 potential intermunicipal competences. Of these 84 competences, we have preselected 23. In fact, some competences are very rarely exercised. One such example is '*Record-keeping*', which is exercised by just one intermunicipality of the 2,543 in our sample. Conversely, other competences are almost always exercised. These include the competence '*Creation, planning, maintenance and management of zones of industrial, commercial, service-based, artisanal or tourist activity*', which is exercised by 90.7% of intermunicipalities in the sample. Yet with such low variability, it is difficult to take anything away from this as regards any decision to transfer such competences to the intermunicipal level. For this reason, only those 23 powers that are exercised by 25 to 75% of the sample intermunicipalities were preselected. ➔

Box 4 (contd.)

Figure A
Percentage of intermunicipalities studied exercising every one of the 84 intermunicipal powers

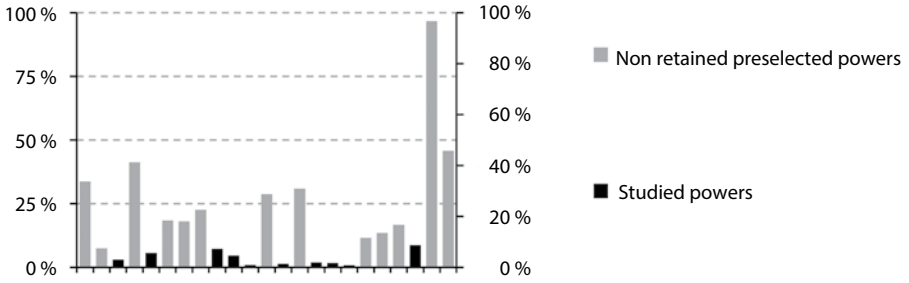


Scope: 2,543 EPCIs with own fiscal powers (as of 1 January 2012) in Metropolitan France (Corsica excepted).
Sources: DGCL, *Banatic* 2012.

EPCIs with their own fiscal powers constitute a form of intermunicipal cooperation in France, as do EPCIs with no fiscal power that consolidate various different types of associations (Single-purpose Intermunicipal Associations (SIVU) or Multi-purpose Intermunicipal Associations (SIVOM), Closed Joint Intermunicipal Associations (SMF) or Open Joint Intermunicipal Associations (SMO)). Municipalities have the choice either to transfer a given competence to the intermunicipal level or retain it for themselves, and are likewise able to choose the form of intermunicipal cooperation. Estimation results could therefore be biased in cases where they relate to competences commonly entrusted to intermunicipal associations. However, due to the superposition and entanglement of the perimeters of intermunicipal associations, it is difficult to integrate them into any econometric analysis.

Furthermore, out of the 23 preselected powers, the 10 least frequently entrusted to these EPCIs with no fiscal powers were eventually selected for this study. These are, namely: '*Local Housing Programme (PLH)*'; '*Planned Housing Improvement Operation (OPAH)*'; '*Social Housing Policy*'; '*Land-banking*'; '*Territorial consistency scheme (SCOT)*'; '*Sector Scheme*'; '*Creation of Joint Development Zones (ZAC)*'. The influence of intermunicipal associations on the choice of competences entrusted to the EPCIs with own fiscal powers is similarly limited.

Figure B
Percentage of municipalities that have transferred one of the 23 preselected powers to an EPCI without own fiscal power



Scope: 2,543 EPCIs with own fiscal powers (as of 1 January 2012) in Metropolitan France (Corsica excepted).
Sources: DGCL, *Banatic* 2012.

Result 1a – *The heterogeneity of citizens' preferences is holding back the transfer of competences from municipalities to the intermunicipal level.*

We can see that $CP1_X^{emp}$ and/or $CP2_X^{emp}$ have a significant and negative impact with respect to most of the competences studied, especially 'housing' and 'urban planning'[13] (see Tables 1 and 2). In other words, the more heterogenous the population of a given intermunicipality's member municipalities –in terms of education level, CSP and standard of living– the less inclined it is to transfer competences to the intermunicipal level. Proposition 1 therefore holds and the argument of Tiebout (1956), which stipulates that centralisation generates a significant social cost in view of its inferior consideration of the spatial heterogeneity of citizens' preferences, is reflected in French intermunicipalities with their

13. This is the case for powers over the local housing programmes, social housing policy, sports activities, SCOT, sector schemes and SPA creation.

own fiscal powers. These results complement those of Di Porto *et al.* (2016), who show that a municipality's decision to integrate into an EPCI is all the more complicated as its member municipalities' socioeconomic characteristics differ. In other words, territorial heterogeneity is holding back both the construction of intermunicipalities, and the transfer of competences to them.

Comparatively speaking, $CP1_X^{demo}$ et $CP2_X^{demo}$ play a more secondary role here. Only $CP1_X^{demo}$ has a significant (and negative) effect on 'social housing policy' and 'creation and maintenance of sports' (columns 1.3 and 3.3). When spatial autocorrelation is taken into account, $CP1_X^{demo}$ no longer has any significant impact on the 'creation and maintenance of sports facilities' (see column A3.3 in the appendix). Thus, the various sources of heterogeneity do not have the same impact on municipalities' decisions to transfer competences to the intermunicipal level: only the heterogeneity of municipal populations

Table 1
Probit* estimates in the area of competence *Housing

	1.1	1.2	1.3
	Local housing programme	OPAH[a]	Social housing policy
$CP1_X^{emp}$	0.038 (0.033)	0.016 (0.031)	-0.088* (0.036)
$CP2_X^{emp}$	-0.115* (0.057)	-0.015 (0.053)	-0.039 (0.061)
$CP1_X^{demo}$	-0.031 (0.029)	0.036 (0.027)	-0.087** (0.032)
$CP2_X^{demo}$	0.016 (0.044)	-0.048 (0.041)	0.034 (0.047)
$log(n_X)$	0.672** (0.165)	0.235 (0.156)	0.119 (0.195)
$log(\bar{n}_X)$	0.040 (0.167)	-0.144 (0.156)	0.510** (0.195)
$IHH_X^{pot\_fi\_hab}$	-0.465 (1.064)	-1.352 (1.017)	-4.254** (1.361)
$Unemployement\_rate_X$	0.024 (0.019)	-0.016 (0.018)	-0.049* (0.021)
$Median\_income_X$	-0.00002 (0.00003)	-0.00001 (0.00003)	-0.0001 (0.00003)
Pct_b15	0.083** (0.028)	0.113** (0.027)	0.112** (0.030)
Pct_o75	0.036 (0.031)	0.111** (0.029)	0.146** (0.033)
$Surface\_area_X$	-0.00000 (0.00000)	0.00000 (0.00000)	0.00000 (0.00000)
CU_CA_X	1.674** (0.379)	-0.172 (0.213)	1.514** (0.266)
$Small\_average\_area_X$	0.143 (0.138)	0.544** (0.135)	0.352* (0.142)
$Rural\_isolated_X$	0.250 (0.128)	0.223 (0.124)	0.213 (0.138)
Constant	-7.871** (1.385)	-3.939** (1.282)	-6.933** (1.500)
Observations	2,543	2,543	2,543
Log likelihood	-1,570.651	-1,710.083	-1,462.396
Correct predictions (%)	63.04	58.67	71.14
LR test ($H_0 : \rho = 0$)	95.514**	52.073**	141.749**

a: Planned housing improvement operation (OPAH).
Note: * p<0.1; * p<0.05; ** p<0.01; standard deviations in brackets.
Reading note: $CP1_X^{emp}$ does not significantly affect (critical probability greater than 10%) the probability of *local housing programme* and *OPAH* competences being transferred, but does negatively affect the probability of *social housing policy* competence being transferred (significant at the 10% threshold).
Scope: 2,543 EPCIs with own fiscal powers (as of 1 January 2012) in Metropolitan France (Corsica excepted).
Sources: Insee, *Census* 2012, Insee-DGFIP-Cnaf-Cnav-CCMSA, fichier localisé social et fiscal *(Filosofi)* 2012; DGCL, *Banatic* 2012; Insee-Datar, *ZAU* 2010; authors' calculations.

measured in terms of education level, SPC and standard of living holds back the transfer of competences to the intermunicipal level.

Result 1b – *Although heterogeneity relating to socio-professional category, standard of living and citizens' education level is holding back the transfer of competences from municipalities to the intermunicipal level, heterogeneity in terms of age and household size plays a more secondary role here.*

We also observe that the coefficient associated with the intermunicipality's population n_X is either insignificant, or significant and positive. In other words, the probability of these competences being transferred increases commensurately with the size of the intermunicipality, indicating the presence of the economies of size effect that ought to foster cooperation among municipalities (Proposition 3). This is especially true in the case of 'creation and maintenance of sports facilities' (column 3.3), where

Table 2
Probit* estimates in the area of competences *Urban planning

	(2.1)	(2.2)	(2.3)	(2.4)
	Land-banking	SCOT[a]	Sector schemes	Creation of ZAC[b]
$CP1_X^{emp}$	-0.054 (0.033)	-0.092** (0.036)	-0.067** (0.033)	-0.068** (0.034)
$CP2_X^{emp}$	0.009 (0.056)	-0.124* (0.063)	-0.059 (0.056)	-0.056 (0.059)
$CP1_X^{demo}$	-0.027 (0.029)	-0.032 (0.032)	-0.002 (0.029)	-0.016 (0.030)
$CP2_X^{demo}$	0.016 (0.044)	0.053 (0.049)	0.007 (0.043)	0.069 (0.045)
$log(n_X)$	0.168 (0.171)	0.999*** (0.182)	0.182 (0.170)	0.735*** (0.175)
$log(\overline{n}_X)$	-0.056 (0.172)	-0.206 (0.186)	0.325* (0.170)	0.018 (0.178)
$IHH_X^{pot\_fi\_hab}$	-1.723 (1.138)	-0.436 (1.113)	-2.088* (1.123)	-1.396 (1.144)
$Unemployement\_rate_X$	0.004 (0.020)	-0.102*** (0.021)	-0.020 (0.019)	-0.015 (0.020)
$Median\_income_X$	0.0001*** (0.00003)	-0.0001*** (0.00003)	-0.00003 (0.00003)	0.00002 (0.00003)
Pct_b15	0.031 (0.028)	0.041 (0.031)	0.035 (0.028)	0.058** (0.029)
Pct_o75	0.101*** (0.031)	-0.062* (0.033)	0.044 (0.030)	0.065** (0.032)
$Surface\_area_X$	-0.00000 (0.00000)	-0.00002*** (0.00000)	0.00000 (0.00000)	-0.00000 (0.00000)
CU_CA_X	1.363*** (0.231)	0.059 (0.354)	0.807*** (0.250)	1.733*** (0.450)
$Small\_average\_area_X$	0.263* (0.138)	-0.547*** (0.153)	-0.171 (0.135)	0.140 (0.141)
$Rural\_isolated_X$	0.155 (0.131)	-0.507*** (0.139)	-0.167 (0.128)	0.158 (0.130)
Constant	-5.481*** (1.388)	-3.039** (1.481)	-4.065*** (1.357)	-8.503*** (1.455)
Observations	2,543	2,543	2,543	2,543
Log likelihood	-1,590.865	-1,306.621	-1,625.750	-1,514.084
Correct predictions (%)	66.18	74.75	63.66	66.30
LR test ($H_0 : \rho = 0$)	138.106***	273.668***	216.640***	139.508***

a: Territorial consistency scheme; b: Joint development zones.
Note: * p<0.1; * p<0.05; ** p<0.01; standard deviations in brackets.
Reading note: $CP1_X^{emp}$ does not significantly affect the probability of *land-banking* competence being transferred, but does negatively affect the probability of *SCOT, sector scheme* and *SPA* competences being transferred (significant at the 5% threshold).
Scope: 2,543 EPCIs with own fiscal powers (as of 1 January 2012) in Metropolitan France (Corsica excepted).
Sources: Insee, *Census* 2012, Insee-DGFIP-Cnaf-Cnav-CCMSA, fichier localisé social et fiscal *(Filosofi)* 2012; DGCL, *Banatic* 2012; Insee-Datar, *ZAU* 2010; authors' calculations.

the sharing of fixed generation costs expected and the subsequent economies of size are significant. By contrast and despite the similar cost structure (Proposition 2), this result is not observed for 'sports activities' and 'creation and maintenance of (socio-)cultural facilities' (see Table 3, columns 3.1 and 3.2).

However, the presence of economies of size alone cannot explain the significant positive impact that can also be seen for the following competences: 'local housing programmes', 'territorial coherence schemes' and 'creation of Special Planning Areas' (see Tables 1 and 2, columns 1.1, 2.2 and 2.4). In this case, the need for coordination with respect to local public choices would come into play: in intermunicipalities with larger populations the need for coordination is greater and these competences tend more often to be entrusted to the intermunicipal level.

Result 2 – *Economies of size and the need to coordinate local public choices predetermine that some competences will be exercised at the intermunicipal level.*

When it is significant, the estimated coefficient of the member municipalities' average

Table 3
Probit* estimates in the area of competences *Spatial planning

	3.1	3.2	3.3
	Sports activity	Creation/maintenance of (socio-) cultural facilities	Creation/maintenance of sports facilities
$CP1_X^{emp}$	-0.092*** (0.033)	0.007 (0.035)	-0.017 (0.036)
$CP2_X^{emp}$	0.007 (0.056)	-0.062 (0.059)	-0.025 (0.059)
$CP1_X^{demo}$	0.001 (0.029)	-0.013 (0.031)	-0.062** (0.031)
$CP2_X^{demo}$	0.044 (0.043)	-0.025 (0.046)	0.048 (0.046)
$log(n_X)$	0.254 (0.164)	0.202 (0.177)	0.685*** (0.172)
$log(\bar{n}_X)$	-0.220 (0.164)	-0.104 (0.177)	-0.397** (0.172)
$IHH_X^{pot\_fi\_hab}$	-1.154 (1.065)	-1.103 (1.174)	-0.294 (1.113)
$Unemployement\_rate_x$	-0.051*** (0.019)	0.066*** (0.020)	0.020 (0.020)
$Median\_income_x$	-0.0001* (0.00003)	0.0001** (0.00003)	0.00002 (0.00003)
Pct_b15	0.056** (0.028)	0.027 (0.030)	0.024 (0.030)
Pct_o75	0.013 (0.031)	0.043 (0.033)	0.017 (0.033)
$Surface\_area_x$	-0.00000 (0.00000)	-0.00000 (0.00000)	-0.00001*** (0.00000)
CU_CA_x	-0.102 (0.221)	0.552** (0.225)	-0.020 (0.222)
$Small\_average\_area_x$	0.165 (0.137)	0.045 (0.148)	0.185 (0.143)
$Rural\_isolated_x$	0.237* (0.128)	-0.065 (0.140)	0.245* (0.136)
Constant	-0.872 (1.347)	-4.809*** (1.437)	-5.547*** (1.421)
Observations	2,543	2,543	2,543
Log likelihood	-1,645.320	-1,460.486	-1,515.450
Correct predictions (%)	63.15	72.63	68.82
LR test ($H_0 : \rho = 0$)	90.404***	149.667***	193.644***

Note: * p<0.1; * p<0.05; ** p<0.01; standard deviations in brackets.
Reading note: $CP1_X^{emp}$ negatively impacts the probability of *sports activities* competence being transferred (significant at the 1% threshold), but does not significantly affect the probability of *Creation/maintenance of (socio-)cultural facilities* and *Creation/maintenance of sports facilities* competences being transferred.
Scope: 2,543 EPCIs with own fiscal powers (as of 1 January 2012) in Metropolitan France (Corsica excepted).
Sources: Insee, *Census* 2012, Insee-DGFIP-Cnaf-Cnav-CCMSA, fichier localisé social et fiscal *(Filosofi)* 2012; DGCL, *Banatic* 2012; Insee-Datar, *ZAU* 2010; authors' calculations.

population $\overline{n}_X$ can be negative as predicted by Proposition 4 (see Table 3, column 3.3), but also to the opposite sign (see Tables 1 and 2, columns 1.3 and 2.3). However, contrary to previous results, it is sensitive to the presence of spatial autocorrelation (not taken into account in the results presented in Tables 1 to 3). Once this spatial autocorrelation is treated (appendix, Tables A1, A2 and A3), the estimated coefficient for $\overline{n}_X$ becomes negative when it is significant (columns A2.2, A2.1 and A3.3), whereas positive coefficients consequently lose their significance (columns A1.3 and A2.3). This result, which is an indirect consequence of the zoo effect, confirms Proposition 3: the smaller a municipality, the less able it is to fund many public goods on its own and the more it tends to turn to the intermunicipality.

Result 3 – *An indirect consequence of the zoo effect is that intermunicipalities made up of small municipalities have a higher probability of being entrusted with some competences.*

Furthermore, the control variables show different effects depending on the competence in question, thus demonstrating the complexity of local cooperation choices. We shall observe the net effect of the legal statuses of *Communautés d'agglomération* and *Communautés urbaine* on the most of the studied competences. Compared to *Communautés de communes* and *Syndicats d'agglomération nouvelle*, *Communautés d'agglomération* and *Communautés urbaines* would consequently be more readily entrusted with competences by their member municipalities. This result is consistent with the guidelines set out in the Law of 12 July 1999 on the strengthening and simplification of intermunicipal cooperation, and further bolstered by the RCT and NOTRe laws, which were intended to promote greater intermunicipal integration, especially with regard to *Communautés d'agglomération* and *Communautés urbaines*.

Lastly, the likelihood ratio tests systematically show the presence of spatial autocorrelation. Tables A1, A2 and A3 in the appendix present the results of the autoregressive spatial model's estimates (Equation 9), obtained using the maximum likelihood method proposed by McMillen (1992). Above all, it can be seen that the results shown until this point are robust to the treatment of this spatial autocorrelation, and even strengthened in the case of Result 3. Moreover, the estimator of the autoregressive term is always significant and positive: the probability that the intermunicipality exercises a particular competence is all the higher if the bordering intermunicipalities also exercise this competence, and vice versa. These results are consistent with those obtained by Emond (2015), who identified the same local mimicking behaviour among French intermunicipalities for competences of social assistance.

Result 4 – *The choice to transfer competences to the intermunicipal level greatly depends on the choice of neighbouring intermunicipalities, indicating a mimicking behaviour among contiguous intermunicipalities.*

* *
*

By studying the competences exercised by French intermunicipalities, this article shows that the choice of municipalities to transfer some of their competences to the intermunicipal level indicates an arbitrage of sorts between economies of size and the cost of the heterogeneity of citizens' preferences. Oates's decentralisation theorem (1972) is therefore fully illustrated within the framework of intermunicipal cooperation.

On the one hand, the estimations show that the economies of size expected from cooperation provide an incentive for municipalities to cooperate. Depending on the competences in question, this result can be explained by two mechanisms. The first is the potential for improved coordination of local public choices — as is the case with competences over 'local housing programmes', 'territorial coherence schemes' or 'creation of joint development zones'. The second is the opportunity for collective funding of local public goods that are difficult to fund individually —as it is the case for the competence 'creation and maintenance of sports facilities'.

In addition, intermunicipalities made up of small municipalities have a higher probability of being entrusted with specific competences, *ceteris paribus*. This result appears to be an indirect consequence of the zoo effect: the smaller a municipality, the less able it is to fund many public goods on its own and the more it tends to turn to the intermunicipality. In the literature, this original result indicates a mechanism specific to voluntary intermunicipal cooperation, where economies of scale and size are at work simultaneously but in opposite directions on

municipalities' cooperation choices. Economies of size realised through cooperation provide an incentive for municipalities to transfer their competences, whereas the potential economies of scale from which they could benefit individually without the need to cooperate, make cooperation less critical and hold back the transfer of compentences by municipalities.

On the other hand, the estimations show that the more heterogeneous intermunicipalities tend less frequently to transfer their competences to the intermunicipal level. In accordance with the Tiebout's argument (1956), the centralisation brought about by the transfer of competences to the intermunicipal level and the resulting cost of the spatial heterogeneity of citizens' preferences are influencing municipalities' cooperation choices. These results complement those of Di Porto *et al.* (2016), who show that a municipality's decision to integrate into an EPCI is all the more complicated as its member municipalities' socioeconomic characteristics differ. In other words, territorial heterogeneity is holding back both the construction of intermunicipalities, and the transfer of competences to them.

According to Estèbe (2008), this territorial heterogeneity has in some cases led to the formation of defensive intermunicipalities. In order to avoid being absorbed by the central municipal structure, peripheral intermunicipalities have emerged with the purpose of consolidating more homogenous municipalities. This type of strategic behaviour is only possible in light of the large room for manoeuvre which municipalities are afforded when it comes to their cooperation choices. However, the effort to streamline intermunicipalities by enhancing the role of prefect –which was a product of the RCT and NOTRe laws– intends to combat precisely this kind of practices. There would therefore be an element of friction between the spontaneous and non-cooperative behaviour of municipalities that make their cooperation choices on the primary basis of defending the interests of their own citizens, and the cooperative objectives of their intermunicipality as supported by legislation, where community interests would take precedence over the individual interests of member municipalities[14].

As we embark upon this new phase in the development of intermunicipality in France, a choice must be made: are we moving towards a type of intermunicipality whose sole objective is to optimise local public spending, or are we trying to create a genuine level of territorial governance that is capable of responding to the territories' heterogeneity? In particular, the prefects' interventions regarding the delimitations of intermunicipal perimeters, as well as on the definition of which competences should be transferred to the intermunicipal level, are a natural experiment that may provide the first part of the answer. □

*14. Indeed, Epstein (2009, p.7) observed that "many [*communautés*] were formed over small areas, amalgamating socially homogenous communities, whereas the legislation was intended to consolidate heterogeneous municipalities."*

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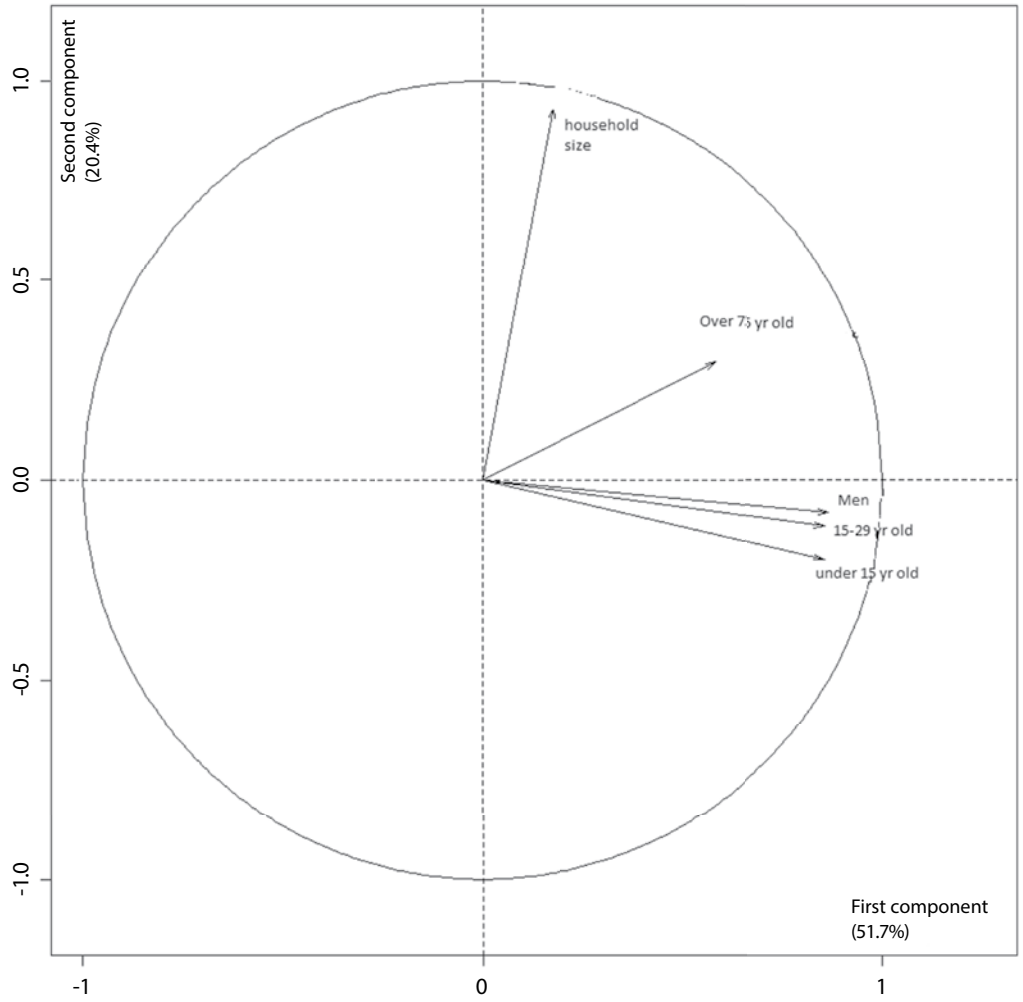
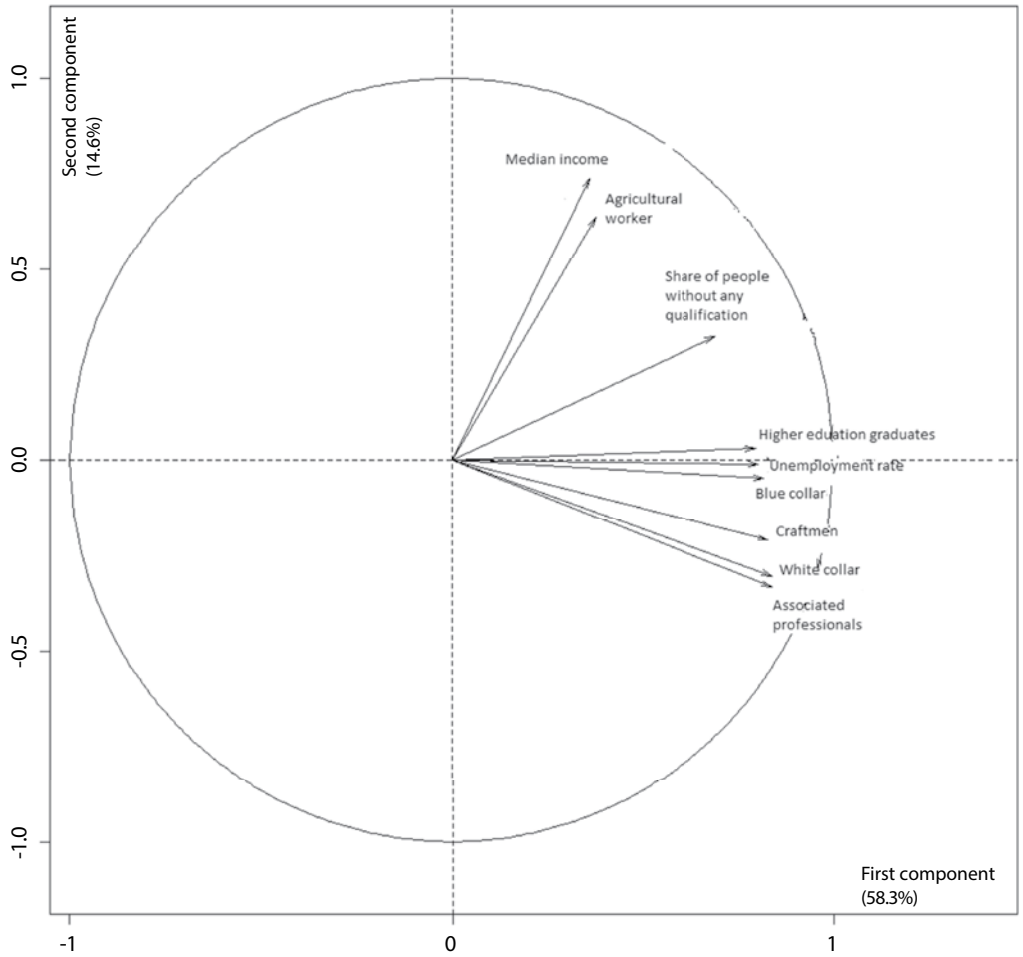
Figure AI
Circle of correlations of Gini indices relating to demographic variables – Principal Component Analysis



Reading note: Being associated with a point of contact (0.80; -0.10) in the first factorial plan, the Gini index relating to the portion of the intermunicipality's population who are men has a correlation of 0.80 with the first main component and a correlation of -0.10 with the second main component.
Scope: 2543 EPCIs with own taxation powers (as of 1 January 2012) in Metropolitan France (Corsica excepted).
Source: Insee, *Census* 2012; authors' caluculations.

Figure AII
Circle of correlations of Gini indices relating to employment variables – Principal Component Analysis



Lecture: Being associated with a point of contact (0.74; -0.08) in the first factorial plan, the Gini index relating to the share of blue collars in the intermunicipality has a correlation of 0.74 with the first main component and a correlation of -0.08 with the second main component.
Scope: 2,543 EPCIs with own taxation powers (as of 1 January 2012) in Metropolitan France (Corsica excepted).
Sources: Insee, *Census* 2012; Insee-DGFIP-Cnaf-Cnav-CCMSA, fichier localisé social et fiscal (*Filosofi*) 2012; authors' calculations.

Table A1
Probit* estimates in the area of competences *Housing

	A1.1.	A1.2.	A1.3.
	Local housing programme	OPAH[a]	Social housing policy
$CP1_X^{emp}$	0.007 (0.005)	0.002 (0.004)	-0.010* (0.006)
$CP2_X^{emp}$	-0.020* (0.012)	-0.002 (0.006)	-0.004 (0.010)
$CP1_X^{demo}$	-0.004 (0.008)	0.008 (0.006)	-0.012** (0.006)
$CP2_X^{demo}$	0.004 (0.007)	-0.012 (0.010)	0.007 (0.009)
$log(n_X)$	0.141*** (0.009)	0.061 (0.039)	0.043 (0.032)
$log(\bar{n}_X)$	-0.012 (0.018)	-0.039 (0.039)	0.052 (0.032)
$IHH_X^{pot\_fi\_hab}$	-0.039 (0.060)	-0.288 (0.270)	-0.495** (0.198)
Unemployement_rate$_x$	0.003 (0.003)	-0.003 (0.005)	-0.007* (0.004)
Median_income$_x$	-0.00001 (0.00001)	-0.00000 (0.00001)	-0.00001* (0.00001)
Pct_b15	0.012* (0.006)	0.023*** (0.006)	0.014** (0.006)
Pct_o75	0.006 (0.007)	0.023*** (0.007)	0.020*** (0.006)
Surface_area$_x$	-0.00000 (0.00000)	0.00000 (0.00000)	0.00000 (0.00000)
CU_CA$_x$	0.151*** (0.046)	-0.048 (0.049)	0.322*** (0.045)
Small_average_area$_x$	0.036 (0.029)	0.116*** (0.032)	0.085*** (0.028)
Rural_isolated$_x$	0.040 (0.028)	0.047 (0.029)	0.044* (0.026)
Constant	-1.037*** (0.248)	-0.468 (0.330)	-0.719*** (0.266)
ρ	0.269*** (0.026)	0.217*** (0.028)	0.328*** (0.025)
Observations	2,543	2,543	2,543
Log likelihood	-1,521.069	-1,687.143	-1,459.489

a: Planned housing improvement operation.
Note: * p<0.1; * p<0.05; ** p<0.01; standard deviations in brackets.
Reading note: $CP1_X^{emp}$ does not significantly affect the probability of *local habitat programme* and *OPAH* competences being transferred (critical probability greater than 10%), but does negatively affect the probability of *social housing policy* competence being transferred.
Scope: 2,543 EPCIs with own fiscal powers (as of 1 January 2012) in Metropolitan France (Corsica excepted).
Sources: Insee, *Census* 2012, Insee-DGFIP-Cnaf-Cnav-CCMSA, fichier localisé social et fiscal *(Filosofi)* 2012; DGCL, *Banatic* 2012; Insee-Datar, *ZAU* 2010; authors' calculations.

Table A2
Spatial *Probit* estimates in the area of competences *Urban planning*

	A2.1.	A2.2.	A2.3.	A2.4.
	Land-banking	SCOT[a]	Sector schemes	Creation of ZAC[b]
$CP1_X^{emp}$	-0.008 (0.006)	-0.016*** (0.004)	-0.020*** (0.008)	-0.012* (0.006)
$CP2_X^{emp}$	0.0003 (0.001)	-0.010 (0.009)	-0.004 (0.014)	-0.013 (0.011)
$CP1_X^{demo}$	-0.005 (0.006)	-0.004 (0.005)	0.001 (0.005)	-0.001 (0.080)
$CP2_X^{demo}$	0.003 (0.004)	0.010 (0.008)	0.003 (0.003)	0.017 (0.011)
$log(n_X)$	0.049 (0.031)	0.137* (0.068)	0.050* (0.026)	0.155*** (0.024)
$log(\bar{n}_X)$	-0.031** (0.012)	-0.045** (0.020)	0.027 (0.031)	-0.024 (0.030)
$IHH_X^{pot\_fi\_hab}$	-0.251 (0.198)	-0.070 (0.128)	-0.311 (0.219)	-0.190 (0.157)
$Unemployement\_rate_x$	0.001 (0.001)	-0.014*** (0.003)	-0.004 (0.004)	-0.003 (0.004)
$Median\_income_x$	0.00002*** (0.00000)	-0.00002 (0.00002)	-0.00001** (0.00000)	0.00000 (0.00000)
Pct_b15	0.002 (0.001)	0.00001 (0.001)	0.004 (0.007)	0.005 (0.006)
Pct_o75	0.013*** (0.004)	-0.010*** (0.003)	0.008* (0.005)	0.010 (0.007)
$Surface\_area_x$	-0.00000 (0.00000)	-0.00000*** (0.00000)	0.00000 (0.00000)	-0.00000 (0.00000)
CU_CA_x	0.318*** (0.046)	-0.042 (0.030)	0.184*** (0.045)	0.108** (0.046)
$Small\_average\_area_x$	0.061** (0.029)	-0.044* (0.025)	-0.011 (0.039)	0.050* (0.029)
$Rural\_isolated_x$	0.035 (0.027)	-0.087*** (0.023)	-0.027*** (0.006)	0.023 (0.029)
Constant	-0.453** (0.179)	0.100*** (0.000)	-0.305 (0.302)	-1.051*** (0.273)
ρ	0.323*** (0.026)	0.419*** (0.023)	0.383*** (0.025)	0.319*** (0.025)
Observations	2,543	2,543	2,543	2,543
Log likelihood	-1,599.803	-1,232.085	-1,502.375	-1,529.299

a: Territorial consistency schemes; b: Joint development zones.
Note: * p<0.1; * p<0.05; ** p<0.01; standard deviations between brackets.
Reading note: $CP1_X^{emp}$ does not significantly affect the probability of *land-banking* competence being transferred, but does negatively affect the probability of *SCOT, sector scheme* (significant at the 1% threshold) and SAP (significant at the 10% threshold) competences being transferred.
Scope: 2,543 EPCIs with own fiscal powers (as of 1 January 2012) in Metropolitan France (Corsica excepted).
Sources: Insee, *Census* 2012, Insee-DGFIP-Cnaf-Cnav-CCMSA, fichier localisé social et fiscal *(Filosofi)* 2012; DGCL, *Banatic* 2012; Insee-Datar, *ZAU* 2010; authors' calculations.

Tableau A3
Spatial *probit* estimates in the area of competences *Spatial planning*

	A3.1.	A3.2.	A3.3.
	Sports activities	Creation/maintenance of (socio-) cultural facilities	Creation/maintenance of sports facilities
$CP1_X^{emp}$	-0.014** (0.007)	0.001 (0.003)	-0.002 (0.008)
$CP2_X^{emp}$	-0.001 (0.005)	-0.008 (0.010)	-0.001 (0.005)
$CP1_X^{demo}$	0.001 (0.007)	-0.001 (0.001)	-0.007 (0.006)
$CP2_X^{demo}$	0.009 (0.021)	-0.005 (0.007)	0.005 (0.008)
$log(n_X)$	0.042 (0.048)	0.032 (0.022)	0.112*** (0.020)
$log(\bar{n}_X)$	-0.033 (0.038)	-0.018 (0.022)	-0.063*** (0.014)
$IHH_X^{pot\_fi\_hab}$	-0.241 (0.211)	-0.158 (0.136)	-0.058 (0.289)
Unemployement_rate$_x$	-0.009* (0.005)	0.007* (0.004)	0.001 (0.007)
Median_income$_x$	-0.00001 (0.00001)	0.00001 (0.00000)	0.00000 (0.00000)
Pct_b15	0.009** (0.004)	0.002 (0.002)	0.00004 (0.001)
Pct_o75	0.001 (0.002)	0.004 (0.004)	0.0003 (0.0002)
Surface_area$_x$	-0.00000 (0.00000)	-0.00000 (0.00000)	-0.00000** (0.00000)
CU_CA$_x$	-0.019 (0.077)	0.133*** (0.043)	0.024 (0.026)
Small_average_area$_x$	0.026 (0.034)	0.016 (0.024)	0.041 (0.028)
Rural_isolated$_x$	0.039 (0.047)	-0.008 (0.014)	0.043* (0.025)
Constant	0.251 (0.360)	-0.239* (0.127)	-0.409*** (0.103)
ρ	0.269*** (0.027)	0.334*** (0.026)	0.367*** (0.026)
Observations	2,543	2,543	2,543
Log likelihood	-1,681.399	-1,445.584	-1,491.182

Note: * p<0.1; * p<0.05; ** p<0.01; standard deviations in brackets.
Reading note: $CP1_X^{emp}$ negatively impacts the probability of *sports activities* competence being transferred (significant at the 5% threshold), but does not significantly affect the probability of *land-banking,creation/ maintenance of (socio-)cultural facilities* and *creation/maintenance of sports facilities* competences being transferred.
Scope: 2,543 EPCIs with own fiscal powers (as of 1 January 2012) in Metropolitan France (Corsica excepted).
Sources: Insee, *Census* 2012, Insee-DGFIP-Cnaf-Cnav-CCMSA, fichier localisé social et fiscal *(Filosofi)* 2012; DGCL, *Banatic* 2012; Insee-Datar, *ZAU* 2010; authors' calculations.

Comment
The difficult equation of territorial reforms: from big is beautiful to the impossible simplification of the institutional layer-cake

Comment on articles *"Disparities and territorial discontinuities in France with its new regions: A multiscalar and multidimensional interpretation"* by Kim Antunez, Brigitte Baccaïni, Marianne Guéris, Ronan Ysebaert and *"Does the decentralisation theorem apply to the French local governments? An empirical test on intermunicipal competences"* by Quentin Frère and Lionel Védrine

André Torre*

Abstract – Do territorial reforms have a meaning, an economic and spatial rationale or are they the result of a legislative whim? In this comment on the articles by Frère and Védrine, and Antunez *et al.,* we will go back over the slow process of France's territorial organisation and the attempts at simplification introduced by the recent reforms, as well as the issues they raise, in particular in terms of transfer of powers between local authorities and disparities in the new organisation of the regions in mainland France. We emphasise that the territorial layer-cake was shaped patiently over the centuries, to the point of becoming very heavy indeed, and that the NOTRe and MAPTAM laws, enacted to modify the institutional architecture of the French territories by giving priority to large structures, raise questions regarding the transfer of powers and resources, as well as on spatial inequalities, yet without providing definitive solutions toward the aim of administrative simplification.

Keywords*:* decentralisation, territorial reforms, transfer of skills, spatial inequalities

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Reshaping, carving and redefining the map of the territories is a very French game, which ignites political minds and mobilises local players, in a never-ending endeavour to delineate the strata that form the territorial layer-cake, from basic surface simplifications to the development of new spaces for growth. Yet this national passion for land planning (Béhar *et al.*, 2009; Esteath, 2015) is not futile. It reflects the tension, which constantly springs anew, between different conceptions of France's geographical and institutional structure, torn between Jacobine temptations and decentralising advances, between efforts to concentrate developing zones and preserve natural spaces, between conurbations of globalised activity and the desire to keep local communities strongly-rooted.

In this comment on the articles by Quentin Frère and Lionel Védrine, and by Kim Antunez, Brigitte Baccaïni, Marianne Guérois and Ronan Ysebaert (this issue) we go back over the slow preparation of France's territorial architecture and the attempts at simplification introduced by the recent reforms, as well as on the issues they raise, particularly as regards the transfer of powers between local authorities and territorial disparities in the new organisation of mainland France's regions.

The slow preparation of the territorial layer-cake

The history of the tensions between the absolute power of the State and the local level advocating for more freedoms is as old as France and the patiently carried-out annexation of its provinces. It was with the French Revolution, however, and the fall of the *Ancien Régime* that the administrative structures still familiar to us today first took shape. 36,000 municipalities, designed as the local administrative level at the citizens' doorsteps, became the successors to the pre-1789 parishes. The same year, the *départements* were formed, each headed by a prefect representing the State, while the provinces faded away. From this point on, the country would be organised in a uniform manner, with four administrative layers: the *department*, the *arrondissement*, the canton and the municipality. Far from being decentralising, this unification of territorial organisation, desired by the Jacobins, made France a "one and indivisible" Republic, centred around Paris. The Consulate, and thereafter the Empire, would only complete the centralisation of power and the search for a unitary State.

It would not be until 1861 that the first "Decentralisation" Act, in reality a De-concentration Act, would emerge. The State transferred powers to the prefects, while the prerogatives of the municipalities and *départements* were gradually extended. Despite the enactment of the 1884 law instituting the election of the mayor by the city council, prefectural guardianship remained omnipresent at all administrative levels. Given the large number of municipalities, the 3rd Republic instituted, in 1890, an additional layer, with the inter-municipal syndicates. And it was only in 1955-56 that 21 "programme regions" were created, not yet considered as local authorities but supposed to provide responses, in terms of regional action and economic development, to critics describing the unequal distribution of wealth – this was described as "Paris and the French desert" (Gravier, 1947).

General de Gaulle would launch multiple attempts at regionalisation. From as early as January 1946, French economic planning came into being, with the creation of the *Commissariat du Plan*, the "burning obligation" born of the realisation that municipalities and *départements* as administrative bodies are unsuited to socio-economic issues. In March 1964, he proposed the creation of regions based on the pre-revolutionary provinces: under the supervision of a prefect, they would be the armed wing of the central government in implementing its economic planning and regional development policy. Five years later, the French would reject, by referendum, the constitutional reform instituting the regions as territorial communities, and thereby set the process for his departure in motion. The following presidencies would continue that "quiet revolution", in the words of President Giscard d'Estaing, who called for a basic law to determine the real powers of the State, *départements* and municipalities, while President Pompidou's mandate gave the regions status as public institutions and their own budget.

François Mitterrand's rise to power would break with 200 years of centralism, with "Decentralisation: Act I". The 2 March 1982 Law instituted the region as new local authority, while the President of the General Council replaced the prefect as the head of the *département*'s executive. With the various councils of the municipal, *départements* and regional bodies then elected by the people, the Regional Audit Chamber was created, in charge of auditing local finance. In 1988, two new layers were

added: the districts and the urban communities. Ten years later, the Chevènement Act of 12 July 1999 promoted the strengthening of the inter-municipality, but it would take until 2004 for the regions to be recognised in the Constitution.

The legislative package spearheaded by President Chirac was "Decentralisation: Act II", with a significant transfer of powers to the local authorities. The region is conceived of as the active driver in economic development, while the social side is left more to the *département*. It is also during this period that the reference to participatory democracy emerged explicitly: regions, *départements* and municipalities would now be able to consult their constituents by referendum. Lastly, local authorities were granted their own resources with financial autonomy and the possibility to setting and levy local taxes. In the 2000s, with the 2010 Finance Act, President Sarkozy removed the business tax, which was accused of weighing down companies' budget, and force them into offshoring. A territorial economic contribution and a fixed tax were instituted to replace it. That same year, the bill to reform the local authorities was adopted: it is simplifying, strengthening and strongly encouraging inter-municipality. The opportunity was also taken to add a new segment to the territorial layer-cake, with the creation of metropoles.

Territorial reforms: the NOTRe and MAPTAM laws

The election of François Hollande marked a new stage in the territorial development process. The President wished to run "Decentralisation: Act III". On 3 June 2014, he announced the launch of a reform aimed at modifying the Republic's territorial architecture and attaining its ambition to simplify and clarify the territorial organisation of France, so that everyone would know who decides, who finances and using what resources. The debate quickly turned into a conflict around two points: the borders of the future regions (and their Capitals) and the maintenance or removal of the *départements*. It revealed deep divisions about the objectives and means of possible reform, as well as the very design of the decentralized structure of the Republic. The differences were particularly stark as regards the levels to be eliminated, the initial idea of abolishing the *départements* having slowly died out, due to the mobilisation of local elected officials, but also the difficulty inherent in distributing their many powers and related financing to other parts of the institutional system.

The other question pertained to the boundaries of the new regions, as well as the merger of some of them, with identical scopes as no internal reconfiguration was allowed. The initial map was replaced, as discussions went along, with varying configurations and architectures, which more often than not gave primacy to local alliances rather than to rationalisation imperatives or economies of scale. The solution ultimately selected, consisting of 13 mainland regions, concentrated the alliances in the South-West, North and East of France. On 1 January 2015, the law aimed at modernising territorial public action and the affirmation of the metropoles, known as the "MAPAM Law" or "MAPTAM", created a new status for 11 metropoles[1] (conurbations of more than 400,000 inhabitants) with powers in economic development, innovation, the energy transition and city policy. Lastly, on 16 July, the law on the new territorial organisation of the Republic (or NOTRe Act) was definitively adopted, and published in the Official Gazette of 8 August 2015.

How many layers are there currently in the territorial layer cake? In addition to the three main levels of local authorities - the municipality, the *département* and the region - there are a multitude of other layers: metropoles, cantons, lands, communities of municipalities, urban communities, conurbation communities, conurbation syndicates, etc. These administrative levels, public institutions and intermunicipal groups are the heirs to the history of the French State's construction. There is creation, recombination, but rarely any removal.

Like many commentators, we can question the merits of these successive reforms and their advantages for people and economic activity, on the need to continuously add layers, or, conversely, group together entities that had proven themselves in the past (Torre & Bourdin, 2015). In recent years, the mantra *Big is beautiful* prevailed, whether with regard to large regions, metropoles or large inter-municipalities. The articles by Frère and Védrine, and Antunez *et al.* examine alliances and groupings between EPCIs (Public Intermunicipal Cooperation Institutions), and in particular municipalities and regions, which have reshaped the map of territorial France and led to numerous questions about their legitimacy and efficiency, as well as about the consistency of the new units formed.

1. In addition to the Nice Côte d'Azur metropolis, already created on the basis of the 2010 Law, as well as the special-status metropoles, Grand Paris and Lyon. As at 1st January 2018, there were 21 metropoles.

The reform of the regions in question: useful or high-risk?

The article by Kim Antunez, Brigitte Baccaïni, Marianne Guérois and Ronan Ysebaert discusses the merging of the regions, resulting from the NOTRe Act, and raises questions about the legitimacy and homogeneity of those groupings. The new regions are often criticised as being rather heterogeneous and not being based on a strong internal logic, or even bringing together extremely different entities, and doing nothing more than setting institutions side by side. The transition to 13 mainland regions may sometimes appear a whim of the legislator or a step toward longer-term merging within mega-entities, without any real grounds, except the attempt to achieve larger size. Why such groupings? And what underlying logic? The authors respond in different ways, seeking to measure the heterogeneity of the new regions and territories that form them, based on data on the level of employment (rate and development), standard of living (per capita income) and demographics (youth and population density) in 2014.

The first question pertains to territorial disparities within the 13 new mainland regions, examined based on principal component factorial analysis to show the similarities and differences between the 22 initial regions. The contrasting results reveal significant disparities along two main lines of differentiation. The first contrasts the regions where the situation on the labour market is favourable (high rate of employment and levels of standard of living) with those where it is less so. The second contrasts densely populated and young areas with the more rural and ageing regions. A number of similarities can be seen between the merged regions as in the case of Nouvelle-Aquitaine (between Poitou-Charentes and Limousin in particular), but also numerous dissimilarities. This is the case with the very particular situation of Hauts-de-France, due to the unusual position of Nord-Pas-de-Calais, which is characterised by a very significant demographic dynamic compared with its low employment rate. A similar observation can be made for the new AURA region (Auvergne-Rhône-Alpes), where Auvergne appears quite aged and sparsely populated compared to Rhône-Alpes. Lastly, given the extremely advantageous position of Alsace, its reluctance to tie its fate, within the Grand Est region, with Lorraine and Champagne-Ardenne is understandable, given their far less favourable profiles (Beyer, 2017).

A second approach consists of studying possible disparities within the regions themselves, based on an analysis of the employment zones using three composite indicators relating to the labour market, shifting patterns in employment and demography. With the exception of Île-de-France and Corsica, which show a certain homogeneity, the other regions are characterised by a highly-contrasting panorama, with the coexistence of different types of job areas, from the most favourable (mainly in the Paris region, Rhône-Alpes or in the West), to those facing the most struggles, and which form the "diagonal of emptiness" (Oliveau & Doignon, 2016). This result shows that disparities persist even within metropolitan regions; moreover, the authors show that the main heterogeneities are at the heart of the latter, and not at their borders, further accentuating the idea that it is the differences between the various types of zones (urban, outer-suburban, rural, etc.) that matter above all, casting doubt on the value of the recent regional mergers in terms of territorial cohesion.

Besides these important elements, the reform of the regions also raises other questions. One may wonder, for instance, about the reconfigurations' possible negative impact on territorial equity, with greater concentration of activities in the most productive zones, but also a reduction in the quality, or even outright lack of local services with a view to reducing costs. Concerns might also be raised for inhabitants living in territories remote from major cities, in a context of reduced public resources, rationalisation of equipment and elimination of local services (high schools, hospitals, jobs, etc.) or railway lines. Some new regions are true giants, the expanse of which may cause some of the populations to be significantly removed from the decision-making centres. Many local officials or decision-makers are located far from their regional Capital, hence difficulty being heard and relaying peoples' voices and interests. The latter, meanwhile, can experience the authorities' remoteness as further withdrawal of the State from the peripheral or rural territories.

There is also concern due to the uncertainties on the links between local authorities, and especially the regions/metropoles tandem. Above and beyond collaborations between levels, it is primarily the ability to generate positive peer pressure or development effects and set shared dynamics in motion. Abolishing the universal powers clause is a step toward rationalising public action and clarifying powers; it helps

identify the devolutions, slows down the fragmentation of expenditure and limits the desire for unbridled intervention. The risk of a lack of specialisation is actually significant. While the European strategy for smart, sustainable and inclusive growth, "EU 2020", puts the focus on the choice, by each region, of a limited number of activities or technologies within a value chain, and therefore a differentiation in functions and output (Foray, 2014), the opposite effect is to be feared here. Organised around their metropoles, macro-regions can be tempted to behave like small States, reproducing all the internal powers and specialisations, without making real development choices.

Moreover, the French regions continue to receive very little financial endowment, the transfer of powers having been completed without the related transfer of resources. Compared to their European neighbours, their budget is very low: whereas, on average, the expenditure of European regions amounts to EUR 4,000 per inhabitant per year, that of the French regions is ten times lower. Lastly, the reform raises different questions about the role and place of the State. What is the future of regional civil servants and decentralised agencies? What is the foreseeable economic and social impact of site shutdowns, staffing reductions or staffing transfers on development or land dynamics, for example? Not to mention the related costs of reform, estimated at around EUR 1 million, for relocating the services, integrating them and aligning pay grids for civil servants, while the savings to be expected would be low according to a Standard & Poor's report (2015).

The intermunicipality: a response to the impossibility of merging municipalities

The article by Quentin Frère and Lionel Védrine is about the – somewhat unexpected – success of the 1999 Chevènement Acts. After previous failed attempts to reduce the number of municipalities (in contrast to the United Kingdom and Germany or Scandinavian and Central European countries), the intermunicipality has stirred deeply-rooted support in France as a credible alternative to merging, and one acceptable to the local populations. Accused of being the most profligate territorial level, the municipality, the lowest common denominator of the territorial organisation, tends to be increasingly questioned in territorial reforms. Today, each municipality is covered by an EPCI (community of municipalities, conurbation or urban areas, metropolitan areas and agglomeration trades), and variable rules, particularly in terms of powers transfer. However, these groupings raise numerous questions, particularly in terms of efficiency of sharing, modalities of contribution to operations delegated to the EPCI, equity between the inhabitants of the different municipalities, or social justice for the populations involved.

The authors focus on the municipalities' decision as to whether a given power should be transferred to an EPCI. This is a matter of importance because the menu of powers to be transferred is not clearly established by the legislator and the municipalities are therefore required to make choices in this regard. There can be questions in particular about their cooperative behaviour: should they transfer competences and if so, which ones? Under what circumstances should they do so? Does the size of the municipality and its specific characteristics – particularly the greater homogeneity or heterogeneity of the populations – play a part in this regard, and should they encourage different choices based on internal characteristics?

Economic theory provides responses in terms of economies of scale or ranges. For the purely territorial dimension, the Oates Theorem (1972), which inspires the article, states that the decision of the municipalities to transfer powers is the result of arbitration between the cost of citizen preferences' spatial heterogeneity and the benefits of economies of scale. In other words, considerable heterogeneity between municipality populations (and thus between the preferences of players) will plead in favour of a transfer of powers to the inter-municipality, the latter however enabling the construction of non-rival public goods such as pools or schools, which are too costly for small municipalities. The analysis is carried out on 2012 data, before the NOTRe Act, which makes certain transfers mandatory, as the heterogeneity of preferences is based on the principal component analysis of a heterogeneity indicator based on 15 socio-demographic variables. It must make it possible to assess the mechanisms that drive municipalities to transfer powers.

The results of the econometric study, based on the powers least frequently transferred, are clear and largely verify the Oates Theorem. First of all, the search for economies of scale spurs municipalities to cooperate and therefore

to transfer powers, probably in order to be able to finance infrastructure or joint local-level programmes. Secondly, the significant heterogeneity of the population puts a brake on the transfer of powers and the creation of intermunicipalities, thus confirming Tiebout' s (1956) arguments on citizens "voting with their feet".

Far from being a French exception, municipal fragmentation can also be found in other countries, although rarely to the same extent. Throughout Europe, the economic crisis has fostered grouping aimed at reducing the cost of everyday operations, globalisation and increased competition between local authorities, hence better pooling of resources. It raises questions about local finances, such as the collection of funds, an issue at the fore when the aim is to lower funding from the various local authorities, and equalisation thereof in terms of financial federalism (Wildasin, 2004). Still other questions can be raised about land, with the abolition of the housing tax and the search for alternative ways of collecting funds by municipalities, such as fines on public roads, for example, and questions about land occupancy and management modes, with the intermunicipal PLUs (Local Urbanism Plans) coming into widespread use.

Lastly, no discussion of inter-municipalities would be complete without mention of the heightened role and powers of the metropoles (Brennetot & de Ruffray, 2015), which are now being given greater autonomy and extensive functions – in particular through the possibility of contracting with other EPCIs, or even adopting a driving role. This option could generate new dynamics, giving the urban populations, the largest in terms of volume, the power to take initiative. At the same time, it raises the issue of the isolation of remote rural or outer suburban spaces and the problem of a fictional urban France, at the risk of leaving many territories in dire circumstances.

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The territorial reform processes initiated in Europe (Italy, Portugal, Spain, Netherlands, etc.) share a common feature. Regions and metropoles are pushed into the limelight, while intermediate territorial levels such as *départements* appear to be challenged. Like other European countries, the French territorial reform follows this twofold trend of deepening the role of the regional level and large cities, with a transfer of competences to the regions and large-scale intermunicipalities. However, unlike France, most European countries have only one or two levels of local authorities. The allocation of powers and financial resources between these different entities is very heterogeneous and often depends on the level of regionalism or federalism of the State in question. As a result, the process of transferring powers proves less complex to implement than in France, although this still does nothing to erase inequalities. Lastly, in France as elsewhere, size is not the determining factor. It is economic dynamism, along with the powers and resources allocated to each local authority that play the predominant role in the development of the territories. □

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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. Depending on the situations, segregation is more marked in the centre-city (Aix-Marseille, Strasbourg, Nantes) or in the suburbs (Paris, Lyon, Lille). These differences often stem from local urban history and housing policies.

JEL Classification : A14, I32
Keywords: standard of living, inequalities, segregation, social diversity

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Since 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[1] 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,

1. 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[2], 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

2. 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 population 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 *département* 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[3]. 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

3. 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).

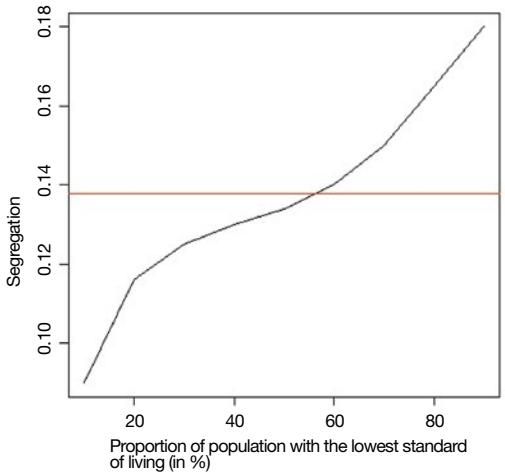
The principle of rank ordered index, detailed in Box 2, is based on a calculation of a series of Theil-Finizza indicators that offer the attractive property of being decomposable. The simplest expression of a Theil-Finizza indicator (using the case of two sub-populations) is as follows (Theil & Finizza,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

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

where $E(p) = -\left[p \log_2(p) + (1-p) \log_2(1-p) \right]$ 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[4]. 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[5] 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.

4. 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.

5. 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_1, …, r_k , …, r_K. For each of the items in this series, a series of proportions p_1,…, p_k,…, p_K is associated where p_k refers to the proportion of the territory's population whose income per unit of consumption is less than r_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$_k$, a Theil-Finizza type index is calculated, noted as H_k and based on entropy

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

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.

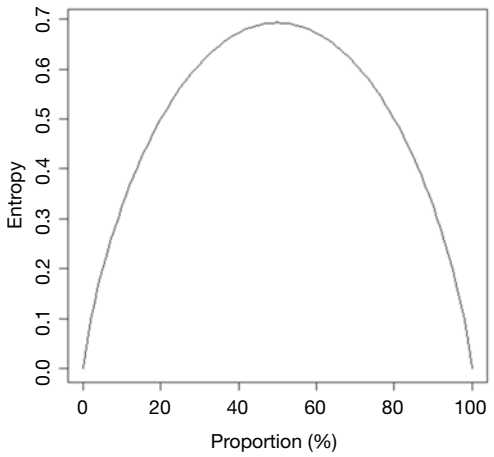
The series of indicators (H_1, …, H_k, …, H_K), which can be calculated for all income levels, makes it possible to build a segregation profile, showing whether the "segregation of the rich" or "segregation of the poor" predominates (figure I in the text).

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.

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:

$$H^R = 2ln(2)\int_0^1 E(p)H(p)dp$$

The local weighting in p is:

$$\frac{E(p)}{\int_0^1 E(q)dq}$$

which is approached by:

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

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

$$H^R = \frac{\sum_{g=1}^{G} T_g \left[\int_0^1 \frac{E(p) - E_g(p)}{\int_0^1 E(p)dp} dp + H_g^R \right]}{T}$$

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.

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 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,

Table 1
Composite indices of segregation in metropolitan urban areas and their territorial components

Urban area	Total	*including*			"Inter" component (%)
		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 suburbs					
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		

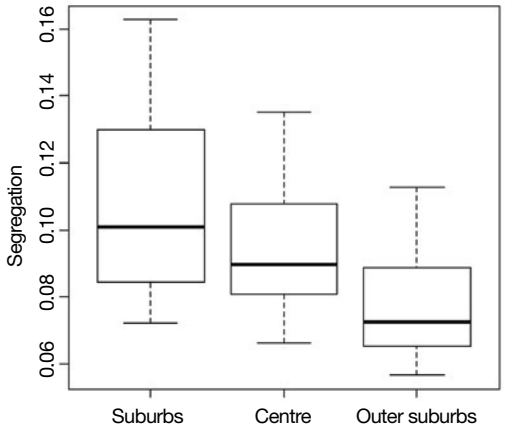
Reading note: in Montpellier, the segregation indices come out at 0.089, 0.073 and 0.056 in the centre-city, the suburbs and the outer suburbs, resulting in a value of 0.103 in the urban area. The "inter" component, which can be ascribed to the differences in segregation between centre-city, the suburbs 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.

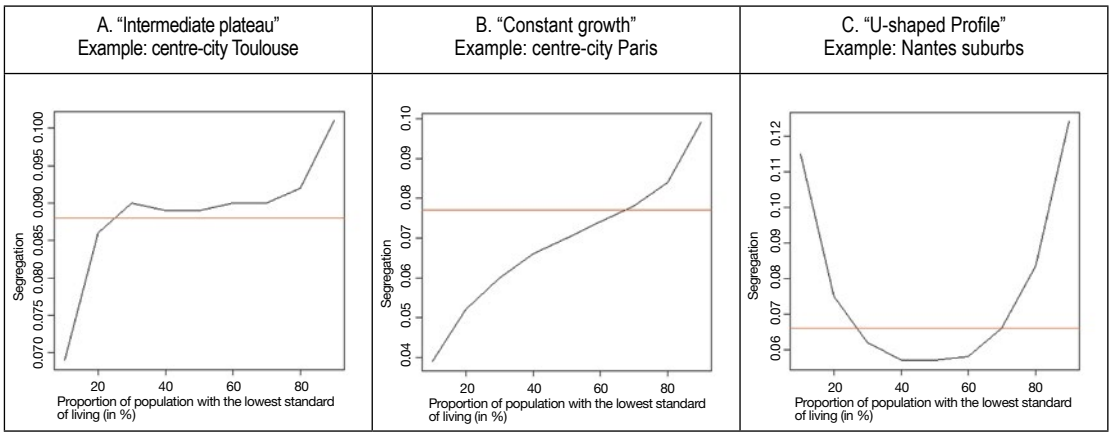
The high segregation figures shown for high-income populations are also seen in United States cities. In all the conurbations with more than 500,000 inhabitants, the Theil indicators amounted respectively to 0.158 for the segregation of the poor and 0.195 for the rich (Reardon & Bischoff, 2011a; 2011b).

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[6], 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.

Table 2
Level and nature of segregation in metropolitan urban areas

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

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.

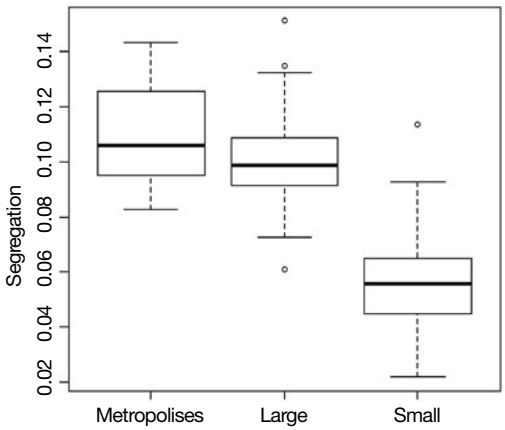
In contrast, there is a (slight but significant) relationship between the inequality in income distribution measured by the Gini index and the segregation indices. This is observed for any territorial subgrouping (Figure V). This relationship is more pronounced when Paris centre-city is removed, with 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

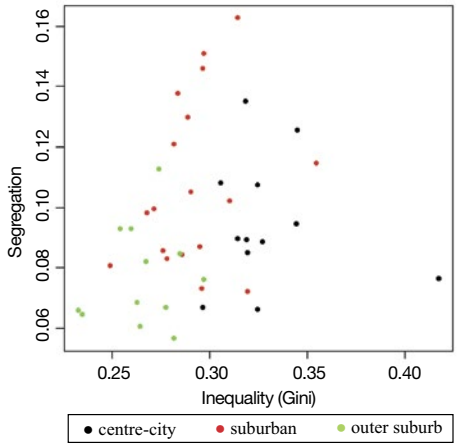
The segregation indicators are calculated based on a relatively fine-grained geographical matrix, but provide a metric relating to the entire urban area (or its components, centre-city, suburb and outer suburb). They indicate the extent of spatial segregation, enable comparisons between urban areas, 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).

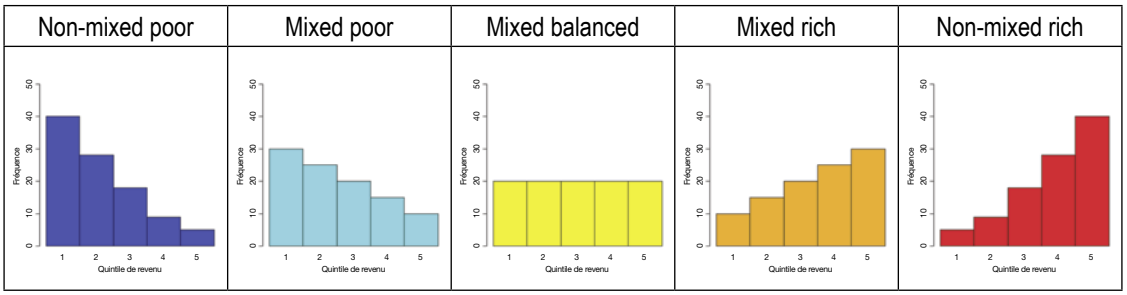
Five standard profiles have been selected for the analysis (Figure VI). Three of them are described as mixed, insofar as their profile differs little or moderately from the national distribution in quintiles. The first (in yellow on the maps) is close to a balanced distribution, with the numbers being 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).

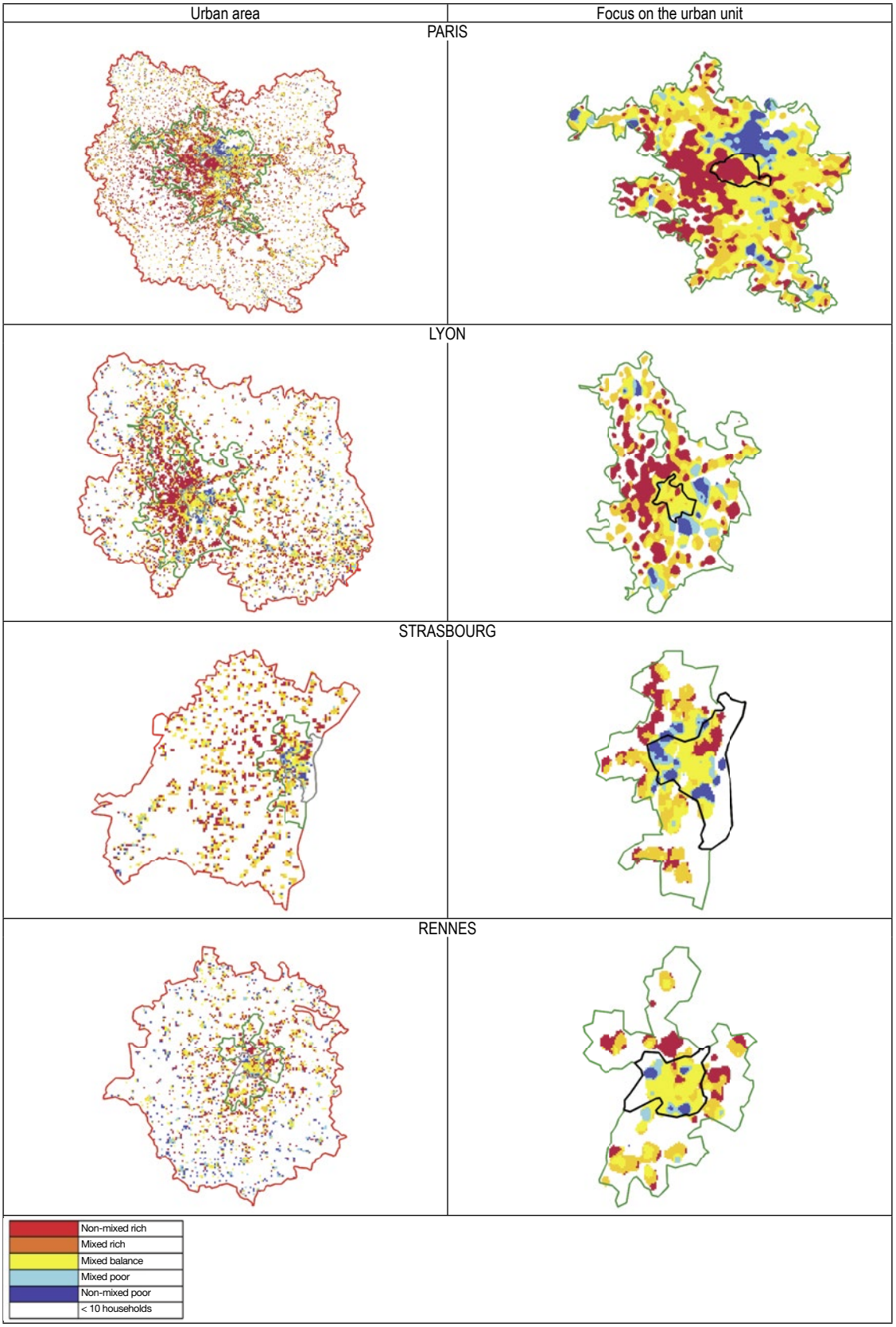
At first sight, some cartographic results may seem surprising when compared to the segregation indices. In the centre-city of Paris, while the segregation index is low, the mapping shows a very high predominance of squares (neighbourhoods) referred to as non-mixed wealthy. This apparent paradox can be 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



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.

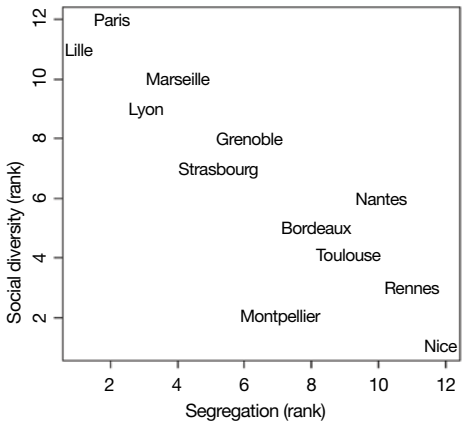
While public policies aim to foster social diversity, always invoked but often difficult to define (Epstein, 2013), statistical indicators such as concentration indicators or rank ordered segregation indices measure different types of segregation, de facto an absence or lack of socio-spatial diversity. 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

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

In %

Neighbourhoods	Non-mixed	Mixed				Non-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

Scope: the 11 provincial urban areas selected in mainland France.
Sources: Insee-DGFIP-Cnaf-Cnav-CCMSA, Localised Social and Fiscal Register (*Filosofi*) 2012; author's calculations.

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

Neighbourhoods	Non-mixed	Mixed				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

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[7], 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

7. 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), 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[8]. This is obviously a central question for public policies aimed at fostering social diversity. □

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.
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.

8. 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			Median 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).

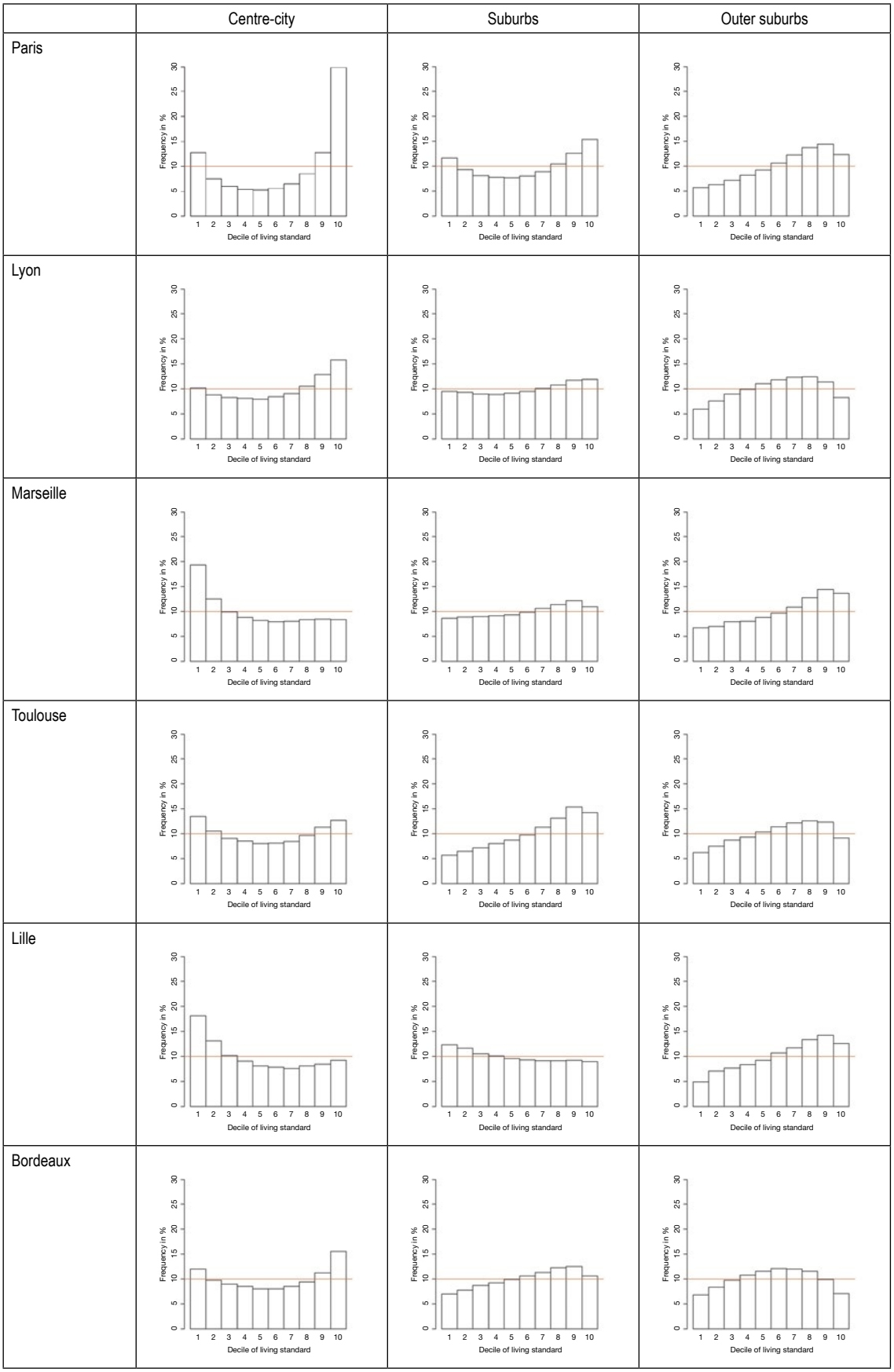
Outside Paris and Lyon, median standards of living are lower in the centre-city. However, depending on the case, the outer suburbs can be wealthier than the suburbs (Marseille, Lille, Strasbourg, Grenoble) or vice versa (Toulouse, Bordeaux, Nantes, Nice, Rennes, Montpellier). These differences in situation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

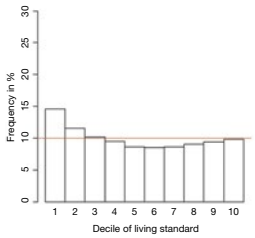
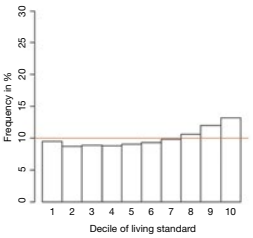
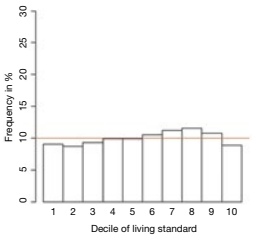
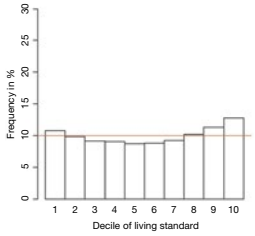
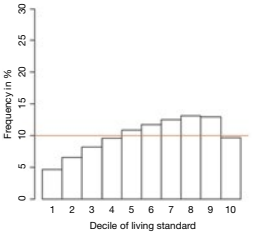
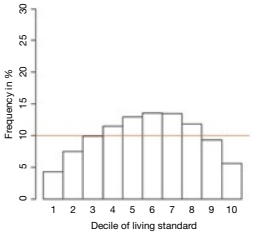
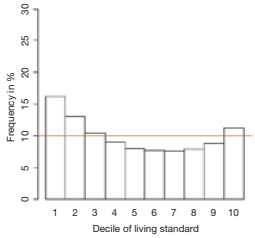
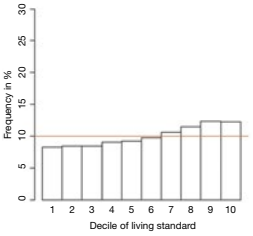
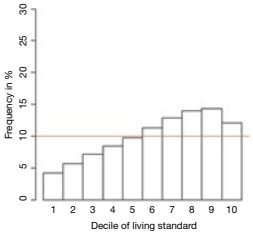
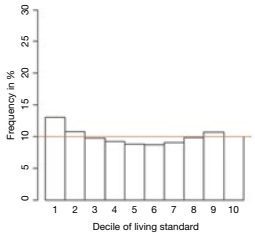
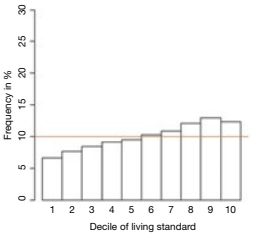
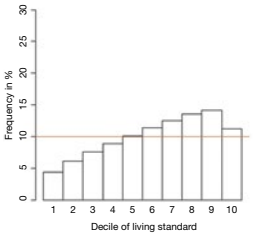
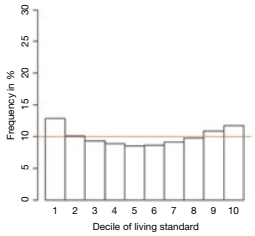
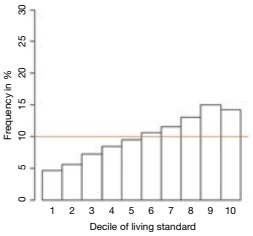
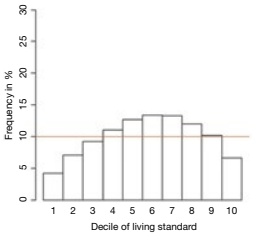
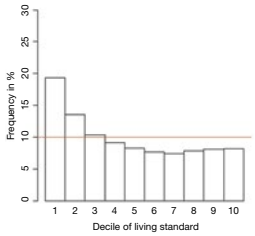
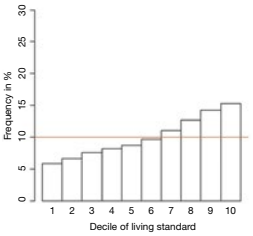
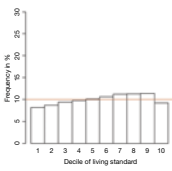
Median income tends to depart from the standard, the further away from the city centre one moves. The Rennes urban area shows a very steady trend in income: quite high incomes in the centre-city, a marked drop in the inner boundary of the centre-city where the majority of priority neighbourhoods are 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)

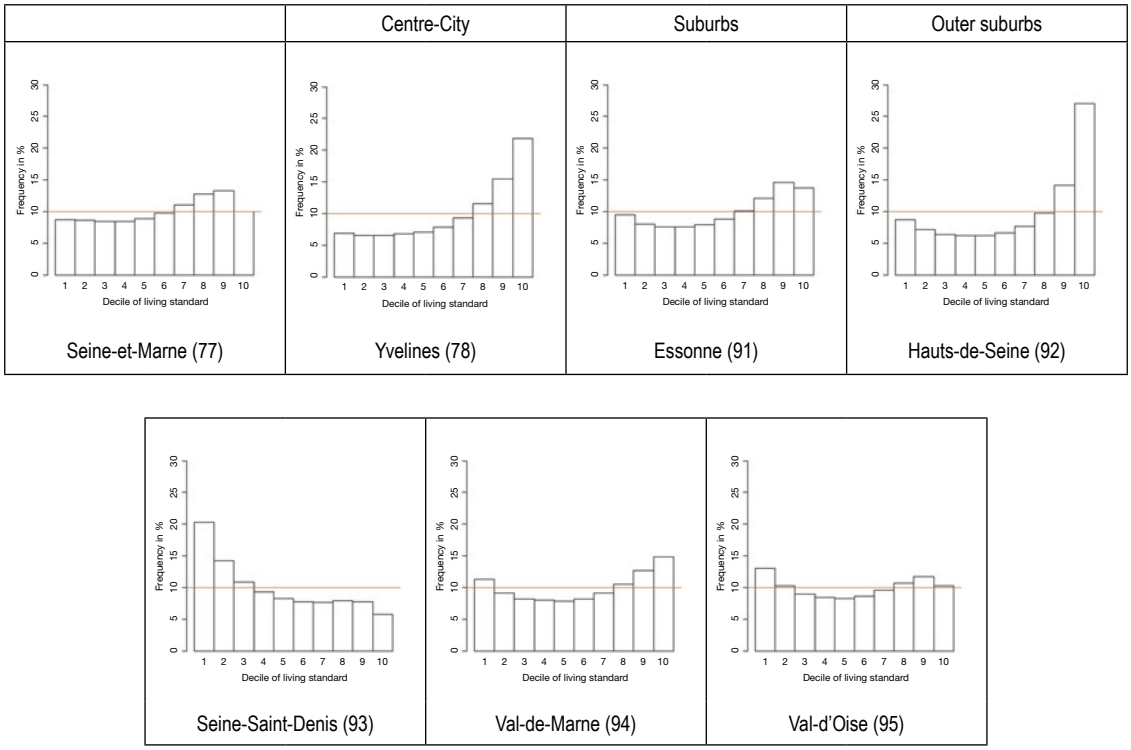
Figure A1-a
Standard of living profiles in metropolitan urban areas



	Centre-City	Suburbs	Outer suburbs
Nice			
Nantes			
Strasbourg			
Grenoble			
Rennes			
Montpellier			

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 1st 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.

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



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

APPENDIX 2

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 indicator 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
Spatial and low-income spatial concentration in metropolitan urban areas

	Centre-city		Suburbs		Outer suburbs	
	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	

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

Comment
Income segregation in cities: A reflection on the gap between concept and measurement

Comment on *"Standards of living and segregation in twelve French metropolises"* by Jean-Michel Floch

Ana I. Moreno-Monroy*

Abstract – In his study of twelve French metropolises, Jean-Michel Floch argues that the level of segregation, defined as the spatial separation of groups with different living standards within cities, is higher, in the city-centres as well as the suburbs than in the outer-suburbs. It is also more marked in the higher living standards. This commentary argues that income segregation in French cities is low for international standards. Based on issues around the measurement and comparability of income segregation indices, it elaborates on three issues. The first is that, contrary to popular belief, the segregation of poverty contributes little to overall city segregation, while the segregation of affluence as a large contributor remains under-debated. The second is that an empirical or normative benchmark for segregation is needed to frame the discussion around "too much" segregation. The third is that the actual degree of physical disconnection between income groups, and between income groups and city amenities and services, is not truly measured by current income segregation measures, limiting the usefulness of such measures for policy designs.

JEL Classification: A14, I32
Keywords: segregation, income inequality, city planning

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The article by Jean-Michel Floch compares segregation in standards of living levels of twelve French metropolises. Segregation is understood as the unequal distribution of households between different areas of cities. The article uses a combination of two methodologies. First, it analyses segregation profiles built on 500 square meter neighborhoods based on rank order measures by standard of living percentiles, as well as their correspondent city-level aggregates across living standards groups. These indicators allow for the comparison of segregation levels across cities and their city-centres, suburbs and outer-suburbs. Second, to obtain information on the contribution of neighborhoods to segregation levels, a typology of neighborhood profiles is constructed based on the classification of the distribution of living standards by national quintiles into histograms, which range from "poor non-mixed" to "rich non-mixed" neighborhoods.

Besides the wealth of information provided in the article about the segregation situation in different French metropolises, one fact not mentioned in the article stands out: segregation levels in France are low for international standards. A recent OECD study (Veneri *et al.*, forthcoming) also uses rank order segregation indices[1] with values between 0.02 and well below 0.1 for a group of cities in OECD countries including Ireland, New Zealand, Denmark, the Netherlands, Canada, Australia, Mexico and France; between 0.05 and 0.15 for cities in the US; and between 0.1 and above 0.24 for cities in South Africa and Brazil. In the OECD study, French cities show one of the lowest values of income segregation across countries and one of the lowest variations in inter-city values on the same indicator.

It is then worth asking the question: does France present a high level of segregation in comparison with OECD comparable countries? Which level of segregation is to be considered problematic from a policy perspective? The article by Floch offers a good opportunity to reflect more generally about the gaps between the concept and measurement of income segregation. In this commentary I will elaborate on three issues. The first is that average segregation levels are by no means indicative of the segregation of poverty. The second is that there is a need for a clear benchmark when analyzing segregation levels, which is currently lacking. The third is that although income segregation is fundamentally a spatial phenomenon, the tools used to analyse it do not have a truly spatial component, often hiding inequalities in access.

While income segregation and the segregation of poverty are wrongly assumed to be the same in the public debate, the segregation of affluence remains insufficiently debated

The article by Floch rightfully and clearly points out at the difference between income segregation and the segregation of poverty. Implicitly or explicitly, when talking about segregation in general public and policy circles alike, the concept tends to be directly and unequivocally associated of those at the bottom of the income distribution, when in reality income segregation measures are often averages constructed for the entire income distribution. In fact, in many cases segregation indices averaged over the entire income distribution are more a reflection of high segregation levels of high-income households. In this sense, the identification made by Floch of different profiles based on the shapes of plots of income percentiles versus income segregation values is a welcome addition to the analysis. These profiles are informative about segregation levels experienced by each income group, which can be highly different at the extremes of the distribution in comparison to the mean value. It is worth mentioning at this point that the lack of statistical information for households at the extremes of the distribution may affect the shape of this curve, particularly if there are groups with no registered income (e.g. homeless or other itinerant populations), or restrictions on information beyond a certain level of income.

On a more general note, studies usually list the consequences of segregation on the poor to justify the study of segregation, disregarding the possible consequences of the segregation of affluence, consequently excluding cross-group effects such as public service provision skewedness. Floch's finding that segregation is more pronounced for higher levels of affluence across the cities analysed is in line with recent evidence in studies using a similar index of segregation for developed countries such as Canada, United States and New Zealand (Veneri *et al.*, forthcoming), as well as for cities

1. Based on 1000 m scale (instead of 500 m scale) and calculated at the level of Functional Urban Areas, which comprise urban cores and surrounding commuting zones (OECD, 2013). It is worth noting that a larger radius on a neighborhood definition mechanically results in lower segregation indices (Reardon & O'Sullivan, 2004).

in developing countries, for instance in Hong Kong (Monkonnen & Zhang, 2014) and Brazil (Moreno-Monroy, forthcoming).

As rightfully pointed out by Floch, this is a finding that has yet to permeate the public debate that tends to equate income segregation with the segregation of poverty. The explanation for the segregation of affluence is not limited to group behaviour, and is also related to other reasons such as the existence of localized amenities (e.g. cultural amenities) (Brueckner *et al.*, 1999) or inequalities in service provision (e.g. quality of public transport, street cleaning, safety, etc.). There is a certain stigma associated with the debate on the segregation of affluence which is perhaps associated with the view that the wealthy segregate purely based on "homophily". Such arguments are difficult to substantiate empirically and leave little room for policy designs. A more promising approach to the study of the segregation of affluence is on understanding the existence and reach of club-type of effects, where high spatial concentrations of wealthy households can tip off the balance in the provision of public services against other income groups (Tiebout, 1956).

There is no benchmark for establishing how much segregation is "too much" segregation, especially in large cities in developed countries

As mentioned earlier, the existent empirical evidence supports the view that income segregation levels in French cities are low for international standards. Technically speaking, the rank order segregation indices, a measure of the family of information theory indices, vary between zero and one, with zero indicating no segregation. Unlike other indicators with less desirable properties, such as the dissimilarity index, it does not have a simple interpretation (Reardon & O'Sullivan, 2004). However, this does not mean that its interpretation is only limited to ranks, as distances between values within the range are telling about observed differences in levels. For instance, it is clear that Brasilia, a city with an indicator of 0.35 for a 500m neighborhood definition (Moreno-Monroy, forthcoming) is far more segregated than Montpellier, an urban area with an indicator of 0.103, and that it is more difficult to infer actual differences in segregation levels between Montpellier and Bordeaux, which has an indicator of 0.096. In other words, the fact that the empirical exercise is made for cities in one country does not rule out the comparison of the levels of the indicator and the absolute differences between the cities analysed, which may be hidden in an interpretation based on rankings.

In any case, some may argue that segregation levels in France are higher than what is currently socially desirable. How much segregation is "too much" segregation is certainly a normative question intrinsically linked with a similar question for inequality levels, being that residential segregation is the spatial expression of income and wealth inequality levels. Of course these questions have no direct answer. Nevertheless, any evidence on the effect of segregation of groups at the bottom and top of the income distribution can help discern when segregation can be doomed as problematic.

That being said, an alternative empirical approach to establish an empirical benchmark for segregation levels, which can be then used to discern statistically significant differences in segregation levels, has been proposed by Louf and Barthelemy (2016). They build a benchmark based on the theoretical case of an unsegregated city, which is one where all households are distributed at random over the urban space. Given the properties of the function adopted in the theoretical model, the over- or underrepresentation of a certain group in a neighborhood in a city is defined based on confidence values of the normal distribution. The measure of segregation proposed by Louf and Barthelemy is interpreted as (statistically) significant deviations from the unsegregated case. Whereas such a framework has not been adopted for studies using segregation measures of the rank order type, it allows for a reflection on the meaning of significant differences in segregation and the limitations in the interpretation of the magnitudes of information theory indices when values are relatively small and the variation across cases very narrow, as in the case of France.

An interesting insight that arises from the analysis of Louf and Barthelemy is that neighborhoods become more "coherent" as cities grow, which can partly explain why segregation increases with urban size. The argument is that as cities grow they become more complex, allowing for more sophisticated pockets (e.g. areas with a specialized building types that caters a particular groups) that in measurements translate into the concentration of more homogenous groups. Given this, the initial question of "how much segregation is too much segregation" extends then to "how much segregation

is tolerable for cities of different sizes". To correctly answer this question, one would ideally measure the level of segregation related to size (scale) and that related to other factors, especially those related to policies which constrain spatial sorting within large cities. This is of probably not feasible but it is useful as a reminder of the need for suitable benchmarks when evaluating segregation.

Regarding the question of urban size and segregation, Floch's article correctly considers the entire urban area, which includes the core and suburban areas. This is a welcome addition to the French evidence, in line with the recent work of Veneri *et al.* (forthcoming) on income segregation measures at the Functional Urban Area (FUA) (OECD, 2013) across cities in selected OECD countries. Along the lines of arguments of increased complexity in urban agglomerations and their relationship with segregation, urban systems are not limited to urban cores and the right unit of analysis should be therefore the FUA or a similar unit. As segregation is a process that applies to the entire urban system, while comparing differences in segregation levels between different components of urban areas is informative, it is clear that changes in residential sorting at any part of the city have consequences for the entire urban system, for which future analysis on the temporal change of segregation indices are more meaningful at the level of the urban area than at local area level.

Although segregation is often related to being far from "where things happen", segregation indicators do not measure the level of physical disconnection between income groups, or inequalities in provision between poor and affluent areas

In the public mind, segregation is often associated with poor households being "stuck" in low quality neighborhoods which besides being homogenous in terms of levels of income, are located far away from action centres or places "where things happen" – things being cultural entertainment, quality education, quality jobs, higher urban services, parks or other social and cultural amenities. However, segregation measures are silent about the actual physical distance between social groups within the city, and the relative location of poor households with respect to urban amenities and services. In other words, the indices only point at the existence of spatial separation, in the sense that particular income groups live in "different" areas of the city, but is insensitive to whether these areas are located at 1, 5 or 25 kilometres from each other, or whether the areas concentrating the affluent have exclusive access to certain amenities and services in the city.

This is an issue that is often misunderstood in the literature because of the existence of so-called "spatial" indices of income segregation (Reardon & O'Sullivan, 2004). In this literature, "spatial" relates to the definition of neighborhoods and related analysis on the scale of segregation (macro versus micro) (Wong, 2004), but not with the idea of physical distance between groups or between certain groups and unequally distributed amenities and services in the city. In his article, Floch acknowledges this limitation of segregation measures and subsequently complements the analysis of segregation indices with a mapping approach, which allows visualizing the concentrations of households with low and high living standards. While informative as a neighborhood characterization exercise, a visual analysis of segregation can be misleading since it does not represent differences with respect to the average neighborhood, which is what segregation indices intend to capture, and have no clear benchmark for comparison.

Perhaps the interesting analysis on neighborhood profiles developed by Floch could be extended to understand the difference in the amenities and access that these different types of neighborhoods offer, as a way to bridge the gaps between what non-mixed wealthy neighborhoods offer in comparison to other neighborhoods, instead of focusing on the occurrence of more social mixing *per se*. For policy purposes, segregation indicators and visual representations can be combined with simple measures indicating difficulty of access, excessive commuting, lack of access within a reasonable commuting time (by public transport) to amenities and higher services, access to high-quality public education, etc., to fully understand the issues related to the geographic concentration of certain income groups within cities. □

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Technical change and automation of routine tasks: Evidence from local labour markets in France, 1999-2011

Pauline Charnoz* and Michael Orand**

Abstract – In France as well as in other developed economies, a skill-biased labour demand shift occurred in the past three decades. We test one of the main hypotheses put forward to explain this particular shift: a skill-biased technical change driven by the dissemination of Information and Communication Technologies and the automation of routine tasks, leading to their disappearance in favour of high-skilled and service jobs. Using a theoretical model developed by Autor and Dorn (2013) based on the employment structure of local labour markets to identify national effects of technical change, we find evidence of a link between technical change and the 1990-2011 evolution of the labour force in France. In particular, we find that low-skilled workers switch from routine jobs to service jobs or unemployment. We also find that the shift in labour demand interacts with a spatial functional specialisation. These results are robust when other hypotheses, such as globalisation and the growth of international trade, or demographic change, are taken into account.

JEL Classification : F16, F60, J23, J24, O33, R23
Keywords: technical change, automation, local labor markets

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Translated by the authors from: « Progrès technique et automatisation des tâches routinières : une analyse à partir des marchés du travail locaux en France dans les années 1990-2011 »

During the 1990s and 2000s, deep changes have occurred in labour supply and demand in France. The increase in education levels caused a rapid growth in the number of college-educated workers. During the last 20 years, they concentrated in big cities. Following Moretti (2013), Charnoz and Orand (2016) conducted a joint analysis of this concentration and of the relative wage of college-educated workers and pointed out a skill-biased demand shift. The dynamics of the French labour market is therefore close to that of the United States. Several explanations for the demand shift observed in the U.S. have been proposed. They fall roughly in two categories: those that refer to technical change and Information and Communication Technologies (ICT) and those relating to globalization and international trade. In this paper, we investigate the first one for France.

The hypothesis of technical change relates the change in demand for skills to the dissemination of ICT, which are assumed to increase high-skilled workers' productivity more than that of low-skilled workers. For instance, Beaudry *et al.* (2006; 2010) estimate the effect of PC adoption on labour supply and demand by skills across U.S. metropolitan areas. They find that cities initially endowed with relatively abundant and cheap skilled labour adopted PCs more aggressively. The effect of technology on jobs has been defined more precisely by Autor *et al*. (2003) as an automation of routine tasks. Jobs that consist of routine tasks disappear as these tasks can be performed by computers and the price of computers decreases, while abstract or manual tasks remain. This is why the phenomenon is sometimes referred to as "routine-biased technological change" (Goos *et al*., 2014). As shown in Autor and Dorn's theoretical model (2013), the progressive adoption of new technologies and the automation of routine tasks should lead to different evolutions in local labour markets, depending on the initial share of routine tasks for instance. By estimating the evolution of the various types of tasks in these local labour markets, one can identify the effect of technological change on the evolution of the entire labour market. That is what we intend to do for France, showing that the evolution of the different types of tasks across local labour markets is consistent with the technical change and automation hypotheses.

One of the many reasons that lead to study skill-biased technological change is its potential effect on wage inequalities. Abstract tasks being paid at the top of the wage distribution and manual tasks at the bottom, it may indeed lead to a rise in wage inequalities. This is why the automation of routine tasks has often been related to labour market polarisation (Autor *et al*.,2003; Goos *et al*., 2009; Goos *et al*., 2014; Michaels *et al*., 2014; Firpo *et al*., 2011; Machin & van Reenen, 1998). Labour market polarisation refers to increasing proportions of the lowest paid and the best paid occupations, while that of medium-paid occupations declines. It is observed in the U.S. and to some extent in Europe[1] and is an important factor in explaining the increase in wage inequalities. Harrigan *et al*. (2016), on private sector wage data, or Bock (2016), on the basis of employment rate by skill level, have found evidence of such a link between labour market polarisation labour and a shift in labour demand, in particular through the adoption of new technologies.

Another explanation relates the rise of wage inequality to import competition from low-wage countries (Autor *et al*., 2013a; Rigby *et al*., 2015; Keller & Utar, 2016). As trade barriers declined, low-skilled jobs have faced a higher competition than high-skilled jobs, and this could explain a rise in wage inequality between skill levels due to an alignment of the domestic labour cost on the foreign labour cost and to specialisation: indeed, as predicted by trade theory and the Stolper-Samuelson theorem, when trading costs decrease, the return on the abundant factor (high-skilled labour relatively to low-skilled labour in advanced economies) increases.[2] Another explanation referring to international trade is the offshoring of jobs or tasks (Grossman & Rossi-Hansberg, 2008). If certain jobs or tasks can be performed in low-wage countries and the cost of offshoring them decreased (because trade barriers, such as transportation or communication cost, decreased), low-skilled labour demand might have decreased. Note that this phenomenon can partly be related to ICT, in the sense that ICT certainly decreases communication costs. The international trade hypothesis to explain the demand shift and the interaction with technological change is studied in our paper, by testing the robustness of our results to taking into account import competition and offshoring. We find that the effects of technical change and automation are maintained even when taking into account these other hypotheses.

1. In Europe and particularly in France, the share of low-skilled jobs has grown not so much, that's why the pertinence of the use of the concept of polarisation has been discussed (see Jolly (2015) for instance).
2. Although the effect might be opposite as shown by Lorentowicz et al. (2005) in the case of Austria and Poland.

Our empirical strategy is based, as Autor and Dorn (2013), on using the differences between local labour markets to test for these explanations. For the U.S. (Autor & Dorn, 2013; Autor *et al*., 2013a; 2013b) found that import competition had a negative effect on the level of employment for all skill levels. They also found evidence of Skill-Biased Technical Change (SBTC) in both manufacturing and non-manufacturing sectors and showed that, among routine jobs, the share of production jobs decreased first, then the share of information processing jobs (such as clerical jobs).

While these papers used local labour markets mainly as a way to identify a nation-wide phenomenon, another set of papers looked into the spatial component of wage inequalities by skills (Lindley & Machin, 2014; Moretti, 2013). They found that a spatial concentration of high-skilled workers occurred, and related it to a skill-biased spatial shift in labour demand. Similar patterns have been documented for France by Charnoz and Orand (2016). A potential explanation for this spatial shift in labour demand could be that the initial local industrial mix made some local labour markets more exposed to SBTC, offshoring or import competition.

Other mechanisms analyzed in economic geography, such as agglomeration economies and distance related costs, could also contribute to the explanation of this spatial shift. Baum-Snow *et al*. (2014) showed that there has been an increase in agglomeration economies for high-skilled workers in the U.S. They did not study the cause of this increase, but they analyse it as knowledge spillovers, which are often higher for high-skilled workers and may have increased. This skill-biased rise in agglomeration economies would explain a higher concentration and higher wages for high-skilled workers in big and dense cities. Another channel, which in fact links ICT to geography, is the decreasing cost of communication between locations entailed by the communication dimension of ICT, whereas SBTC refers to its contents in terms of information. Duranton and Puga's model (2005) predicts that a fall in communication costs between headquarters and affiliates, leads to a functional specialisation of cities. Some cities specialise in headquarters and business services and other in production activities. Even though their model does not explicitly encompass skills, the fact that headquarters and business services employ more skilled workers could explain that the demand for high-skilled workers has increased more in some cities than others. Evidence of such an increase in the functional specialisation of local labour markets has been found for French firms by Charnoz *et al*. (2016), who study the impact of high-speed train in France on the relation between headquarters and subsidiaries. In order to take into account this phenomenon of functional specialisation, we introduce a new dimension into our analysis, by differentiating support and production functions for the different types of tasks. We show that high-skill jobs have concentrated in areas where the support functions were initially more present. That indicates a functional specialisation and a technical change-led shift in labour demand.

Evidence for France is much scarcer than for the U.S. Aubert and Sillard (2005), Barlet *et al*. (2009) and Fontagné and d'Isanto (2013) proposed an assessment of the extent of offshoring but not of its effects on labourwages. Malgouyres (2016) implemented Autor *et al*.'s (2013a) strategy to test for the effect of import competition in France, and found a negative effect on employment. This effect is polarised in the manufacturing sector wherein it is much stronger for medium-skilled occupations while it is stronger on low-skilled occupations in the non-manufacturing sector. This is different from the results of Autor *et al.* (2013a; 2013b) who did not find a polarising effect of import competition in the U.S. As for the SBTC hypothesis in France, at national level, Goux and Maurin (2000) provided evidence of technical change, but to a smaller extent than in the U.S. They found that computers and new production technologies explained a fall of around 15% in the share of unskilled workers (with less than high-school education) in total employment over 1970-1993. In the same way, Pak and Poissonnier (2016), using a macroeconomic decomposition of changes in employment, show that technological change has led to a fall in employment of roughly 1% each year, with a bias in favour of high-skilled workers. Goos *et al*. (2009) studied the distribution of employment between occupations in Europe and found evidence of job polarisation in France between 1993 and 2006. Machin and van Reenen (2001) used a panel on seven OECD countries between 1973 and 1989, including France, and found a significant association between skill upgrading and R&D intensity. Caroli and van Reenen (2001) find evidence of a skill-biased organizational change in France in the early 1990s (and in the UK in the late 1980s). They show that new form of organization of firms, with fewer layers, is more favourable to high-skilled workers. One

of the potential factors of this delayering could be the decreasing communication costs induced by ICT. To sum up, for France, there is some evidence of a link between ICT and the demand for high-skilled relatively to low-skilled workers but only before the 1990s. For the recent period, there is some evidence that the share of high-skilled jobs and that of the lowest paid low-skilled jobs increased in France, but it has not been related to ICT and there is no evidence of the impact of ICT at the level of local labour markets. So far, the factors the most studied are mostly referring to international trade growth or to institutional nation-level factors, such as exemptions from social security contributions for low-wage jobs. This paper complements the empirical literature for France by studying the link between ICT and labour demand shift.

The next section presents the theoretical model of Autor and Dorn and our extensions to empirically identify the effect of skill-biased technological change on the evolution of French local labour markets. We use data from the French Census at the level of Employment Zones, and add information to distinguish different types of tasks (abstract, routine and manual) and functions (support or production). We show that the evolution of French local labour markets between 1990 and 2011 is consistent with the predictions of the automation theoretical model. These results are robust to the introduction of alternative hypotheses, such as the increase in international competition or offshoring.

Theoretical model and empirical strategy

The routine task automation hypothesis of Autor and Dorn (2013) states that there must be a decline in routine tasks and an increase in manual and abstract tasks, and thus explains why the technical change could be skill-biased. In this paper, we document the spatial dynamics of occupations in France since the 1980s and use local labour markets to test whether there have been such changes in the different types of tasks and therefore confirm the Autor and Dorn (2013) hypothesis.

Theoretical model

More precisely, the main purpose of Autor and Dorn (2013) was to test whether the polarisation of jobs observed in the U.S. is due to non-neutral technical change. The idea is that ICT made the automation of repetitive and more easily codified jobs possible, whereas in-person services such as food services, house cleaning or home care services have not been much impacted by ICT. They formalized this intuition in a theoretical model, which states that production is divided into two sectors, goods and services. Production of goods Y_g combines three factors: routine labour L_r, abstract labour L_a and computer capital K; production of services Y_s uses only manual labour L_m. Services production is only labour intensive ($Y_s=a_sL_m$), whereas the production function for goods is a combination of a CES and a Cobb-Douglas functions:

$$Y_g = L_a^{1-\beta}\left[\left(a_rL_r\right)^{\mu} + \left(a_kK\right)^{\mu}\right]^{\beta/\mu}$$

This production function is based on two main hypotheses: substitutability between computer capital and routine tasks on the one hand, and complementarity between abstract labour and routine input (produced by the combination of routine labour and capital) on the other hand. Because both goods and services are consumed, when computer capital price falls, computer capital substitutes to low-skilled workers for routine tasks in the production of goods and low-skilled workers switch from the goods sector to the service sector. These services being non-storable and non-tradable, low-skilled workers must be located where services are consumed.

The idea of Autor and Dorn (2013) was therefore to use spatial differences in local labour markets to test the routine task automation hypothesis. They applied their model in a spatial setting in which high-skilled labour is mobile between local labour markets, whereas low-skilled workers are immobile. The model predicts the effect of technical change on local labour markets, according to their initial distribution of routine tasks. More precisely, the model predicts four spatial dynamics of labour market outcomes following a fall in computer capital price:

1. the largest decreases in the share of routine jobs take place in areas where routine jobs are initially more numerous;

2. the share of in-person service jobs increases where the share of routine jobs is initially higher as low-skilled workers are reallocated from routine jobs to in-person service jobs;

3. the share of abstract jobs increases more in areas with a high initial level of routine jobs because of their complementarity with ICT capital;

4. wages in manual or abstracts jobs increase more in areas with a high initial level of routine jobs.

The third prediction differentiates the technological change hypothesis from hypotheses linked to the growth of international trade (import competition or offshoring). In the case of technological change, routine tasks do indeed not completely disappear from the production line, but are replaced by computer capital. Routine tasks are still localized in the same area and should also grow. That is why we expect in this case a growth of abstract labour, complementary to abstract tasks, which would not occur in the case of offshoring for instance.

Empirical strategy

Using U.S. data, Autor and Dorn empirical analysis focused mainly on the second prediction as it is related to job polarisation, which is the main stylised fact they documented and wished to explain. They found that the share of in-person service jobs did increase more in local labour markets where the share of routine jobs was initially higher. In the case of France, there is less strong evidence of job polarisation, but this does not mean that the routine task automation hypothesis is not relevant. Therefore, we look for evidence of this hypothesis with the same empirical strategy, testing the predictions of Autor and Dorn's model (2013) for France[3].

We compute the share of routine, low-skill service and high-skill occupations in employment for each local labour market in 1990 and 2011, and study their evolution between these two dates that correspond to the diffusion of ICT in France. We then study the sign of the correlation between these evolutions and the initial share of routine occupations in the area, and compare it to the theoretical prediction. It is worth noting that, in the theoretical framework, the initial share of routine occupations relates to the production technology of the area: Autor and Dorn (2013) argue that the empirical measure must reflect the "long run, quasi-fixed component of their industrial structure". We therefore decide to take the share of routine occupations in 1982 as our "initial share of routine occupations" rather than that of 1990. The 1982 measure, anterior to the period studied and to the bulk of ICT dissemination, is less likely to be correlated to shocks between 1990 and 2011. Autor and Dorn (2013) also implemented an instrumental variables (IV) strategy to address this issue and found similar effects, sometimes larger than with the classical strategy. We cannot implement this IV strategy as we do not have the same type of information (they use 1950 local industry structure). We have therefore to keep in mind that our results might be slightly downward biased. Finally, we propose an extension of the model by splitting the share of routine occupations in 1982 between production and support routine occupations.

Moreover, Autor *et al.* (2013b) found that among routine occupations, the decrease in clerical and low-skilled production jobs did not occur at the same period of time. In other words, the automation of production tasks and of information-processing tasks (performed in clerical jobs, which are mostly support jobs) did not take place simultaneously. It therefore suggests that technical change could have different effects for support functions and for production functions. In the same vein, the model of Duranton and Puga (2005) describes another potential effect of ICT on spatial disparities, linked to the fall in communication costs rather than in information costs. This would lead to an increase in the functional specialisation of cities, with some cities specialising in headquarters and business services, i.e. support functions. If that is the case, technical change might impact local labour markets differently depending on whether they are specialised in support or production activities. This might explain the different results for production routine jobs or support routine jobs. Technically, the automation of clerical and manufacturing functions might also be of a different nature. An addition of our analysis to that of Autor and Dorn (2013) is to examine whether distinguishing production and support routine jobs provides valuable insights.

Moreover, Autor and Dorn's (2013) theoretical model assumes that low-skilled jobs are perfectly transferred from routine occupations to service occupations. Because of the French context of high unemployment, we suspect that some of the destroyed jobs are not recreated. This should lead to an increase in the unemployment rate of low-skilled workers. We test this supplementary hypothesis by estimating the correlation between low-skilled workers' unemployment rate and the initial share of routine occupations across local labour markets, which should turn out to be positive.

3. Except for the prediction concerning wages, for which we have no information in our data base.

Finally, the technological change hypothesis is not the only one related to labour market polarisation: offshoring or import competition can also play an important part. Even though the technological change hypothesis seems more pertinent regarding the growth of high-skilled labour (due to the complementarity between routine tasks and abstract labour), we have to test for these other hypotheses. We do so by taking into account offshoring and import competition in our model, and verifying the robustness of our results.

Data issues and descriptive statistics

Data

Our empirical strategy requires measures of the contents of jobs in routine, manual and abstract tasks. Therefore, we rely on a detailed classification of occupations[4]. Note that, in this paper, skills and occupational classifications refer to jobs while education levels refer to workers: for instance, workers with different education levels can be found within the high-skilled occupation group.

We define local labour markets using "Employment Zones" as defined by Insee on the basis of commuting information. This is very similar to the concept of Commuting Zones used in Autor and Dorn (2013). The 304 Employment Zones in metropolitan France are areas in which the most part of the workers live and work at the same time, with firms recruiting most of their workforce in the same Employment Zone. That allows us to consider Employment Zones as a good approach to local labour markets. Note that, in Autor and Dorn's theoretical model, low-educated workers are immobile between these zones while high-educated workers are mobile. This seems a strong assumption, but actually the model remains valid as long as high-educated workers are more mobile than low-educated workers, which actually is the case in France (Charnoz & Orand, 2016).

Datasets providing detailed information and enough observations at that geographical level are not very numerous. Moreover, since many in-person service jobs are performed by self-employed workers, it is preferable not to rely on wage earners databases such as the DADS (Social Data Annual Declarations). We therefore use the one fourth samples of the French 1982, 1990 and 1999 Censuses and the 2006 and 2011 census surveys, especially the detailed information provided about occupations (classification at the 4-digit level) and labour market status.

These data also provide information on the level of education, allowing to distinguish workers between college education level (post-secondary education) and non-college education level (high-school degree or less). Since the French censuses don't provide any information on wages or earnings, our analysis focuses on the predictions of Autor and Dorn's model for routine, service and high-skilled jobs.

Tasks and occupations

We present now our definition of routine, service and high-skilled jobs based on French data and also that of support and production functions. Our analyses cover the employed labour force, with the employment status used only to compute low-skilled workers' unemployment rate.

For the sake of clarity, we retain seven groups of occupations. We define firstly a group of high-skilled occupations including managers, executives and engineers (table C1-2 in Online complement C1); low and medium-skilled occupations are broken down into the following groups: production and craft, manufacturing, clerical jobs, retail jobs, service occupations and transport, construction or farming[5]. More precisely, (low-skilled) service occupations are occupations in food service, health service (except doctors and pharmacists), home and personal care (Table C1-3 in Online complement C1). At the national level, the shares of high-skilled and service occupations increased between 1982 and 2011, the share of manufacturing and transport-construction-farming occupations decreased, while there was no change in the shares of the other occupational groups (Table 1).

We also characterise occupations according to their intensity in routine tasks. We build a transition matrix between the U.S. and the French classifications of occupations (4-digit level 1982 classification). Then, we use Autor and Dorn's (2013) database on task contents by occupations, computed from the U.S. Dictionary of Occupational Titles descriptions, to allocate a content in routine, manual and abstract tasks to each occupation of the French classification.

4. The information on the industry where they worked is not used, although the local industry mix is used for robustness checks.
5. It is similar as Autor and Dorn (2013), but we separate clerical from retail occupations.

Table 1
Evolution of the distribution of major occupational groups

In %

	1982	1990	1999	2011
Support				
Managers/executives/engineers	13	16	18	20
Clerical	9	9	10	11
Production				
Production/craft	11	10	10	10
Transport/construction/farming	15	12	10	09
Manufacturing	17	14	12	10
Retail	16	17	16	15
Service occupations	19	21	25	25

Coverage: employed labour force, metropolitan France.
Source: Insee, 1982, 1990, 1999 and 2011 *French Censuses*.

Doing this, we assume that the content of jobs is not too much different between France and the US. This is why we use the most detailed level of the classification, in order to limit the consequences of such an assumption. In a similar way to Autor and Dorn (2013), we build a Routine Task Intensity (RTI) index that allows taking into account simultaneously the content of each occupation in terms of abstract, manual and routine tasks[6]. According to this index, clerical and manufacturing occupations are the most routine-tasks intensive, with clerical occupations notably more intensive. Next, we classify all occupations in "support" or "production" occupations. We define management and administrative functions as support occupations (see Online complement C1 for details) and the remainder as production functions. Following Autor and Dorn (2013), we classify the one third of 4-digit level occupations with the highest RTI index in the 1982 distribution of jobs as routine occupations[7]. We then split the group of routine occupations in support routine occupations and production routine occupations (see Figures I and II). Table 2 shows how each of the seven occupational groups is positioned in terms of content in the three types of tasks and RTI index and their distribution between support and production functions. Routine occupations belong mostly to the groups of manufacturing or clerical occupations (especially secretaries, administrative employees, finance and accounting employees).

6. More precisely, the routine task intensity index is equal to log(routine tasks) - log(manual tasks) - log(abstract tasks).
7. We also classify, even if marginally, as routine occupations some occupations in the executive and service occupation groups. The routine occupations classification and the previous classification in 7 groups therefore do not match perfectly.

Table 2
Task intensity of major occupational groups in 1982

	Abstract tasks	Routine tasks	Manual tasks	RTI index
Support				
Managers/executives/engineers	+	-	-	-
Clerical	-	+	-	+
Production				
Production/craft workers	-	+	+	-
Transport/construction/farming	-	-	+	-
Manufacturing workers	-	+	+	+
Retail	+	-	-	-
Service occupations	-	-	+	-

Note: (+) indicates a task value above average across all occupations in 1982 weighted by employment and (-) below average.
Coverage: employed labour force, metropolitan France.
Source: Insee, 1982 *French Census*, Autor and Dorn (2013) database of task intensity by occupations.

Table 3 shows the distribution of the share of routine occupations in employment by Employment Zone in 1982. Across Employment Zones, the share in routine occupations reflects in part the sectorial repartition of employment: it is higher in the north of France, a historically industrial region, in the Paris region and in some cities such as Nantes or Nice. Distinguishing between support routine occupations and production routine occupations shows very different distributions across space. The share of support routine occupations is higher in the Paris region, in the South-East and in large cities. The share of production routine occupations is higher in the North and the East and in some central areas.

Figure I
Classification of routine occupations

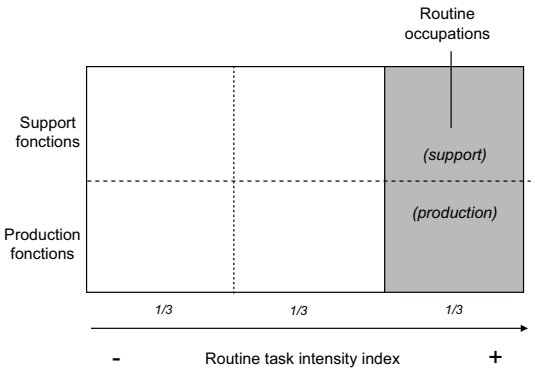


Figure II
Classification of the occupation groups

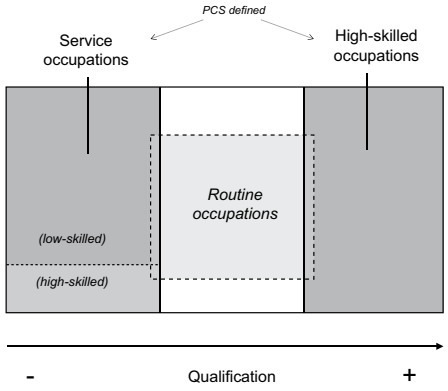


Table 3
Share of routine occupations by employment zone in 1982

Share of routine occupations by Employment Zone (in %)					
All		Production		Support	
Mean	30	Mean	17	Mean	13
Standard error	5	Standard error	4	Standard error	4
Q3	34	Q3	19	Q3	15
Median	30	Median	16	Median	13
Q1	27	Q1	14	Q1	10
Highest 10		Highest 10		Highest 10	
Lille	40	*Charolais*	25	*Poissy*	23
Saint-Dié-des-Vosges	41	*Vallée de la Bresle-Vimeu*	27	*Roissy - Sud Picardie*	24
Créteil	41	*Roubaix-Tourcoing*	27	*Versailles*	24
Saint-Omer	41	*Cholet*	28	*Evry*	25
Marne-la-Vallée	41	*Longwy*	28	*Saclay*	25
Paris	41	*Les Herbiers*	30	*Orly*	26
Orly	41	*Saint-Dié-des-Vosges*	30	*Cergy*	26
Remiremont	42	*Saint-Omer*	30	*Marne-la-Vallée*	26
Roubaix-Tourcoing	46	*Remiremont*	32	*Paris*	26
Vallée de l'Arve	46	*Vallée de l'Arve*	35	*Créteil*	27
Lowest 10		Lowest 10		Lowest 10	
Ghisonaccia-Aléria	12	*Ghisonaccia-Aléria*	6	*Ghisonaccia-Aléria*	6
Saint-Flour	16	*Corte*	8	*Saint-Flour*	7
Carhaix-Plouguer	16	*Saint-Flour*	9	*Carhaix-Plouguer*	7
Porto-Vecchio	17	*Porto-Vecchio*	9	*Mauriac*	7
Mauriac	18	*Carhaix-Plouguer*	9	*Segré*	7
Loudéac	19	*Lannion*	10	*Avranches*	7
Calvi-L'Ile-Rousse	20	*Loudéac*	10	*Brioude*	8
Lannion	20	*Mauriac*	10	*Sablé-sur-Sarthe*	8
Avranches	20	*Guingamp*	11	*Porto-Vecchio*	8
Guingamp	20	*Ajaccio*	11	*La Flèche*	8

Note: the first quartile Q1 indicates that 25% of the employment zones have a lower routine occupations share than its value.
Coverage: employed labour force, metropolitan France.
Source: Insee, 1982 *French Census*, Autor and Dorn (2013) database of task intensity by occupations.

Trends in the spatial distribution of occupations

Before testing the effect of the initial share of routine occupations on the changes in the share of routine occupations, service occupations and high-skilled occupations, we describe briefly their dynamics across French local labour markets over the years 1990-2011, up to now little documented (Tables 4, 5 and 6 respectively for routine, service and high-skilled occupations). A first observation is that routine and service occupations are not located in the same Employment Zones. The share of service occupations is high on the Atlantic and Mediterranean coasts and in some rural areas. The share of routine occupations has decreased over 1990-2011 and seems to be more evenly distributed in 2011 than in 1990. Indeed, when regressing 1990-2011 change on 1990 level, there is a significant negative relationship, meaning a convergence in the level of the share of routine occupations among employment zones (figure III-A). And this is also true when separating between college and non-college employment. The share of high-skilled occupations is higher in large cities and all the more in 2011 than in 1990 (figure III-B)[8].

We do not present the results for high-skilled occupations separately for college and non-college workers as non-college workers in high-skilled occupations are not very numerous. Lastly, the share of service occupations has increased in most employment zones over 1990-2011. For non-college employment, there is a negative relationship between the 1990-2011 change and the 1990 level, meaning also a convergence between employment zones. For college employment in service occupations, the effect is not significant. In the remainder of the article, we focus on the share of service occupations in non-college employment, as Autor and Dorn prediction on service occupations relates to low-educated workers, and for the sake of comparison with their results.

8. Moreover, most of the national evolution of the share of routine, high-skilled and service occupations occurs within the employment zones: with a constant total employment level structure across employment zones between 1990 and 2011, these evolutions are almost identical.

Table 4
Share of routine occupations by employment zone in 1990 and 2011

Share of routine occupations by employment zone (in %)				Evolution of the share of routine occupations by employment zone between 1990 and 2011 (in %)	
1990		2011			
Mean	33	Mean	31	Mean	-2
Standard error	4	Standard error	2	Standard error	3
Q3	36	Q3	33	Q3	-3
Median	33	Median	31	Median	-2
Q1	30	Q1	30	Q1	0
Highest 10		Highest 10		Highest 10	
Roissy - Sud Picardie	41	*Orly*	36	*Saint-Flour*	4
Cergy	41	*Ajaccio*	36	*Carhaix-Plouguer*	4
Créteil	41	*Vallée de la Bresle-Vimeu*	36	*Avranches*	4
Paris	41	*Créteil*	36	*Brioude*	4
Vallée de la Bresle-Vimeu	42	*Cergy*	36	*Ploërmel*	4
Marne-la-Vallée	42	*Marne-la-Vallée*	37	*Royan*	4
Orly	42	*Roubaix-Tourcoing*	38	*Corte*	5
Saint-Omer	43	*Longwy*	38	*Vire Normandie*	5
Roubaix-Tourcoing	45	*Thionville*	38	*Porto-Vecchio*	5
Vallée de l'Arve	48	*Vallée de l'Arve*	39	*Ghisonaccia - Aléria*	7
Lowest 10		Lowest 10		Lowest 10	
Ghisonaccia-Aléria	19	*Saint-Flour*	24	*Vallée de l'Arve*	-9
Saint-Flour	20	*Loudéac*	24	*Cholet*	-8
Carhaix-Plouguer	21	*Mauriac*	24	*Saint-Omer*	-8
Loudéac	21	*Carhaix-Plouguer*	25	*Cambrai*	-8
Mauriac	22	*Pauillac*	25	*Issoudun*	-7
Ploermel	24	*Ghisonaccia-Aléria*	25	*Roubaix - Tourcoing*	-7
Morvan	24	*Thiérache*	26	*Thiers*	-6
Pauillac	24	*Pontivy*	26	*Foix - Pamiers*	-6
Pontivy	25	*Morvan*	26	*Saint-Quentin*	-6
Brioude	25	*Calvi-L'Ile-Rousse*	26	*Orly*	-6

Note: the first quartile Q1 indicates that 25% of the employment zones have a lower routine occupations share than its value.
Coverage: employed labour force, metropolitan France.
Source: Insee, 1990 and 2011 *French Censuses*, Autor and Dorn (2013) database of task intensity by occupations.

Table 5
Share of service occupations by employment zone in 1990 and 2011

Share of service occupations by employment zone (in %)				Evolution of the share of service occupations by employment zone between 1990 and 2011 (in %)	
1990		2011			
Mean	22	Mean	28	Mean	6
Standard error	3	Standard error	3	Standard error	2
Q3	23	Q3	30	Q3	5
Median	22	Median	28	Median	6
Q1	20	Q1	26	Q1	7
Highest 10		Highest 10		Highest 10	
Ussel	27	*Le Blanc*	33	*Calais*	9
Le Blanc	27	*Saint-Amand-Montrond*	33	*Castres - Mazamet*	9
Corte	28	*Verdun*	33	*Vierzon*	10
Céret	28	*Honfleur*	34	*Ghisonaccia - Aléria*	10
Honfleur	28	*Saint-Girons*	34	*Argentan*	10
Berck-Montreuil	30	*Calvi-L'Ile-Rousse*	34	*Saint-Omer*	10
Calvi-L'Ile-Rousse	30	*Ussel*	34	*La Thiérache*	10
Prades	31	*Prades*	34	*Cambrai*	10
Briançon	33	*Berck-Montreuil*	35	*Saint-Amand-Montrond*	11
Menton Vallée de la Roya	34	*Menton Vallée de la Roya*	36	*Commercy*	12
Lowest 10		Lowest 10		Lowest 10	
Vallée de l'Arve	13	*Vallée de l'Arve*	19	*Briançon*	-1
Morteau	14	*Morteau*	19	*Paris*	0
Saint-Claude	15	*Rambouillet*	20	*Le Mont Blanc*	0
Oyonnax	16	*Saint-Quentin-en-Yvelines*	20	*Houdan*	0
Les Herbiers	16	*Paris*	20	*Corte*	1
Wissembourg	17	*Oyonnax*	21	*Menton - Vallée de la Roya*	1
Thiers	17	*Saclay*	21	*Rambouillet*	2
Vallée de la Bresle-Vimeu	17	*Saint-Claude*	21	*Cannes - Antibes*	2
Epernay	18	*Les Herbiers*	22	*La Rochelle*	2
Ambert	18	*Wissembourg*	22	*Montpellier*	2

Note: the first quartile Q1 indicates that 25% of the employment zones have a lower service occupations share than its value.
Coverage: employed labour force, metropolitan France.
Source: Insee, 1990 and 2011 *French Censuses*, Autor and Dorn (2013) database of task intensity by occupations.

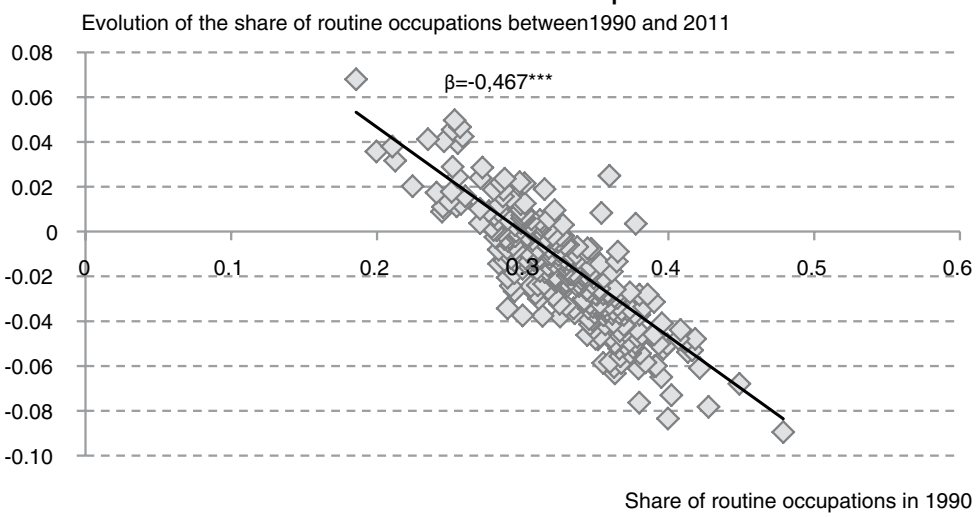
Table 6
Share of high-skilled occupations by employment zone in 1990 and 2011

Share of high-skilled occupations by employment zone (in %)				Evolution of the share of high-skilled occupations by employment zone between 1990 and 2011 (in %)	
1990		2011			
Mean	12	Mean	15	Mean	3
Standard error	3	Standard error	4	Standard error	2
Q3	13	Q3	17	Q3	2
Median	11	Median	14	Median	3
Q1	10	Q1	13	Q1	4
Highest 10		Highest 10		Highest 10	
Cergy	20	*Grenoble*	26	*Rennes*	7
Créteil	20	*Toulouse*	28	*Grenoble*	7
Lille	20	*Aix-en-Provence*	28	*Saclay*	7
Montpellier	21	*Poissy*	29	*Toulouse*	8
Aix-en-Provence	22	*Lille*	29	*Saint-Louis*	9
Paris	23	*Versailles*	30	*Lille*	9
Versailles	23	*Rambouillet*	32	*Poissy*	10
Saint-Quentin-en-Yvelines	24	*Saclay*	35	*Lyon*	10
Rambouillet	26	*Saint-Quentin-en-Yvelines*	36	*Houdan*	12
Saclay	28	*Paris*	40	*Paris*	17
Lowest 10		Lowest 10		Lowest 10	
Mayenne	7	*Péronne*	9	*Brioude*	0
L'Aigle	7	*Mauriac*	10	*Ussel*	0
Morteau	7	*Loudéac*	10	*Chatillon*	0
Louhans	7	*Louhans*	10	*Péronne*	1
Ghisonaccia-Aléria	7	*Chatillon*	10	*Draguignan*	1
Wissembourg	8	*Saint-Flour*	10	*Soissons*	1
Vitré	8	*Brioude*	10	*Tergnier*	1
Segré	8	*Jonzac-Barbezieux-Saint Hilaire*	10	*Verdun*	1
Loudéac	8	*Les Herbiers*	10	*Commercy*	1
Nogent-le-Rotrou	8	*Vallée de la Bresle-Vimeu*	10	*Cambrai*	1

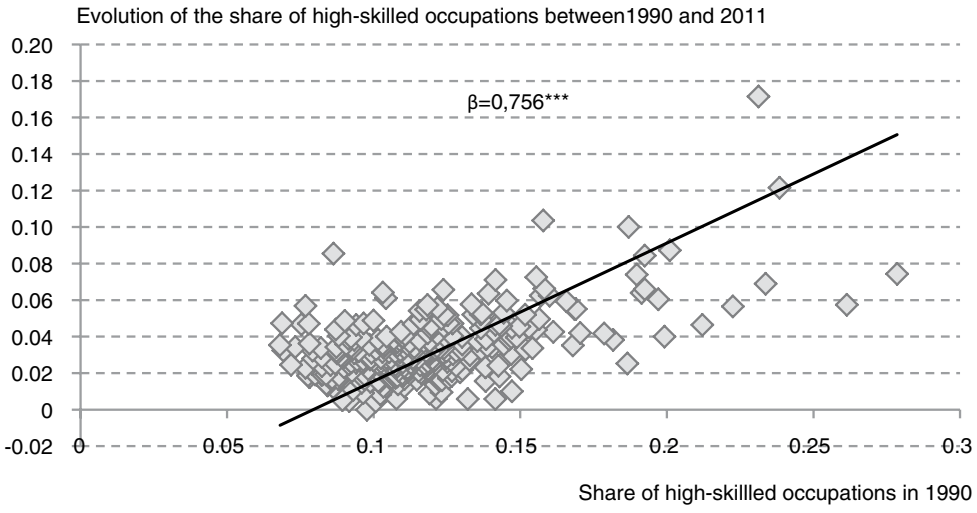
Note: the first quartile Q1 indicates that 25% of the employment zones have a lower high-skilled occupations share than its value.
Coverage: employed labour force, metropolitan France.
Source: Insee, 1990 and 2011 *French Censuses*, Autor and Dorn (2013) database of task intensity by occupations.

Figure III
1990-2011 spatial dynamics of the share of occupations in employment

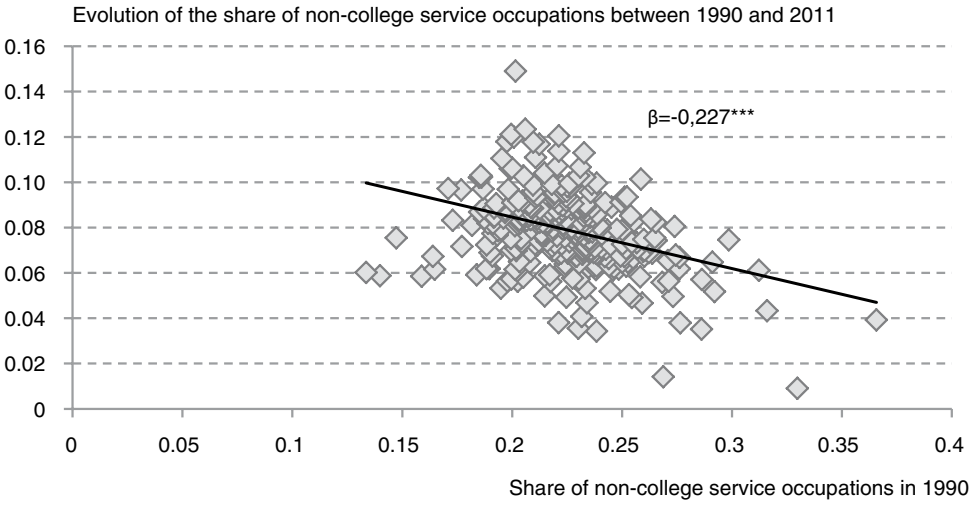
A - Routine occupations



B - High-skilled occupations



C - Non-college service occupations



Note: For each outcome, the change between 1990 and 2011 is regressed on its own level in 1990 (at the employment zone level, 304 observations): $\Delta X_{1990\text{-}2011}=\alpha+\beta*X_{1990}+\varepsilon$. Estimations are weighted by 1982 employment zone population.
*p<0,10 ** p<0,05 *** p<0,01.
Coverage: employed labour force, metropolitan France.
Source: Insee, 1990 and 2011 *French Censuses*.

Routine occupations and ICT

The predictions of Autor and Dorn's (2013) model are based on the fact that ICT can be used to perform routine tasks. Before testing these predictions, we therefore assess whether there is a link between the initial routine level of a local labour market and subsequent dissemination of ICT in the area. We do not have access to a local measure of ICT capital or other measures of ICT dissemination[9] but we know the evolution of ICT capital stock by industry at the national level and the employment composition by industry for each Employment Zone. We therefore build for each zone an "ICT dissemination exposure" index, with a method similar to the import competition exposure index of Autor *et al*. (2013b). We compute, for 1990 and 2011 and each industry, the national level of ICT capital normalized by the employment level in 1982. We use the level of employment in 1982 rather than the current employment level because the current level is probably correlated to ICT capital. For each local labour market and each year, we then apply this national ICT capital per 1982 worker and per industry to the 1982 local employment distribution by industry. This gives an estimation of what the local level of ICT would have been if the employment structure by industry had remained that of 1982 and the local evolution by industry had been the same as at national level. The change in this index between 1990 and 2011 is a measure of how much the employment in a given zone was exposed to ICT dissemination because of its 1982 employment distribution by industry (see Online complement C2 for details). Hereafter, we refer to it as the "1990-2011 change in ICT exposure". This measure is an approximation of the real ICT exposure in the Employment Zone, but has the advantage of being more exogenous than an actual measure of the local level of ICT. It does indeed not take into account the fact that, within an industry, some Employment Zones might have adopted more or less ICT due to unobservable characteristics that could be correlated to our variables of interest, thus biasing the estimations[10].

As the routine tasks automation hypothesis states that ICT should have been adopted more quickly in places where many routine tasks were performed, there should be a positive correlation between ICT dissemination and the initial level of routine occupations in an Employment Zone. Column (1) of Table 7 shows that indeed Employment Zones with a higher share of routine occupations in 1982 were exposed to a significantly higher 1990-2011 change in ICT exposure. In columns (2) and (3) of Table 7, we test this relationship for support and production routine occupations separately. The 1990-2011 change in ICT exposure is significantly related to the initial share of support routine occupations, but not to the initial share of production routine occupations. Given how the measure was built, it means that, between 1990 and 2011, industries with a high share of routine production jobs in 1982 did not experience more or less ICT capital development than those with a low share of routine production jobs. It may be that technical change did not happen in the form of ICT capital in production activities, or that ICT capital in these activities was adopted prior to the period we investigate. On the contrary, industries with a high share of support routine jobs in 1982 experienced a higher development of ICT capital. This furthermore justifies the distinction between

9. ICT capital as it is theoretically defined has a broader spectrum than the accounting definition. It can for instance include robots, that can replace routine workers, as shown in Graetz and Michael (2015).
10. More generally, there is a potential bias of endogeneity between employment structure and technical change or trade. We do not address directly this issue in this paper, since we test stylized facts of a theoretical model rather than estimate an empirical causality.

Table 7
Initial share of routine occupations in employment and 1990-2011 change in ICT exposure by Employment Zone

	1990-2011 change in ICT exposure		
	(1)	(2)	(3)
1982 share of routine occupations	1.792*** (0.282)	1.991*** (0.145)	- 0.427 (0.388)
Type of routine occupation	All	Support	Production
Observations	304	304	304

Note: OLS regression coefficients. Standard errors in parentheses. ICT in thousands of euros. The change in ICT exposure is computed using the national change in ICT capital by worker by industry and weighting for each employment zone by the 1982 local employment share by industry. Estimations are weighted by 1982 employment zone population.
*p<0,10 ** p<0,05 *** p<0,01.
Coverage: employed labour force, metropolitan France.
Source: Insee, 1990 and 2011 *French Censuses*, https://www.insee.fr/fr/statistiques/2832673 (series 6.418) for ICT capital.

support and production routine occupations in the analysis we are conducting afterwards.

A test of the automation hypothesis predictions on French data

We have found evidence that ICT dissemination might be related to a higher 1982 share of routine jobs, particularly for support functions. We now turn to tests of the predictions of Autor and Dorn's model in the French case.

We have seen in the previous section that the share of routine occupations decreased more over 1990-2011 in areas where it was high in 1990. As explained previously, we prefer to use 1982 rather than 1990 as our initial point for the test of Autor and Dorn (2013) predictions. We therefore check that the share of routine occupations decreased more over 1990-2011 in Employment Zones where this share was high in 1982 (column (1) of Table 8). We next regress the 1990-2011 change in the share of high-skilled occupations in employment and in the share of service occupations in non-college workers' employment on the 1982 share of routine occupations by Employment Zone. Results are presented respectively in columns (2) and (3) of Table 8. As predicted by the model, the share of high-skilled occupations has increased more where the share of routine occupations was initially higher, with a positive and statistically significant link. Similarly, the positive and significant link between change in the share of service occupations in non-college workers' employment between 1990 and 2011 and the initial share of routine occupations tends to validate the model of Autor and Dorn (2013).

Lastly, in the theoretical model, the transfer from routine to in-person service jobs relies on the assumption that low-skilled workers are immobile inside their local labour market. In the French context of high unemployment and higher minimum wage, this hypothesis could translate in low-skilled workers moving to unemployment rather than to in-person service jobs, in particular if the demand for in-person services was not strong enough. We therefore test the impact of the initial share of routine occupations on non-college workers' unemployment rate. Column (4) of table 8 shows a significant positive relationship between the initial share of routine occupations and non-college workers' unemployment. So it seems that in the French case, when routine jobs declined, they were not entirely replaced by low-skilled service jobs, hence a growth in the unemployment rate of non-college workers.

The evolution of the French local labour markets appears consistent with the predictions of the theoretical model, and with the hypothesis of a technical change that lead to the automation of routine tasks. We also investigate whether the result holds for the two types of routine tasks, support and production. This allows us to integrate some mechanisms related to functional specialisation, as described for instance in Duranton and Puga (2005), in our analysis. Indeed, the functional specialisation (between production and support –approximated by management functions) of Employment Zones has increased between 1990 and 2011 (Table 9): smaller cities have focused on production occupations whereas bigger cities have specialised in support occupations. The simultaneity of this functional specialisation, that favours support occupations in some areas, and the technical change, that reduces the share of routine tasks, may cause interactions leading to different evolutions for support or production routine occupations.

Table 8
Effect of the initial share of routine occupations on 1990-2011 change in labour market outcomes by Employment Zone

	1990-2011 change in			
	employment share of routine occupations	employment share of high-skilled occupations	non-college share of service occupations	non-college unemployment rate
	(1)	(2)	(3)	(4)
1982 share of routine occupations	- 0.353*** *(0.014)*	0.482** *(0.229)*	0.100*** *(0.025)*	0.266*** *(0.04)*
Observations	304	304	304	304

Note: OLS regression coefficients. Standard errors in parentheses. Estimations are weighted by 1982 employment zone population.
*p<0,10 ** p<0,05 *** p<0,01.
Coverage: employed labour force; labour force for the unemployment rate, metropolitan France.
Source: Insee, 1982, 1990 and 2011 *French Censuses.*

Table 9
Functional specialization by Employment Zone in 1990 and 2011

Local population	Functional specialisation in management against production	
	1990	2011
< 50 000	- 0.52	- 0.52
50 000-100 000	- 0.44	- 0.50
100 000-250 000	- 0.36	- 0.38
250 000-500 000	- 0.17	- 0.19
500 000-1 000 000	0.04	0.08
1 000 000-2 000 000	0.41	0.57
> 2 000 000	1.36	3.49

Note: this measure is similar to the one used in Duranton and Puga (2005). It is the percentage difference from the national average of executives and managers per production worker (occupied in precision production, fabrication or assembly). The last category (more than 2 million people) contains only one employment zone, Paris.
Coverage: employed labour force, metropolitan France.
Source: Insee, 1990 and 2011 *French Censuses*.

Table 10
Effect of the initial share of production and support routine occupations on 1990-2011 change in labour market outcomes by Employment Zone

	1990-2011 change in				
	Employment share of production routine occupations	Employment share of support routine occupations	Employment share of high-skilled occupations	Employment share of non-college service occupations	Non-college unemployment rate
	(1)	(2)	(3)	(4)	(5)
1982 share of production routine occupations	- 0.444*** *(0.022)*	0.028* *(0.015)*	- 0.001 *(0.035)*	0.147*** *(0.023)*	0.223*** *(0.03)*
1982 share of support routine occupations	- 0.050*** *(0.01)*	-0.285*** *(0.015)*	0.621*** *(0.213)*	0.087** *(0.037)*	0.279*** *(0.042)*
Observations	304	304	304	304	304

Note: OLS regression coefficients. Standard errors in parentheses. Estimations are weighted by 1982 employment zone population.
*p<0,10 ** p<0,05 *** p<0,01.
Coverage: employed labour force; labour force for the unemployment rate, metropolitan France.
Source: Insee, 1982, 1990 and 2011 *French Censuses*.

Table 10 presents the same estimations as in the previous section but splitting the initial share of routine occupations into production and support occupations. The share of each type of routine occupations has decreased more in Employment Zones where it was initially higher. Our results hold for the share of service occupations among non-college workers' and non-college unemployment: both have increased more in Employment Zones where the share of production routine occupations in 1982 or that of support routine occupations was initially high. The share of high-skilled occupations has increased more in zones where the initial share of support routine occupations was higher but not in those where the initial share of production routine occupations was higher. This last result contradicts the predictions of Autor and Dorn (2013), particularly that of a complementarity between routine production tasks and abstract tasks. But one could assume that this complementarity does not require geographical proximity, even less as ICT develops and communication costs decreases. If this is the case, the lack of geographical proximity seems more valid for production than for support functions.

For non-college workers, the impact of the initial share of routine occupations has been stronger on the unemployment rate than on the share of service occupations. The higher disappearance of routine occupations in Employment Zones with a higher initial level of the share of routine occupations seems to have led to a higher increase of non-college unemployment rather than of non-college employment in service occupations. Moreover, the effect on the share of services occupations is stronger for production than for support routine occupations. So, it seems that the demand for service occupations

was less important in zones with routine support jobs than in zones with routine production jobs. In Autor and Dorn (2013) theoretical model, results for low-skilled workers are driven by their immobility and the consumer demand for services. The fact that there is a smaller effect on service occupations in the places where the share of high-skilled occupations has increased the most, entails that in, France, the demand for service occupations may not have been due to local workers. In other words, the rise in the demand for service occupations might not have been driven by local workers consumption[11]. Given the places where the rise in service occupations took place, it is more likely to have been due to the aging of the population or to tourism. This would be a demand induced by consumers who were not in the labour force (retired people) or who did not work in these places (tourists).

Other explanations for the skill-biased spatial shift in labour demand

In this section, we try to take into account other potential explanations of the labour demand shift and to see how these factors interact with the technical change and routine tasks automation hypothesis. In particular, we test if the results of the previous section are robust to the introduction of these alternative hypotheses. First we test the results for low-educated workers. The development of international trade is the main alternative explanation for the decrease of demand for low-educated workers: we take it into account in our model by introducing measures of offshoring and import competition, as complementary measures of two main manifestations of the growth of international trade.

The growth of international trade has made cheaper to transfer certain tasks to other countries, especially low-wage countries, and thus incited to offshoring. The more or less offshorable nature of an occupation is possibly correlated to its intensity in routine tasks as easily codified tasks may also be easily offshored. However, some service occupations, even if they were intensive in routine tasks, are less easily offshorable: this is especially the case of services that have to be produced precisely where the consumer is located. Autor and Dorn (2013) use a measure of job offshorability based on two variables of the US Department of Labour Occupational Information Network database: Face-to-Face contact and On-site job. "The measure captures the degree to which an occupation requires either direct interpersonal interaction or proximity to a specific work location." We use their database to compute a similar measure for French occupations, with the method we used for the task intensity of occupations. Table 11 shows that the occupations with the highest level of offshorability are clerical occupations. Low-skilled manufacturing occupations are not considered much offshorable according to this measure[12]. We then calculate the average level of this index of offshorability in each Employment Zone across occupations and we use the 1982 level of this average level for our robustness check. In all the Employment Zones, this measure is positively correlated to the share of support routine occupations in 1982, but not to the share of production routine occupations.

11. The hypothesis of a skill-biased consumption to explain the skill-biased shift in demand is then less credible. Pak and Poissonnier (2016) also find that the domestic demand has a rather unbiased effect on employment.
12. This result may seem surprising at first, but is consistent with most of the offshorability measures (Blinder & Krueger, 2013).

Table 11
Offshorability of major occupation groups

	Offshorability index
Support	
Managers/executives/engineers	-
Clerical	+
Production	
Production/craft workers	+
Transport/construction/farming	+
Manufacturing workers	-
Retail	-
Service occupations	-

Note: (+) indicates a value above average across all occupations in 1982 weighted by employment and (-) below average.
Coverage: employed labour force, metropolitan France.
Source: Insee, 1982 *French Census*, Autor and Dorn (2013) database of offshorability by occupations.

A second channel of the impact of globalisation on labour demand by skills is through import competition. Globalisation might have induced stronger import competition in industries employing low-skilled workers and thus a decrease in the demand for these jobs, that are possibly routine jobs, in the manufacturing sector for example. We construct an indicator of exposure to import competition based on the sectorial structure of each Employment Zone, very similarly to the measure used in Autor *et al*. (2013a) and to our previous ICT dissemination exposure index. More precisely, we apply the national level of import per employment per industry to the 1982 employment per industry in each Employment Zone. We then use the 1990-2011 change in this indicator of import competition exposure. It measures the extent to which the local employment structure by industry was exposed to import competition in 1982, given how import evolved nationally between 1990 and 2011 (see Online complement C2 for details). Table 12 shows that this indicator is positively and significantly

Table 12
Initial share of routine occupations and 1990-2011 import competition exposure by employment zone

	1990-2011 change in import competition exposure		
	(1)	(2)	(3)
1982 share of routine occupations	1.007*** *(0.207)*	0.396** *(0.179)*	1.386*** *(0.387)*
Type of routine occupation	All	Support	Production
Observations	304	304	304

Note: OLS regression coefficients. Standard errors in parentheses. Estimations are weighted by 1982 employment zone population.
*p<0,10 ** p<0,05 *** p<0,01.
Coverage: employed labour force, metropolitan France.
Source: Insee, 1982, 1990 and 2011 *French Censuses*, https://www.insee.fr/fr/statistiques/2832661 (series 5.405) for import data.

Table 13
Robustness of the effect of initial routine share on 1990-2011 change in low-skilled labour markets outcomes by employment zone

	1990-2011 change in the non-college employment share of service occupations				
	(1)	(2)	(3)	(4)	(5)
1982 share of routine occupations	0.105*** *(0.023)*	0.123*** *(0.027)*	0.092*** *(0.024)*	0.082*** *(0.031)*	0.085*** *(0.029)*
1982 female participation	- 0.01 *(0.026)*				-0.018 *(0.026)*
1982 share of 75 year olds		0.112** *(0.052)*			0.212*** *(0.048)*
1982 offshorability index			0.001 *(0,001)*		0.002** *(0.001)*
1990-2011 change in import exposure				0.005*** *(0.002)*	0,009*** *(0.002)*
Observations	304	304	304	304	304
	1990-2011 change in non-college unemployment rate				
	(1)	(2)	(3)	(4)	(5)
1982 share of routine occupations	0.221*** *(0.019)*	0.256*** *(0.05)*	0.164*** *(0.024)*	0.246*** *(0.048)*	0.122*** *(0.03)*
1982 female participation	0.106*** *(0.022)*				0.094*** *(0.027)*
1982 share of 75 year olds		- 0.053 *(0.064)*			0.008 *(0.045)*
1982 offshorability index			0.007*** *(0.001)*		0.004*** *(0.002)*
1990-2011 change in import exposure				0.006** *(0.003)*	0.011*** *(0.003)*
Observations	304	304	304	304	304

Note: OLS regression coefficients. Standard errors in parentheses. Estimations are weighted by 1982 employment zone population.
*p<0,10 ** p<0,05 *** p<0,01.
Coverage: employed labour force; labour force for the unemployment rate, metropolitan France.
Source: Insee, 1982, 1990 and 2011 *French Censuses*, https://www.insee.fr/fr/statistiques/2832661 (series 5.405) for import data.

correlated to the share of routine occupations in 1982, and more strongly to the share of production routine occupations than to that of support routine occupations.

We then add the 1982 offshorability and the 1990-2011 import competition exposure as controls in our regression of 2011-1990 change in the share of service occupations in non-college workers' employment and unemployment rate on the initial share of routine occupations (Table 13 and Table 14 distinguishing support and production functions). They are positively correlated to the share of service occupations in non-college workers' employment and to their unemployment. The effects of the initial share of routine occupations, either distinguishing between production and support functions or not, are lower than previously but still significant. As for the intensity of effects[13], those of the initial share of routine occupations and import competition are comparable, whereas the effect of offshorability is slightly less important. Our results for the test of the task automation hypothesis are thus still valid once controlled for offshoring and import competition[14].

As mentioned earlier, given that the share of service occupations among non-college workers increases more in places where the share of high-skilled occupations decreases, it is likely that the "skill-biased consumption" (that is the greater service demand from high-skilled workers than from low-skilled workers) has no or little influence on the evolution of French local labour markets. But demand for in-person services could also be driven by demographic changes. Increasing female participation in the labour market may increase the demand for services that were previously home produced such as cleaning or childcare. The aging of the population may induce a higher demand for home care services. To avoid a spurious

13. One can compare the effect of the different variables by multiplying the estimated value of the coefficient by the standard-error. This is comparable to use a model with standardized variables.
14. But we do not rule out that globalization might have an effect too.

Table 14
Robustness of the effect of initial share of support and production routine occupations on 1990-2011 change in low-skilled labour markets outcomes by employment zone

	1990-2011 change in the non-college employment share of service occupations				
	(1)	(2)	(3)	(4)	(5)
1982 share of production routine occupations	0.148*** *(0.024)*	0.161*** *(0.024)*	0.140*** *(0.023)*	0.104*** *(0.027)*	0.083*** *(0.024)*
1982 share of support routine occupations	0.084** *(0.035)*	0.110*** *(0.04)*	0.039 *(0.044)*	0.078** *(0.038)*	0.086* *(0.048)*
1982 female participation	0.006* *(0.03)*				-0.018 *(0.025)*
1982 share of 75 year olds		0.103* *(0.057)*			0.214*** *(0.06)*
1982 offshorability index			0.003 *(0.002)*		0.002 *(0.001)*
1990-2011 change in import exposure				0.005*** *(0.002)*	0.009*** *(0.002)*
Observations	304	304	304	304	304
	1990-2011 change in non-college unemployment rate				
	(1)	(2)	(3)	(4)	(5)
1982 share of production routine occupations	0.236*** *(0.031)*	0.217*** *(0.031)*	0.201*** *(0.029)*	0.147*** *(0.035)*	0.125*** *(0.037)*
1982 share of support routine occupations	0.213*** *(0.024)*	0.269*** *(0.054)*	0.123*** *(0.036)*	0.263*** *(0.042)*	0.119*** *(0.038)*
1982 female participation	0.112*** *(0.025)*				0.094*** *(0.027)*
1982 share of 75 year olds		-0.043 *(0.067)*			0.005 *(0.049)*
1982 offshorability index			0.008*** *(0.001)*		0.004** *(0.002)*
1990-2011 change in import exposure				0.009*** *(0.003)*	0.011*** *(0.003)*
Observations	304	304	304	304	304

Note: OLS regression coefficients. Standard errors in parentheses. Estimations are weighted by 1982 employment zone population.
*p<0,10 ** p<0,05 *** p<0,01.
Coverage: employed labour force; labour force for the unemployment rate, metropolitan France.
Source: Insee, 1982, 1990 and 2011 *French Censuses*, https://www.insee.fr/fr/statistiques/2832661 (series 5.405) for import data.

correlation between the level of the share of routine occupations and these demographic variables, we should take them into account in our model. When adding the 1982 female participation rate and the 1982 share of elderly people (over 75 years old) as control variables, results remain pretty similar for the share of service occupations in non-college workers' employment and unemployment rates (cf. Tables 13 and 14) and for routine occupations (table C3-1 Online complement C3).

Introducing controls for import competition and offshoring does not change much the results from our main specification (Table 15). Other competing explanations for the concentration of high-skilled workers in some zones are the functional specialization of large cities proposed by Duranton and Puga (2005) or an increase in the agglomeration economies for high-skilled jobs (Baum-Snow *et al*., 2014). If Employment Zones with a high density of population (and thus potentially high agglomeration economies) are the same as those with a high initial level of support routine occupations, then it may bias our estimation. We therefore add the 1982 population density as a control variable (table 15).

First, we see that a higher density in 1982 is indeed significantly correlated to a higher increase in high-skilled occupations between 1990 and 2011. As high-skilled jobs are mainly support functions, it is consistent with the functional specialization of cities modelled by Duranton and Puga (2005).

Second, previous results hold. The share of high-skilled occupations increased more in Employment Zones where the share of support routine occupations was high but not those where the share of production routine occupations was high. So the evidence of a spatial complementarity between support routine tasks and abstract tasks remains.

Table 15
Robustness of the effect of initial share of support and production routine occupations on 1990-2011 change in the share of high-skilled occupations by Employment Zone

	1990-2011 change in the share of high-skilled occupations			
	(1)	(2)	(3)	(4)
1982 share of production routine occupations	- 0.055* *(0.029)*	- 0.041 *(0.039)*	- 0.018 *(0.042)*	- 0.075** *(0.032)*
1982 share of support routine occupations	0.198*** *(0.065)*	0.327*** *(0.081)*	0.618*** *(0.213)*	0.166*** *(0.059)*
1982 density	0.013*** *(0.001)*			0.012*** *(0.001)*
1982 offshorability index		0.015*** *(0.006)*		0.002 *(0.003)*
1990-2011 change in import exposure			0.002 *(0.003)*	0.002 *(0.002)*
Observations	304	304	304	304

Note: OLS regression coefficients. Standard errors in parentheses. Estimations are weighted by 1982 employment zone population.
*p<0.10 ** p<0.05 *** p<0.01.
Coverage: employed labour force, metropolitan France.
Source: Insee, 1982, 1990 and 2011, *French Censuses*, https://www.insee.fr/fr/statistiques/2832661 (series 5.405) for import data.

Conclusion

We find evidence of the automation of tasks, both in production and support functions, in France over 1990-2011. More precisely, we show that with the development of ICT, low-skilled workers switch from routine tasks to service occupations (manual tasks), or to unemployment. This could explain the skill-biased demand shift and its spatial expression.

At the same time, a functional specialization of local labour markets seems to have occurred over the period 1990-2011 and probably contributed to the spatial shift in demand. High-skilled jobs concentrated in zones where the share of high-skilled occupations was initially higher, and where support routine jobs were also over-represented.

These results are robust to the introduction of controls relating to other explanations such as offshoring of jobs, import competition, or agglomeration economies. However, it cannot be excluded that they have played a role too. Assessing their effects is beyond the scope of this analysis and left for further research. □

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Measurement and anticipation of territorial vulnerability to offshoring risks: An analysis on sectoral data for France

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Abstract – While economic studies generally conclude that there is little impact from offshoring at the macroeconomic level, offshoring generates significant asymmetric shocks at the local level, which it is important to accurately anticipate. This is what this study is about, with the construction of an original indicator of territories' vulnerability to the risks of offshoring manufacturing activity. Firstly, the factors of vulnerability are identified at a fine-grained level of activity. Using principal-component analysis at the sector level, four types of manufacturing industry sectors are brought out according to their potential for offshoring, which is a function of the characteristics of their jobs and their content in routine tasks, and product characteristics. Then, following the approach Aubert and Sillard (2005) implemented on data by establishment, an index of actual offshoring at the sector level is estimated. This makes it possible both to characterise the risk of offshoring in the four main types of sectors and to measure the economic vulnerability of employment zones.

JEL Classification : R12, R3, R58, C38
Keywords: Territory vulnerability, territory attractiveness, offshoring, employment, French employment zones

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Public perceptions continue to place a high degree of importance on the effects of offshoring on employment. However, most economic studies on France show that offshoring is responsible only for a very small percentage of job destruction (Aubert & Sillard, 2005; Daudin & Levasseur, 2005; Barlet *et al.*, 2007, 2009). For instance, according to the *Global Value Chains* survey, carried out by Insee in 2012, offshoring, motivated mainly by the search for lower production costs, affected only 4.2% of the 28,000 non-financial retail companies with 50 employees or more in France between 2009 and 2011 (Fontagné & D'Isanto, 2013). The increase in job destruction in the manufacturing industry and the growing wage inequalities between skilled and unskilled workers are often associated with the effects of offshoring resulting from the fragmentation of global value chains by companies (Mouhoud, 2017). However, the reasons for these changes in employment and wage inequalities are more complex and underpinned by different factors.

As recent literature on the subject shows (Acemoglu & Autor, 2011; Autor & Dorn, 2013), job losses in industry are explained mainly by productivity gains that are higher overall in the production of manufactured goods than in that of services. Moreover, the increase in household income, which stems partly from this growth in industry productivity, has contributed to the change in the structure of consumption, to the benefit of services and at the expense of basic goods and industrial products (Demmou, 2010).

At the same time, a change can be seen in the sectoral distribution of French employment. In 2015, the manufacturing industry accounted for no more than 11% of jobs compared with more than 78% in services according to Insee data. Moreover, the share of skilled workers' employment increased in the labour market. Consequently, the share of managers and white-collar professionals doubled between 1982 and 2014, from 8.7% of the working population to 17.5% (Bisault, 2017). Over the same period, the share of unskilled manual workers in total employment fell from 15.6% to 8.4%.

Similarly, there has been a change in the wage distribution between the different groups of workers since the 2000s. In the United States, studies reveal a rise in wage growth at the bottom of the distribution (low-skilled workers skilled in services activities) and at the top of distribution (highly skilled workers) at the expense of workers in the middle of the range, consisting mainly of skilled and unskilled manual workers (Autor & Dorn, 2013). This so-called wage polarisation effect would also be observed in France, to a lesser extent (Charnoz *et al.*, 2013; Verdugo, 2014).

Two main explanations for these observations are found in the literature: first, information and automation technologies increase in particular the productivity of the most qualified workers (Levy & Murnane, 1996; Acemoglu, 1999; Acemoglu & Restrepo, 2017); secondly, offshoring and international subcontracting or outsourcing to low-wage countries reduce demand for unskilled labour in the manufacturing industry (Feenstra & Hanson, 1996; Leamer, 1996). The effect of the expansion of international trade and competition from low-wage countries is also often suggested.

Moreover, these two phenomena of technological progress and the expansion of international trade interact. The more international competition is intensifying as a result of globalisation, the more firms are encouraged to introduce processes and products innovations. Defensive innovation makes it possible to curb competition and preserve margins (Neary, 2002). Companies then seek to position themselves on processes that are more intensive in skilled labour. In addition, a selection effect of the most efficient firms leads to an increase in the sectors' average productivity level. In the case of France, Pak and Poissonnier (2016) show a decisive impact of technology on employment changes biased in favour of highly skilled workers, particularly in the production of business services (R&D, information and communication). The losers are also the least skilled workers employed in low technology-intensive production activities.

However, there is a discrepancy between the relative optimism that can be seen in empirical studies on the effects of offshoring in France and the public's very negative perceptions. Our assumption is that this is partly due to the highly localised nature of the impacts of offshoring. Some territories are more exposed to offshoring when they specialise in activities, particularly manufacturing, that are particularly vulnerable to international competition (Houdebine, 1999; Mora & Moreno, 2010). Nevertheless, these territorial shocks are hardly offset by labour mobility to regions where companies labour demand does not

meet with adequate supply[1]. An annual survey run by the French Employment Agency includ-ing 400,000 companies shows that 191,100 jobs went unfilled in 2015[2]. These recruitment challenges can be explained in part by the low mobility of workers between regions affected by job destruction and territories experiencing difficulties in hiring workers in specific sectors and for specific professions (Donzeau & Pan Ké Shon, 2009; Fabre & Dejonghe, 2015).

The negative effects of this offshoring should be able to be better identified or even anticipated through an observation of the characteristics of territories and the activities they host. One of the first empirical reference studies measuring the effect of offshoring on employment at the production unit level in France is that of Aubert and Sillard (2005). The authors construct a variable of presumption for offshoring, at the production unit level, considering an increase in imports from the group holding the production unit, proportional to the production shutdown, and concurrent with a sharp reduction in the production unit's workforce. Offshoring in this context is defined as a firm's decision to give up production in France in order to produce or sub-contract abroad. This approach provides a measure of the number of jobs offshored, with a breakdown by sector and by employment zone (EZ)[3]. Barlet *et al.* (2009) take up the same methodology using national accounting data by sector, based on the Trade Balance job content method. Lastly, the study by Barlet et al. (2010) measures the degree of offshorability[4] of service activities at the level of the EZs, using the Insee's *CLAP* database (Knowledge of Local Production Structures), but does not include the manufacturing industry.

One recent study (Autor *et al.*, 2013), carried out on a division of the territory into 722 commuting zones, defined according to residence and job criteria, as in the case of French EZs, measures these zones' exposure to local technological and commercial shocks, attempting to distinguish the effect of technical progress from that of trade with China on the structure of employment. Two types of data are used: data on trade with China on the one hand and data on the intensity in routine tasks and office jobs (1980 data) on the other. A recent study is based on the same methodology, using, in the case of the French cantons and departments, an indicator of exposure to import shocks from six countries considered low-wage, to relate it to extremist votes recorded over the period 1995-2012 (Malgouyres, 2017).

In the same vein as these research, the contribution of this article[5] lies in the construction of an indicator of the vulnerability of EZs to offshoring risks, based on a typology of manufacturing activities, according to the characteristics of the relevant jobs and products and relevant manufacturing processes. The criteria for offshoring risk are not limited solely to trade with low-wage countries. Competitiveness, technological innovation and productivity and the intensity of local jobs in routine tasks or intellectual tasks are also taken into consideration.

The first section presents the theoretical determinants of manufacturing activity location decisions and analyses the risks of offshoring, based on the characteristics of jobs and tasks carried out by workers on the one hand, and the characteristics of the sectors and products on the other. The second section proposes a typology of activities based on their offshoring risk, using an analysis of the factors determining activity location decisions. In the third section, an index of offshoring of activities is constructed by connecting the trend in imports with that of jobs in each activity sector over the period 2008-2010 and taking into account the activity typology determined previously. An indicator of vulnerability to the risk of offshoring in the territories is then measured for French EZs. Lastly, a fourth section maps out the territories' specialisations, according to the typology of manufacturing activities more or less likely to be offshored. In conclusion, public aid policies for territories after restructuring or offshoring are discussed in light of the results of this analysis.

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1. As Insee shows, migration from one region to another remain rare: between 2001 and 2006, they occurred in only 6% of the population above age 5 (Fabre & Dejonghe, 2015).

2. See (in French) http://www.pole-emploi.org/actualites/les-offres-non-pourvues-@/543/view-article-139756.html?

3. Employment zones are defined periodically by Insee. This zoning is free from administrative divisions and is aimed at identifying territories within which most of the working population is active and resides, and in which production units can find the bulk of the workforce needed to occupy their positions.

4. The English term offshorability *has been translated into French as* "délocalisabilité".

5. This article draws inspiration from the study we conducted for the Ministry of Industrial Recovery (DGCIS), PIPAME and DATAR in 2013 (Offshoring of industrial activities in France, 2013).

Identifying offshoring risk in manufacturing activities: a literature review

It should be specified that we aim to consider the factors that are conducive or non-conducive to the vertical offshoring of production processes from the perspective of the fragmentation of global value chains and not that of foreign direct investment (FDI) in search of new markets. Two broad approaches can be used. The first focuses on the characteristics of jobs and tasks borne by workers in the different sectors of activity studied. The second also takes into consideration the nature and characteristics of products that can influence incentives for offshoring.

The approach based on characteristics of workers' jobs and tasks

According to a traditional approach, the key motivation behind offshoring lies in reducing unit wage costs by offshoring the assembly or mounting segments that require more unskilled labour (Dana *et al.*, 2007; Grossman & Rossi-Hansberg, 2008; Jabbour, 2010). Inversely, the potential substitution of capital for labour with robotised production processes discourages offshoring followed by end-product re-import. Firms make their choice between deploying labour-intensive technologies in low-wage countries and robotising their assembly segments in their home country.

However, the nature of the tasks and the degree of skill required for a job do not necessarily coincide. The fact that a job is described as skilled or unskilled is not enough to make it offshorable or non-offshorable. The association of the jobs' characteristics with the types of tasks performed by workers in each activity (routine tasks or execution tasks, versus interactive coordination tasks, etc.) play a crucial role in offshoring decisions (Reich, 1993; Grossman and Rossi-Hansberg, 2008; Muendler & Becker, 2010; Oldensky, 2012; Peri & Poole, 2012; Autor & Handel, 2013). These tasks can be more or less easily offshored and/or robotised.

Blinder and Krueger (2013) show that there is little relationship between the measure of job offshorability and the skills of the person employed. Highly skilled people can sometimes hold offshorable jobs in particular when they occupy positions directly connected with production and are in charge of more or less routine execution tasks[6]. This is often the case in industry, finance, insurance, information services, technical services and services to businesses. For instance, a study distinguishing professional from functional specialisation in industrial activities, shows that R&D engineers have benefited from greater growth in employment than "technical engineers in industry" who are assigned to more direct production tasks (Lainé, 2005).

To assess the potential for offshoring of activities, consideration must therefore be given to the characteristics of the tasks performed by the workers according to their codifiable versus tacit, routine versus non-routine, and manual versus grey-matter natures. A breakdown of employment by type of task in relation with workers' skills was made for the first time to our knowledge in the case of France, using a jobs/skills matrix inspired by the United States Bureau of Labor Statistics' *O*NET survey* (Laffineur, 2015; Charnoz & Orand in this issue). For each job, the different skills are grouped into five main categories of tasks: interactive, analytical, grey-matter, routine manual and non-routine manual[7]. Workers perform routine or non-routine tasks and engage or do not engage in interaction with employees and customers, as a result of which they are more or less vulnerable to the risk of offshoring (Becker *et al.*, 2013).

The losers and winners of offshoring can, based on the above, be identified in a more fine-grained manner. Managers and workers holding interactive and analytical jobs are positively affected by offshoring while those assigned to production and in charge of manual execution tasks are rather the losers in globalisation (Laffineur & Mouhoud, 2015).

In summary, while traditional analyses highlight the cost of labour, capital intensity and investment in company offshoring choices, recent literature emphasises the importance of the characteristics of the tasks performed by employees. Concurrent to this, product characteristics (volume, weight, technology, value

6. The same applies to certain job functions in administrative departments the tasks of which are routine and codifiable, albeit immaterial.

7. The skills required for "communication" include oral understanding and expression, clarity of discourse, etc. Complex tasks are carried out by skilled, administrative or office professionals who perform repetitive tasks in accordance with predefined procedures. Grey-matter tasks require responsiveness, creativity, decision-making and problem solving. Manual dexterity and responsiveness are among the skills required for manual tasks and can be non-routine or routine.

chain fragmentation, etc.) also play a significant part in these choices.

The approach based on product characteristics

The breakdown of productive processes is a significant variable in determining potential for offshoring. To analyse the determinants of vertical offshoring, the literature highlights the concept of value chain modularity[8] or fragmentation (Baldwin & Clark, 2000; Frigant & Layan, 2009). The final product is broken down into a series of sub-systems connected with one another by standardised interfaces. Technically, modularisation reduces the complexity of productive processes by organising their subdivisions into sub-sets, which can in turn be entrusted to subcontractors depending on the nature of their production process. The vertical fragmentation rationale in productive processes makes it possible to maximise the return to the production of each fragment. Decrease in transaction costs (transport, customs duties, exchange rates, etc.) promotes the manufacturing of fragments of productive processes in different countries. The international fragmentation of productive processes assumes, firstly, the possibility of breaking down production and, secondly, a specific gain sought in exploiting differences in comparative benefits between countries. International specialisations are then seen in the fragments of productive processes (Amador & Cabral, 2009).

However, there are interdependency and coordination constraints on the various fragments of the value chain, created by the product's final assembly. Managing this interdependency constraint entails costs, which often increase with distance, and can cancel out the benefits of exploiting differences in comparative advantages between countries. The weightier and bulkier the products, the more the cost of transportation and coordination between fragments of the value chain (productive process) before final assembly will have a bearing on total manufacturing costs. The same applies to products that need to be consumed quickly and therefore close to their place of production.

In addition, the degree of differentiation between products (varieties, qualities), the importance of territorial or national labels or brands ("Guaranteed of French Origin" label, AOC, AOP, IGP, etc.), are expected to reduce the benefits of offshoring. In knowledge- and capital-intensive areas of R&D, competition is paced by the product innovation dynamic. Competitiveness is then based on non-cost benefits that increase the added value of employee production and compensation but which, at the same time, make consumers little aware of price fluctuations and enable production to be maintained in countries and territories with higher wage levels.

In practice, both types of characteristics, tasks and products, combine to influence the decision in favour of or against offshoring (see Box 1). Taking into account the dominant characteristics of products and tasks in each sector, it should be possible to observe differences in their performance levels and degree of offshoring, as well as in the rationale for their offshoring (offensive, in order to access markets, or defensive in order to take advantage of differences in labour costs).

Classifying manufacturing activities by their offshoring potential

Data and methods used

During the first stage, a manufacturing industry typology [9] is constructed, using Principal Component Analysis (PCA), drawing upon variables that characterise the determinants of manufacturing activity location decisions. The data made available by the ESANE 2010 (Development of Annual Enterprise Data) system[10] and those of Insee's 2010 Population Census provide twelve variables (Table 1).

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8. The distinctive property of modular systems is to be "divisible into parts, with high interaction density between the components of each of the parts and lower interaction density between the components of the different parts" (Simon, 1962). Modular production is found in many industrial sectors: automotive, textiles, clothing, electronics, IT, etc.

9. Of the 732 activities identified in the NAF, we selected only the 258 manufacturing activities that can be freely-located (thus excluding energy, mining industries, construction, forestry, services, etc.) and which align with section C of the NAF entitled "manufacturing industry" and comprising divisions from Codes 10 to 33. From these 258 manufacturing activities, we have excluded four artisanal industries (delicatessen, bread-product baking, breads and bakery-pastries, and pastries) which cannot be displaced or exchanged and those for which no data are available. The result is a list of 229 manufacturing industry activities.

*10. The ESANE system has been a source of structural business statistics since 2008. It was instituted in replacement of two previous systems, which operated in parallel with each other: the EAEs (*Enquêtes Annuelles d'Entreprises*/Annual Business Surveys) and SUSE (*Système Unifié de Statistiques d'Entreprises*/Unified Business Statistics System). It is buttressed by two Administration-run sources: the annual business profit declaration registers (e.g., the BIC, for industrial and commercial P&L, the BNC, for non-commercial profits, and the BA, for agricultural-sector profits) which make it possible to collect accounting information about companies, and the Annual Social Data Declarations (DADS), supplemented by the Annual Sector Survey (ESA) which provide data respectively about the workforce, their compensation and on commercial equipment, customer type, etc.*

Box 1 – **The case of textiles and clothing**

The textiles and clothing sector effectively illustrates how these two approaches combine by product and by task to influence the potential for offshoring. As regards the characteristics of the branch's products, clothes are particularly light and small in size; the transport costs for conveying intermediate goods or finished goods assembled abroad are very low. At the same time, barriers to entry into these types of sectors are low (little R&D and patents, etc.). The logic of price or cost competitiveness dominates, even though the differentiation of products by brand image can be a significant competitiveness factor. As regards the characteristics of the tasks, the sewing activity consisting of working with flexible materials is still not very automated, and makes significant use of unskilled labour: labour costs account for more than two-thirds of production costs. While the weaving and spinning phases (upstream from the function) and cutting (laser) are largely automated, this is not true of the assembly activity (sewing). Although robot prototypes have been rolled out in an attempt to automate the sewing activity, they remain in the test phase and are used by only a few major companies. In addition, these robots are still used in a semi-automatic mode that requires manual intervention. The proportion of individuals employed in functions associated with low-skilled, routine, easily offshorable tasks is high. The export rates are relatively low and defensive vertical offshorings driven by differences in wage costs predominate.

Variables on jobs' and tasks' characteristics

Employment variables (labour costs, labour productivity, nature of tasks) and capital-related variables (cost, potential substitutability to work, etc.) are included as determinants of offshoring. The degree of automatisation, approximated by capital intensivity and investment rate variables, limits the decision to offshore in order to benefit from differences in unit wage costs with emerging countries.

The employment data from Insee's 2010 census and broken down by type of function (van Puymbroeck & Reynard, 2010), make it possible to approximate the tasks performed by employees (execution tasks, routine or cognitive tasks, etc.). These data are available at the level of the 732 sub-classes in the French Activities Nomenclature (NAF) and broken down by EZ. The "proportion of functions associated with routine tasks" variable offers an initial grasp on offshorable jobs. The "proportion of cognitive functions" and "proportion of cognitive socio-occupational categories" variables in employment reflect the search for specific skills that are more difficult to offshore[11].

The "annual compensation per employee" variable is a proxy for the high qualifications of workers and the quality of production. It differs from the "wage cost" variable insofar as sectors with a high wage bill/workers ratio are also sectors that employ more skilled workers, are more intensive in technology and file more patents. Contrary to the approach focused on so-called "pure" price competitiveness, the Kaldorian approach to competitiveness emphasises the paradox that the countries that export the most are also those with the highest relative prices (Kaldor, 1978). The explanation offered by the literature for this paradox lies in the increase in production costs, including wage costs, which, as it heightens the qualifications and skills of workers, reflects an increase in the relative quality of products and therefore in firms' performance (Fagerberg, 1988; 1996; Erkell-Rousse & Le Gallo, 2002). This variable is therefore connected both with the characteristics of work and those of products.

Variables related to products' characteristics

Three variables have been identified to characterise the sectors' performance and positioning in terms of quality: the export rate, the added-value rate, and number of patents filed, all relating to product characteristics through the search for innovation and product differentiation likely to reinforce non-cost competitiveness or the geographic anchoring of activities.

Lastly, the "customer payment terms" variable reflects physical proximity between suppliers and customers and expresses a constraint on the geographical dispersion connected with the fragmentation of value chains. As the data mobilised are sectoral and not individual, we cannot approximate the proximity constraint

11. The "proportion of grey-matter functions" variable is derived from census data (RP). The "proportion of grey-matter SOCs" variable is derived from SOC surveys taken at production unit-level, in the ESANE database. While these two variables may seem similar, in reality, higher socio-occupational categories may also include more or less routine functions, albeit in a lesser proportion than other SOCs.

using a mere geographical proximity indicator. The literature regarding services (Jensen Bradford & Kletzer, 2006; Barlet *et al.*, 2010) generally uses geographical distance on demand to define tradable services and thus their potential for offshoring, in line with Krugman's analyses (1991). This methodology is not adequate when it comes to manufacturing industry activities or branches. In the context of industry, the 'payment terms' variable offers an proxy for the trend toward the international fragmentation of value chains. Several studies have shown that, within manufacturing activities, payment terms turned out to be longer in the capital goods and intermediate goods industries, in other words upstream from the production chain (Insee, 2006). The same can be observed with firms whose products are intended for companies compared to firms focused on satisfying final demand (Souquet, 2014). These findings tend to show that a link exists between payment terms on the one hand and the nature of the demand on the other. However, satisfying final demand implies a more pronounced geographic proximity constraint and payment terms would make it possible to approximate this constraint. This relationship is confirmed by the work of the Banque de France's Observatory on Payment Terms which, by analysing in particular firms located in Corsica or overseas France, highlights that the geographic distance between customers and suppliers extends payment deadlines (Prost & Villetelle, 2017). In other words, payment terms and geographic proximity constraints appear to be negatively correlated.

A typology of manufacturing activities according to their potential for offshoring

The results of the PCA applied to twelve variables across the 229 manufacturing sectors are shown in Figure I. The first factorial axis (horizontal) reflects a net sector divergence in terms of task characteristics and innovation. The activities located to the left of the horizontal axis (manufacture of ceramic articles, processing and storage of poultry meat, book-binding activities, etc.) have a high proportion of functions associated with routine tasks. These sectors contrast with those characterised by a significantly high proportion of grey-matter functions, through the strong presence of cognitive SOCs and high staff salaries (manufacture of navigational assistance equipment, communication equipment, industrial gases, etc.).

Table 1
Variables and databases

Variables	Description	Sources
Patents - use of technology	Charges including royalty fees for patents, licenses / turnover excluding tax	ESANE (2010)
Customer payment times	Total trade receivables for the whole sector / total annual turnover, including VAT, divided by 360.	ESANE (2010)
Capital intensiveness	Amount of property, plant and equipment / value added excl. tax	ESANE (2010)
Proportion of cognitive SOCs	Proportion of executives and intellectual professions in employment	ESANE (2010)
Proportion of functions associated with routine tasks	Proportion of "manufacturing" and "management" functions in employment	Calculations based on 2010 Census data (INSEE)
Proportion of cognitive functions (Insee functions)	Proportion of "intellectual services", "research design" and "education – training" functions in employment	Census 2010 (INSEE)
Proportion of personnel costs	Personnel costs / turnover excluding tax	ESANE (2010)
Apparent labour productivity per capita	Added value excl. tax / workforce in full-time equivalent	ESANE (2010)
Annual compensation per employee	Annual compensation per employee	ESANE (2010)
Export rate	Turnover from export / turnover	ESANE (2010)
Investment rate	Amount of tangible investments / added value exc. VAT	ESANE (2010)
Added value rate	Added value excl. taxes / turnover	ESANE (2010)

The second factorial axis (vertical) shows another recurring opposition to the labour-capital substitution. At the top of the graph, activities entailing high personnel costs (manufacture of fibre-cement structures, raw oils and fats, paper pulps, etc.) are opposed to those, at the bottom of the graph, with capital intensity, high investment rate and labour productivity (manufacture of navigation assistance equipment, shipbuilding and the construction of floating structures, repair of electronic and optical equipment, etc.).

The construction of industrial classes

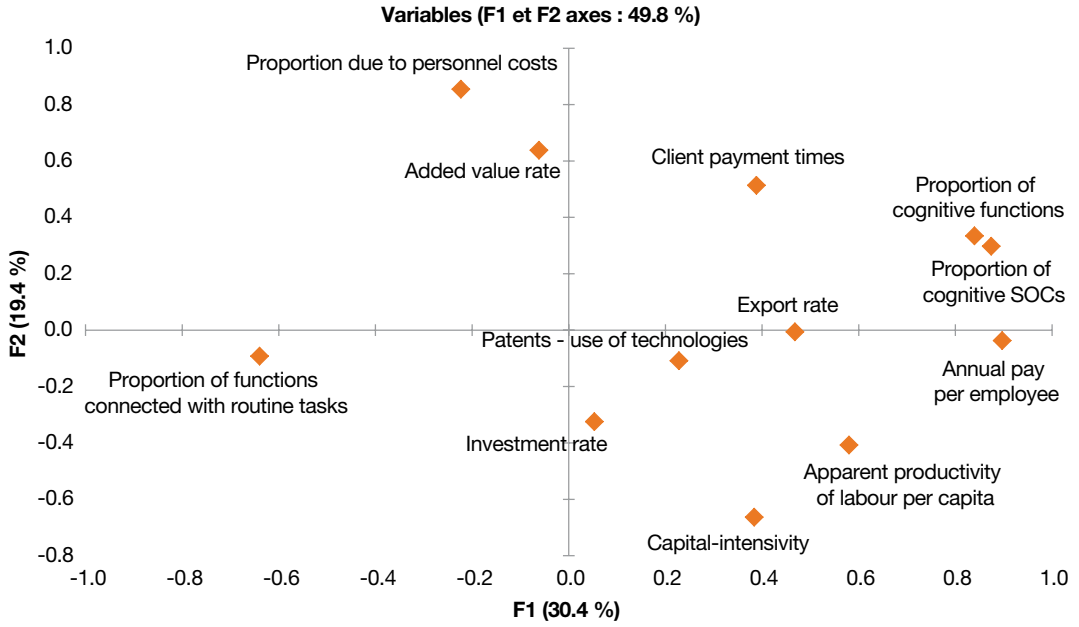
Based on this PCA, the *k*-means classification method, also known as the dynamic cloud method, is used on the first six significant factorial axes, accounting for 85.4% of the cumulative variance. This method refers to deterministic non-hierarchical models that sub-divide a population into disjoint *k* classes, the value *k* being set using a supplementary methodology such as Ascending Hierarchical classification (AHC), as in this article. Concretely, the AHC algorithm makes it possible to obtain a range of typological *k* groups. The AHC provides, as its best result, a four-class typology[12]. On this basis, the *k*-means methodology makes it possible to assign each of the 229 activities of the NAF manufacturing industry into four homogeneous classes, based on the offshoring variables.

Table 2 shows the correlations between the four classes and each of the twelve variables. Table 3 shows the relative weight of each class in total employment across the 229 manufacturing industry activities on the one hand and French total employment on the other. There is a clear initial separation between classes 2 and 4 (even-numbered classes) and classes 1 and 3 (odd-numbered classes) in accordance with the characteristics of the workforce and the types of tasks carried out by the workers.

The distribution of manufacturing jobs between the four classes of sectors shows that the categories 1 and 3 concentrate two thirds of the employment of the jobs in the

12. A range of 3 to 5 groups has been defined, taking into account the size of the sample (229 sectors). The algorithm makes it possible to show the change in intra-class variance (which decreases mathematically as the number of classes increases). If the data are distributed evenly, the negative growth observed is linear. If there is a group structure, a bend can be seen for the relevant number of classes. In this case, the algorithm identifies 4 classes as its best solution.

Figure I
Analysis of principal components, findings on the twelve variables



Scope: 229 manufacturing sectors from the nomenclature of activities (NAF 700 products), Mainland France and Overseas Departments.
Sources: Insee, ESANE system, 2010; Census, 2010; authors' calculations.

229 manufacturing sectors studied[13]. Class 3, which comprises 90 activity sectors, accounts for 42% of manufacturing jobs, i.e. almost 5% of total employment in France. Class 1 accounts for 24% of manufacturing jobs and encompasses 69 sectors (Table 3).

The sectors belonging to these 'odd' classes are characterised by the presence of unskilled workers with routine tasks and low labour productivity rates (Table 2). Cognitive SOCs (–26.1% in class 1 and –38.1% in class 3) and intellectual functions (–30.4% in class 1 and –37.9% in class 3) are much less represented than on average in manufacturing activities. Export rates for these sectors are also lower than in 'even' classes.

The difference between classes 1 and 3 is due to the specific mix of unskilled labour and routine tasks with combined greater capital intensity for class 1 (investment rate of +15.6%), versus lower capital intensity in class 3, resulting in a higher share of personnel costs and low investment rates. Added-value levels are very low in class 1 and high in class 3. The proximity constraint for class 1 activities is higher, in that the payment terms needed to approximate it appear to be lower than the average (–21.1%). These include bulk-product sectors, more constrained by the proximity of demand and more focused on the domestic market, such as most agri-food industries[14] and the production of construction materials[15]. Conversely, the proximity constraints are looser in class 3 activities. The added-value rate in class 3 is higher insofar as it is rather the assembly phases that would be offshored, which is consistent with the low export rate. Traditional consumer goods sectors such as textiles and clothing are strongly represented there.

On the other hand, in the even-numbered classes, the higher socio-occupational categories employees and those engaged in cognitive tasks are over-represented and labour productivity rates are higher. As a result, the export rate is much higher than in the odd-numbered sectors.

The differences between classes 2 and 4 primarily are due to the geographic proximity constraints that are stronger for class 2 sectors than for class 4. In class 2, which has 31 sectors and 14% of manufacturing jobs (Table 3), the

13. In 2010, total French manufacturing industry accounted for only 12% of total employment. The activities of our four classes combined amounted to approximately 11% of total employment in 2010.
14. The presence of some agri-food in this category can be ascribed to the use of data related to industrial specifics. In sectors in this class, the share of exports is not so high, compared to other manufacturing sectors. Although in absolute terms, the amounts exported are significant, the local market, which itself is very sizeable, determines these companies' location decisions. The agribusiness branches posting the highest export (e.g. champagne) do not appear in this class.
15. Table 1 in Appendix presents examples of sectors for each class while online supplement C1 lists all sectors of each class.

Table 2
Correlations between sector classes and offshorability variables (%)

Variables	Classe 1	Classe 2	Classe 3	Classe 4
Patents - use of technology	- 9.3	19.1***	- 4.0	- 0.8
Customer payment terms	- 21.1***	- 11.3*	- 4.6	42.0***
Capital intensiveness	1.9	69.7***	- 35.3***	- 19.9***
Proportion of cognitive SOCs	- 26.1***	15.9**	- 38.1***	67.0***
Proportion of functions associated with routine tasks	5.1	- 16.5**	42.9***	- 47.0***
Proportion of cognitive functions (Insee functions)	- 30.4***	13.0**	- 37.9***	74.5***
Proportion of personnel costs	- 47.7***	- 42.5***	60.5***	18.3***
Apparent labour productivity per capita	- 16.7**	69.7***	- 34.8***	2.1
Annual compensation per employee	- 30.1***	55.1***	- 41.3***	40.2***
Export rate	- 15.7**	13.8**	- 24.4***	38.3***
Investment rate	15.6**	10.1	- 13.0**	- 11.2*
Added value rate	- 55.0***	- 13.5**	53.9***	9.4

Note: The values differ from 0 at the significance level: *** alpha=0.01; ** alpha=0.05; * alpha=0.1.
Scope: 229 manufacturing sectors in the nomenclature of activities (NAF 700 products), Mainland France and Overseas Departments.
Sources: Insee, ESANE system, 2010; Census, 2010; authors' calculations

sectors are more focused on innovation (patents). Capital intensivity and apparent labour productivity there are far higher than in the other classes. It includes the chemical, metallurgy and automotive sectors[16].

In class 4, which includes 39 sectors and 19% of manufacturing jobs, the sectors are more internationalised, not only through higher export rates but also due to the possibility of international fragmentation in the value chain allowed by the limited proximity constraint. For example, it includes the electronics, aeronautics, luxury and perfumery sectors.

All in all, there are four categories of activity:

- activities entailing a high percentage of cognitive SOCs workers and with high export rates (class 2 and 4) with high capital- and patent-intensiveness (class 2) or low capital-intensity (class 4);

- activities entailing a low percentage of cognitive SOCs workers and characterised by low productivity (classes 1 and 3) and with medium capital-intensity and low internationalisation (class 1) or low capital intensity (class 3).

An index of activities offshoring to measure the territory vulnerability

We process in three stages. In the first, an index of offshoring of activities is constructed by linking up the trend in imports in the activity sectors with that of jobs during the period 2008-2010. In a second step, we analyse the positioning of each of our four manufacturing industry classes in relation to this offshoring index. In the third stage, we build an indicator of vulnerability to the risk of offshoring in the 321 EZs, as a sum of the index of offshoring for each sector weighted by its share in the EZ total employment.

A manufacturing industry sector offshoring index

To construct the index of actual offshoring in manufacturing industry sectors, we draw from the approach adopted by Aubert and Sillard (2005) at the level of the production units. In this approach, offshoring is presumed to have occurred when a sharp reduction in staff levels (at least 25% of the initial workforce) comes alongside an increase in imports proportional to the production shutdown in France.

In this article, to estimate how much each sector *s* has been subject to offshoring, we compute an offshoring index ($Ideloc_s$) based on the following two variables: the change in employment, measured by full-time equivalent workforce between 2008 and 2010 (in logarithm);

16. The automotive sector is internationalising in two ways:
- by FDI (foreign direct investment) to conquer markets, often through mergers and acquisitions (M&A) as illustrated by the Renault-Nissan Merger to conquer the Asian market. As the automotive sector is a bulk-product sector, companies often favour export FDI;
- via regional fragmentation of the value chain in different countries in the regional market, for example in Europe, to serve it through export.
The construction of motor vehicles belongs to class 2 because it is an export sector that does not rely on vertical offshoring followed by reimport of the final product. However, automotive electronic components are in class 4 (intermediate products, with a strong offshoring presumption, see Table 5, hereafter).

Table 3
Characteristics of jobs in four large groups of sectors in 2010

Type of industry sectors Manufacturing	Number of jobs	Proportion of manufacturing employment in %	Proportion of total employment as % (including services and other activities)
Class 1 (69 sectors)	699,571	24.2	2.7
Class 2 (31 sectors)	408,185	14.1	1.6
Class 3 (90 sectors)	1,229,853	42.6	4.7
Class 4 (39 sectors)	547,651	19.0	2.1
Total four classes	2,885,260	100	11.0

Reading note: Class 3 (comprising 90 sectors) has more than 1.2 million jobs, representing 42.6% of manufacturing employment and 4.7% of total employment.
Scope: 229 manufacturing sectors in the nomenclature of activities (NAF 700 products), Mainland France and Overseas Departments.
Sources: Insee, Census, 2010; authors' calculations.

the change in the share of imports in turnover excluding taxes (T excl. VAT) between 2008 and 2010[17].

Three linear regressions are estimated using ordinary least squares in the manufacturing sectors studied (Table 4). The first equation confirms the hypothesis of Aubert and Sillard (2005) and shows the existence of a negative and significant link between changes in employment and variations in imports. An analysis of the gap between the actual change in employment in a sector and the change in estimated employment makes it possible to understand the offshoring presumption in business sectors. When a sector experiences both an actual drop in employment and a decline in estimated employment due to the change in its imports, the sector is supposed to have effectively relocated over the period studied.

Based on this analysis, it is possible to estimate the potential for offshoring of each of the four manufacturing sectors in the typology. Equation (1) is supplemented by two other regressions equations : Equation (2) adds to the initial regression three manufacturing activity variables in classes 1, 3 and 4, with class 2 now being taken as reference to analyse the other three classes (Table 4). The negative and significant relationship between changes in employment and imports is confirmed overall (estimated coefficient of –0.00457). Moreover, classes 3 and 4 show a more negative and significant change in employment (respectively –0.167 and –0.119). When four variables are added, combining the sectors' belonging to each of the four classes with the change in

17. We will use Years 2008 (1st year of the existence of ESANE) and 2010 as the data mobilised in grey-matter and routine function content are derived from the 2010 Census, the most recent data available at the start of the study in 2013.

Table 4
Estimation of the offshoring potential of the four manufacturing sector classes. Change in employment and imports/turnover excl. tax

VARIABLES	(1) Change in employment (in log) 2010/08	(2) Change in employment (in log) 2010/08	(3) Change in employment (in log) 2010/08
Class 1		- 0.0800 (0.0521)	- 0.0880 (0.0536)
Class 2		*Reference*	*Reference*
Class 3		- 0.167*** (0.0500)	- 0.172*** (0.0524)
Class 4		- 0.119** (0.0576)	- 0.115* (0.0590)
Class 1 x var import/turnover excl. tax			0.00322 0.00427)
Class 2 x var import/turnover excl. tax			- 0.00409 (0.00302)
Class 3 x var import/turnover excl. tax			- 0.0107*** (0.00263)
Class 4 x var import/turnover excl. tax			- 0.00763* (0.00423)
Change in import/turnover excl. tax (log) 2010/08	- 0.00462** (0.00194)	- 0.00457** (0.00208)	
Constant	7.45e-09 (0.0137)	0.109** (0.0462)	0.110** (0.0484)
Observations	227	227	227
R2	0.029	0.102	0.137
Adjusted R2	0.0245	0.0857	0.109

Note: two sectors of activity with extreme values in terms of imports in 2008 were excluded from the regressions and the rest of the analysis: sector 2640Z (manufacture of consumer electronic products) and 2823Z (manufacture of office machinery and equipment, except computers and computer peripheral equipment). The variables are centred.
OLS. Significance threshold of coefficients: *** p<0.01, ** p<0.05, * p<0.1.
Scope: 227 manufacturing sectors in the nomenclature of activities (NAF 700 products), Mainland France and Overseas Departments.
Sources: Insee, ESANE system, 2008, 2010; authors' calculations.

imports (equation (3)), this result is reinforced: classes 3 and 4 are the most affected by offshoring[18] (the estimated coefficient of variation in imports are, respectively, –0.0107 and –0.00763).

The offshoring index is computed from equation (3) as follows:

Ideloc = max (Observed change in employment, Estimated change in employment) if observed change in employment <0 and estimated change in employment < 0 (presumption of offshoring)

Ideloc = min (Change in employment, Estimated change in employment) if observed change in employment > 0 and estimated change in employment > 0 (presumption of offshoring)

Ideloc = 0 in all other cases (indeterminate)

When the observed change in employment, and the change in employment estimated based on variations in imports and belonging to the four classes are both negative, the activities show a high level of "presumption of offshoring". When the changes in actual employment and estimated employment are both positive, the activities show a "presumption of non-offshoring"[19]. Lastly, the index takes on zero value when, for a given sector, changes in employment on the one hand and estimated employment on the other show opposite signs.

By using only the lowest negative values (where *Ideloc* = max) and the lowest positive values (where *Ideloc* = min), this index avoids overweighting the impact of imports on employment and allows to avoid defining an arbitrary threshold with which the loss of jobs in a sector would be equivalent to offshoring[20].

The four manufacturing industry classes in the face of actual offshoring

The share of sectors affected by a presumption of offshoring in all the sectors of each class of activity is higher in class 3, where it reaches two-thirds of the sectors[21] (Table 5). These sectors include, unsurprisingly, textiles/clothing, furniture, tooling and light metals. This is the most vulnerable class of activity in terms of offshoring risk. In this class, only 4.5% of sectors show a presumption of non-offshoring such as, for example, footwear items, which are one of France's speciality niches.

Class 4 shows almost 30% of its sectors with presumed offshoring compared to less than 24% of sectors with no presumed offshoring. The sectors most affected by potential offshorings are the manufacture of electronic components, computers, electrical and electronic automotive equipment, and printing machines. The sectors carrying a non-offshoring presumption include, for example, luxury products (perfume, clothes), medical irradiation equipment, and portable hand-held power tools. These are generally sectors with a strong non-cost advantage and benefiting from a product differentiation effect.

The first two classes are little (7.2% of sectors in class 1) or not at all (class 2) affected by presumed offshoring (Table 5). The sectors with presumed non-offshoring in class 1 are represented by the agribusiness industries, bulky construction and public works products, agricultural and forestry machinery, etc. Lastly, 71% of the activities in class 2 show a presumed non-offshoring, as illustrated by the luxury agri-food products sectors (champagne, etc.), chemical and pharmaceutical products, etc.

Crossing the characteristics of the manufacturing industry resulting from Table 2 and the offshoring indices makes it possible to qualify the four classes in terms of exposure to the risk of offshoring. Class 1 encompasses the "domestic sectors little-suited to offshoring" dominated by moderately capital-intensive activities, with little grey-matter-job intensity, and a greater focus on the domestic market; class 2 comprises the "export sectors little-suited to offshoring", in which activities are more capital-intensive, more intensive in grey-matter functions and more likely to export; class 3 includes "defensive offshoring activities", the activities of which are labour-intensive and intensive in routine tasks, and considerably more involved in import; and lastly, class 4 aggregates "offensive offshoring sectors", the activities of which are labour-intensive,

18. A Fisher test leads to reject equation (1) for equation (2) with a probability <0.01. A likelihood ratio test leads to the rejection of equation (2) for equation (3) at the threshold of 0.05 (p=0.03).

19. It is helpful to recall that according to the INSEE Global Business Chain survey (Fontagné & D'Isanto, 2013) 3% of the 28,000 non-financial companies asked had decided against offshoring their activities, while 4.2% of them offshored their business.

20. A variation on this index was also tested. It used the offshoring index, Ideloc = average (change in observed employment, change in estimated employment). This variation tends to increase the index relative to that used. The correlation between this variation and the index used in the article is 0.782. The rank correlation (Spearman) is also high, exceeding 0.86. In both cases, the correlation is significant at 99%.

21. Online complement C1 shows the list of sectors with presumed offshoring and presumed non-offshoring, by relevant class.

Table 5
Proportion of manufacturing sectors affected by the presumption of offshoring and non-offshoring, by class

in %

	Non-offshoring presumption (*Idéloc* = min)	Offshoring presumption (*Idéloc* = max)
Class 1	52.2	7.2
Class 2	71.0	0.0
Class 3	4.5	69.7
Class 4	23.7	28.9

Reading note: 52.2% of the class 1 sectors show a non-offshoring presumption.
Scope: 227 manufacturing sectors in the nomenclature of activities (NAF 700 products), Mainland France and Overseas Departments.
Sources: Insee, ESANE system, 2008, 2010; authors' calculations.

intensive in grey-matter jobs and largely export-oriented. Offshoring is said to be offensive, because the activities of this class 4 are characterised, as the PCA shows, by competitiveness factors other than costs (patents, cognitive SOC, labour skills, etc.), which stimulate exports (for more details, see Appendix and Online Complement C1).

An EZ vulnerability indicator for offshoring

An indicator of French EZ vulnerability to offshoring risk is proposed, drawing on two factors. The first is derived from the offshoring index $Idéloc_s$ estimated earlier for each sector s. The second measures vulnerability to offshoring in the regions by weighting the offshoring index for its share in the total employment of each of the 321 EZs[22]. In other words, the fragility of an EZ is the result of the offshoring index and the greater or lesser share of employment in the sector relative to total employment in the territory. This indicator allows to avoid overestimating the vulnerability of an EZ by excluding the situations in which changes in employment come from purely cyclical factors.

This vulnerability index is defined as follows:

$$vulner_i = \sum_{s=1}^{227} Ideloc_s \times \frac{N_i^s}{N_i^\bullet} \qquad (2)$$

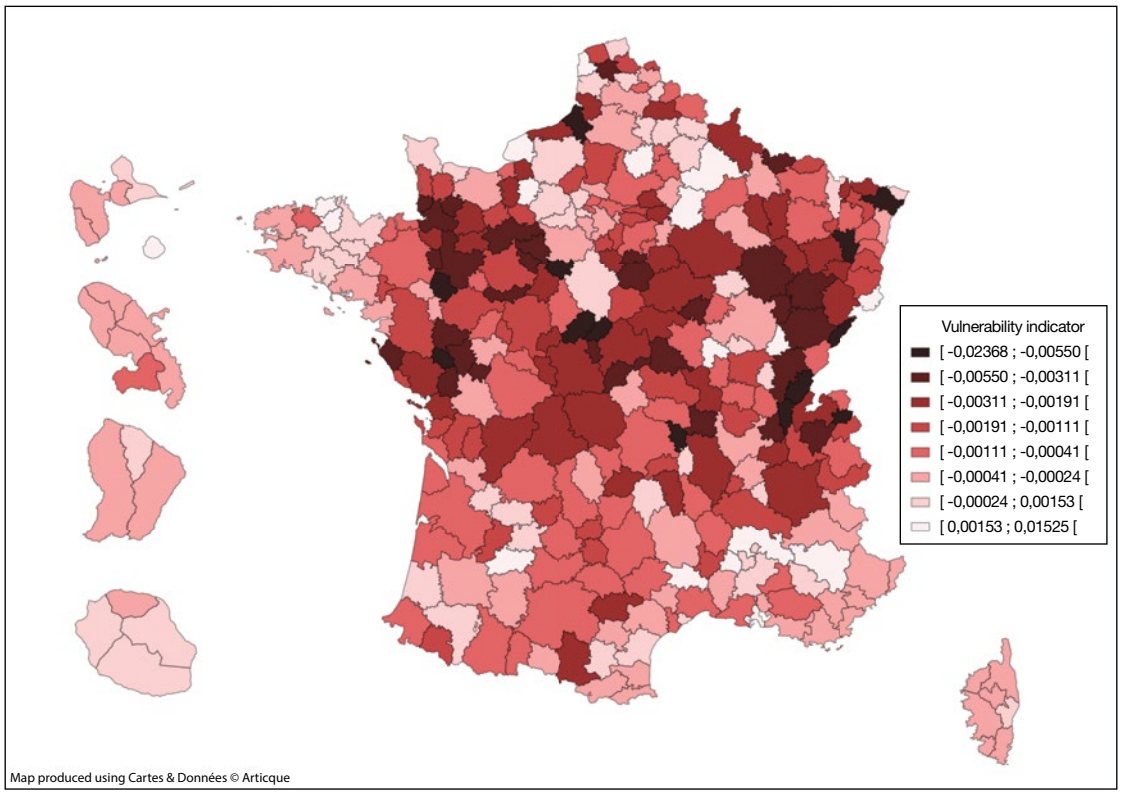
with $Ideloc_s$ the offshoring index of each sector of manufacturing industry s, N_i^s the employment of each EZ i in sector s and $N_i^\bullet$ total employment of this EZ i including services and other economic sectors. The more region is specialised in a sector considered more subject to offshoring, the more it is considered to be vulnerable.

Figure II illustrates the results of this vulnerability indicator for each EZ. Discretization is carried out using the nested average method, using an eight intervals classification. The vulnerability index allows highlighting the EZs the most affected by job-destroying defensive offshoring. The demarcation between a broad northern half and the southern half of France is quite clear, along a Nantes-Valencia axis. The northern half concentrates the most vulnerable areas with a high number of EZs actually affected by offshoring. The territories located in the north-east quarter of the country have already been hard hit by dis-industrialisation and business restructuring. During the period studied, offshoring most frequently occurred in the eastern territories, along an axis from Haguenau (Bas-Rhin) to Annecy, via Saint-Dié-des-Vosges, Morteau, Saint-Claude, Oyonnax and the Arve Valley. The latter, even though recognised as a dynamic industrial employment zone, shows the highest vulnerability index out of the 321 EZs.

Other zones encompassing several EZs are also affected: in the heart of the Auvergne-Rhône-Alpes region, the Thiers and Roanne EZs appear particularly vulnerable. The same applies to the Romorantin-Lanthenay, Vierzon and Issoudun EZs in the Centre-Val de Loire region. The other vulnerable territories are located in the west of the country along a vertical axis from the English Channel (Granville) to the Choletais region (Fontenay-le-Comte) via Segré

22. *For each EZ, the Population Census (2010) and its scope are used to measure employment in manufacturing industry, within the 227-sector selection, as well as including jobs in all sectors (732 sub-classes).*

Figure II
Comparative positioning of French EZs according to their vulnerability indicator



Note: the darker the EZs, the greater the vulnerability to offshoring. The results of the index vary from -0.0237 for the most vulnerable EZ (Arve Valley) to 0.0152 for the least vulnerable (Autun).
Scope: 227 manufacturing sectors for the nomenclature of activities (NAF 700 products), 321 EZs in mainland France and Overseas Departments.
Sources: Insee, ESANE system, 2008, 2010; Census, 2010; authors' calculations.

and Les Herbiers. Some EZs in the Choletais region, which had been hit by the exacerbation of international competition in textiles-leather-clothing industry as a result of the dismantling of the World Trade Organisation Multi Fibre Agreement in 2005, remain relatively vulnerable.

Lastly, among the most vulnerable EZs, some isolated territories can be found within less exposed EZs. This is the case of the Bresle Valley in Normandy, Saint-Omer in Hauts-de-France and Avallon in Burgundy. The mapping also shows a more widespread fragility in peripheral areas around large cities such as Lille, Lyon, Rennes, Strasbourg, Dijon, Orléans and Rouen. Around the Paris Region, the most vulnerable zones are found beyond the outer suburbs, particularly in the south of the Île-de-France region: in the south-east with Montargis and Nemours and in the south-west with Châteaudun, and Nogent-le-Rotrou.

In the northern half of France, the regions of Brittany and Île-de-France seem to be less affected by offshoring. However, this does not mean that Brittany, for example, is not affected by exposure to other types of economic shocks than the potential offshoring measured by this index. The territories located in the southern half of France, more precisely in the south of the Nantes-Valence axis, show less vulnerability due to their specialisation in tertiary activities. Only two EZs in the south-west are more affected by offshoring: Foix-Pamiers and Castres-Mazamet.

The vulnerability index confirms the localised or even dispersed nature of the offshoring shocks: few EZs are actually affected, but their exposure to shocks is highly intensive. These more exposed zones are unsurprisingly located in the territories of the northern half of France, particularly in the Eastern part.

Having detected the most vulnerable EZs using the vulnerability indicator, the next step consists in taking into account the specialisation of the EZs in our four classes of activities with

varying degrees of offshorability, in order to map the weak points and industrial performance levels of our territories.

Predicting the risks and performance of territories based on their specialisation in the four types of activity

Measuring the specialisation of territories in the four main types of manufacturing activities

One of the interests of the typology lies in the ability to characterise the weaknesses or performance of the territories according to their specialisation in each of the four classes of activity. A Hoover relative specialisation index is calculated for each EZ and for each class of activity (Box 2).

Let us begin with the analysis of territorial fragility through the mapping of EZ specialisations in the odd-numbered classes of our activity class typology. Once again, these are activities entailing a low percentage of cognitive SOC workers and characterised by low productivity (classes 1 and 3) and with medium capital-intensity and low internationalisation (class 1: domestic sectors hardly offshorable) or with low capital-intensiveness (class 3: sectors with offensive offshoring).

The EZs most specialised in **domestic activities hardly offshorable** (class 1) tend to be rural and agricultural, peripheral to large conurbations and not densified (figure III). These rural EZs are host activities that are intensive in capital- and intermediate consumption, hence low labour skills requirements. This is the case of the ZEs in Brittany, Mayenne, Laon in Maubeuge, in the Dacquoise region, around Rodez and Brive, as well as in several Northeast territories. In fact, these territories are no less fragile than those specialised in defensive offshoring sectors (class 3), as agri-food activities with low added-value and dominated by price competitiveness make up the bulk of these specialisations. These activities are, for example, sensitive to exchange rate, changes in world commodity prices and possible changes to aid mechanisms relating to the common agricultural policy. It is not surprising that Brittany's ZEs are particularly affected.

Class 3 activities, in which **offshoring is defensive**, are characterised by relatively low labour intensivity and higher levels of routine production tasks (figure IV). The number of EZs housing such activities is particularly high. However, these activities are more prevalent in less diverse areas such as the Bresle Valley (manufacture of hollow glass, taps), Oyonnax (manufacture of plastic products), the Arve Valley (machining), Thiers (powder metallurgy, cutlery, ...), etc. While the large metropolises are spared, a number of average-size cities show a significantly high specialisation index in these activities, as illustrated by Saint-Etienne (technical and industrial textiles), Troyes (undergarments, pneumatics), or Laval (manufacture of assembled electronic parts, rubber articles, etc.). It is in the south of France and in the overseas municipalities that the least specialised EZs are found in this second class of activity.

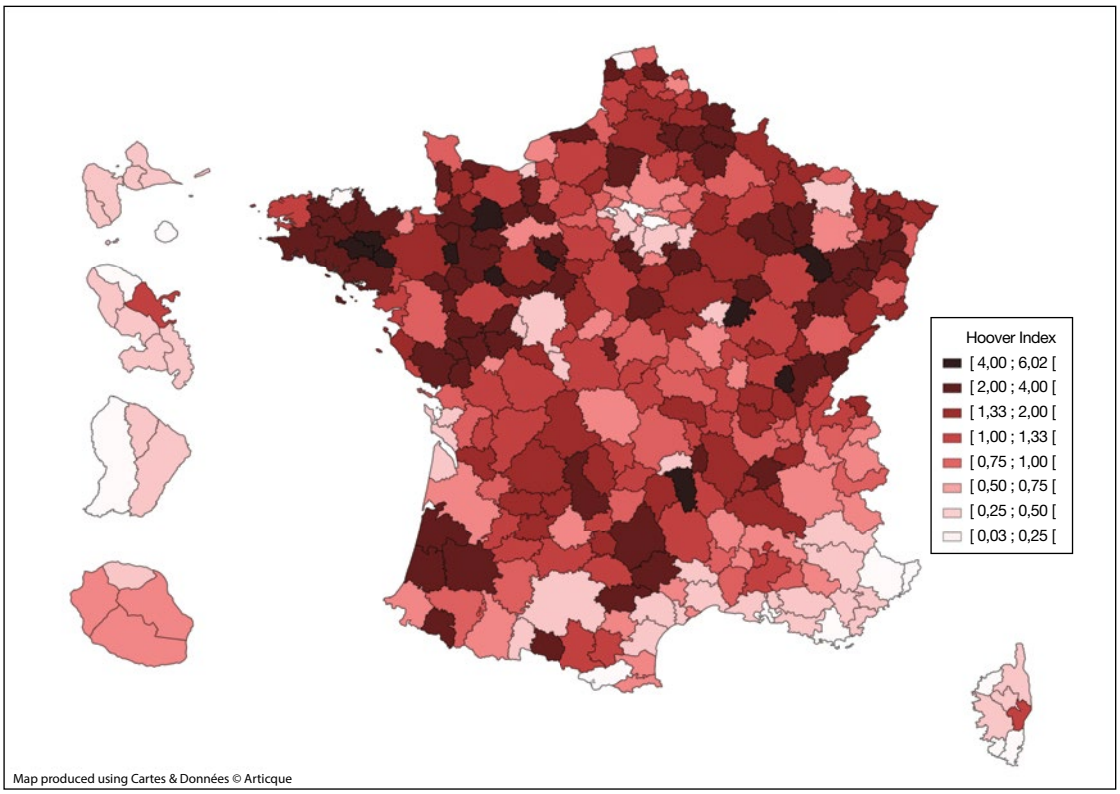
This brings us to the mapping of EZ specialisations in the **even-numbered activity classes**, i.e. in the exporting sectors with a high degree of capital intensity and patents (class 2: export activities little-suited to offshoring) or low capital intensity (class 4: activities with offensive offshoring).

Specialisation in class 2 **exports industries hardly offshorable** (Figure V) shows greater disparities between territories. Fewer EZs are affected. The most specialised territories are, with a few exceptions, located in the north of France (Seine axis, some EZs in the North and Pas-de-Calais, Dole, Mulhouse, etc.). In the Southern half, the zones are more geographically isolated (Istres-Martigues, Ambert, Issoire or Annonay), and are distinguished by a strong specialisation in this type of industrial activity.

With regard to activities involving **offensive offshoring** such as aeronautics, electronics, or luxury (class 4), the disparities are, as in the case of class 2 activities, much more prominent between the territories (Figure VI). A small number of EZs show a strong specialisation in these activities. They are found in certain large cities, such as in the south and west of Paris (Rambouillet, Évry, Melun) and Cergy, in the metropolitan areas of Toulouse, Grenoble or Aix-Marseille, or for instance outside certain large conurbations such as Ancenis, Châtellerault or Molsheim–Obernai.

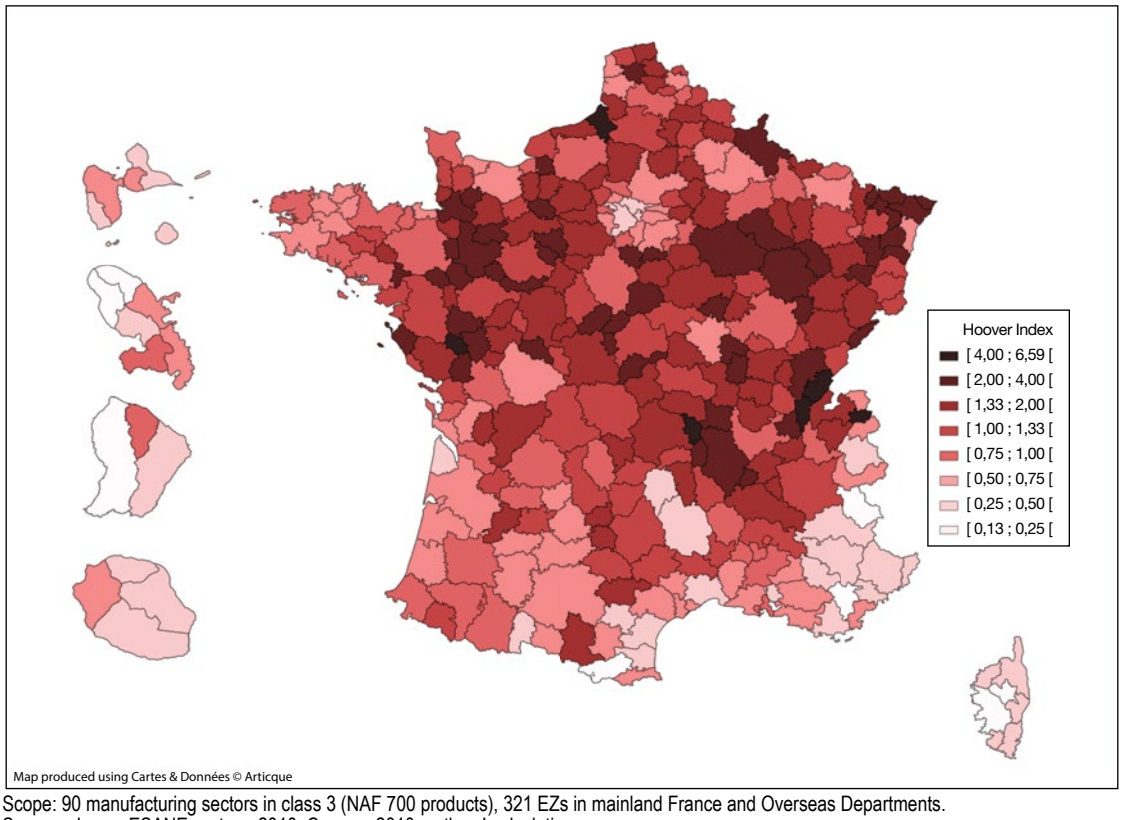
All in all, activities requiring more capital, grey-matter functions, high productivity and

Figure III
Specialisation of EZs in domestic sectors hardly offshorable



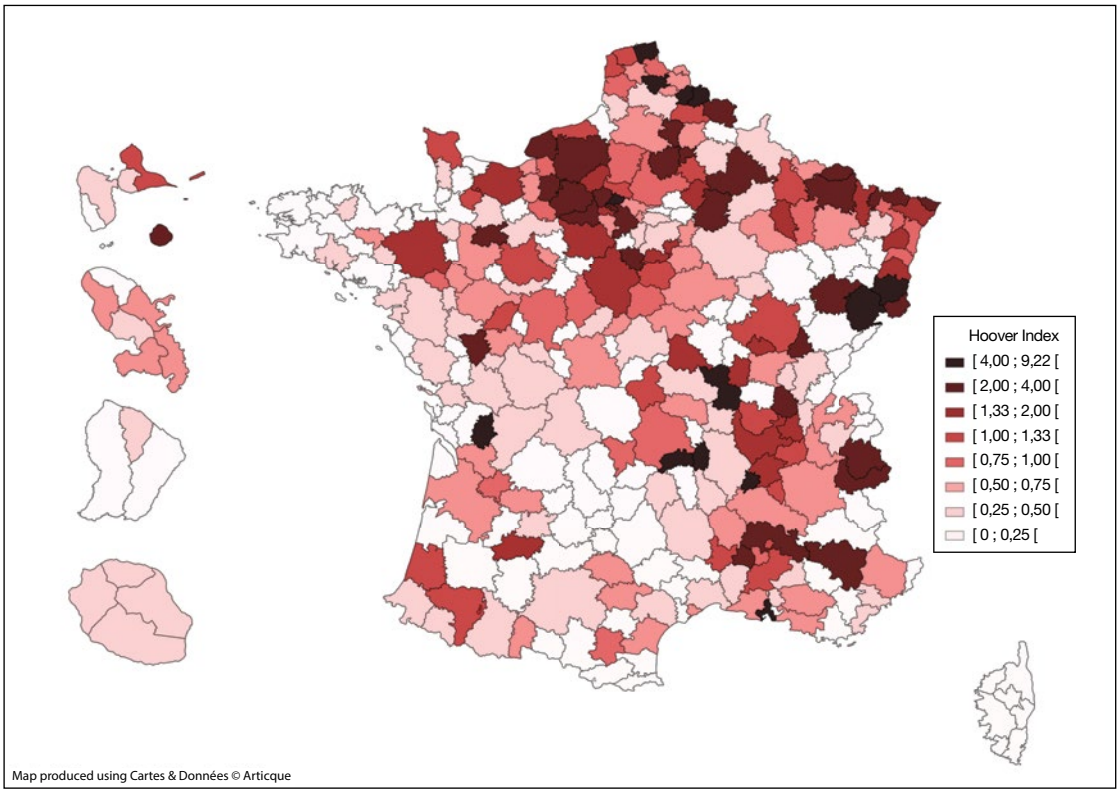
Scope: 69 manufacturing sectors in class 1 (NAF 700 products), 321 EZs in mainland France and Overseas Departments.
Sources: Insee, ESANE system, 2010; Census, 2010; authors' calculations.

Figure IV
Specialisation of EZs in defensive offshoring sectors



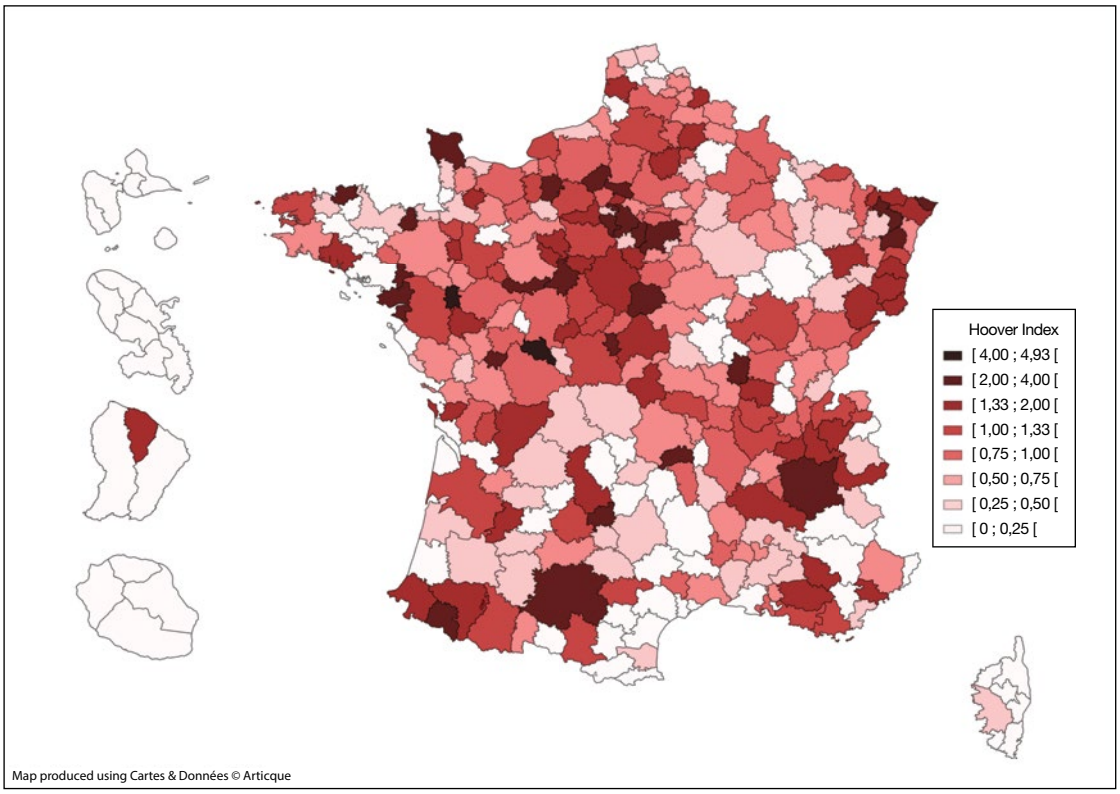
Scope: 90 manufacturing sectors in class 3 (NAF 700 products), 321 EZs in mainland France and Overseas Departments.
Sources: Insee, ESANE system, 2010; Census, 2010; authors' calculations.

Figure V
Specialisation of EZs in exporting sectors hardly offshorable



Scope: 31 manufacturing sectors in class 2 (NAF 700 products), 321 EZs in mainland France and Overseas Departments.
Sources: Insee, ESANE system, 2010; Census, 2010; authors' calculations.

Figure VI
Specialisation of EZs in the offensive offshoring sectors



Scope: 39 manufacturing sectors in class 4 (NAF 700 products), 321 EZs in mainland France and Overseas Departments.
Sources: Insee, ESANE system, 2010; Census, 2010; authors' calculations.

Box 2 – Measuring EZ specialisation

To measure the relative importance of each manufacturing industry industry c*l* (c*l*=c1,...,c4) within an EZ *i* (i.e. its over-representation or under-representation in this class), we calculate the Hoover indicator (or the Balassa specialisation index). The weighting basis is total employment in the NAF's 732 sectors of activity for the 321 EZs taken into account in this study. The indicator is as follows:

$$HOOV_{i,cl} = \frac{N_{cl}^{i}}{N_{\bullet}^{i}} \Big/ \frac{N_{cl}^{\bullet}}{N_{\bullet}^{\bullet}} \qquad (1)$$

The first term is the ratio between the workforce of one of the 4 classes *cl* of the EZ *i* (N_{cl}^{i}) to the total workforce of the EZ *i* ($N_{\bullet}^{i} = \sum_{k=1}^{732} N_{k}^{i}$), by counting the NAF's 732 sectors *k*. This yields the proportion, i.e., the relative weight, of the class *cl* in the total employment of the EZ *i*. The indicator is relative insofar as a ratio is established between this first proportion, relative to an EZ *i*, and the total proportion of this class *cl* in the French economy (second term of expression with $N_{cl}^{\bullet} = \sum_{i=1}^{321} N_{cl}^{i}$ measuring the number of jobs in class *cl* in France and $N_{\bullet}^{\bullet}$, representing the total workforce in the French economy). The value of the index indicates whether, in terms of jobs, the proportion of a class in an EZ is moving significantly away from that of this same class in the French economy.

This makes it possible to identify the manufacturing classes that are relatively decisive in the production structures of each EZ. The values of the indicator theoretically go from zero to infinite. An upper (lower) value index for the unit on an EZ indicates that the class is more (less) present in this territory relative to the other EZs.

internationalised by exports (class 2) or by offensive offshoring (class 4) are more present in large conurbations and in EZs located close to medium-sized cities. Activities with lower levels of productivity, low export levels and where the jobs' structure requires more routine production functions, whether they are not very offshored (class 1) or highly offshored (class 3), most notably mark the industrial territories of northern France and the rural territories of the west and north-east.

* *
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This article provides an initial empirical contribution to the construction of a methodology useful in anticipating the impacts of offshoring or competitiveness faced by territories. It addresses a gap in public debates between, on the one hand, the macroeconomic reality of observed offshoring, which, according to most empirical work, shows the limited effects of offshoring on job destruction, in contrast to productivity gains and, on the other hand, the massively destructive globalisation in which the general public believes. In reality, the offshoring has primarily micro-economic level and local effects, hence part of the disparity. Consequently, public policies should do more to take into account the lack of adjustment and inadequacy of the mechanisms used for offsetting the effects of territorial shocks due to offshoring.

While, for thirty years, public policies are introduced after the fact, in an attempt to save territories once offshoring or restructuring has occurred, it appears preferable in contrast to anticipate the shocks of offshoring. It can be recommended that State aid be focused on the most vulnerable territories by promoting vocational training, research and innovation, which help restore competitive advantages compared to low-wage countries and therefore relocation in the territories. The aim is also to promote the desired mobility of workers, all too often "locked" in areas highly vulnerable to offshoring and industrial restructuring, to external performance areas experiencing recruitment difficulties. While the effects of globalisation are heavily localised, as this article helps highlight, there appears to be a need for a true observatory to anticipate territorial shocks. This study is, in this regard, a first step that should be continued over time and extended to additional analyses. □

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APPENDIX

EXAMPLES OF SECTORS COMPOSING THE FOUR CLASSES

Domestic sectors hardly offshorable (69 sectors)	Exporting sectors hardly offshorable (31 sectors)	Sectors with defensive offshoring (90 sectors)	Sectors with offensive offshoring (39 sectors)
Manufacture of ready-mixed concrete	Construction of motor vehicles	Manufacture of knitted and crocheted hosiery	Manufacture of air and spacecraft and related machinery
Manufacture of liquid milk and fresh produce	Enrichment and reprocessing of nuclear materials	Manufacture of stationery	Manufacture of locomotives and other rolling stock
Manufacture of mattresses	Distilling, rectifying and blending of spirits	Manufacture of plastic packaging	Manufacture of electronic components
Manufacture of macaroni, noodles, couscous and similar farinaceous products	Manufacture of glass fibres	Manufacture of office and shop furniture	Manufacture of electricity distribution and control apparatus
Industrial manufacture of bread and fresh pastry	Manufacture of industrial gases	Manufacture of carpets and rugs	Manufacture of optical instruments and photographic equipment
Table water industry	Manufacture of pulp	Manufacture of hollow glass	Production of perfumes and toilet products
Copper production	Manufacture of pesticides and other agrochemicals	Casting of light metals	Manufacture of navigation assistance equipment
Processing and conservation of butchery meat	Manufacture of basic pharmaceutical products	Manufacture of watches and clocks	Manufacture of medical irradiation equipment, electromedical and electrotherapeutic equipment
Preparation of fruit and vegetable juices	Manufacture of sugar	Printing of newspapers	Manufacture of electrical and electronic automotive equipment
Milling	Production of effervescent wines	Preparation and spinning of textile fibres	Manufacture of scientific and technical instrumentation
Processing and preserving of potatoes	Production of crude oils and fats	Binding and related activities	Manufacture of computers and peripheral equipment

Scope: 229 manufacturing sectors in the nomenclature of activities (NAF 700 products), Mainland France and Overseas Departments.
Sources: Insee, ESANE system, 2008, 2010; Census, 2010; authors' calculations.

Comment
The impact of globalisation and technology on local labour markets

Comment on the articles *"Technical change and automation of routine tasks: Evidence from local labour markets in France, 1999-2011"* by Pauline Charnoz and Michael Orand and *"Measurement and anticipation of territorial vulnerability to offshoring risks: An analysis on sectoral data for France"* by Hugues Jennequin, Luis Egidio Miotti and El Mouhoub Mouhoud

Farid Toubal*

Abstract – The rise of new technologies and globalization has recently generated major structural changes in developed economies. These changes alter significantly economic activities and affect spatial disparities. The articles by Charnoz and Orand and by Jennequin, Miotti and Mouhoud offer two original analyses of changing patterns in local labour markets in France. They show that structural changes affect employment zones differently depending on their employment structure and their international exposure. Because of their specialisations in high value-added jobs, major cities emerge the winners from these changing patterns. The rural territories and cities traditionally specialised in routine jobs have, meanwhile, turned to computers and robotisation and are thus experiencing a decline in these jobs. This phenomenon is magnified by offshoring. These papers have important implications for economic policies, as they identify the infranational territories that may have large effects on employment and wages trends at the national level.

JEL Classification: F16, F60, J23, J20

Keywords: Technical change, globalisation, employment polarisation, local labour markets

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The growth of new technologies and global trade has, in recent decades, led to major structural changes in developed economies. These changes are profoundly altering economic activities and transforming their comparative advantages. They also operate within sectors of activity by reallocating resources between companies, occupations and tasks within a single sector. These developments have in turn resulted in a polarisation of employment, which is characterised by an increase in the proportion of low-wage and high-wage jobs, at the expense of intermediate-pay jobs. By fostering the reallocation of these intermediate-pay jobs to higher-wage and lower-wage professions, but by also removing some workers from the labour market, this phenomenon is accompanied by widening wage inequalities.

Several papers using data for the United States (Autor & Dorn, 2013) and the United Kingdom (Goos & Manning, 2007) have highlighted the ongoing polarisation of the labour market. The phenomenon has also been observed in Germany (Spitz-Oener, 2006), France (Harrigan, Reshef & Toubal, 2016) or other European countries (Adermon & Guvstasson, 2005; Goos, Manning & Salomons, 2009). While these studies can clearly identify the phenomenon, the consequences of globalisation and the dissemination of technologies on the distribution of employment and its structure at the infra-national level are still little known in France. The articles by Charnoz and Orand and Jennequin *et al.* propose to analyse the shift in employment patterns across French employment zones and to identify the impact of the dissemination of technologies and globalisation on local labour markets in France.

The concept of employment zone is particularly suited for both analyses. It is based on the empirical observation of the low mobility of workers most often looking for job opportunities in their local labour market. Labour market equilibrium is thus specific to each employment zone. Differences in wages and employment rates between the various local labour markets can be particularly stable over time, leading to a certain persistence in regional employment and wage disparities.

Technical change, tasks and activities

One of the most favoured hypotheses in studies of the impact of technical change on employment is that of technical change biased toward non-repetitive tasks (Autor, Levy & Murnane, 2003). It is suggested that the spread of technical change would reduce the demand for labour of those performing routine tasks, the said workers being gradually replaced by computers and automation. In most cases, these are machine operators and office employees classified as occupying intermediate-pay occupations. Quite to the contrary, technical change is complementary to the non-routine cognitive tasks performed by highly skilled workers and very high-wage occupations. It would increase demand for them and in turn the wages in these occupations (directors, engineers, researchers). As for manual tasks, which are characterised by a combination of specific motor movements (services to individuals, construction, etc.), they are still difficult to replace by machines or computers. The dissemination of technical change would therefore have very little impact on professions with high content in manual tasks, most often located at the bottom of the wage scale. Thus, based on the hypothesis of skill-biased technical change, the weight of low and high wage categories should increase compared with that of categories based on repetitive, gradually automatable tasks.

One can intuitively see the consequences of this routinisation hypothesis at the local level. Although companies located in the different employment zones in France should all have access to the same technologies, technical change has distinct consequences depending on the local labour markets as a result of a combination of industry, professions and differing tasks. These local specialisations are mostly inherited from the past and primarily related to the physical geography of natural resources. Thus, the nearby availability of a crucial raw material such as coal in northern France, or proximity to a river or access to infrastructures, largely explains these local combinations. However, by reducing communication costs, technical change can also amplify spatial disparities by accentuating the functional specialisations of employment pools. The analysis of Jennequin *et al.* like the one of Charnoz and Orand, moreover, show that the activities requiring support functions are more prevalent in large agglomerations and medium-sized cities.

As the article by Charnoz and Orand shows, local-level specialisations are very heterogeneous in France, where routine jobs are not located in the same employment zones as service jobs. Moreover, these routine jobs are concentrated in northern France, a highly industrialised region,

in the Parisian area and in a few agglomerations. Based on a relatively short period of time, the analysis of Charnoz and Orand shows that the local employment pools which largely employ a workforce carrying out repetitive tasks in 1990 adopted more information and communication technologies and experienced a significant decrease in routine employment in 2011. These employment zones, which are highly dependent on routine tasks, have seen these tasks progressively become automated, replaced by computers and robots. These developments were moreover very unfavourable to the least-educated workers by increasing this population's unemployment rate. From 1990 to 2011, local job pools therefore experienced a polarisation in employment.

Exposure to international competition and local labour markets

The comparison between different local labour markets does not only make it possible to establish a more direct link between technical change and jobs polarisation, but also to distinguish the effects of technological change from other important economic factors.

In addition to the role of routinisation as a result of technical change, many authors have associated the phenomenon of polarisation with that of globalisation (Autor *et al.*, 2013a, 2013b, 2015; Goos, Manning & Salomons, 2014; Malgouyres, 2016). Globalisation increases the trade in goods, services, capital and knowledge, but also speeds up the spread of technology. It also offers companies the opportunities to reorganise their activities at the global level, either through trade or by locating all or part of their production activities for goods and services in foreign countries. These reorganisations are not just important in the manufacturing sector, as shown by the analysis of Jennequin *et al.*; they are also significant in services. Globalisation could therefore be an alternative factor explaining the decline on the proportion of intermediate professions by replacing, for example, the tasks associated with these jobs with those carried out by a less costly workforce abroad. It can also favour highly qualified workers by increasing the demand for non-routine tasks, those associated with organisational changes or related to management and communication between a company's foreign affiliates.

In addition to the inequalities between jobs and socio-occupational categories, globalisation can generate disparities between different employment pools. These effects will differ depending on the places where internationalised companies choose to locate, and depend on the growth or decline of the latter. Through an induced effect, territories will be affected to varying extents, depending on the intensity of their exposure to globalisation. As with technical change, the effects of globalisation can also be differentiated according to the characteristics of local labour markets. The study by Jennequin *et al.* enables to identify the local labor markets that are particularly exposed to international competition and offshoring. The approach is statistical and aims to construct an indicator reflecting the vulnerability of employment zones to the risk of offshoring, based on the characteristics of jobs (tasks and qualifications), products and productive processes (positioning of sectors in terms of quality and international fragmentation of value chains).

The analysis highlights the sectors the most exposed to the risk of offshoring (textiles/clothing, furniture and machining and electronic equipment) and those less exposed (luxury products, chemicals and pharmaceuticals). These results confirm that sectors that are vulnerable to the risk of offshoring are also those producing highly differentiated varieties of goods, or goods with high added value. The sectors affected by the risk of offshoring are those with activities intensive in routine tasks. Globalisation would thus reinforce the negative effects of technical change on routine jobs.

The mappings presented by Charnoz and Orand and Jennequin *et al.* show a certain coincidence of the effects of technical change and globalisation on local labour markets. In principle, there would be a correlation between the areas which would be the most affected by technical change in the study by Charnoz and Orand and those that would be the most vulnerable to offshoring in the study by Jennequin *et al.* However, according to the study by Autor, Dorn and Hanson (2013b) for the United States, the local labour markets that are mostly affected by technical change are not necessarily those that experience a dramatic increase in competition from Chinese imports (see also Autor, Dorn & Hanson, 2015). Blinder (2009) argues that the repetitive nature of some tasks is only partially related to the offshorable nature of certain activities. It is therefore necessary to analyse technical change and globalisation jointly in order to

isolate their respective effects on employment and its structure.

The empirical analysis of individual firm-level data on jobs and wages from annual administrative data (DADS) in France, matched with those on international trade in the Customs Database and those drawn from the French *SIRENE* database (directory of establishments and companies), enabling geo-location of companies by employment zone, would be an interesting way of taking the study by Charnoz and Orand to greater depth, distinguishing between the effects of globalisation on local labour markets as compared with those of technological change.

Impact of international trade on employment and its structure

The question as to the impact of globalisation on employment in developed countries can be answered only in part. So long as data are lacking, it will be difficult to assess the effect of increased trade in services, goods and offshoring at the same time. We do, however, have more perspective on the impact of international trade in goods because the data are much more precise. We can therefore expect a greater effect from international trade on the most exposed sectors. This is the case with the manufacturing sector in France, which concentrates the most internationalised firms. The analysis conducted at company level by Harrigan *et al.* (2016) shows that the growth reported by firms that have chosen to go international is in fact not so different from that of firms that have not taken this path. These average effects nevertheless mask significant growth disparities depending on the type of goods traded and their country of origin or destination. While exports have very little effect on growth in employment among firms (irrespective of the type of good or country of destination), a more in-depth analysis reveals lower employment growth for companies with intermediate products originating from low-wage countries. These effects tend to confirm the negative impact of competition from low-wage countries on employment (Autor, Dorn & Hanson, 2013a).

While the assessment of a net positive impact of globalisation on employment in developed countries is consensual in the literature (Crozet & Orefice, 2017), it also emphasises that adjustment costs are not borne in the same way depending on workers' age and qualification, and that there are also significant regional or local disparities. Consequently, the costs are higher for older and relatively less qualified workers as well as for workers who are highly exposed to international competition. Given the low sector diversity within the regions and relatively low mobility for less skilled workers, the effects of globalisation can strengthen those of deindustrialisation by creating zones of inactivity when wages are rigid.

The analysis of Biscourp and Kramarz (2007), carried out at the level of companies located in France, shows that competition from imports is specifically associated with the destruction of production jobs, and especially that of unskilled workers. In particular, the import of finished products, a manifestation of foreign offshoring of all or part of local production, most prominently accompanies the decline in relative demand in unskilled employment. Harrigan *et al.* (2016) confirm this result in an analysis of a more recent period.

Since the majority of economic activity is organised by firms, changes in their status, in their internal organisation and in their dynamics are important factors that generate both structural changes and a change in the distribution of jobs and wages. Consequently, the firm-level analysis is well-suited for identifying the causal mechanisms of adjustment. Overlooking the importance of the firm can be misleading as we can illustrate below.

According to the hypothesis of skill-biased technical change, technical change reduces the proportion of intermediate professions in favour of high-wage and very low-wage jobs. It is thus assumed that there would be a substitution between socio-occupational categories, this phenomenon being strengthened by the globalisation process. However, the shifts observed in the studies by Charnoz and Orand and Jennequin *et al.* can mask organizational changes at company level. The fact that there is substitution does not mean that this should be considered the only explanation for changes in the employment structure of the regions. These changes could be due to the growth of firms that compose them and to the fact that they intensively use some occupations or tasks rather than others. Alongside the substitution effect, one can add a composition effect based on changes in a company's size. Although the composition effect is significant, the hypothesis of technical change biased in favour of non-repetitive tasks would only partially explain the polarisation of jobs. The firm approach therefore makes it possible

to distinguish between competing theories of the determinants of structural change and its impact on the distribution of jobs and incomes.

The future of employment

Technology plays a major and constant part in employment and its structure in all sectors, while the effects of globalisation appear to be more nuanced and concentrated in the manufacturing sector. It is entirely conceivable that, with the exponential advances in artificial intelligence, robotics and algorithms, as well as with the rapid rise of emerging countries, intellectual occupations, which have been quite the winners in recent decades, may also be threatened in developed countries in the future. With regard to the impact of technological change, Frey and Osborne (2017) estimate that 47% of jobs in the United States are likely to disappear by 2020. However, their methodology has been challenged and Arnzt *et al.* (2016) assess that on average only 9% of US jobs are actually at high risk of automation. Very recently, the *Conseil d'Orientation de l'Emploi* (2017) confirmed this estimate where France is concerned, pointing out that "fewer than 10% of jobs accumulate vulnerabilities that could threaten their existence in a context of automation".

Technological change and globalisation can create losers, but they also bring about opportunities in terms of jobs and wages for certain categories of workers. Existing jobs are furthermore destined to undergo profound change. For technical change and globalisation to benefit to all, workers need to be able to master new technologies and to have the necessary qualifications to take full advantage from the benefits that international trade provides. This is what Jan Tinbergen termed, already in 1974, the "*race between education and technology"* (Tinbergen, 1974). In this sense, it is essential to increase the efficiency and equity of the initial training system, but also that of continuing training. Lifelong learning is what enables individuals to escape skills obsolescence, down-grading and unemployment. The gains generated by technological change and globalisation also need to be better distributed among workers (more winners, fewer losers), so as to increase demand and thereby promote job creation. □

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Geographical pathways of individuals born in France: Construction of a typology

Henri Martin *

Abstract – The rise of geographical mobility is an important component of the changing patterns in lifestyles over the past few decades. The *History of Life* survey (*Histoire de vie*, Insee-Ined, 2003), which picks up on all the geographical pathways of the individuals sampled, makes it possible to gain a precise overview of such population movements. Of the individuals born in France and residing in mainland France in 2003, 38% have never left their department and 58% have never left their region of residence. These data also make it possible to construct "standard geographical pathways" using an optimal matching method. Six "standard geographical pathways" emerge for generations born before 1938. A fine-grained analysis of this typology shows that the geographical pathways involving the most mobility are more common in managers, graduates and individuals who have experienced more unstable professional and domestic life trajectories than the average. Lastly, younger generations experience geographical mobility more frequently than their elders.

JEL Classification: R23, Z13, Y80
Keywords: geographical pathway, optimal matching, typology, generations

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Since the 1980s, the theme of geographical mobility has become a highly invested research topic in demographics, geography and sociology. Adopting a historical perspective on the literature dealing with this subject, Jacques Brun (1993) shows that the term "mobility" has gradually (from the 1970s) edged out the term "migration". This shift in terminology reflects a change in how society sees its connections with space: migration is often considered rare and exceptional, while mobility is more often perceived as commonplace. Many recent contributions deal with the decision-making process behind mobility (Faure, 2009; Bonnet & Collet, 2009) and with explanatory factors for mobility (Debrand & Taffin, 2005; Couet, 2006), or for instance try to model the phenomenon (Courgeau & Lelièvre, 1990). This research agrees on the role of family (couple's formation and dissolution, birth, widowhood) and professional events (change of job or in the terms and conditions of employment), as well as individuals' socio-demographic characteristics (age, standard of living, education, employment, household composition and housing occupancy status) in explaining mobility.

A mere change in housing unit can have very different implications for the individuals involved. Courgeau (1980) distinguishes between "residential mobility", which refers to a change in housing and "migration", which is also characterised by a significant change in the living environment. Moreover, Debrand and Taffin (2005) show that residential mobility and migration as defined by Courgeau are not explained by the same factors: family factors (the need to occupy an accommodation suited to the needs of the family) and residential (e.g. home ownership) are predominant in the former instance, whereas migration is more often the corollary of professional choices or decisions related to education. These results are confirmed by other research, which shows that a large proportion of long-distance mobility is due primarily to professional reasons (Lelièvre, 1988).

In the context of this study, it will not be possible to follow these conceptual definitions, as the data mobilised does not enable residential mobility to be distinguished from migration (as defined by Courgeau). Changes in housing within a single municipality of residence are not recorded, and there is no information enabling possible changes to the living environment to be assessed. The focus here will be on changes in individuals' municipality of residence (the only ones recorded in the data used) which can, depending on the circumstances, imply a change in the living environment. This intercommunal mobility may correspond to residential mobility (i.e. a simple housing change) as well as migration (i.e. a change in the living environment).

While there is ample literature on the subject overall, few studies have aimed to identify and describe standard geographical pathways over the lifecourse. Recently, however, statistical analysis has developed new methods for the study of trajectories (Robette, 2011). More specifically, statistical methods, grouped under the name of sequence analysis methods in which optimal matching plays a central part, now make it possible to identify the regularities and similarities between different trajectories and to infer the construction of typologies in standard sequences. In social sciences, it was Andrew Abbott (Abbott & Forrest, 1986) who started using optimal matching methods to analyse historical processes (Lesnard & Saint Pol, 2004). These methods have been applied to issues relating to geographical mobility such as international migration (Sierra-Paycha, 2014), residential mobility in the metropolis of Dakar (Lessault & Imbert, 2013), trajectories in terms of the social composition of municipalities of residence (Bringé & Bonvalet, 2014) and the professional and geographical trajectories of couples (Lelièvre & Robette, 2010).

This study sets out two objectives. The first is to provide descriptive data regarding changes in individuals' municipality, as well as department, region and country of residence, and the change in patterns over generations. The second consists of uncovering a typology of geographical pathways by implementing an optimal matching method and describing to the finest degree of detail possible (in terms of socio-demographic characteristics, but also life pathways) the sub-populations that share comparable geographical trajectories. Compared to the work previously mentioned (in particular Lelièvre & Robette, 2010 and Bringé & Bonvalet, 2014) this contribution differs both in terms of its scope (all the individuals born in France) and its approach to geographical pathways (considered since birth and the initial municipality of residence[1]).

1. The municipality of residence is defined as the municipality in which the individual resided in the first year of life. It may be different from the municipality of birth.

Six standard geographical pathways have emerged for generations born before 1938: 18% of individuals almost never leave their initial municipality of residence; 47% of individuals leave their initial municipality of residence, but their geographical pathways remain almost entirely within that municipality's department; 13% of individuals leave the department of their initial municipality of residence, but their geographical pathway is almost entirely within the said municipality's region. The remaining 22% of individuals experience longer-term changes in region (8% of individuals leaving the department of their initial municipality of residence, 8% of individuals moving to the Ile-de-France region and 6% of individuals to another region in the provinces).

Sources and sample

This study is based on data from the *Life history* survey (*Histoire de vie*, HDV), resulting from a cooperation between Insee, Ined and several ministerial statistical departments[2]. It was a one-time survey conducted between February and April 2003 in mainland France. 8,403 individuals at least 18 years of age were interviewed. The aim of the HDV survey was to better understand the identity construction processes, in particular in relation with life pathways[3]. Geographical pathways appear, in the survey, to be a component of individual identity. The questionnaire covers a very broad spectrum of information drawing on interviewees memory of events in their past. In particular, it provides information on individual trajectories in a variety of areas (municipalities of residence, working life, health, family history). To the extent that it is one of the few exhaustive sources on geographical pathways (in the sense that the entirety of the pathway from is covered from birth), the HDV survey provides insight into the research issues dealt with in this contribution.

Other sources could have been used to study geographical mobility. The *Biography and Entourage* survey carried out in 2000 by Ined provides similar information, but its scope pertains only to Île-de-France residents born between 1930 and 1950. Consequently, it covers only those geographical pathways involving the Île-de-France region, and does not allow an overview of geographical pathways across France. Insee's *Permanent Demographic Sample* (EDP) contains information on the place of residence of individuals from two main sources: *Population Censuses*, known as the *Annual Census Surveys* (EAR) from 2004 on, and the panel study, *Annual Declarations of Social Data* (DADS) on "All Employees", the scope of which has expanded over time, from private sector employees since 1967, then including those of the civil service from the 1980s and more recently those of certain sectors that were not covered initially (agriculture, personal service jobs). Geographical trajectories are therefore incomplete in the intervening periods, particularly as regards non-employees and inactive people. Lastly, the *Family, work and migratory biography* survey carried out in 1981 by Ined, is somewhat too old.

To ensure accuracy in the information about early pathways (places of residence abroad are poorly recorded), the article focuses on individuals born in France. Thus, the 6,726 individuals in our sample all started their geographic trajectory in France. In the HDV survey, each year of life is associated with a municipality of residence[4]. If, for a given year, an individual resides in more than one municipality, he or she is assigned the municipality in which the length of residence was the longest in that same year (referred to as the "predominant municipality"). It is then possible to construct geographical stages, each of which is equivalent to a predominant municipality of residence for a period of at least one year. If the individual resides in the same municipality for several years, the duration of the stage is equivalent to the number of years spent there. For each individual, the HDV survey details all geographical milestones that have marked their lives over the period from birth to the date of the survey (2003). The construction of these stages does not therefore take into account changes in housing within the same municipality or very temporary places of residence (which are defined as non-predominant municipalities for a given year). For each geographical stage (i.e., for each predominant municipality), the survey lists the department and the region where the municipality is located.

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2. Several studies detail the process by which the survey was constructed (Crenner et al., 2006; Ville & Guérin-Pace, 2005).

3. Issue 393–394 of the journal Economie et Statistique / Economics and Statistics *contains a great deal of research on this topic.*

4. The survey considers within its definition of municipalities all French municipalities as at 1st January 2003. The districts of Paris, Lyon and Marseille are also considered municipalities.

From the semantic point of view, the decision was made – for practical reasons – to assimilate the geographical stage with the (predominant) municipality of residence. From a theoretical standpoint, a geographical stage should be defined more as a significant change in living environment rather than a change in municipality. However, the HDV survey does not provide the information to make the distinction. The underlying assumption is therefore that the majority of the changes in municipality imply a change in living environment.

Describing geographical mobility: Changes in municipality, department, region and country

The HDV survey lists those changes in municipality, department, region and country that are as many milestones along individual geographic pathways. In contrast to some research (Baccaïni, 1993), which focuses solely on residential pathways from adulthood (which can be defined as starting at age 15, 18, 20 or even 25), it is the aim here to study all geographical pathways since the individuals' birth until the time of the survey. This will allow to understand the diversity of the territories visited (in the sense that each individual has experienced at least one geographical stage in a given territory) over the lifecourse. Some of the changes mobility associated to an individual will in fact be the consequence of parental geographical choices (for example, changes in municipality during childhood). The individuals in our sample are of widely-differing ages at the time of the survey (between 18 and 97 years) and are not observed at the same time of their life cycle. For this reason, some indicators will then be presented by age.

In 2003, individuals born in France and age 18 or above had experienced 3.4 changes in municipality

On average, an individual born in France and age 18 or above in 2003 has changed municipality of residence just over three times (3.4 times)[5]. By extending the scope to all changes in housing, and limiting the focus to the number of people at least 15 years of age, Baccaïni (1993) reached an average of 4 residential moves in generations born between 1911 and 1938. This average hides a number of disparities, however, in particular depending on the age of individuals: the distribution is much denser to the right in the "30-49" and "above 50" brackets than in those ages 18-29 (Figure I). This finding combines both an age effect (an older person is more likely to have changed municipality of residence) and a generation effect. It can also be noted that more than 12% of our sample has never left its original municipality of residence. This proportion ranges from 22% among individuals under 30 to 6% for those between ages 30 and 49. These results are in line with the conclusions of the *Triple biography* survey (Ined, 1981), which results in a slightly higher figure (around 15%), even though it pertains to older generations and is therefore not directly comparable (Baccaïni, 1993).

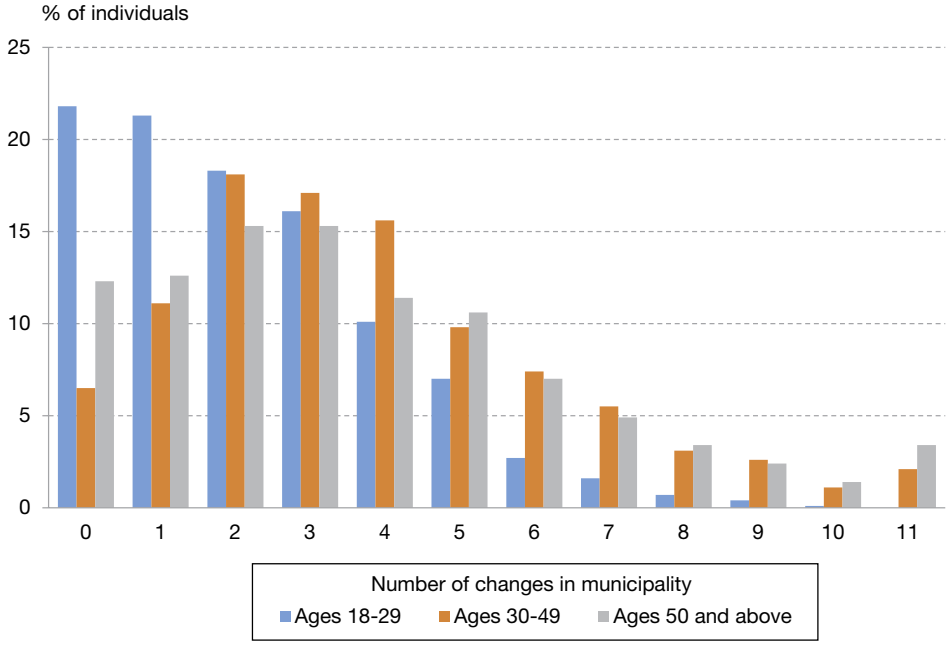
Changes in department: High pathway redundancy

Compared to changes in municipality, which may take place over very short distances, changes in department usually involve a change in living environment. Two indicators can be contrasted to interesting effect: firstly, the number of changes in municipality that led to a change in department; and secondly, the total number of departments of residence over the course of an individual's life. These two variables do not always coincide. For example, an individual born in Paris, who moves to Marseille before returning to Paris and then returns to live in Marseille, will be reported to have resided in just different departments (Paris and Bouches-du-Rhône), when three of the said changes in municipality actually led to a change of department. While the total number of changes in municipality leading to a change of department is a good indicator of the intensity of geographical mobility, the number of departments of residence informs as to the size of the living environments involved.

38% of the individuals in our sample have never left their first department of residence (Table 1). Moreover, the destination departments are often the departments in which the individuals have already resided during their lifetime. For example, among the individuals

5. The statistical results presented in this study are computed using the weightings provided with the survey. They correct for the over-representation of certain populations over-sampled in the survey (disabled, immigrants, and children of immigrants).

Figure I
Distribution by the number of changes in municipality by age bracket at the time of survey



Scope: 6,726 individuals born in France, residing in mainland France and at least age 18 in 2003.
Sources: Insee-Ined, *History of Life* survey, 2003.

who have experienced two events of mobility, each involving a change in department, almost 70% of them actually returned to their home department during their second departmental mobility. This clearly shows that geographical pathways are very often redundant in the sense that individuals often return to departments in which they have already resided in the past. These return trips between departments appear to be an essential characteristic of mobility in France.

Table 1
Changes in department and number of different departments in which an individual has resided (in the sense of having experienced a geographic stage there)

In %

Number of different departments of residence	Changes in department							
	0	1	2	3	4	5	6 and above	Total
1	37.8	0.0	0.0	0.0	0.0	0.0	0.0	37.8
2	0.0	13.6	13.5	2.6	1.2	0.6	0.0	31.3
3	0.0	0.0	5.8	5.3	2.7	1.0	0.5	15.4
4	0.0	0.0	0.0	2.5	2.6	1.7	1.5	8.3
5	0.0	0.0	0.0	0.0	1.2	1.3	1.5	4.0
6 and above	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0
Total	37.8	13.6	19.3	10.3	8.0	4.6	6.5	100

Note: The departments considered in the survey align with the configuration of the French departments at the time of the survey (early 2003). In particular, Mayotte was not yet a department.
Reading note: over the sample as a whole, 19.3% of individuals have changed department 2 times in their lifetime and thus have resided at most in 3 different departments. 13.5% of individuals have changed department 2 times, but have resided in only 2 different departments over the course of their lives.
Scope: 6,726 individuals born in France, residing in mainland France and at least age 18 in 2003.
Sources: Insee-Ined, *History of Life* survey, 2003.

Changes in region are infrequent

What is observed for inter-departmental migration also appears to be valid for inter-regional migration. 58% of individuals in our sample have never left the first region in which they resided (Table 2). Changes in region therefore remain relatively rare. Likewise, inter-regional migration is also highly redundant. For instance, out of those individuals who have moved to another region twice during their lives, the second mobility involving a change in region is actually a return to the region of origin in almost 70% of cases. Return trips between regions are therefore very common.

Most of the changes in municipality (45%) are carried out at intra-departmental level and can in fact pertain to very close municipalities. About a quarter of these changes in municipality (28%) lead to a change in region and another quarter (26%) in a change in department within the same region. Using another source[6], Debrand and Taffin have similar results for the period 1984–2002 (Debrand & Taffin, 2005).

More frequent moves abroad at the start of adult life and destination choices connected with France's history

While individuals residing abroad at the time of the survey do not appear – by construction – in the sample, the HDV survey records stays abroad lasting at least one year for all individuals interviewed. Out of the 29,750 geographic stages listed in the survey, 1,089 took place abroad and can be identified with a single country[7]. They last on average 3.1 years and pertain to 993 individuals, i.e. 14.3% of the sample. They take place on average at age 20.9 and nearly 90% of them started before age 30.

The destination countries of these stages abroad are closely intertwined with the Nation's history. Colonisation and the colonial wars[8] explain that geographical stages abroad are concentrated strongly in the Maghreb, Africa and Asia (50% of them) (Figure II). The predominance of European destinations (43%) is probably the upshot of geographic proximity. A dynamic study of these stages abroad highlights the decline in the number of destinations of military or colonial nature such as the Maghreb and Asia, regions of the world where the former French colonies were located (which respectively accounted for 52% and 7% of the stages abroad for the people of the generations 1930-1939, compared with 5% and 4% for those of generations 1960-1969). In contrast, there is a clear rise in regions of the world such as North America or Europe where migration related to professional activity and education is concentrated (their respective shares increase from 2% and 26% to 12% and 61% in the same generations).

6. Insee, Housing Surveys.
7. For certain moves abroad, the individual may report having resided in several different countries (including France).
8. Mainly the Indochina Wars (1946–1954) and the Algerian War (1954–1962).

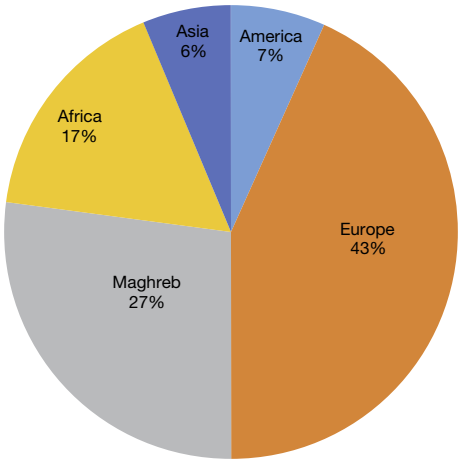
Table 2
Number of changes in region depending on total number of different regions in which an individual has resided (in the sense of having experienced a geographical stage there)

In %

Number of different regions of residence	Changes in region					
	0	1	2	3	4 and above	Total
1	58.0	0.0	0.0	0.0	0.0	58.0
2	0.0	14.4	10.6	0.7	0.3	26.0
3	0.0	0.0	4.5	3.4	1.8	9.7
4 and above	0.0	0.0	0.0	1.4	4.8	6.2
Total	58.0	14.4	15.1	5.5	6.9	100

Note: the regions considered in the survey matched the configuration of the French regions at the time of the survey (early 2003), i.e. before the territorial reform that came into effect on 1st January 2016.
Reading note: over the sample as a whole, 15.1% of individuals changed region 2 times in their lifetime and thus have resided in at most 3 different regions. 10.6 % of individuals have changed region 2 times, but have only resided in 2 different regions over the course of their lives.
Scope: 6,726 individuals born in France, residing in mainland France and at least age 18 in 2003.
Sources: Insee-Ined, *History of Life* survey, 2003.

Figure II
Geographical stages spent in a foreign country, by world region



Reading note: out of all the geographical stages that can be identified with a country, 43% took place in a European country.
Scope: 1,069 geographical stages abroad that can be identified with a single country. These stages involved 993 individuals born in France, residing in mainland France and at least age 18 in 2003.
Sources: Insee-Ined, *History of Life* survey, 2003.

Increasing geographical mobility over generations

The most recent generations (1960-1969) experience more geographical mobility than their elders (1920-1929) (Figure III and Box 1). Generally speaking, the younger a generation, the more it has experienced changes in municipality and region at a given age. However, the 1940-1949 and 1950-1959 cohorts are exceptions: the 1940-1949 cohort is slightly more mobile than the next generation. The mobility gaps between these cohorts, very low at the age of 20, increase at age 30 before stabilising. This finding encourages us not to conclude to a uniform increase in the intensity of mobility in generations. It also matches the conclusions of Debrand and Taffin (2005), who highlight a steady but well-known increase in the mobility rate over the period 1980-2002 (with, for example, a decrease in the 1990s).

Box 1 – Studying geographical mobility over generations with the HDV survey

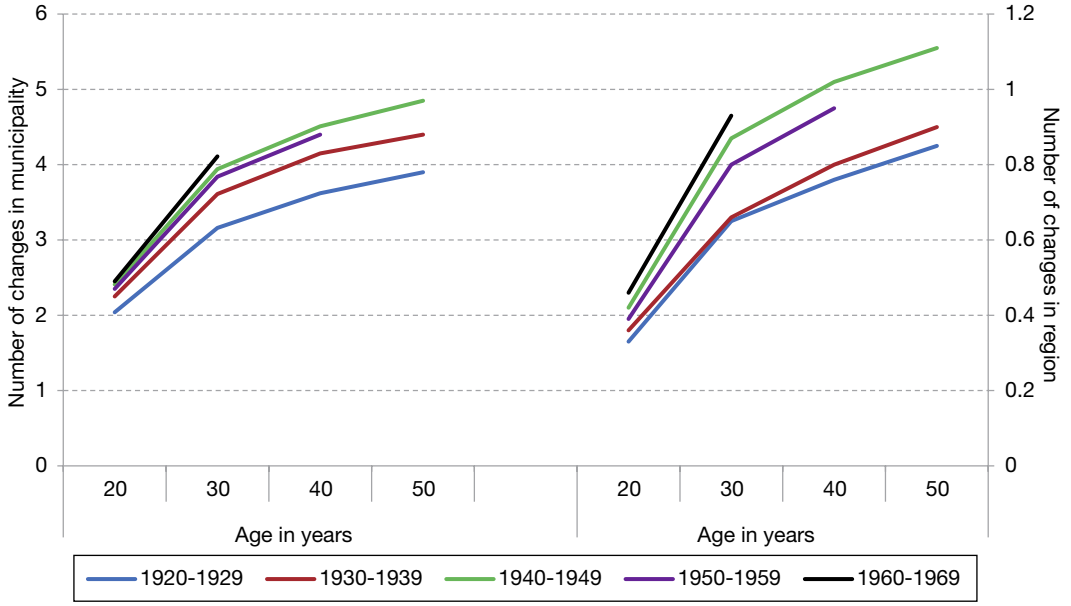
To study the influence of generation effects on geographical mobility, six cohorts were built according to the birth dates reported by the individuals in our sample. Several mobility indicators were analysed: the number of changes in municipality and region depending on age. Cohort construction and, in particular, the choice of a 10-year interval was determined to face a sample size requirement. For purposes of clarity, cohorts were designed from a rounded age (Table A).

Table A
Cohort construction for studying mobility over generations

Year of birth	Number in cohort	Average age at time of survey
1920-1929	517	77.1
1930-1939	753	67.7
1940-1949	1 086	57.1
1950-1959	1 370	47.8
1960-1969	1 327	37.8
1970-1979	1 035	27.9

Coverage: 6,088 individuals born in France.
Reading note: in the sample of individuals born in France, residing in mainland France in the survey History of life, 517 people were born between 1920 and 1929. At the time of the survey (in 2003), their average age was 77.1.
Sources: Insee-Ined, *History of life* survey, 2003.

Figure III
Number of changes of municipality and region, by age in generation



Scope: 5,053 people born in France, by generation.
Sources: Insee-Ined, *History of Life* survey, 2003.

To take into account possible structural effects – for example, the individuals of the 1920-1929 generation present in our sample are more often women because of the difference in life expectancy with men – an econometric modelling of the probability of a change in commune between 25 and 30 years old is proposed (logistic regression). The choice of this age group proceeds from the previous descriptive results: it is between 25 and 30 years that most of the differences in mobility between generations are concentrated. The cohort indicators are the explanatory variables of interest. Control variables are also introduced to account for structural effects (gender, marital status, PCS, and education). The choice of the 25- to 30-year interval also makes it possible not to include changes in municipalities that took place during World War II (between 1939 and 1945)[9]. Changes in municipalities that took place during the Algerian War (1954-1962) were excluded from the model[10]. Both these events led to massive mobilities for some cohorts, and it seemed important to distinguish in the evolution of mobility what results from a structural trend, stemming from the behaviour of households, from that which relates to situational factors. In practice, such a model is equivalent to reconstructing a counterfactual of what geographical mobility would have been for the different generations if the society's structural characteristics (breakdown by PCS, by educational category, historical events) had remained constant over generations.

The logistic model confirms the results of the descriptive analysis: it shows a lower likelihood of mobility between ages 25 and 30 for individuals from the oldest generations, even if the mobility gaps between people of the 1960-1969 generation and those of the 1940-1949 generation are not significant (Table 3). These results provide information on the long-term evolution of geographical mobility: the younger generations are more mobile than their elders.

Six "standard geographical pathways" emerge for generations born before 1938

In order to group the geographical pathways having the most similarities, an optimal matching method is implemented (see Box 2). Each year of a pathway is characterised by its geographical proximity with the original municipality of residence. Each year is assigned one of the following modalities:

9. The oldest people in our sample were born in 1920. They reached age 25 in 1945, after the World War II.
10. In practice, changes in municipality occurring between 1954 and 1962 and involving a municipality (whether the arrival or departure municipality) located in Algeria were excluded from the estimate.

Table 3
Impact of generation effects on the likelihood of changing municipality between ages 25 and 30, estimate based on a logistics model

Generations	Parameter estimated (estimated standard deviation)	Odds ratio
1920-1929	-0.67*** (0.16)	0.51
1930-1939	-0.52*** (0.13)	0.59
1940-1949	-0.18 (0.13)	0.83
1950-1959	-0.27** (0.12)	0.76
1960-1969	Reference	Reference

Note: parameters resulting from the estimation of a logistics model, the explained variable of which is 1 if the individual has experienced a change in the municipality of residence between ages 25 and 30 and 0 otherwise. The parameters associated with the control variables have not been listed. The resulting control variables applied are: gender in the form of an indicative variable for women, an indicator that is worth 1 when individuals reported having lived in a couple at least once over the course of their lives, SOC in the form of indicator variables for farmers, manual workers, office workers, craftspersons and managers, intermediate professions are the reference modality (the SOC used is reported by the individual at the time of the survey; retirees are assigned the SOC of their last position), the highest degree earned by the individual in the form of indicators in the primary cycle, the secondary cycle, vocational education and the higher education (the Baccalaureate level if the benchmark modality).
***significant at the 1% threshold, ** at the 5% threshold and * at the 10% threshold.
Reading note: being born between 1920 and 1929 multiplies by 0.51 the likelihood of mobility between ages 25 and 30 (or divides it by 1.96), relative to the generation born between 1960-69.
Scope: 5,053 people born in France between 1920 and 1969.
Sources: Insee-Ined, *History of Life* survey, 2003.

- 'Initial municipality of residence'. This municipality is the individual's predominant municipality of residence in the first year of life.

- 'Department of the initial municipality of residence' where the municipality of residence is a municipality other than the original municipality of residence but is located in the same department[11].

- 'Region of the first municipality of residence' if the department is a department other than that of the original municipality of residence but is located in the same region. The regions considered here are those that prevailed at the time of the survey (2003), i.e. before the territorial reform implemented on 1st January 2016. Since the HDV survey was conducted prior to that date, it seemed the former division made the most sense for respondents.

- 'Region neighbouring the region of the original municipality of residence' if the municipality of residence is located in a region neighbouring the region of the original municipality of residence.

- 'Île-de-France region' if the municipality of residence is located in Île-de-France and provided that it is not the first region of residence. The 'Île-de-France region' modality prevails over the 'Region neighbouring region of the region of residence' modality. The aim is to isolate the specificities of the pathways going through the region. This choice seems sensible for two reasons. Firstly, the rural exodus has long been an important component of geographical pathways. Secondly, a great deal of research shows that Île-de-France occupies a specific place in the geographical pathways, particularly at the time of the studies or the entry into working life (Baron & Perret, 2006; Degorra, 2015).

- 'Other region' if the municipality of residence is located in a French region that is neither the region of the original municipality of residence nor a region adjacent to it, nor the Île-de-France region.

- 'Foreign' if the individual reports residing abroad.

This classification based on the administrative boundaries of the territory is not entirely satisfactory. To truly grasp a living space in the broadest sense, it would have been preferable to mobilise other geographical delineations

11. The departments considered in the HDV survey align with the configuration of the French departments at the time of the survey (early 2003). In particular, Mayotte was not yet a department.

such as living basins, employment zones or possibly urban areas. Moreover, mobility between two municipalities of neighbouring regions will be interpreted as a major change, even if the distance between the two municipalities concerned is very short. Unfortunately, information about these zoning distinctions and distances between municipalities is not available in the HDV survey. In order to work with pathways of the same length, i.e. covering the same number of years (which is preferable when implementing optimal matching), the sample was restricted to individuals aged 65 years or above at the time of the survey (2003), i.e., generations born before 1938. The geographical pathways studied thus spread over the period from the individual's birth to age 65. As such, they are truncated to the right. The age-65 threshold was chosen to reconcile the concurrent need for adequate sample size and representativeness, on the one hand, and the benefit of having almost complete geographical pathways. Taking a higher age limit would lead to a reduction in the size of the sample and reduce its representativeness, particularly because of the differential mortality between men and women and between social classes. At the same time, the 65-year threshold, beyond which almost all of the generation born before 1938 is retired, is sufficiently high to take advantage of possible geographical mobility at the time of entry into retirement[12]. A great deal of research has highlighted the importance of mobility at this pivotal stage of life (Caradec, 2010; Cribier & Kych, 1992). In addition, by restricting the sample to individuals for whom

12. For these generations, the age of 65 is that at which retirement pension is automatically paid at full rate. At that age, almost all individuals have wound up their pensions.

Box 2 – Optimal matching applied to geographical pathway analysis

Optimal matching methods are designed to build a typology of sequences, similar to geographical pathways. In the sample considered, resulting from the *History of life* survey (2003), for each individual, and for each year of life, the predominant municipality of residence has been identified. Geographical position is characterised by the original municipality of residence. For example, assuming an individual lived the first two years after birth in the initial municipality of residence ('PC' below) before moving to another municipality in the same department ('CD') and remained there for 3 years, the pathway will read:

PC	PC	CD	CD	CD

Optimal matching then proceeds in two stages. In the first, a distance is constructed between the pathways. In the second, geographical pathways showing similarities are grouped using a classification method.

Stage I: construction of the distance between pathways

The distance between two pathways depends on the operations needed to transform one to the other. To transform a pathway, one of two operations can be performed:

- integration-deletion operations, that consist of adding or deleting a component of the pathway (referred to as *indel*);

- substitution operations. In such operations, one component of the pathway is replaced by another.

To transform a pathway into another, many combinations of operations, known as paths, can be used. Optimal matching is based on identifying all possible paths for a given transformation. The idea is then to assign a cost to each operation. Each pathway enabling the transformation of a pathway into another is associated with a total cost that corresponds to the sum of the costs associated with each necessary operation. Optimal matching provides the minimum cost. The distance between two pathways is then equal to the lowest overall cost out of all possible paths. The central element of the method is then based on the costs setting (Lesnard & Saint-Pol, 2004). The indel and substitution costs may depend on the modalities they entail (for example, deletion of a PC component may not be associated with the same cost as deleting a CD component).

Stage II: classification

This stage consists of forming classes using classification methods such as ascending hierarchical classification.

The parameter setting retained is based on a standard approach in the literature: the level of *substitution* costs is set based on the empirical transition probabilities between the modalities on a basis equal to 2. The substitution cost between two methods is equal to 2, minus the probability of empirical transition between these methods (the higher this probability, the lower the cost). The *indel* costs are arbitrarily set at 1.1. This choice follows the recommendations of Lesnard and Saint-Pol (2004) and Robette (2011): in order to favour the succession of modalities rather than their simultaneity, it is preferable to prioritise the *indel* costs. These parameters could have been set differently, however the tests carried out show that the result is robust to these choices. To construct the classes, an ascending hierarchical classification using the Ward method is implemented.

the geographical pathways are fully covered, our field of study encompasses 1,185 individuals. Because of the gender differential in mortality at the highest ages, the sample includes a higher percentage of women than the overall population (58% women) and its sociodemographic structure is distorted to the disadvantage of the categories most exposed to mortality at advanced ages (only 17% of blue-collar workers). Lastly, graduates and managers are overrepresented in our sample, while much research has brought out their greater propensity to mobility (Couet, 2006). These various factors may bias the results.

The optimal matching method results in a six-class construction (Table 4) for which the main socio-demographic traits are specified. Out of the variables chosen to characterise them are demographic indicators such as age, gender or family structure, but also socio-economic information such as the education level and socio-professional category relating to the last job held by the respondent. In order to reconstitute the geographical pathways within the life pathways, variables relating to the number of job-related changes and marital separations were added. Job-related changes include both changes in profession, professional status (changes in the conditions of professional activity), and professional positions listed in the HDV survey (whereby the date on which these changes occurred is also known). Marital separations are those having occurred in live-in relationships lasting more than one year. Many studies have shown that residential and professional mobility often go hand in hand (Lelièvre, 1988). In *Triple Biography* nearly 30% of the grounds for mobility stem from professional issues (Baccaïni, 1993). Similarly, the results of an investigation conducted by Ined in 1985 highlighted the correlation between divorce and mobility (Festy, 1988).

From the "immobile" to the "mobile to distant regions in the provinces"

Individuals in class 1 (18% of the weighted sample) – referred to here as "immobile" – leave their original municipality of residence only very episodically (Figure IV-A). The cumulative duration in the other modalities is only a very small fraction of the 65 years of life studied. These individuals account for almost 18% of the sample. This proportion is comparable to the result obtained by Couet (2006) based on EDP data which shows that approximately 20% of the individuals found in the five censuses of 1968, 1975, 1982, 1990 and 1999 and ages 24 to 40 in 1968 have always reported the same municipality of residence. The standard portrait of the "immobile" individual is usually that of a woman whose education is most frequently at the primary level (Table 5). Farmers are also largely over-represented. On average, these individuals experience more stable pathways than the average: they have experienced fewer marital separations and job-related

Table 4
Summary of the geographic pathway typology

Class	Name	Total numbers (% of the weighted sample)	Key socio-demographic features	Average number of geographical stages before age 65
1	Immobile	195 (18)	Women, primary education, farmers, stable pathways, inhabitants of Brittany	1.15
2	Mobile at the departmental level	565 (47)	Representative overall of the sample	4.56
3	Mobile at regional level	152 (13)	Managers, intermediate professions, career paths, Île-de-France residents	5.45
4	Mobile to neighbouring region	100 (8)	Men, managers, intermediate professions, graduates	5.57
5	Mobiles to the Île-de-France region	87 (8)	Women, managers, office workers, graduates, Breton origins and the Paris basin	6.66
6	Mobiles to a remote region in the provinces	86 (6)	Men, office workers, intermediate professions, graduates, unstable pathways	6.79

Reading note: Class 1 includes 195 individuals, i.e. 18% of the weighted sample. These are mostly women, farmers and individuals whose level of education is classified as primary education and whose individual pathways in the professional and family areas are more stable than the average. These individuals have experienced on average 1.15 geographical stages before reaching age 65.
Scope: 1,185 people born in France and age 65 or above at the time of the survey.
Sources: Insee-Ined, *History of Life* survey, 2003.

changes than the average. In geographical terms, these individuals' initial municipality of residence is more often than the average found in Brittany, Champagne-Ardenne or in the regions of the South such as Auvergne, Limousin or Midi-Pyrénées.

Individuals in class 2 (47% of the weighted sample), the "mobile at the departmental level", have in common to have left their original municipality of residence to establish themselves in another municipality in the same department (figure IV-B). This mobility occurs most often before age 30, with a peak between ages 20 and 24, at which time they enter higher education or a first job (Appendix, Figure A-I). The geographical pathways unfold almost entirely at the departmental level. The average length of time spent in a municipality outside the original department of residence is 3 years and the related geographical stages often come shortly after age 20. Episodes spent outside the original department of residence share the characteristic of brevity. This class is by far the largest in number, accounting for 47% of geographical pathways. The individuals in this class are generally representative of the sample (Table 5). Similarly, in geographical terms, the regions of residence between which these individuals are divided up at age 65 are close to the distribution observed across the sample.

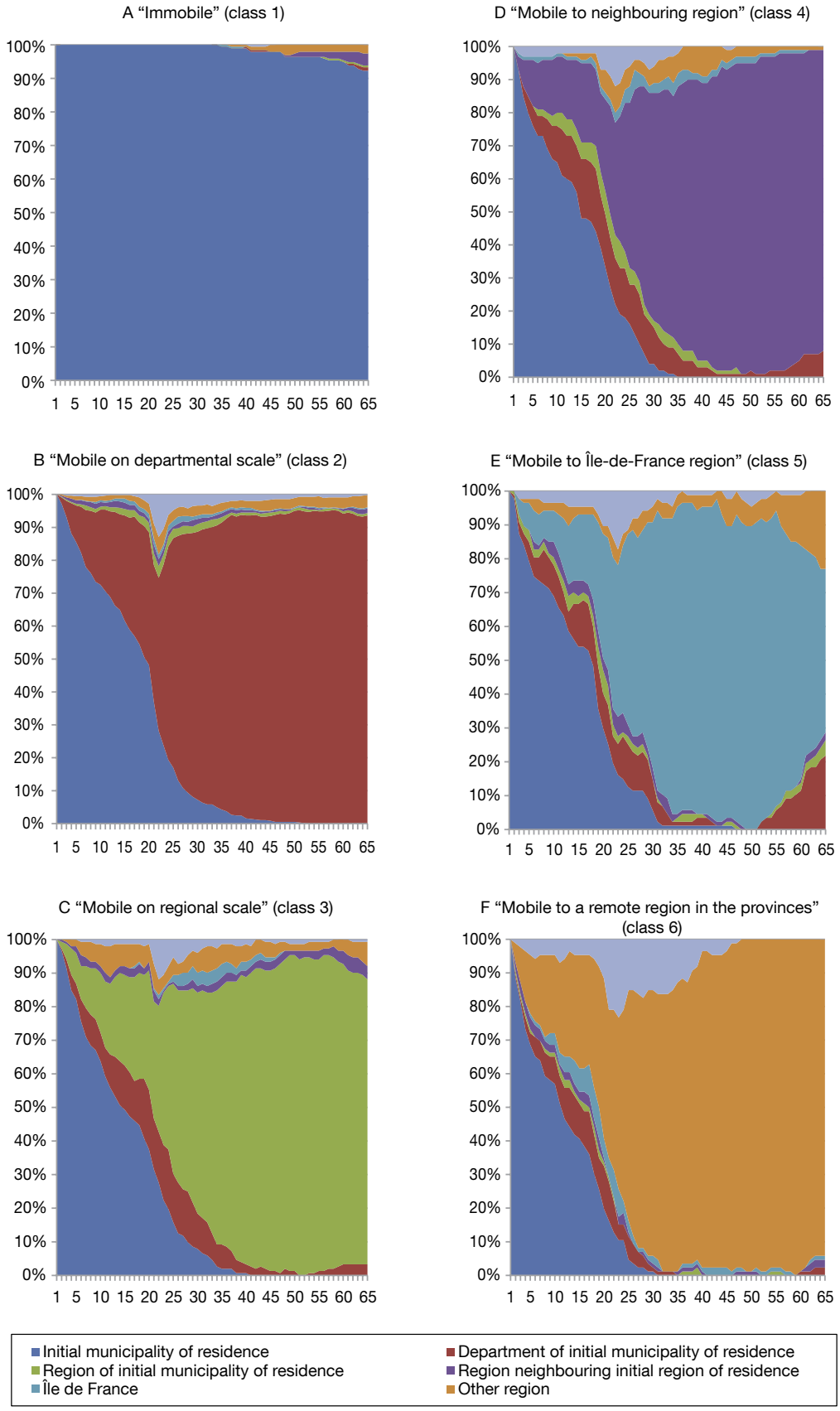
Individuals in class 3 (13% of the sample sample), referred to here as "mobile", have left their initial municipality of residence before age 30 and gradually migrated to another municipality in the same region but located in another department (figure IV-C). These mobilities usually take place between ages 20 and 24, but are also frequent during childhood (28% take place before age 15) (Appendix, figure A-II). The geographical pathways here unfold primarily at the regional level. A departmental stage is observed (residence in a municipality other than the original municipality of residence but located in the same department) for 42% of the people in the class, characterised by a relatively short duration (under 4 years). It also means that for almost 60% of the individuals in a given class, there is no departmental stage and that the individual migrates directly from their original municipality of residence to a municipality located in another department in the region. Most of these geographical pathways unfold in the same region as the original municipality, but in another department (44 years out of the 65). The average pathway[13] for individuals in this class is as follows. They live in their original municipality of residence until the age of 21, before settling in another municipality in the region but located in a different department. Subsequently, they do not return to their original department of residence but remain, for the majority, in the same region. This class overrepresents managers, intermediate professions and graduates of higher education, at the expense of farmers and workers (see Table 5). The regions affected by these migration pathways are primarily in Île-de-France (41% of people in the class are Île-de-France residents at age 65), and the Rhône-Alpes region (9%). The Île-de-France region – the departments of which have a reduced surface area – is more conducive to these pathways, as a change in department may appear less significant than in another region. Class 3 individuals experience more job-related changes than average. They also have more unstable family lives than the average and are more mobile in terms of changes in municipality.

Individuals in class 4, the "mobile to a neighbouring region" (8% of the weighted sample) have in common to have left their initial municipality of residence before age 35 and migrated to a region bordering their initial region of residence (figure IV-D). The age of arrival in this adjoining region is most often after 20, either during youth or later during adult life (25% after age 30, see Appendix, figure A-III). Subsequently, these individuals' geographical pathways go only very episodically beyond the regions bordering the initial region of residence, even though a fraction of them (8%) can be seen returning to the department of origin. Individuals in class 4 are most often men, managers or intermediate professions and graduates of higher learning (Table 5). They experience more geographical mobility and have more children than the average. They account for 8% of the sample.

Individuals in class 5, those "mobile to the Île-de-France region" (8% of the weighted sample) left their initial municipality of residence before age 30 and migrated to the Île-de-France region (figure IV-E). The age of arrival in the Île-de-France region is usually under 40, with a peak at the time of youth and the start of adult life (Appendix, figure A-IV). After age 50, they split into three groups: some

13. In other words, this is the pathway that associates each age with the most common modality within the class.

Figure IV
Distribution of individuals in each class by age



Reading note: the charts show at each age the proportion of individuals in each class covered by each of the modalities.
Scope: individuals born in France and above age 65, belonging to each class (class 1: 195 observations, class 2: 565, class 3: 152, class 4: 100, class 5: 87, class 6: 86).
Sources: Insee-Ined, *History of Life* survey, 2003.

remain in the Île-de-France region (around 50%), others go back to their region or department of origin (about 25%), and lastly, others establish themselves in another region (around 25%), most often in the regions of the South (Provence-Alpes-Côte d'Azur, Aquitaine or Languedoc-Roussillon), or West (Brittany). These regions are among those with the most positive migratory balance in recent decades (Baccaïni, 2007). This finding coincides with that of Kych and Cribier (1992), who show, based on a survey of 1,370 Parisians having retired in 1972, that a third of them leave the Paris urban area for a reason that is closely or remotely related to the end of working life. While the age of 50, the time at which these moves begin, appears desynchronised with the timing of the end of professional activity (which occurs at age 60), research has shown that future retirees tend to anticipate the end of their working life in their residential choices (Dubujet, 1999). Shifts through other modalities (than Île-de-France and the initial municipality of residence) are relatively frequent within this class. 48% of the individuals in the class had at least one stage in another municipality in their original department of residence and 46% in another region. However, the duration of these stages is short (less than 4 and 1 year respectively). While the individuals involved in these pathways are relatively marginal in the sample (8%), they show specific sociodemographic characteristics: they are most often women, managers, intermediate or employed professions, and graduates of higher education (Table 5). They were most often born in Western or Parisian regions (Brittany, Picardie, Normandy and the Centre are over-represented). These individuals were also particularly mobile in geographical terms and

Table 5
Socio-demographic characteristics of the individuals in the six classes

Variables	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Total sample
Age (in years)	74.4	73.8	72.9	74.3	74.0	73.5	73.8
Sex (%)							
Male	32.5 ***	44.8*	42.9	49.1 **	26.4 ***	52.6 ***	41.5
Female	67.5***	55.2 *	57.1	50.9 **	73.6 ***	47.4 ***	58.5
Family life							
Number of separations	0.24**	0.29	0.35**	0.31	0.27	0.34**	0.29
Number of children	2.43	2.51	2.29*	2.87**	2.16***	3.07***	2.50
SOC (%)							
Farmer	40.3 ***	20.3	7.5 ***	6.7 ***	0.0 ***	0.9 ***	18.4
Independent	10.7 **	16.8 *	15.7	15.0	9.9 **	11.4 **	14.5
Manager	4.2 ***	8.4 *	18.6 ***	15.3 **	21.5 ***	14.0 *	11.0
Intermediate occupation	4.7 ***	10.5	18.2 ***	25.4 ***	15.3 **	22.7 ***	11.2
Office worker	18.6 **	21.9	24.0	19.1 *	30.6 ***	30.5 ***	22.6
Manual worker	14.3 **	19.3	13.1 **	17.5	21.7 **	17.2	17.5
Inactive	7.2 **	2.9	2.9	0.8 **	1.1 **	3.4	3.4
Changes in occupation	1.07***	1.76	2.05**	1.67	2.27***	2.17**	1.73
Degree (%)							
Primary studies	73.4 ***	58.7	46.5 **	52.5	35.4 ***	31.4 ***	55.8
First cycle of secondary school	9.4 **	5.6 **	13.0	15.4	15.7	18.9 **	13.0
Vocational education	10.0 **	15.7	18.2 **	5.9 ***	17.9 **	17.8 **	13.6
General Baccalaureate	5.4	5.4	8.6 *	6.1	2.1 *	15.2 ***	6.4
Higher education	1.4 ***	6.8 **	13.7 **	20.1 ***	26.8 ***	16.6 **	10.0
Geographical mobility	0.15***	3.56	4.45***	4.57***	5.66***	5.79***	3.44

Note: *** significant at the 1% threshold, ** at the 5% threshold and * at the 10% threshold for the average equality test with the whole sample.
Reading note: out of the Class 1 population, 32.5% are men, whereas the latter account for 41.5% of the sample.
Scope: 1,185 people born in France, residing in mainland France and age 65 or above at the time of the survey.
Sources: Insee-Ined, *History of Life* survey, 2003.

nearly one-third of them have resided at least one year abroad (compared with only 8% in the sample). Class 5 individuals also experience intense mobility in profession in place of residence. A recent study on a sample of Île-de-France residents revealed a similar profile, emphasising that these were individuals who arrived in the Île-de-France region between ages 25 and 30[14] and who establish themselves first and foremost in the suburbs (immediate or outer suburbs) rather than in Paris itself (Morand *et al.,* 2012).

Individuals in class 6, the "mobile to a remote region" (6% of the weighted sample) have left their initial municipality of residence before age 20, and migrated to a regional province that is not adjacent to their initial region of residence (figure IV-F). Mobility to this new region has most often occurred during childhood (50% take place before age 20) or at the time of youth or the start of adult life (Appendix, Figure A-V). Most of these geographical pathways take place outside the initial region of residence in which the individuals in the class reside on average for only 15 years, compared to 47 years in non-neighbouring regions. Relatively few individuals in this class have experienced a departmental or regional stage (under 20%). Unlike class 5 individuals, the return to the department or the initial region of residence is not seen in Class 6 individuals. These pathways are relatively marginal in that they pertain to only 6% of the sample. Individuals in this class are most often men, employees, intermediate professions or managers, and graduates of higher education (Table 5). They also have a more unstable family and professional lives than the average. In addition, their geographical trajectories point to intense mobility: on average, they have experienced 5.8 changes in municipality before age 65 (compared with 3.4 for the sample as a whole). The sub-population of Class 6 also has more children than the sample average (average of 3.07 children compared to 2.5 for the sample as a whole). Almost half of these individuals experienced a geographical stage abroad before age of 65 (compared to 8% for the sample as a whole). At age 65, individuals in this class mainly live in the regions often considered the most attractive: Provence-Alpes-Côte-d'Azur (21%), Languedoc-Roussillon (10%), Midi-Pyrénées (10%) and Aquitaine (7%).

Immobile individuals highly attached to their place of residence and more distant Île-de-France neo residents

The construction of a typology of geographical pathways is likely to shed new light on the question of ties between these pathways and the subjective relationships which individuals develop with places. The causality can be two-fold. The emotional bond with a place can influence residential location decision-making. Reciprocally, the geographical pathway will undoubtedly play a role in constructing the subjective relationship with places.

Individuals in the least mobile classes (Classes 1 and 2, which encompass individuals whose geographical pathways are mainly in the same department) are both those who would most regret a prospective departure from their current region of residence and those most attached to their place of residence (Table 6). Conversely, the "immobile" are also those who are the least likely to be attached to a place other than their place of residence (less than 15% compared with 28% for the whole sample). This result is probably the corollary of a less varied geographic pathway. On the contrary, individuals in Classes 4, 5 and 6, who are the most mobile in the sample (on average more than four geographical stages before age 65) are those who would regret the least the departure from their current region of residence. Even in these classes, however, still almost 60% of individuals say they would regret such a departure. Individuals whose pathways have been labelled "mobile to the Île-de-France region" (class 5) have a distinctive response behaviour. They are the ones who would regret a departure the least (only 58% compared with 80% for the sample as a whole), even though paradoxically 60% declare themselves to be attached to their place of residence. Individuals in Classes 3, 4 and 6 who have in common to have changed department before age 65 are the least attached to their place of residence. Symmetrically, they are also those most often attached to another location. These few results are consistent with the ties highlighted by France Guérin-Pace between the territorial component of identity and the geographical pathways of individuals (Guérin-Pace, 2006a, 2006b and 2009).

14. *The authors describe them as "later-life Ile-de-France dwellers."*

A typology valid also for younger generations

The first part of this study showed that younger generations are more mobile than their elders when it comes to geographical mobility. This result leads to the next question: to what extent can the typology established for a sample of individuals born before 1938 be applied to the population as a whole?

Analysis of geographical pathways poses a recurring problem: to study them in their entirety, these pathways must be complete or at least well-underway, making it difficult to carry out studies on the most recent generations. The following methodology was chosen. The sample used so far, containing individuals born before 1938, was kept. A second sample limited to individuals born between 1950 and 1958 was built (Table 7). A new capping threshold, set at 45 years, was defined for geographical pathways. The same optimal matching method was used, based on the set formed by the two samples. The choice of years of birth and the age limit obeys a triple constraint. First of all, the constraint of observing trajectories long enough for geographical pathways to have already started to take shape (in particular, optimal matching is sensitive to the succession of modalities, and it is therefore important that the pathways have stabilised after the mobility that took place during the youth), hence the decision to set the threshold at 45 years (and to keep only those born before 1958). Secondly, maintaining a sample with sufficient size so that the results are reasonably robust (hence the decision to extend the range of years from birth, in the second sample, to at least 1950). Lastly, ensuring that the cohorts represented in each sample are sufficiently distant in terms of years of birth in order to be able to bring out any significant intergenerational differences between geographical pathways (hence the decision to set the years of birth in the second sample between 1950 and 1958). The gap between the average ages of the two samples is 25 years (Table 7) that is, approximately one generation.

The classes derived from the optimal matching are the same in terms of interpretation and reading of pathways as those of the first sample. The breakdown between classes in the two samples then provides information about a possible distortion of the geographical pathways between cohorts[15].

The proportion of "immobile" individuals decreases sharply between the two cohorts, increasing from 20% for individuals born before 1938 to 9% for those born between 1950 and 1958 (Figure V). The proportion of individuals named "mobile to remote regions"

15. The breakdown of individuals born before 1938 between the different classes differs slightly from the results presented above because the pathways are truncated at 45 years.

Table 6
Geographical pathways and subjective experience of place

Class	Name	(% of the weighted sample)	% of people who would regret leaving	% of individuals attached to the place of residence	% of individuals attached to a place other than the place of residence
1	Immobile	(18)	86.4	81.7	14.5
2	Mobile at departmental level	(47)	83.8	62.9	28.2
3	Mobile at regional level	(13)	79.0	53.2	35.7
4	Mobile to neighbouring region	(8)	67.3	48.7	41.2
5	Mobile to the Île-de-France region	(8)	58.2	60.0	32.9
6	Mobile to a remote region in the provinces	(6)	77.6	51.2	34.3
Total sample		(100)	79.9	63.0	28.5

Reading note: Out of the individuals in class 1, 86.4% stated they would regret having to leave their region.
Scope: 1,185 people born in France, residing in mainland France and age 65 or above at the time of the survey.
Sources: Insee-Ined, *History of Life* survey, 2003.

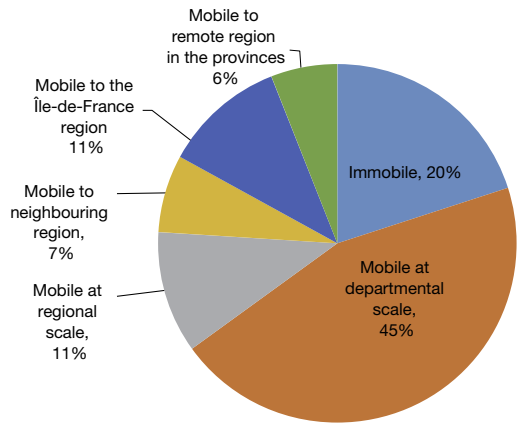
Table 7
Construction of samples for studying geographical pathways over generations

	Year of birth	Number of observations	Average age at the time of survey
Sample 1	Before 1938	1,185	Age 73.8
Sample 2	1950-1958	1,217	Age 48.7

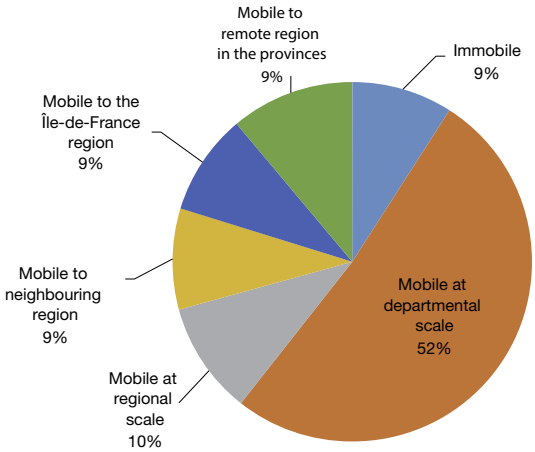
Reading note: Sample 1 contains 1,185 people. At the time of the survey (in 2003) they were 73.8 years old on average.
Sources: Insee-Ined, *History of Life* survey, 2003.

Figure V
Distribution between the different "geographical standard pathways" for generations born before 1938 and between 1950 and 1958

V-A Individuals born before 1938



V-B Individuals born between 1950 and 1958



Note: The construction of the classes was carried out on the ground, by combining two samples. The names of the classes contain the names chosen to describe the classes in the typology built above.
Scope: individuals born in France (1,185 born before 1938, 1,217 between 1950 and 1958)
Sources: Insee-Ined, *History of Life* survey, 2003.

increases significantly, from 6% to 11%. The other developments are not significant. These factors are in line with previous results: over the generations, geographical pathways entail more mobility. Nevertheless, the geographical pathways at the departmental level remain by far the most frequent.

* *
*

After providing several descriptive elements concerning the geographical mobility of individuals born in France and developments therein over generations, the core of this study lies in constructing a typology of the related geographical pathways. This typology covers individuals born in France before 1938. Several salient traits emerge from it. Firstly, a significant proportion of the sample (18% of individuals) leave their initial municipality of residence only very episodically. Secondly, most geographical pathways unfold almost entirely at a relatively small territorial level (the department). Two-thirds of journeys almost never go beyond the departmental level[16]. Almost 80% of the geographical pathways only very rarely exceed the territorial framework of the initial municipality of residence's region[17] and 86% the territorial area of regions bordering this initial region of residence[18]. Geographical pathways involv-

16. This figure is reflective of classes 1 and 2 combined, or 66% of the sample.
17. This figure is reflective of classes 1, 2 and 3 combined, i.e. 79% of the sample.
18. This figure is reflective of classes 1, 2, 3 and 4 combined, i.e. 86% of the sample.

ing lasting interregional mobility in regions other than those bordering the initial region of residence do not represent more than 14% of the pathways[19] and are observed mainly for executives or intermediate professions and graduates. This typology therefore reflects the strong territorial anchoring of the geographical pathways, particularly within a departmental or, more rarely, regional framework. While it applies to individuals born before 1938, it is also broadly valid for those born between 1950 and 1958.

However, this study should be completed more in depth on many aspects. Firstly, from a methodological point of view, a corrections for differential mortality could be applied to the sample so as to guarantee proper representativeness of the generations involved (in terms of breakdown by sex and by social categories in particular)[20]. Secondly, the analysis would gain from being conducted on more recent dataand a larger sample (the HDV survey dates back to 2003, the typology is based on a sample limited to 1,185 individuals) in order both to grasp the geographical pathways of the younger generations and to carry out a more fine-grained analysis in terms of territories. Lastly, this contribution is only the first step in a more elaborate research. A second step would consist of taking this work to a deeper level by using multi-sequential methods of analysis that could provide better insights on the links between geographical, family and professional pathways. Insee's *Permanent Demographic Sample* an alternative source from this point of view even though limited to employees alone[21], could offer a wealth of lessons. □

19. This figure is reflective of classes 5 and 6 combined, or 14% of the sample.
20. Such an operation, however, is not easy, especially for individuals who have changed socio-professional category during their lives.
21. See earlier for discussion on sources.

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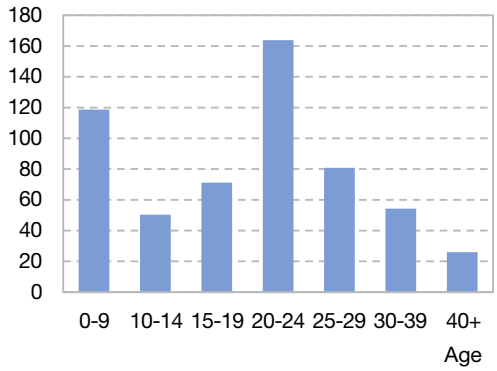
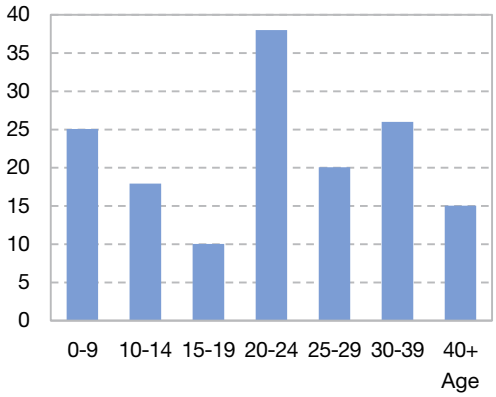
THE AGES OF MOBILITY IN THE SIX GEOGRAPHICAL PROFILES OF THE TYPOLOGY

Figure A
Distribution of the ages of first arrival in the modalities

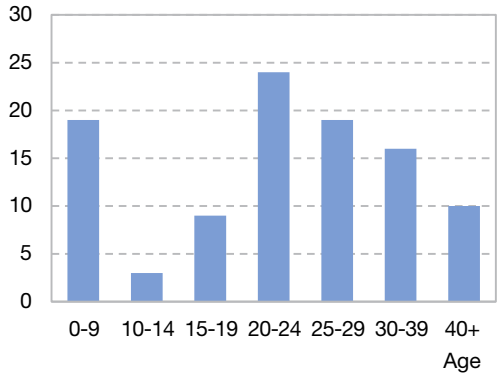
Age of first arrival in a municipality of the initial department but different from the initial municipality for individuals in Class 2 (565 observations)



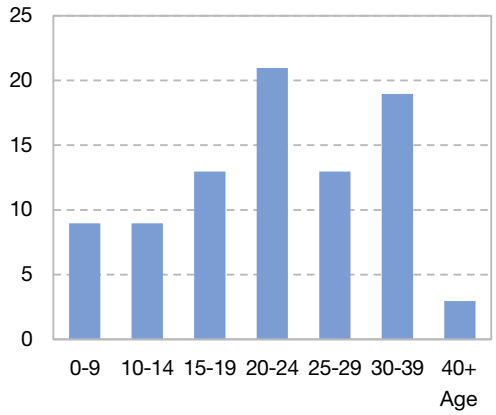
A-II - Age of first arrival in a municipality of the initial region but in another department than the initial municipality for individuals in Class 3 (152 observations)



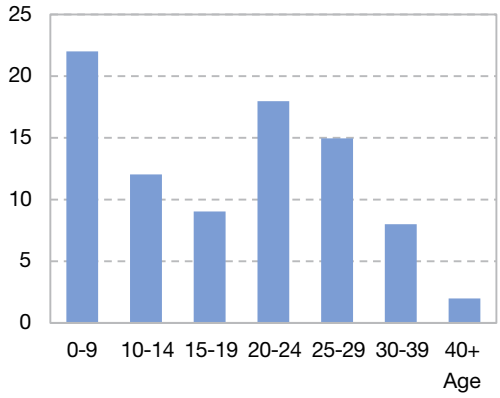
A-III - Age of first arrival in a municipality of a region neighbouring the initial region for individuals in Class 4 (100 observations)



A-IV - Age of first arrival in a municipality of the Île de France region for individuals in Class 5 (87 observations)



A-V - Age of first arrival in a municipality of a region (not neighbouring) other than the initial region for individuals in Class 6 (86 observations)



Scope: individuals born in France, residing in mainland France and above age 65
Sources: Insee-Ined, *History of Life* survey, 2003.

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- An anonymised file of the article (including the main text, illustrations, bibliography and appendices if any), mentioning only the title, abstract, JEL codes and keywords on the front page.

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Economie ET Statistique

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