URBAN EVOLUTION AND SPATIAL MOBILITY IN CHICAGO AND PARIS

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ABSTRACT

The interaction between households' location choices and commuting distances is a key process in understanding urban evolution, sprawl and spatial socioeconomic specialisation. As these phenomena show complex interactions, the comparative analysis of the Chicago and Paris metropolitan areas presented in this paper considers both their global evolution and their household's spatial mobility trends, using a competing rationalities approach to interpret their localisation and travel behaviours. Residential duration data is intensively exploited in order to gain insight on temporal residential processes with cross-sectional information. The obtained results show a remarkable convergence of global indicators of residential mobility and travel, despite sharp differences among residential markets and transportation modal shares. They also suggest that two decision levels could simultaneously determine households' location and travel choices, one that tends to minimise transport costs, and another that promotes the maximisation of the range and number of daily activities. Finally, the observed differences in the evolution of the Chicago and Paris urban areas support the argument for the implementation of strong regulating and redistributing institutions at a metropolitan level.

Keywords: residential duration, travel distances, location choice, household behaviour, housing market, urban sprawl, socioeconomic specialisation.

1. INTRODUCTION

Large urban systems in developed countries evolve with remarkable speed, both by morphological changes such as urban sprawl and by less evident ones such as selective household rotation and spatial socioeconomic specialisation (Weisbrod 1980, Berger 2006). Containing sprawl has become an important objective of urban policies (Horner 2002), in order to reduce space and energy consumption, to avoid the loss of productivity caused by the reduction of the effective labour market size (Prud'homme 1999), and to preserve urban life quality. Another important objective of urban and social policies is to counteract spatial

inequalities (Ghorra-Gobin 2006), which lead to residential segregation and to increasing differences in job-market accessibility among social groups (Wenglenski 2004).

Urban evolution is largely determined by the interaction between global conditions (of transport, housing and economic development) and individual spatial mobility, including residential and travel behaviours, which are ultimately determined by the household's aggregated choices (Alonso 1964, Orfeuil 2008). Understanding the reciprocal relations between these levels is central subject in urban research and has important implications for the orientation of social and urban development policies.

The comparison of the Chicago and Paris metropolitan areas (Metropolitan Chicago and the Ile-the-France region, respectively), both at a global and at the households' behaviour level, is structured by an interpretative model of the competing rationalities that determine location choices. Our hypothesis is that different behavioural patterns coexist in each household's travel and moving strategy. Firstly, at the most constrained level, a tight choice occurs between reducing transport costs and responding to the household's accommodation needs. In normal conditions, a marginal utility equilibrium will determine the optimal choice (Alonso 1964), but wherever one of this two conditions becomes critical (as will be the case for extreme commuting distances or for severe limitations in housing supply), it will overwhelm the other and become the main determinant of choice, which will not be optimal. This can be characterised as "homo economicus" behaviour. Secondly, when income rises and the city offers a larger choice of activities and transportation, individual travel behaviour will not tend to minimise transport costs, but to maximise the number and range of daily activities, within certain limits of their temporal and monetary available budgets (Massot 2008, Orfeuil 2008). This can be characterised as "maximising opportunities" behaviour. Differences in global income, transportation and housing market conditions should partially determine the prevailing behaviour, but as households adapt to local conditions in order to satisfy their life cycle needs, there could be a behavioural convergence of similar groups in different contexts.

The aim of this work is to present a comparative analysis of the Chicago and Paris metropolitan areas, which sustains the above-mentioned conceptual framework, and to contribute to the comprehension of the complex interactions between global market conditions and households' location choices. A particular focus on the exploitation of residential duration variables shows the usefulness of elaborating approximate indicators for time-dependent phenomena, such as residential mobility, with cross-sectional information.

This paper is organized as follows. In this introduction, the social and spatial issues that motivate this research, the working hypothesis and the research purpose have been presented. In sections 2 and 3, a literature revision establishes the theoretical context. In section 4, the data sources and methodology are described. In sections 5 and 6, the main results are analyzed, respectively from a global and a households' behaviour perspective. Section 7 concludes with research perspectives and policy implications.

2. URBAN TRAVEL AND RESIDENTIAL CHOICE BEHAVIOURS

Economic theory and transport costs minimization

Urban economic theory has postulated a tight relationship between land price differences and transport since Von Thünen's "The Isolated State" (1826). Alonso (1964) extends this principle to urban monocentric systems, explaining households and firm competition for location as the simultaneous maximisation of the marginal utility of space, transport costs (negative) and consummation goods, with a limited income or a profits goal.
Based on the urban monocentric model, Hamilton (1982) introduces the concept of "wasteful commuting", as the difference between the observed commuting distances and the theoretical minimum predicted by an optimal household-job distribution. In this line of research but with a different method, White (1988) obtains very low "wasteful commuting" values compared with Hamilton's results. Horner (2002) estimates a theoretical maximum for commuting distances and shows that it is always considerably higher than observed ones in 26 USA cities. One general conclusion of these approaches is that the relative proximity of observed commuting distances with the theoretical minimums suggests a strong influence of travel costs minimization in the households' localization process.
Van Ommeren et al. (1997) propose a search strategy model to explain the long-term households' commuting, residential and employment behaviour, fitted to a retrospective survey in the Netherlands. One important conclusion of their work is that these three dimensions interact in household strategies and that not only instantaneous but lifetime utility is considered in job-residence choices.
In sum, with the progressive inclusion of complexity, uncertainty, market imperfections and individual behaviour in location and commuting models, research in economic theory has accumulated evidence of the importance of transport costs minimization in households' spatial behaviour.

Sociology and life cycle imperatives

However, many empirical works from a sociological perspective consider that factors associated to the households' life cycle and housing characteristics are overwhelming in residential choice. In a seminal work, analyzing panel data in Philadelphia, Rossi (1955) concludes that family composition changes are the main reason for moving. In fact, moving can be considered as the result of an interaction between household strategy and the housing market (Lelievre et al., 1992), influenced by family atomization, life accidents and interpersonal ties (Grafemeyer et al., 1998). The declared moving reasons, in the Dutch (1994) and French (2002) National Housing Surveys, correspond in 87% and 82% of the cases to family cycle and housing conditions. Finally, observing a growing spatial dissociation between jobs and residences in the Ile-the-France (IdF) Region, Berger et al. (2006) assign a weak role of reducing commuting distances in location choice in this context.
In sum, the declared individual reasons for moving and the constraints of location choice imposed by housing markets, have led many social researchers to consider that households' residential needs overwhelm transport costs minimization in their moving behaviour.

Competing rationalities in households' localization behaviour

Integrated approaches show that neither transport cost minimisation nor residential needs have an absolute influence in households' location choices. An optimal utility solution is not always possible, because housing stock is inelastic in the short term and the desired combination of housing type and location may be unavailable. As Polachinni and Orfeuil (1999) show for the IdF Region, it is extremely difficult for big families to buy an adequate house in central locations, regardless of price. Analyzing complete household data for an 18-month period in Minneapolis, Weisbrod et al. (1980) conclude that even if housing and environment characteristics are dominant, commuting times have a smaller but significant influence in residential location choice. Clark & Davies (1999) provide an insight on the interconnected nature of life-course events. They show that residence and job changes tend to occur within short intervals. More than a unidirectional causal relationship, this suggests that life cycle, career and transport considerations are simultaneously and reciprocally adjusted.

The work of Massot et al. (2008, 2006) helps to explain the apparent contradiction between the importance of transport costs and life-cycle imperatives. They show that only a 14% of commutes in the IdF Region are longer than 20 km, even if they represent a 38% of total commuting distance. As most households reside at acceptable distances to their workplaces, only workers in extreme commuting situations would actually see reducing travel as a central criterion for a new residential choice. These authors support a theory of travel behaviour that argues that individuals tend to "maximise opportunities" rather than to minimise transport costs (Massot 2008, Orfeuil 2008). "Travel-time budgets" being remarkably constant even when technical improvements allow for higher speeds (Zahavi 1980), it seems plausible that individuals would try to maximise the number of daily activities up to a certain limit of travelling effort.

In conclusion, understanding households' spatial tradeoffs requires a multi-approach theoretical framework. Depending on income, family structure and context, individuals could alternatively behave as economic optimisers or try to maximise their levels of social interaction and enjoyment of urban amenities.

3. URBAN SPRAWL, INEQUALITIES AND SPATIAL MOBILITY

Household localization is simultaneously affected by and contributes to urban transformation. Mainly driven by the increase in urban travel speeds (Orfeuil 2008), urban sprawl radically changes the spatial structure of cities. This process raises a number of questions concerning the sustainability of low-density and car-dependant urban systems (Newmann and Kenworthy 1989), the loss of neighbourhood social interaction (Horner 2002) and increasing segregation in contemporary cities (Berger 2006, Sassen 2000).

The residential distribution of high and low-income groups shows important variations between North-American and European cities (Zenou 1997). In the first case, high-income groups tend to prefer peripheral locations, which allow having bigger living spaces and demand higher transport costs. On the contrary, lower income groups tend to stay in central areas, often degraded, constrained by transport costs to live in overcrowded conditions

(Alonso1964). For these groups, employment-access problems arise as the entry-level jobs migrate to the periphery, a phenomenon that has been called "spatial mismatch" (Kain 1968). In many European cities, sustained public investment has developed efficient public transport systems and has improved the environmental quality of central areas. The induced gentrification processes of city centres force big families and low-income groups to peripheral areas. As Polachinni and Orfeuil (1999) show for the IdF Region, this distribution creates big differences, mainly by the increase in transport costs, in the total housing and transport effort, which varies from a third to over a half of households' income. In the same context, Wenglenski (2004) calculates that as executives have, in average, access to 68% of their corresponding-level jobs in less than one hour commuting time, in the case of workmen this share drops to 41%. The main reasons are the differences in spatial distributions of jobs and residences. Considering that low-level jobs are often more precarious (Veltz 2000), a lower accessibility to this employment market represents a serious problem.
These situations occur in sprawling urban systems that undergo rapid internal demographic reconfigurations. When housing markets also present important variations of price and accommodation types among sectors, residential mobility can become a powerful driving force of residential segregation (Berger 2006).

Different connotations of residential mobility and stability

As residential immobility is often associated with discrimination and pauperisation of degraded neighbourhoods (Darden 1987, Donzelot 2004), residential mobility generally receives a positive connotation. Strassman (1991) underlines that it favours chain moves that allow access to young households to the housing market. However, as mentioned above, selective residential mobility is a mechanism of segregation and household migration to peripheral areas is a main driving force of urban sprawl, which leads in turn to important increases in commuting distances (Orfeuil 2008). Finally, in the case of households that are forced to move due to family growth or income reduction, residential mobility could involve an important increase in travel costs (Polachinni 1999). Alternatively, residential stability gives the opportunity to reduce travel distances. Longer periods of residence could allow for the progressive approximation of daily activities, from changing jobs to nearby areas to developing social ties and consuming habits in the neighbourhood. In fact, analyzing data of the travel survey in the IdF Region, Courel (2009) demonstrates that after controlling for age, activity, income and household composition effects, recent movers do slightly longer commutes.
In sum, residential mobility can have different connotations and effects on travel distances, depending on income, household characteristics and housing market conditions. Firstly, the reasons that trigger the decision to change residence should be considered: is moving a choice or the outcome of a predicament? Secondly, when the decision is taken, different household capacities can determine opposite situations: after moving, do the new location and accommodation satisfy familiar needs and do travel distances increase or decrease?

4. DATA SOURCES AND METHODS

This research will present general comparison between the Chicago and Paris metropolitan areas. For the latter, the IdF Region is considered, which closely corresponds to the Paris urban system. Diverse methods will be employed to characterise the spatial conditions and recent evolution of each case and the observed spatial mobility behaviour of their households.

The main data sources used for this study have been: the 2008 Travel Tracker Survey (TTS), which provides complete travel information of 14.390 households residing in Metropolitan Chicago (8 Illinois and 3 Indiana counties); and the 2001 Enquête Globale de Transport (EGT), with information of 10478 households from the IdF Region. The travel indicators presented in this paper have been elaborated over comparable populations, excluding data corresponding to children younger than six years, not included in the French survey. A trip level has been elaborated with TTS information, regrouping successive stages that share the same purpose and are separated by an interval shorter than 10 minutes. This provides a better representation of travel behaviour and allows to compare a system with a high share of multi-modal travel (the IdF Region) with another characterised by car dominance (Metropolitan Chicago), which leads to higher shares of single-stage trips.

Other main data sources used in this study have been the 1990, 2000 USA Census and the 1990, 1999, 2006 French Recensement Général de la Population (RGP). These and other complementary sources, such as housing surveys and housing market reports, have been used to complete the statistical and geographic description of each case.

Global comparison and geographic representation

A particularity of this study is the focus on residence duration information (RD), a standard variable of Travel Surveys. Even if it provides cross-sectional and right censored data (the following moving date is unknown) of residence periods, it can be used to elaborate useful indicators of residential mobility. Firstly, this variable has been used to calculate the median RD for the two cities and for tenure groups. This is a good indicator of the relative moving frequency of different populations, even if, being right-censored, it will give lower values than the respective real (unknown) median periods of residence. The obtained results show similar relative variations as those found in longitudinal studies (Levinson 1995, Clark 1999, Van der Vilst 2001, Brunet 2006), which confirms the pertinence of this indicator. Secondly, the RD as been used to elaborate an indicator of household rotation (HR, see table I). This indicator informs simultaneously about the share of the households that have moved at least once in a 10-year period and about their frequency of moving.

For cartographic representation, the Chicago and Paris metropolitan areas have been subdivided in radial cones, centred in main highways, and in concentric rings, graduated by density. The resulting spider-web pattern defines sectors elaborated by census tract (USA) and commune (France) regrouping. Travel Survey sample sizes allow the statistically significant comparison of the analyzed indicators among the defined zones within the same city.

Household spatial mobility analysis

Residential mobility and travel behaviour of households has been analysed for different tenure and income subpopulations, regrouped by RD classes. In order to control for composition effects, class averages of key variables (age of householder, household size, income, number of workers) are calculated. A multivariable regression analysis with RD and average trip distance (TD) as dependent variables (with the above-mentioned, plus tenure and householder's education level as independent variables) further contributes to understand the determinants of spatial behaviour. These variables have been identified as influencing residential mobility by previous research (Levinson 1995, Clark 1999, Van der Vilst 2001, Brunet 2006). Finally, complete travel information of households, grouped by RD, has been analyzed for the whole population and for tenure and income-defined subpopulations. High and low-income classes have been defined, for each tenure group, as being above or below the respective median value of household income by consuming units. The following analysis focus on average TD, in order to show the relationship between households' location and their daily activities.

Data definitions table

Table I – Selected indicators description.

INDICATOR	ABBREVIATION	DESCRIPTION
Residential Duration	RD	Number of years since arrival to actual accommodation.
Median Residential Duration	median RD	Median value of residential duration.
Average Residential Duration	average RD	Average value of residential duration. Calculated only for households arrived since 10 years or less.
Share of recently moved households	%Hh(<10)	Percentage of the households arrived since 10 years or less, over the total population of a particular zone.
Household Rotation	HR	Share of recently moved households divided by their average residential duration. %Hh(<10) / average RD
Average Trip Distance	average TD	Average distance of trips, total or regrouped by purpose. In Kilometres.

5. SPATIAL MOBILITY CONTEXTS

The Chicago and Paris metropolitan areas present certain common characteristics that allow developing a comparative study. Their populations are on a similar scale, respectively at around 9 and 11 millions, and they extend over a similar range, with approximate average radius of 70 and 60 kilometres. Both have a predominantly monocentric structure, with sharp centre-periphery density gradients and powerful radio-concentric transport infrastructures. They are the economic centres of their respective and surrounding regions, preserving an important industrial sector (peripherally located) despite the predominance and rapid increase of the tertiary sector in the second half of the XXth century.

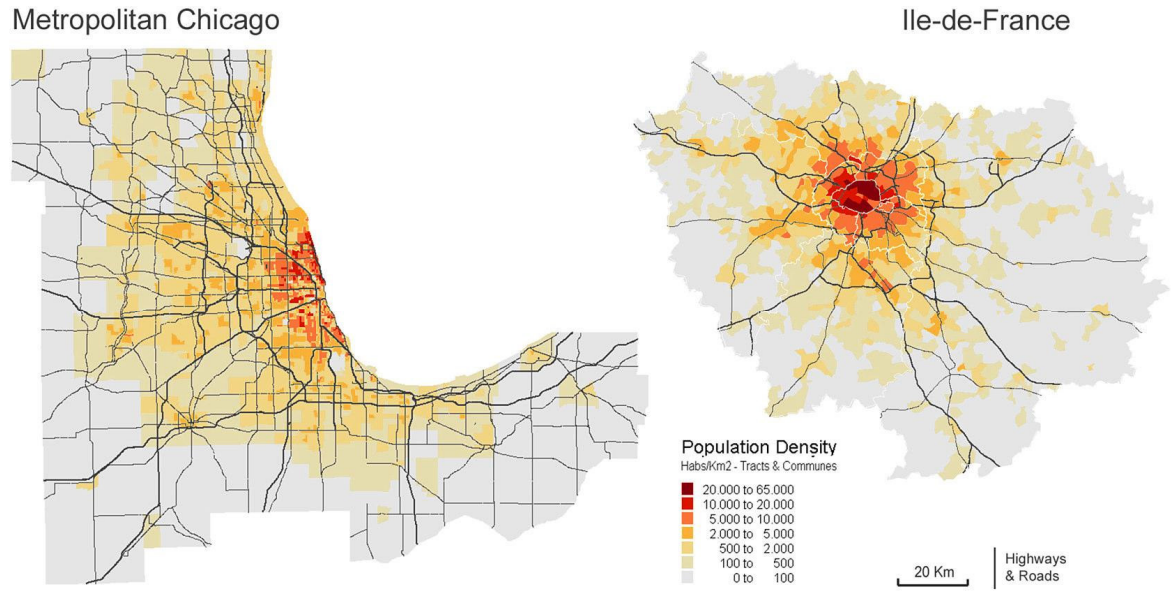


Figure 1 – Population density and main roads in Metropolitan Chicago and in the IdF Region. Sources: Census 2000 (M. Chicago) and RPG 1999 (IdF).

Income distribution and travel indicators

The sharpest divergence between these urban systems is the spatial distribution of income (fig. 2). In Metropolitan Chicago, the poorest population is concentrated in southern central areas and higher-income households are dispersed in the northern suburbs. The IdF Region shows an opposite general pattern, with high-income population concentrated around the west of Paris and surrounding areas, meanwhile the middle and lower classes are dispersed in the periphery, with the exception of a sharp concentration of poor population in the Seine-Saint-Denis department, to the north of central Paris. In both cases, poverty concentration is associated with local predominance of ethnic minorities (maps not shown).

Global household income levels are higher in Metropolitan Chicago, but show greater inequalities of distribution (fig. 3). This difference is partially due to higher tax levels and income redistribution mechanisms in France, and is to some extent compensated by free or low-cost high-quality public services, including unemployment insurance, health and education. A powerful public transport system insures a third of total daily travel distances in the IdF Region (table II). The integrated fare for bus, metro and regional train is highly subventioned, up to three quarters of total transport costs (Orfeuil 2008). In Metropolitan Chicago, the Regional Transit Authority also finances public transport use up to a half of transport costs, but this mode of travel only represents 11% of total daily travel distances.

Despite these sharp differences in modal shares and in a per capita basis, average daily travel distances, travel times, number of trips, average trip distance and average speed are strikingly similar[1]. Considering that income levels are correlated with increased urban travel (Orfeuil 2008), this could be surprising. It would seem that in the IdF Region a long term

[1] Data for the IdF Region corresponds to 2001, however, as Hubert (2009) shows, travel trends in France have remained very stable in the 1994 - 2008 period. This allows comparing it with Metropolitan Chicago's 2008 information.

investment in a powerful, fast and intensely used public transport system has compensated a relatively lower income, attaining identical levels of travelling capacity as those observed in Metropolitan Chicago.

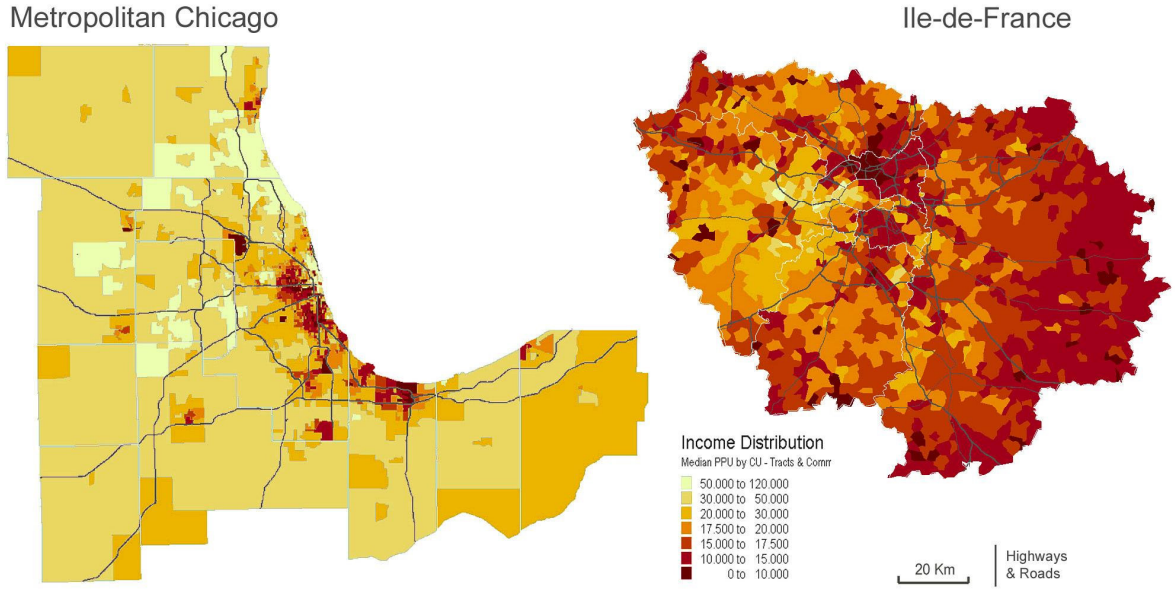


Figure 2 – Median Income geographical distribution in Metropolitan Chicago and in the IdF Region. In purchase parity units (PPU), adjusted for inflation. Sources: Census 2000 (M. Chicago) and INSEE 2001 (IdF)

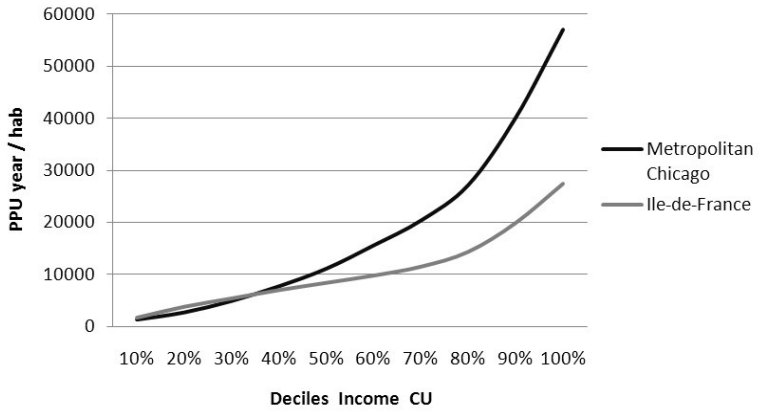


Figure 3 – Accumulated income distribution in Metropolitan Chicago and in the IdF Region. In purchase parity units (PPU) adjusted for inflation. Sources: TTS 2008 (Chicago) and EGT 2001 (IdF).

Table II – Main travel indicators in Metropolitan Chicago and in the IdF Region. Sources: TTS 2008 (Chicago) and EGT 2001 (IdF)

TRAVEL INDICATORS	N° inhab.*	Total Km	Km/hab	Min/hab	Trip/hab	Av. Trip (Km)	Av. Speed (Km/h)
Chicago	6.711.134	127.385.417	18,98	82,50	3,80	4,99	13,80
Ile-de-France	9.357.063	172.434.073	18,43	84,11	3,67	5,02	13,15

* Only households with complete information considered.

MODAL CHOICE	Walk (%Tot Km)	2 Wheels	Car	Public Transport	Other
Chicago	5,00%	0,43%	83,45%	11,07%	0,05%
Ile-de-France	5,89%	2,09%	55,92%	35,55%	0,55%

Residential mobility and housing markets

As shown in table III, the median Residential Duration (median RD) is slightly higher in the IdF Region than in Metropolitan Chicago[2]. The observed global difference is much lower than the differences observed by Strassman (1991) between North-American and European countries. It also seems unrelated to a higher Value/Rent ratio in the IdF Region. The tenure composition of the two housing markets is very different (table III). In the IdF Region, half the households are owners, one quarter are renters and one quarter are social sector renters. In Metropolitan Chicago, three quarters of the households are owners and one quarter are renters (social sector renters cannot be identified with TTS information). The considerably higher median RD observed in IdF Region owners (table IV) is associated with almost doubled roundtrip transaction costs[3], This suggests that transaction costs could have a considerable constraining effect on owner's residential mobility in the IdF Region. Compared to Chicago's equivalent, the private rental sector in the IdF Region shows longer residence periods, which seems associated to strong pro-renter French laws. Evictions are extremely difficult and rent-price controls keep the average rental contracts in course at a 10% lower value than new ones (table IV). As a result, moving implies a considerable rent increase. HLMs have a median RD that doubles the one of private sector renters in the IdF Region. On the contrary, in Metropolitan Chicago, low-income renters have much shorter residence periods, suggesting that in this case social housing has no stabilizing effect.

Table III – Median RD and housing market composition in Metropolitan Chicago and in the IdF Region. Sources: TTS 2008 (Chicago), RPG 2006 (IdF) and Global Property Guide (property prices).

TOTAL	Median RD	Med HH Inc UC (PPA)	Av HH Size	Value/Rent
Metr. Chicago	6,9	28.172	2,7	251
Ile-de-France *	7,1	22.475	2,3	312

* Median RD without considering HLMs

Median RD	Median Residential Duration (years) and Part of Housing Market (%)								
	Owners		High Income (MCh) or Private Sector Renters (IdF)		Low Income (MCh) or Private Sector Renters (IdF)		Total Renters		Total
Chicago	9,3	72,91%	3,3	13,50%	1,8	13,59%	2,8	27,09%	6,9
Ile-de-France	11,4	48,91%	3,3	28,12%	8,1	22,97%	5,1	51,09%	7,4

Table IV – Median RD and housing market conditions for tenure sectors in Metropolitan Chicago and in the IdF Region. Sources: TTS 2008 (Chicago), RPG 2006 (IdF), Global Property Guide and OLAP.

OWN	Median RD Own	Av HH Size Own	m2 Value (PPA)	Value m2/Med Inc	Transaction Cost
Metr. Chicago	9,3	2,8	10.182	0,36	9,07%
Ile-de-France	11,4	2,5	8.662	0,39	16,30%

RENT	Median RD Rent	Av HH Size Rent	Rent 50 m2 (PPA)	Rent (year)/Med Inc	Rent Control Weight ***	Eviction Time (days)
Metr. Chicago *	2,8	2,6	2.028	0,86	No control	49
Ile-de-France **	3,3	2,0	1.388	0,74	10%	226

* Arbitrary renewal refusal. Diverse reasons for eviction, but counter-demand risk. No rent control in Illinois. Agent fees vary between 0 to 2 months rent value.

** Only private sector considered. Strict reasons for renewal refusal. Rent increases limited by construction prices index, no control for new rents. Agent fees: 0-2 months.

*** Considered as the average difference (m2 basis, 1996-2006) to pay when changing an ancient rental contract for a new one (prices are freely fixed in new rental contracts).

[2] For a global comparison, the French rental social sector (HLM) has been excluded, because it presents a particular, non-market assignation process that strongly determines moving frequency.

[3] These include taxes, registration and agent fees, paid by sellers and buyers. Costs estimated for USA and France (as share of property value) by Global Property Guide f, www.globalpropertyguide.com.

In a first analysis, these results show that under the global similarity in median RD values between the Chicago and Paris metropolitan areas, there are great differences in the residential mobility of the owner and rental sectors. Nevertheless, this resemblance could also be a meaningful result. As the smaller difference in household size between renters and owners suggests, in Metropolitan Chicago a larger owner sector could be absorbing a share of fast-moving households, as opposed to a greater specialisation in stable households of the more rigid owner sector in the IdF Region. In other words, similar populations with an intermediary moving frequency could be buying or renting homes depending on the context. As a result, smaller tenure sectors would specialise in frequent movers (rental market in Chicago) or stable households (owner market in Paris). This could explain their extreme median RD values. As global values integrate all kinds of households, they could be a good indicator of general behaviour, regardless of tenure structure.
However, for the whole housing market, the global difference is significant and a higher median RD is associated with greater moving costs, an important regulated sector and offer shortages in the IdF Region housing market[4]. In sum, these results suggest a double effect of life-cycle convergence and of market constraints that could be slowing households' rotation in the IdF Region. However, this analysis is not conclusive and further research is needed to determine the relative importance of these two factors.

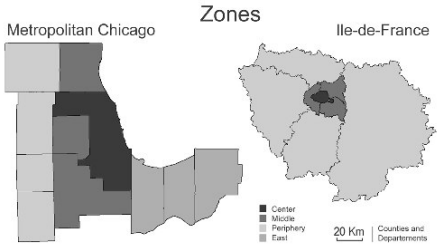
Sprawl, spatial mobility, travel distances and income evolution

Compared to the IdF Region, the lower value of total median RD in Metropolitan Chicago is associated to a higher demographical growth and stronger intra-metropolitan differences in population and housing units' evolution (table V, fig. 4). Peripheral areas show the most important growth, particularly the northwest corridor, an area of rapid development of high-level jobs. In the IdF Region, peripheral population redistribution is milder and no decrease in housing units is observed. Residential mobility, as measured by the housing rotation index (HR, described in section 4, table I), is stronger in central areas, particularly in the IdF Region (fig.5). This sectors show the weakest levels of population and housing growth, but they concentrate the rental housing market (map not shown), which has a much higher moving frequency. In Metropolitan Chicago, where the owner sector is predominant, peripheral sectors also show relatively high HR indexes. However, they also have important shares of rental housing and they don't exactly match the fastest-growing ones. This shows that residential mobility and urban growth are related but different phenomena.
Metropolitan Chicago and the IdF Region present a progressive augmentation of per capita travel distances from the centre to the periphery (map not shown). This distribution closely matches those of average trip distances and of car dominance in total travel distances and is characteristic of a monocentric spatial structure. Considering that in both cases demographic growth is mainly peripheral, population redistribution seems to be a main driver of increasing travel distances.

[4] There is a sustained housing crisis in France and particularly in the IdF Region. A recent rapport by the Fondation Abbé Pierre (www.fondation-abbe-pierre.fr) indicates that there are 3,5 million people in France facing a strong predicament of inadequate housing. Approximately three-quarters of these are located in the IdF Region.

Table V – Population and housing units evolution by grouped Counties and Departments in Metropolitan Chicago and in the IdF Region. Sources: Census Bureau (Chicago), INSEE (IdF).

POPULATION EVOLUTION	1990	2000 (Ch) 1999 (IdF)	2008 (Estimations)
Metr. Chicago	8.044.515	8.925.267	9.363.249
Ile-de-France	10.660.554	10.952.011	11.672.500



Metr. Chicago	Av. annual change 1990-2000		Av. annual change 2000-2008		Av. annual change 1990-2008	
	Population	Housing Units	Population	Housing Units	Population	Housing Units
Center	0,53%	0,37%	-0,19%	0,53%	0,21%	0,45%
Middle	2,39%	2,31%	1,67%	1,85%	2,24%	2,30%
Periphery	3,21%	3,07%	3,66%	3,60%	3,93%	3,80%
East	0,42%	0,94%	0,43%	1,14%	0,43%	1,08%
All Zones	1,09%	0,97%	0,61%	1,11%	0,91%	1,08%
Total Change	10,95%	9,72%	4,91%	8,88%	16,39%	19,46%

Ile de France	Av. annual change 1990-1999		Av. annual change 1999-2006		Av. annual change 1990-2008	
	Population	Housing Units	Population	Housing Units	Population	Housing Units
Center	-0,14%	0,16%	0,38%	0,08%	0,12%	0,13%
Middle	0,14%	0,74%	1,02%	0,78%	0,55%	0,78%
Periphery	0,66%	1,32%	0,71%	0,86%	0,70%	1,17%
All Zones	0,30%	0,79%	0,76%	0,63%	0,53%	0,74%
Total Change	2,73%	7,12%	5,30%	4,40%	9,49%	13,31%

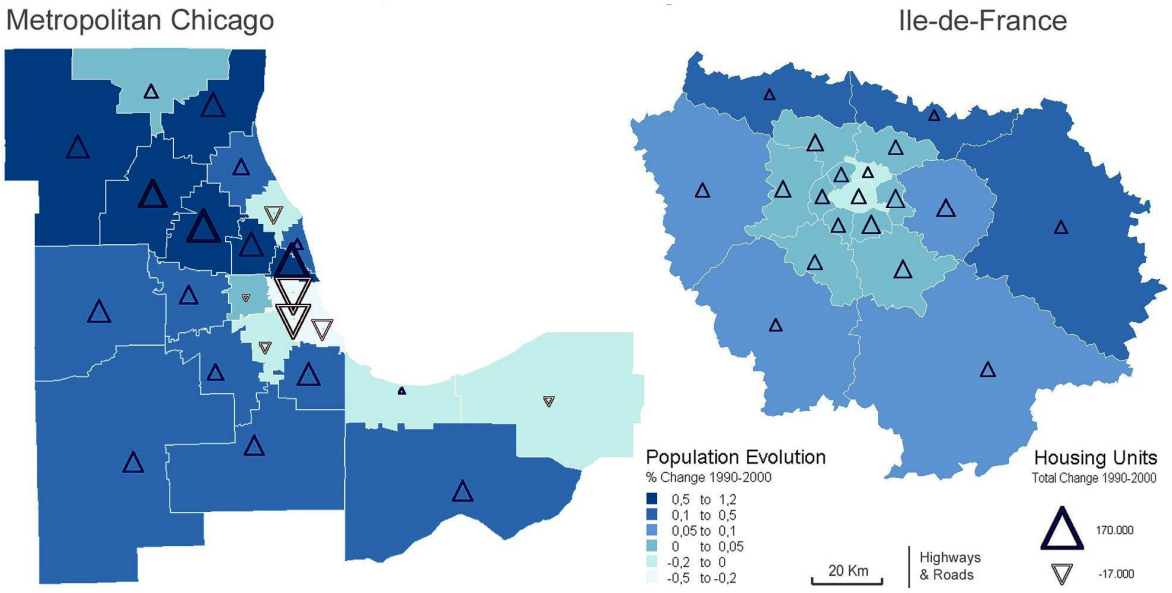


Figure 4 – Population and housing units evolution in Metropolitan Chicago and in the IdF Region. Sources: Census Bureau (M. Chicago), INSEE (IdF).

Interestingly, the sprawling process in this period occurs with almost constant car ownership rates, progressing from 0,54 to 0,56 cars per capita in Metropolitan Chicago and from 0,39 to 0,41 in the IdF Region. In the first case, variations of this indicator (maps not shown) closely match income ones (fig. 6). In the second, the main change is an almost generalized peripheral increase. In both, car ownership is higher in the suburbs. These metropolitan

areas also have a highly developed road network, so actual travel potentials could allow for rapid sprawl. Lower car ownership rates and high public transport use in the IdF Region seem related to the concentration of housing increase in an intermediary ring (fig. 4).

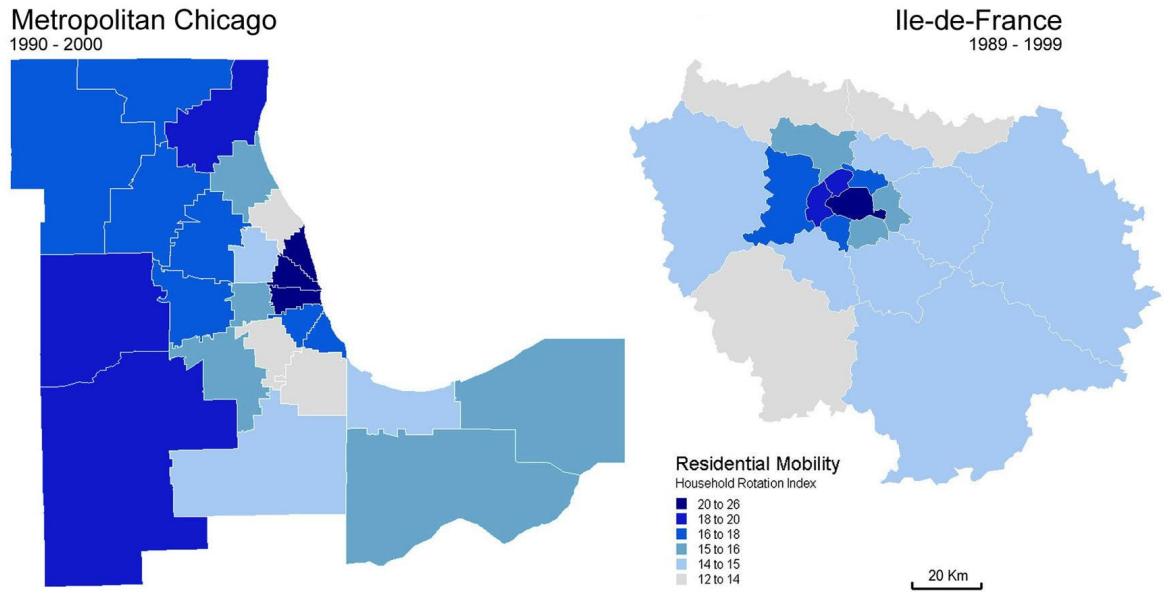


Figure 5 – Household rotation index in Metropolitan Chicago and in the IdF Region. Sources: Census 2000 (M. Chicago), RPG 1999 (IdF).

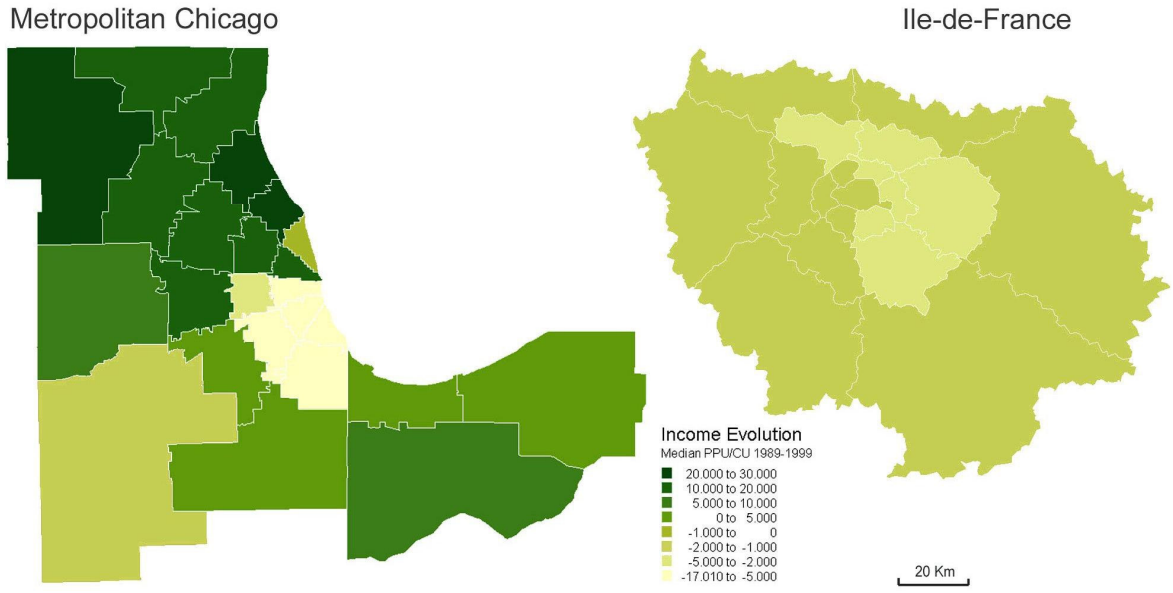


Figure 6 – Median income evolution in Metropolitan Chicago and in the IdF Region. In PPU by consuming units, adjusted for inflation. Sources: Census 1990 and 2000 (M. Chicago), DGI 1990 and 2000 (IdF).

Another important effect of residential mobility is spatial socioeconomic specialization (Berger 2006). The comparison between Metropolitan Chicago and the IdF Region shows that this process is associated to the intensity of population redistribution, construction rates and total median RD. As shown in figure 6, in Chicago's case the differences in the evolution of median income are impressive. In only ten years, as income levels in northeastern sectors have greatly increased, they have dramatically decreased in the south of central Chicago. In

the IdF Region, which evolves at a milder rate, has a quasi-ubiquitous social housing sector and is influenced by strong redistributive policies, this process is much less intense but also relevant. Both cases show the same tendency of selective pauperisation of the historically poorer areas.
All these observations sustain the view of urban systems as very dynamical entities, in which the physical transformations (i.e.: construction) are mild compared with the less visible dynamics of demographic change and urban economics. However, as global effects are driven by the aggregate behaviour of households' location and travel strategies, it is necessary to understand the reciprocal interactions of the metropolitan and the individual levels. Considering the contexts described above, the following section will develop an analysis of households' spatial mobility in order to provide a perspective of individual behaviour.

6. HOUSEHOLDS' SPATIAL MOBILITY

This section will focus on the relationships between residential duration (RD) and average trip distances (average TD), which has been chosen among other indicators (as travel times, total distances or trips number) because it better reflects a household's location choice with respect to their daily activities. This analysis is done with cross-sectional information, so the results presented in this subsection show the simultaneous behaviour of a population and they do not represent a temporal evolution. As data for the two metropolitan areas is from different periods (TTS 2008 and EGT 2001) their overall comparison could be hampered[5], but this shouldn't affect the internal relationships and competition among income and tenure groups in each case, which are the focus of the following discussion.

Residential duration and household characteristics

Moving frequency varies among different household types, so fast-moving ones will be overrepresented in low RD classes. Certain characteristics, notably the householder's age, simultaneously influence the length of residential periods and the average travel distances. In consequence, the composition of RD classes must be analysed for a correct interpretation of travel variations. As table VI shows, age is the most variable characteristic and the only one that constantly increases in parallel with residence periods. The other averages rise until the 5-10 year class and decrease for the most stable households. This is mainly explained by the overrepresentation of retired workers in this class. A multi-variable regression with RD as dependent variable confirms these observations (table VII). Householder's age is by far the most important determinant, with tenure as the only other relevant one. The hierarchy of the β and P values is very similar for the Metropolitan Chicago and the IdF Region, suggesting that households' moving propensity is determined by similar factors in both cases. However, R^2 values are relatively low, particularly for the first. The same variables were used in another regression with average TD as dependent variable (results not shown). R^2 values

[5] Anyhow, travel trends in France have remained very stable in the 1994 - 2008 period (Hubert 2009).

are very low (< 0,1) and the only common relevant determinant is the householder's age. Bivariate correlation values between RD and average TD are also very weak (< 0,1).

Table VI – Average values for key variables in Metropolitan Chicago and in the IdF Region. Regrouped by RD classes. Sources: TTS 2008 (MCh), EGT 2001 (IdF).

Metropolitan Chicago						
Residential Duration	0 - 1	1 - 2	2 - 5	5 - 10	>10	Total
Av. Householder's Age	44	45	47	51	61	55
Av. Household Size	2,44	2,32	2,48	2,48	2,11	2,27
Av. Income	46881	51061	51363	52227	51255	51299
Av. N° Workers	1,30	1,27	1,34	1,33	1,15	1,23

Ile de France Region						
Residential Duration	0 - 1	1 - 2	2 - 5	5 - 10	>10	Total
Av. Householder's Age	36	41	41	45	59	49
Av. Household Size	2,18	2,45	2,62	2,87	2,36	2,48
Av. Income	18878	19464	20537	20308	20113	20047
Av. N° Workers	1,19	1,26	1,30	1,32	0,94	1,13

Table VII – Multi-variable linear regression with in Metropolitan Chicago and in the IdF Region. Residential duration as independent variable. Sources: TTS 2008 (MCh), EGT 2001 (IdF).

Metr. Chicago Regression Model		
VARIABLES		
DEPENDANT	R^2	P
Residential Duration	0,259	<0,0001
INDEPENDANT	β	t
Householder's Age	0,438	47,195
Tenure	0,237	28,330
N° of Workers	0,095	9,451
Education Level	-0,048	-5,613
Income	-0,012	-1,322
Household Size	-0,018	-1,822

IdF Region Regression Model		
VARIABLES		
DEPENDANT	R^2	P
Residential Duration	0,396	<0,0001
INDEPENDANT	β	t
Householder's Age	0,542	46,820
Tenure	0,196	20,156
N° of Workers	0,102	8,808
Education Level	-0,058	-5,828
Income	-0,032	4,834
Household Size	-0,005	-0,488

These results highlight the complexity and non-linearity of the interactions among household's characteristics and their spatial mobility behaviour. They also show that moving frequency and location choices aren't determined by the same households' characteristics. This implies that average TD variations among RD classes will be only partially determined by composition effects, the main bias being the householder's age, and that the analysis of their relationships could reveal the influence of spatial and economic factors.

Residential duration and trip distance variations

When observing spatial behaviour, a tendency of increasing travel distances for recently moved households should be expected. On the one hand, younger households tend to travel farther and more frequently, so their overrepresentation in the lower RD classes will increase their average TD. On the other hand, sprawl increases the possibility that recently moved households will locate peripherally and therefore realise longer trips. This tendency is observed in most of the following cases, but a particular attention is given to those showing the opposite, as they could indicate a situation of slackened constraints for location choice.

In spite of the preceding reasons, variations of average TD show no clear tendency among RD classes for the whole population of Metropolitan Chicago (fig. 7), which is partly explained by the particular situation of low income owners (fig. 9). On the contrary, the IdF Region presents a clear distance reduction for households with longer residence periods, excepting for the last class. This could seem contradictory with the age effect, but the same group realises fewer trips and covers less total distances per capita (figures not shown), as expected for an older population.

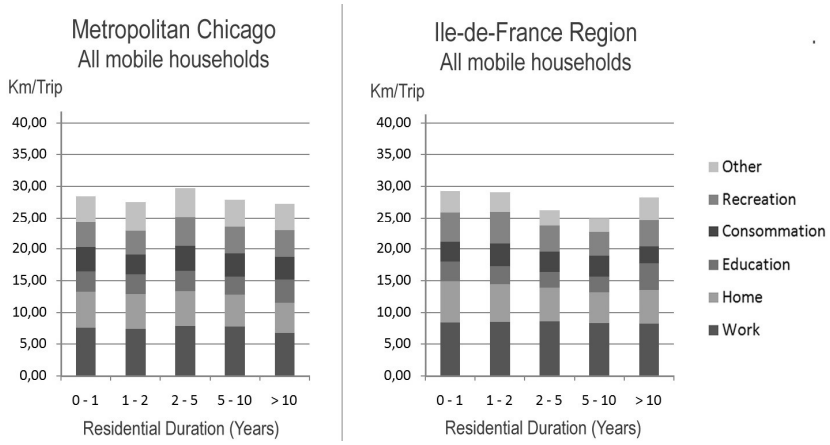


Figure 7 – Average trip distance by residential duration classes in Metropolitan Chicago and the IdF Region. Total population. Sources: TTS 2008 (Chicago), EGT 2001 (Paris).

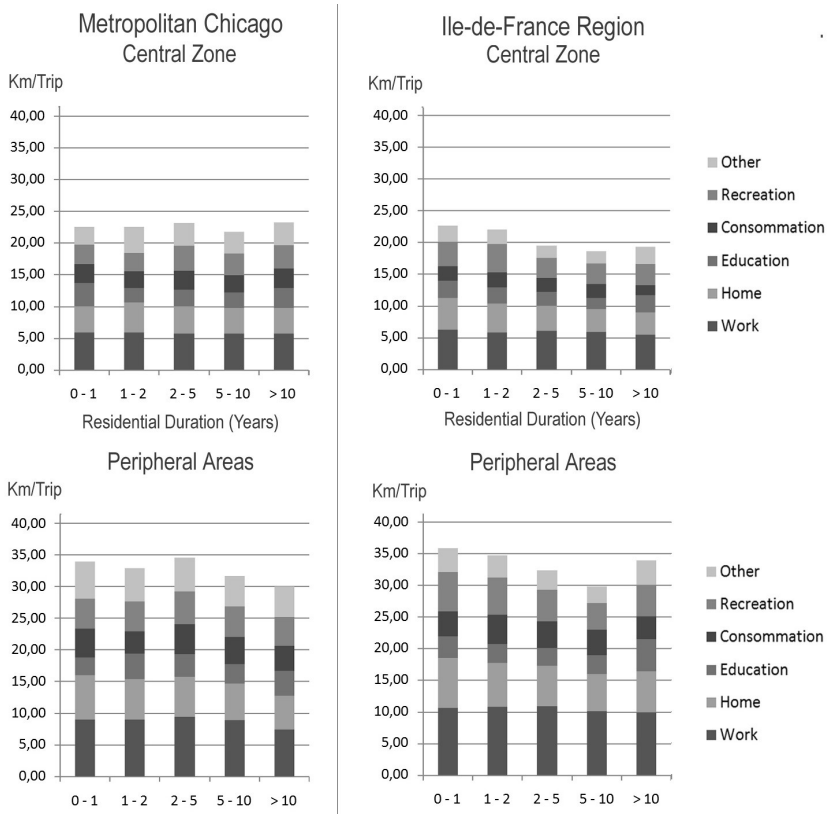


Figure 8 – Average trip distance by residential duration classes in Metropolitan Chicago and the IdF Region. Total population in central zones and peripheral areas. Sources: TTS 2008 (Chicago), EGT 2001 (Paris).

The separate analysis of households' residing in central and peripheral zones shows important differences among them (fig. 8). In Metropolitan Chicago, the expected decreasing tendency appears in the suburbs, but not in the centre, which suggests that the sprawl effect is important in this case. In the IdF Region average TD increase towards the first classes for both sectors; this indicates that the effects of age and of household size reduction (associated with fewer children) predominate.

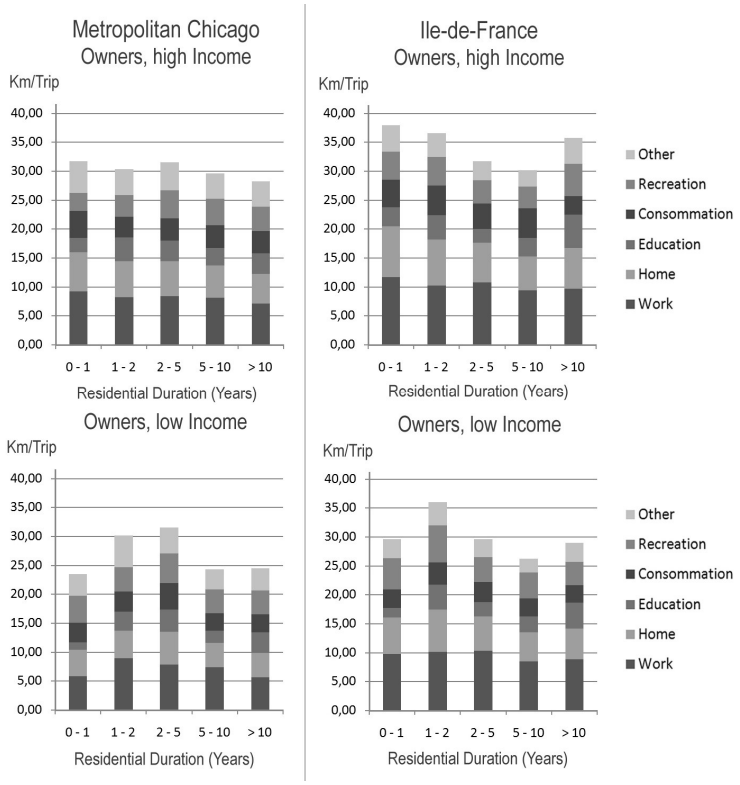


Figure 9 – Average trip distance by residential duration classes in Metropolitan Chicago and the IdF Region. High and low-income owners. Sources: TTS 2008 (Chicago), EGT 2001 (Paris).

In the case of proprietors, average TD variations are sharper and particularly interesting (fig. 9). The distance increase for recently moved households is more pronounced; as they follow the geographical distribution of housing growth, this group should be more affected by sprawl. However, important reductions are observed for the shorter RD classes of low-income owners. A possible explanation is that these periods coincide with sharp increases of oil prices[6]. High-income owners seem to have been immune to this effect and average TD reduction seems to have only affected the most recently moved households (data is cross-sectional and all observed travel is simultaneous). On the one hand, this could be explained by the adaptability of itineraries immediately after moving and their progressive stabilization afterwards (Orfeuil 2008). On the other hand, higher transport costs could have increased

[6] In Metropolitan Chicago's case, it corresponds to fast-rising prices since 2006, and particularly between 2007-2008, when oil passed over $90 the barrel and then arrived to the historical $142 peak. In IdF, the 2000-2001 period coincides with the high prices attained after the Asiatic crisis, due to OPEP production restrictions until the 11 September 2001.

the importance of proximity in households' choice in this period. In Metropolitan Chicago's case, these decreases are more dramatic and they even include commuting distances, which are particularly stable in almost all of the analysed subpopulations. Interestingly, the 2007-2008 period also coincides with a local devaluation of 10% in property value (Case-Schiller index, Standard and Poor's 2008 report) at the beginning of the subprimes crisis. This suggests that the combined effect of higher transport costs and falling property prices could have allowed moving households to choose their residences at shorter distances from their workplaces, buying homes that probably would have been too expensive for them a year before.

For renters (fig. 10), the increasing average TD tendency is also sharper and clearer in the IdF Region's case, probably due to age effects. Following the distribution of the rental market, these households live mostly in central areas, so they realise shorter trips and use public transportation more often. Travelling less and paying stable fees, oil price increases seem to have had no effect on their travel behaviours.

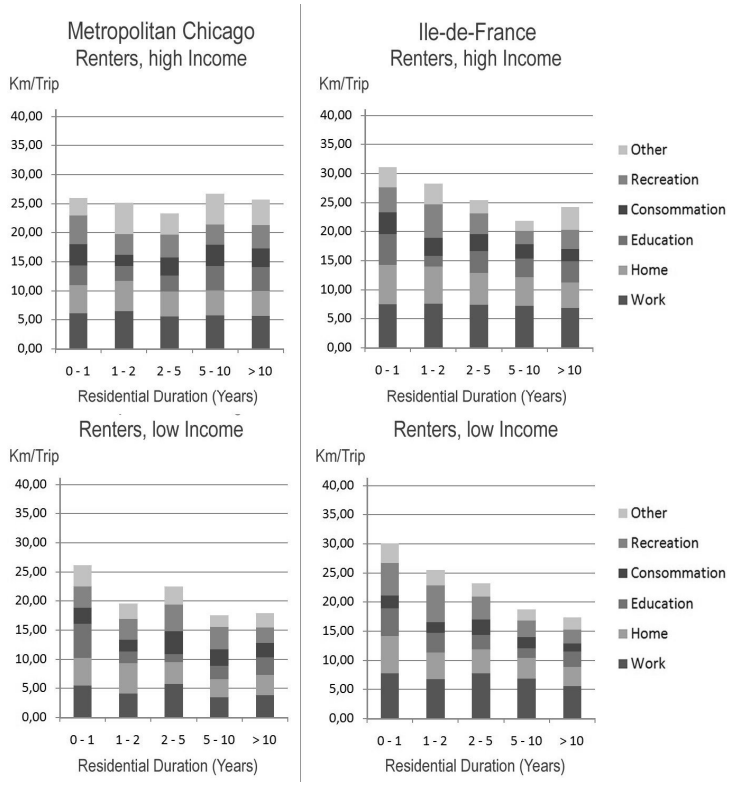


Figure 10 – Average trip distance by residential duration classes in Metropolitan Chicago and the IdF Region. High and low-income private sector renters. Sources: TTS 2008 (Chicago), EGT 2001 (Paris).

A remarkable fact, observed in almost all subpopulations, is that travel variations correspond mainly to not-work purposes (figs. 8, 9 & 10). On the contrary, commuting distances remain very stable among RD classes, with the exception of a probably sprawl-driven slight increase of in the case of recently moved owners (centrally located owners show almost no variations, figure not shown). This suggests that average TD differences are mostly explained by households' propensity to travel, associated with age and size effects.

The opposition between commuting distances stability and not-work travel variability is itself an interesting result, which strongly suggests that both types of travel are determined by

different behaviours. On the one hand, commuting distances are kept almost constant and seem to be weakly affected by age effects, which suggests that their minimisation is an important parameter of location choice. On the other hand, not-work trip distances wildly vary among groups and classes. This suggests that the remaining travel budget, after commuting, is fully employed in providing maximal access to urban services and amenities. In short, individuals could behave simultaneously as "homo economicus", optimizing commuting travel, and by "maximising opportunities", trying to enlarge the spatial range and number of other daily activities, within the limits imposed by households' characteristics.

7. CONCLUSIONS

In this paper, the metropolitan areas of Chicago and Paris have been compared with a multi-dimensional analysis, from a double perspective of their global spatial mobility contexts and of households' spatial mobility behaviour. The exploitation of residential duration variables has allowed the construction of approximate indicators to study time-dependent processes with widely available cross-sectional data. This approach could help to generalise comparative research on residential mobility.

Metropolitan Chicago and the IdF Region show important dissimilarities. Income is higher but more unequally distributed in the first, with an almost inversed geographical pattern between both cases. Modal shares notably differ, respectively with a strong car dominance opposed to a more important role of public transportation. Their residential market structures also show important variations of tenure shares, with a larger owner sector in Metropolitan Chicago and a more equilibrated composition in the IdF Region. Despite these differences, the metropolitan areas of Chicago and Paris present some remarkable similarities. Their global travel indicators, as total distances, temporal budgets and trip numbers, are strikingly similar. Total median residential duration (RD) differs in only half a year, which seems a small variation when compared to the differences in moving costs and among demographic and housing growth rates. At the household's level, even if global trends of average trip distance (TD) variations among different RD classes differ in both cases, there exists a clear distinction between the stability of commuting and the variability of not-work travel distances. These observations suggest an effect of behavioural convergence, as different household types adapt to local transport systems, housing markets and economic conditions, finally developing strategies that satisfy their life cycle's and daily activities' needs in a similar way. Moreover, important variations of non-work travel seem associated to age and household composition characteristics, probably reflecting an inclination to make the most of available transport potentials in order to profit from urban opportunities. On the contrary, sharp average TD reductions observed for recently moved low-income owners suggest a strong sensibility to transport costs and housing price variations, which could have affected their location choice and their travel behaviour.

These results confirm the usefulness of a competing rationalities construct, in which a strictly economical level and an opportunity-maximising one coexist, to interpret the observed households' behaviour. They also suggest that commuting and not-work travel are differently considered in households' travel behaviour and location choice. However, these are exploratory hypotheses and further research should be done, preferably with longitudinal

studies, in order to explain the relationships among households' behaviour and context influence. Anyhow, it seems clear that spatial mobility behaviours sharply vary among age, tenure and income groups, so there is probably no simple model capable of explaining them.

Metropolitan effects of spatial mobility and policy implications

As Metropolitan Chicago's case shows, residential mobility dynamism has the downside of allowing for faster sprawl and for the rapid reinforcement of spatial socioeconomic specialisation, increasing territorialisation of income differences by two parallel mechanisms. Firstly, social composition is an important factor of land value, so as the rich concentrate, the neighbourhood will become increasingly inaccessible for the rest of the population. Secondly, households with rising income will often flee poor neighbourhoods, in order to avoid undesired social-environment effects, as insecurity or lower average education levels (Donzelot 2004, Lewis 2007).

Income differences also generate important inequalities in daily travel capacity (Orfeuil 2006), as is also shown here by the much higher distances realised by high-income households and the observed adaptations of recently moved low-income owners, which suggest that their travel budgets evolve in tight ranges. Moreover, as Wenglenski (2004) shows for the IdF Region, smaller transport budgets, associated to peripheral locations of workers and firms, reduce the accessibility to the job market. This greatly lowers the possibility of changing jobs, increases the risk of long unemployment periods and reduces the size of the effective labour market, also affecting the economic performance at the metropolitan level (Prud'homme 1999). In sum, as contemporary urban systems grow larger and more dynamical, the predicaments of spatial segregation aggravate, with severe consequences to social cohesion, urban life quality and metropolitan productivity. However, at the individual level, increased spatial mobility has many positive aspects, allowing for a better match between household needs, location and daily activities. Ultimately, rather than constraining housing market fluidity, urban development policy should reduce the disadvantages imposed on low-income groups and promote residential and activity localisation in central areas.

Firstly, the increase of intra-metropolitan territorial inequalities can be addressed by social homogeneity taxes on high-income sectors, justified by the increase of land value created by household selectivity. This can raise funds to improve life quality in poor neighbourhoods, in order to avoid the departure of prospering households. Secondly, in order to contain travel distances and car dependence, housing development should be controlled in very large peripheral areas, encouraged in the proximity of urban centres and associated with public transport systems. A successful long-term experience of this strategy is the five-finger schema developed in Copenhagen since 1947, which has resulted in a high urban life quality and a lively city centre where not-car travel dominates (Laigle 2009). The city-state of Singapore, where scarce land is carefully administered in order to ensure future economic growth and social cohesion, is another example that highlights the importance of integrated urban planning, simultaneously considering housing, transport and economic development (Dale 1999).

However, these are exceptions that benefit from particularly strong governing capacities. This is clearly not the case in most contemporary large metropolis, which must face sprawl

and segregation with inadequate policy instruments and relatively weak or inexistent encompassing institutions. These challenges can only be addressed by the implementation of metropolitan governments capable to confront, if needed, cases of local opposition, in order to maintain cohesion and equality of chances in large urban systems (Orfield 1999, Ghorra-Gobin 2006). The effort required to create such large-scale regulating and redistributive institutions seems largely justified by the involved social and sustainability issues.

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