Leaving highly car-dependent areas

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1. INTRODUCTION

In France, and particularly in the Paris Region, rising petrol prices and deteriorating economic conditions are impacting on household budgets, especially in suburban areas where travel is highly car-dependent (Dupuy, 1999; Newman and Kenworthy, 1989). However, many low-income households tend to work and live in these areas because of the deconcentration of low-skilled jobs (Berger, 2004; Massot and Roy, 2004) and the structure and supply nature of the housing market. Housing costs in these areas are lower and the supply abundant. However, the large social housing stock in city centres is sometimes seen as unattractive, either because of the nature of certain areas or because demand greatly exceeds supply.

Against this background, household living standards in the outer suburbs are under greater pressure than elsewhere, since transport costs can account to up to a quarter of household budgets in certain outlying parts of the Paris region (Coulombel et al., 2007; Polacchini and Orfeuil, 1999). Dodson and Sipe (2007) have made a similar observation about three cities in Australia. This issue is all the more important in that the trend in the dominant spatial distribution in French cities and in the Paris region is for a growing number of of low-income households to be concentrated in the outer suburbs (Berger, 2004; Cavailhès and Selod, 2003). Under pressure from unanticipated transport costs, these households nevertheless have no choice but to remain where they are and experience severely straitened living conditions as described by Rougé (2007). The housing market would seem to leave them little choice.

Nevertheless, the development of peripheral periurban areas containing a growing population of low-income households under pressure from the cost of mobility does not seem to be taking place (Beaucire and Berger, 2002). The reason for this could be that residential choices are in fact less limited and they might seem, in particular relocation to areas where the average cost of mobility is not constantly growing, as observed by Motte-Baumvol et al. (2010). That is what this paper seeks to

verify based on 2007 census data and a multivariate analysis modelling household moves in the outer suburbs of Paris.

Two categories of working households are a particular focus of the study. The first category is unemployed households that have experienced a lasting erosion in living standards (Feijten, 2005). The second is single parent families, more exposed to poverty (Breuil-Genier et al., 2001), whose numbers have also grown particularly fast in the outer suburbs of Paris (Motte-Baumvol and Belton-Chevallier, 2011). The study will assess the impact of France's welfare state – in the form of social housing – on these residential moves. Indeed, identifying such practices can be a promising avenue for public policy designed to tackle the increase in petrol prices or a deterioration in the economic situation of many suburban households.

2. BACKGROUND

2.1. Car dependence and the growing cost of transport in periurban areas

More than other areas, the outskirts of cities are structured around the mobility that the car offers: commuting distances are longer (Berger, 2004), services are more sparse (Motte-Baumvol, 2008) and alternative forms of transport are less numerous. Urban outskirts are dependent on the car; this is the logical outcome of a period in which the trend was essentially to promote car use (Giuliano and Narayan, 2003). In these areas, the car has a radical monopoly in the sense proposed by Illich (1974) – it detracts from other means of transport, specifically by offering greater speed of travel and a high degree of flexibility. Dupuy (1999) shows that car dependence leads not only to generalised use of the car in the sense employed by Newman and Kenworthy (1989), but is also a process that drives constantly rising car use. The locations of jobs, shops, services or housing change gradually, as the different actors each time perceive the car as the primary means of access, and household car ownership continues to grow in tandem. For individuals, even those without cars, car pressure increases, prompting them to acquire a car and/or increasingly travel by car, or otherwise find themselves excluded in a society where the presence of the car grows ever stronger. Whilst Dupuy sees car dependence as a manifestly global process, it also has at least two dimensions, one spatial, the other individual (Goodwin, 1997; Motte-Baumvol, 2007; Stradling, 2003). Local and individual conditions inevitably affect car pressure, notably depending on the supply of alternative methods and individual activity patterns.

This means that growing car dependence is not reflected in a general increase in transport costs as a proportion of household finances. On average, the share of transport in household budgets has not increased since the 1990s, whereas the role of the car has grown continuously, reaching 83% of transport expenditure. In 2004, transport represented 14.9% of French household budgets, second only to housing (Arthaut, 2005). The higher cost of motoring compared with other methods, within the context of daily mobility, was offset by rising household incomes and lower acquisition costs[1]. There was no increase in the share of fuel in household budgets, which remained at around 3.6% in 2006, in particular as a result of a drop in unit consumption partially explained by the growing

[1] Reflecting falling volumes on the new car market in favour of second-hand cars.

presence of diesel vehicles in the automobile stock (Besson, 2008). Moreover, where necessary households cut the cost of fuel in their budgets by reducing their mileage. However, reducing mileage is not without impact on the mobility of households, in particular low-income households, where Orfeuil (2004) already points out the "extremely moderate use of the car". Households in the lowest income quintile cover only 9 000 kilometres a year compared with 32 000 kilometres for households in the quintile immediately above (Hivert, 2001). Moreover, the sharp rise in fuel prices since 2004 is now becoming partially reflected in household budgets (Merceron and Theulière, 2010). Finally, although transport costs have, on average, grown relatively little as a proportion of household budgets, circumstances vary widely, and there are sharp inequalities across different residential locations, especially in periurban areas.

Using the 1991 Paris Household Travel Survey, Polacchini and Orfeuil (1999) show that the transport costs of certain low-income car owning houses account for more than 20 per cent of their budgets in the outer suburbs, as compared with around 6 per cent in the inner-city areas of Paris. They observe that, in a monocentric city like Paris, transport costs in working households increase with distance from the centre, whereas income decreases and household size increases. Moreover, household housing costs rise with distance from the centre, in relation with dwelling size, household size and disposable income, resulting in an average cost for housing and transport in excess of 33 per cent of total household expenditure in the centre, as compared with 52 per cent in the outer suburbs. Berri (2007) reaches the same conclusions on the basis of four successive Family Budget Surveys (2007) conducted by the National Institute of Statistics and Economic Studies (INSEE) between 1978 and 1995. Coulombel et al. (2007) also look at the combined costs of transport and housing and update these results on the basis of the 2001 HTS. They observe that transport and housing costs then accounted for 45% in the centre and 57% in the outer suburbs. The authors explain this difference by a sharp increase in housing prices, whereas transport costs remain stable. Dodson and Sipe (2007, 2008) adopt the same type of approach for Australian cities by looking at changes in mortgage interest rates. They conclude that the populations of certain outer suburbs are under financial stress and are most at risk from increases in fuel prices and mortgage interest rates.

2.2. The threat of an increased concentration of households under transport pressure in the outer suburbs

The issue of transport stress takes on a particular importance in the light of the dominant socio-spatial distribution in French cities and in the Paris region, with a trend towards a growing presence of low-income households in the outer suburbs (Berger, 2004; Cavailhès and Selod, 2003). This could result in the development of areas of high vulnerability. Writing of the situation in Australia, Dodson and Sipe (2007, 2008) explore the possibility of the emergence of a new form of socio-spatial segregation in the suburbs, as a consequence of rises in petrol prices and mortgage interest rates. Although, in contrast with the situation described by Dodson and Sipe for Australia, not many French households are at risk from variable mortgage interest rates (Gabrielli et al., 2005), the attraction of low-income households to outer suburban areas is becoming a significant social issue in France, in particular because authors have explored this issue in essays (Donzelot, 2004; Guilluy and Noyé, 2004) that have been taken up by several actors in the public sphere.

Indeed, over the past several decades in France, the outer suburbs have become the focal area for first-time property buyers from the salaried middle classes (Jaillet, 2004), but also for poor households without the means to live in more central areas (Cavailhès and Selod, 2003). It would appear that the dominant spatial distribution in France is as follows: the most well-off households live in the centre, middle income households in the suburbs and the poorest households in between (Goffette-Nagot, 2000) and in remote outer suburban areas (Cavailhès and Selod, 2003). Indeed, low-income households took advantage both of increases in living standards and changes in national housing policy, which in the mid-1970s shifted from construction subsidies to individual subsidies, in order to become homeowners. They were then prompted to move towards periurban areas by the structure of the housing market. House prices broadly decrease with distance from the centre. On the one hand, they were attracted by more affordable properties in peripheral areas, particularly in the case of families with children seeking a larger home (Berger, 2004). On the other hand, the trend towards inner-city gentrification (Bidou-Zachariasen, 2003; Freestone and Murphy, 1998; Préteceille, 2006) made it difficult for them to afford central locations. Finally, low-income households tend to live and work in periurban areas, following the dispersion of low-skilled jobs (Aguilera et al., 2006; Berger, 2004; Massot and Roy, 2004). Low-income households are thus strongly, and probably increasingly, anchored in the outer suburbs, both residentially and in their daily travel behaviour (Guilluy and Noyé, 2004).

The outer suburbs are therefore experiencing a trend towards a growing concentration of low-income and vulnerable households. Berger (Berger, 2004) observes a spatial differentiation between the locations of these households and those of higher income households. Whilst several authors have identified an increase in socio-spatial segregation in French cities (Préteceille, 2006) and especially in the largest (Charlot et al., 2009), the broad consensus points to relatively little segregation in the outer suburbs compared with central areas (Charlot et al., 2009; Dodier, 2009). Several reasons could explain the low level of segregation in periurban areas. To begin with, relatively light pressure on the housing market as a result of increased housing supply (Levine, 1997) placing few restrictions on the residential location of low-income households. Then, the fact that the outer suburbs primarily attract broadly middle-class households (Berger, 2004; Cavailhès and Selod, 2003), which in principle does not lead to sharp socio-spatial differentiation. We can also see in this one of the effects of the Welfare State in France and the ability of the most vulnerable households [2] to access social housing, which is concentrated in central urban areas (INSEE, 2001). Finally, it is also perhaps the result of increased or targeted mobility amongst periurban populations in difficulty, who are leaving highly car dependent locations, where the cost of mobility is particularly high, to move to other, less car dependent areas, as suggested by the findings of Motte-Baumvol (2010). This means that the residential choices of low-income households are not confined to periurban areas and could play a role in regulating the development of increased socio-spatial segregation posited by several authors, as mentioned above. However, Motte-Baumvol's findings are based on bivariate analyses, whereas the extensive literature on residential mobility shows the importance of using multivariate analyses, because of the large number of factors known to be involved. This is what we will now consider.

[2] Defined as those with the greatest probability of experiencing poverty (see INSEE reference)

2.3. Residential mobility in low-income and vulnerable households

Household residential mobility depends on numerous factors which need to be controlled for to study the effects of one particular trigger. From an analysis of the literature, Dieleman (2001) identifies three major types of socio-demographic factors that have particularly significant and well-documented effects on residential mobility. First, there is the stage in the individual life cycle. Individuals aged between 20 and 35 are those with the highest rate of residential mobility. Next, the size and tenure type of the home in the place of origin are also strongly correlated with the level of residential mobility. Owners of large dwellings are those who move the least. Finally, there are clear links between individual and household life events and residential mobility. For example, educational or career stages, as well as family formation or breakdown, are significant triggers for relocation. These three dimensions therefore need, where possible, to be considered together in modelling individual mobility practices.

As regards the effects of income more particularly, moving home entails a substantial transaction cost which tends to inhibit relocation (Kan, 1999), in particularly for the poorest. It should also be noted that for Clark et al. (1996) and for Kitching (1990), individuals with few qualifications and therefore less income seem to balance out their more unstable status on the labour market by seeking stability in the housing market. Böheim and Taylor (2002) thus show that residential mobility in the UK increases with income and that this effect is more marked for intra- and inter-urban mobility than for local mobility. In the French case, Gobillon (2001) then Debrand and Taffin (2005) show a significant link between income and residential mobility.

However, the effect of income levels is disputed and varies between countries and regions. Kearns and Parkes (2003) find no household income effect. From their analysis of the literature and their findings, Van Ham and Feijten (2005) deduce that the link is not clear. Individual education levels, the structure of the housing market, neighbourhood socio-economic composition and economic circumstances interfere with the impact of income levels. Whilst the impact of income level on residential mobility is sometimes disputed, a sudden change in income level increases the likelihood of moving, in particular in the case of a drop in income arising from redundancy or divorce (Feijten, 2005; Feijten and Van Ham, 2008; Mulder and Hooimeijer, 1999; Strassmann, 2001). Conversely, a sharp rise in income also increases the probability of relocation, but to a much smaller degree. Indeed, whilst the intention to move increases substantially with a sharp rise in income, the actual move often only takes place much later (De Groot et al., 2011; Kan, 1999). There is no emergency as there is with a drop in income.

In countries like France, which has an active housing policy, the residential mobility of low-income or vulnerable households also depends on the availability of or access to social housing. For Strassmann (2001), in such countries the existence of these policies results in much lower levels of residential mobility, which are as little as half those of the United States (Long, 1991). Therefore, whilst access to social housing is a trigger for increased residential mobility, social housing once obtained becomes a powerful factor of household stability (Böheim and Taylor, 2002; Burrows, 1999; Debrand and Taffin, 2005; Gobillon, 2001). To the point that, whilst homeowners have the lowest level of residential mobility, the rates for social housing tenants are scarcely higher. However, in the event that social housing can only be obtained in a neighbourhood with an undesirable reputation, this constitutes a powerful brake on residential mobility (van Ham and Feijten, 2005). In a spatial

approach to periurban areas, the availability and location of social housing need to be taken into account. Indeed, social housing in these places is on the one hand very unevenly distributed, concentrated in central areas and in the most highly populated locations. And on the other hand, in certain areas social housing is popular and very hard to obtain, with very little housing turnover (Strassmann, 2001).

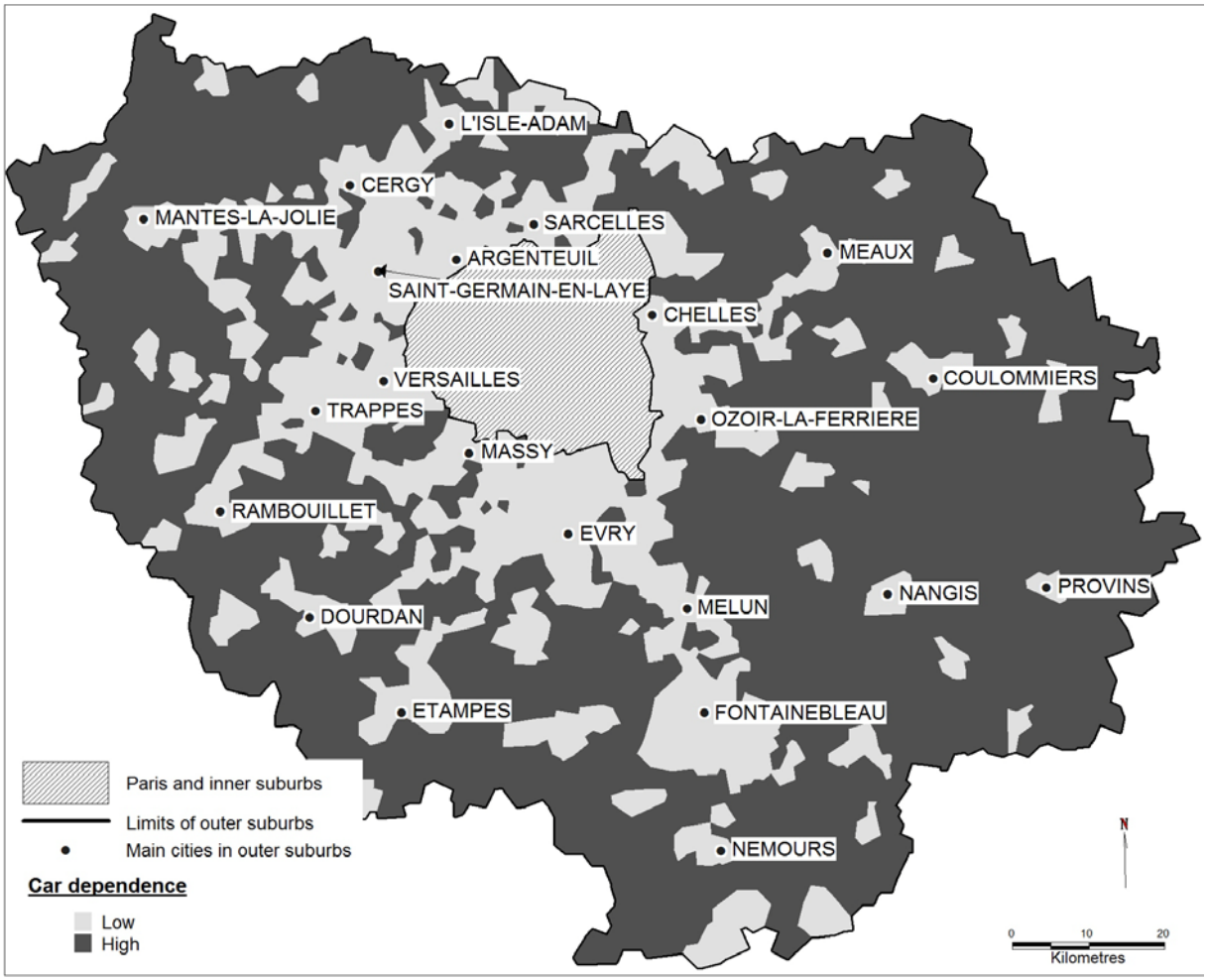
3. HYPOTHESES AND RESEARCH DESIGN

The question we ask here is whether residential mobility constitutes a way out for low-income households affected by car dependence in outer suburbs, facing travel costs that they find hard to afford. Our first hypothesis is that households with limited income are more likely to leave the most car-dependent areas. The second hypothesis is that these households which leave highly car-dependent locations are more likely to move towards an area where car dependence is less. Finally, the third hypothesis is that access to social housing in the destination area constitutes a trigger for this type of residential trajectory. To answer these questions and test the three hypotheses, a multivariate analysis was conducted using microdata from the 2007 population census on one study area, the outer suburbs of Paris.

3.1. The outer suburbs of the Paris region

This study looks at the outer suburbs of the Paris region. Two types of area were distinguished on the basis of their level of car dependence. In highly car-dependent areas, working individuals cover an average of 50% more kilometres by car than those living in places with low car dependence. This typology proved to be quite relevant (Motte-Baumvol, 2007; Motte-Baumvol et al., 2010) in reflecting car dependence in different areas. It is based on data from the Local Inventory (LI), which provides a full inventory of amenities, shops and services for every municipality in France. Municipalities without any local services are considered to have the highest level of car dependence (termed ‘high’), since the households living there must travel to neighbouring municipalities to obtain food and other goods, or to access schools and health services. The absence of local services reflects the scarcity of local job opportunities, which entails longer commuting distances for the households living there. Finally, as walking is precluded by low density and the discontinuity of the urban fabric, and since public transport is poor, there are few alternatives to the car. For all these reasons, these municipalities are characterised by greater car use, a higher level of car ownership and more automobile mileage than other areas in the outer suburbs of Paris (Table 1). At the other end of the scale (‘low’ car dependence) are municipalities with an extended range of amenities which offer their populations the option to obtain supplies and jobs locally, which tends to minimise car use. In these areas, car mobility is lowest.

Figure 1 Levels of car dependence of municipalities in the outer suburbs of Paris



Source: Author's typology from the 2006 permanent amenities database

Table 1: Distances travelled by car and household car ownership levels relative to the level of car dependence of the municipality of residence in the outer suburbs of Paris

	Car travel of a working household	Car travel of the reference individual in a working household	Number of cars per household (all households)
High dependence	65.8	43.2	1.6
Low dependence	42.0	30.6	1.3

Source: Author's calculations based on the 2007 BPE, the 2001 EGT and the 2006 census

3.2. Studying household residential migrations from the census

The empirical research in this study is primarily based on the use of data from the 2007 population census and in particular the detailed file on "Residential migrations by individuals between municipalities" (MIGCOM). The detailed file contains one record per census individual and can be used to draw up individual profiles, by contrast with other types of census data which are aggregated for each area. The MIGCOM file records the most recent move in the last five years and specifies

both the origin and destination of the move across the municipal network. There are almost 1200 municipalities in the study area. To meet statistical secrecy requirements, the different detailed files contain a limited number of variables, with little detail on certain variables.

There is one significant limitation in using the detailed census files to study residential migration, which is that the characteristics of the individuals, their household or the dwelling are only known for the destination and not the point of origin. Using this file alone, it is not possible to link a house move with the search for a larger home, the birth of a child or a change of job. Within this study, when a situation of unemployment, a single-parent family or a social housing dwelling is mentioned, this refers to the date of the census, i.e. a period end, and it is not possible to say whether any of these situations applied at the last known moving date.

Residential trajectories are analysed at the level of households, the basic unit of residential mobility, consumption and reproduction, which influenced the level of income and of social well-being of populations (Wallerstein and Smith, 1992). In addition, this study only took account of households in which the reference individual is of working age (in work or not), the primary drivers of residential dynamics in the outer suburbs of Paris. The objective is to work on a group of households sufficiently homogeneous for it to be possible to study and compare the effects of different explanatory variables from one area to another. In addition, these households need to be potentially affected by conditions of economic vulnerability and life-cycle disruptions: e.g. unemployment or single parenthood. This means that retired households have been excluded from the study, because they rarely experience situations of this kind. It also means that nonworking households have been excluded, because they vary greatly in terms of income or day-to-day mobility, making comparisons between them, compared with working households and between areas, particularly difficult.

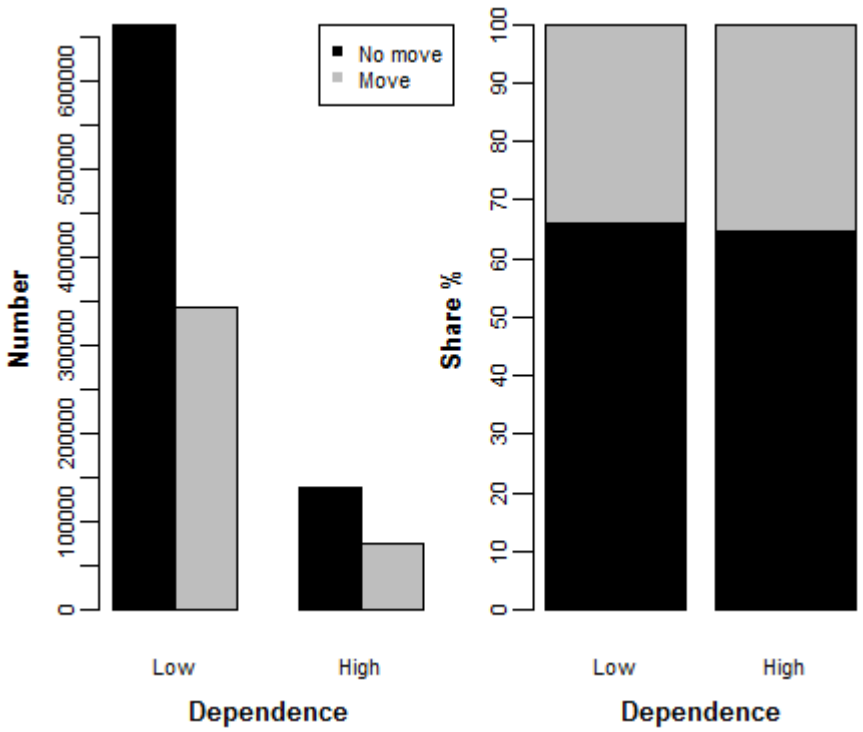
4. FINDINGS

To begin with, we will describe the relocations and characteristics of the households studied. We will then incorporate the variables thus presented into two logistical models, for which we will describe and analyse the findings. The first model looks at the probability of a household leaving a highly car-dependent municipality. The second studies the probability of a household leaving a highly car-dependent municipality and moving to one with the same level of car dependence or conversely to one with low car dependence.

4.1. Fewer residential departures from highly car-dependent areas

Residential departures from highly car-dependent municipalities are less frequent than in municipalities with low car dependence and represent only a small part of all residential departures from the study area (Figure 1). The hypothesis that relocations are more frequent in cases of car dependence therefore proves to be a small-scale phenomenon. Thus the proportion of departing households in highly car-dependent municipalities is lower than in municipalities with low car dependence, -5.5 points (Figure 1).

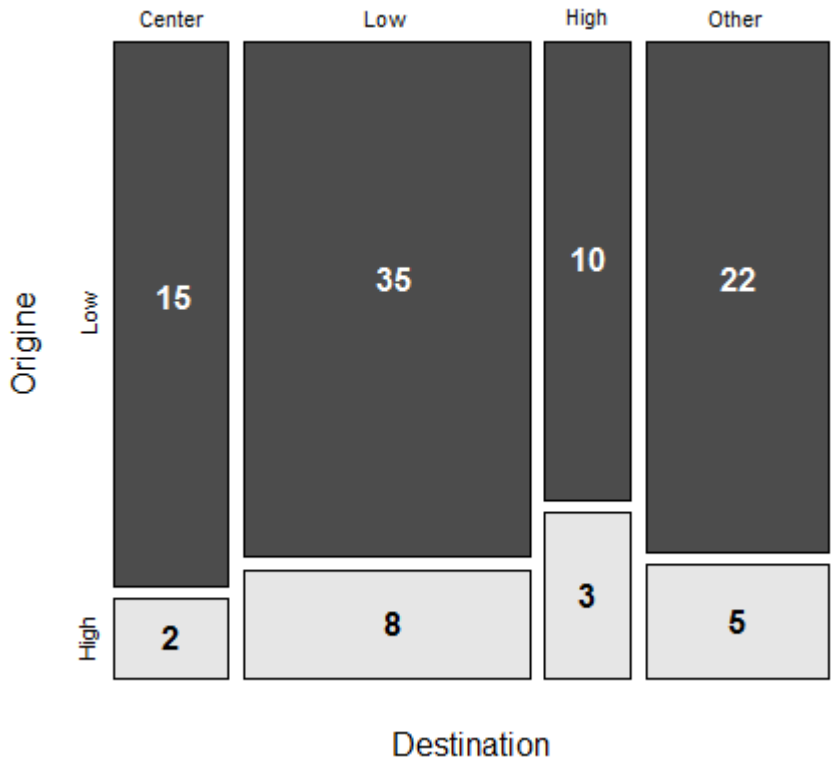
Figure 1 Numbers and percentages of households based on residential trajectory and the level of car dependence in the municipality of origin



Source: Author's calculations from the detailed "MIGCOM" file in the 2007 population census

Moreover, when a household leaves a highly car-dependent municipality, one of its likeliest destinations is another highly car-dependent municipality. This can be seen in Figure 2 by the greater height of the "strong car dependence" destination for households that have moved from a starting point that is already a municipality with strong car dependence. The second hypothesis in this study, which postulates residential departures to areas with low car dependence, or to places in the central part of the conurbation, can only reflect a small-scale trend within relocations as a whole. We therefore need to work from multivariate analyses of household moves, notably considering the socio-economic characteristics of the households, in order to rule out the possibility that a structural effect masks the existence of moves made for the purpose of escaping the excessive car dependence inherent in certain areas.

Figure 2 Distribution of households that have moved from the outer suburbs according to the level of car dependence of the municipality of origin and the type of destination municipality



Source: Author's calculations from the detailed "MIGCOM" file in the 2007 population census

4.2. The unemployed and single-parent families are more likely to leave municipalities with high car dependence

We constructed a model which seeks to explain the decision to move out of one's municipality. This is a logistical regression model incorporating the main explanatory variables for relocation, such as age, tenure type and building type, as identified by the study of the literature on residential mobility. Other explanatory variables were also included, such as the level of car dependence in the area of origin and destination, and the nature of the head of the household's activity, showing whether that person is unemployed. These last two variables have much less explanatory power in the model, but are crucial to the discussion of the core hypothesis of this research.

Table 1 – Description of the explanatory variables used in the model

Variable	Stable		Migrants		All	
	N	Share %	N	Share %	N	Share %
Age						
from 20 to 24	10,808	1.3	34,645	8.3	45,453	3.7
from 25 to 39	214,469	26.8	244,089	58.3	458,558	37.6
from 40 to 54	431,324	53.8	118,515	28.3	549,839	45.1
55 and more	144,876	18.1	21,205	5.1	166,081	13.6
Socio-professional categories						
Higher managerial and professional positions	220,164	27.5	114,459	27.4	334,622	27.4

Intermediate professions	225,184	28.1	127,756	30.5	352,940	28.9
Employees	160,315	20.0	91,395	21.8	251,710	20.6
Unskilled workers	195,815	24.4	84,845	20.3	280,660	23.0
Employment status						
People in work	746,780	93.2	387,131	92.5	1,133,911	92.9
Unemployed	54,697	6.8	31,324	7.5	86,021	7.1
Education level						
Below Baccalauréat or equivalent	420,476	52.5	157,099	37.5	577,575	47.3
General baccalaureate, advanced diploma	128,000	16.0	83,639	20.0	211,640	17.3
Higher education	253,001	31.6	177,716	42.5	430,717	35.3
Place of birth in the region						
FALSE	615,768	76.8	303,144	72.4	918,913	75.3
TRUE	185,709	23.2	115,310	27.6	301,019	24.7
Family type						
Single person	160,140	20.0	121,577	29.1	281,717	23.1
Single parent family with 1 child	52,550	6.6	21,078	5.0	73,629	6.0
Single parent family with 2 children	37,552	4.7	13,946	3.3	51,498	4.2
Single parent family with 3 children or more	13,668	1.7	4,209	1.0	17,877	1.5
Single parent family with 4 children or more	6,108	0.8	1,490	0.4	7,598	0.6
Couple without children	115,041	14.4	86,150	20.6	201,190	16.5
Couple with one child	130,598	16.3	68,318	16.3	198,917	16.3
Couple with 2 children	178,761	22.3	67,972	16.2	246,733	20.2
Couple with 3 children or more	107,059	13.4	33,714	8.1	140,773	11.5
Building type						
House	407,969	50.9	170,382	40.7	578,352	47.4
Apartment	388,750	48.5	243,953	58.3	632,703	51.9
Other	4,758	0.6	4,119	1.0	8,877	0.7
Tenure type						
Homeowner	479,425	59.8	188,198	45.0	667,623	54.7
Tenant	95,899	12.0	143,074	34.2	238,973	19.6
Social housing tenant	198,466	24.8	59,607	14.2	258,073	21.2
Furnished	6,204	0.8	11,741	2.8	17,946	1.5
Other	21,483	2.7	15,834	3.8	37,317	3.1
Car dependence at origin						
Low	663,424	82.8	342,764	81.9	1,006,188	82.5
High	138,054	17.2	75,691	18.1	213,744	17.5
Car dependence at destination						
Low	663,424	82.8	323,947	77.4	987,371	80.9
High	138,054	17.2	94,508	22.6	232,561	19.1

From Table 1, which describes the variables used in the model, we see that the population contains a strong representation of households of couples and homeowners, a trait characteristic of the suburbs but not of all the working households in the Paris region. The study area is also characterised

by a lower population age and a low percentage of households living in private rented accommodation, a consequence of the high proportion of homeowners and a social housing stock that is still substantial in these areas. Single-parent families and the unemployed respectively account for 12.3% and 7.1% of the population, confirming that the populations and residential trajectories at the heart of our analysis account for a limited number within the population as a whole. This is especially true in that the households living in highly car-dependent municipalities represent less than 20% of total households.

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	0.676	0.016	41.197	< 0.001	***
Age (ref.: from 20 to 24)					
from 25 to 39	-0.587	0.013	-44.384	< 0.001	***
from 40 to 54	-1.894	0.014	-139.144	< 0.001	***
55 and more	-2.770	0.016	-177.797	< 0.001	***
Socio-professional categories (ref.: *Higher managerial and professional positions*)					
Intermediate professions	0.026	0.007	3.817	< 0.001	***
Employees	0.078	0.008	9.645	< 0.001	***
Unskilled workers	-0.043	0.008	-5.141	< 0.001	***
Employment status (ref.: People in work)					
Unemployed	0.114	0.009	12.254	< 0.001	***
Education level (ref.: *below Baccalauréat or equivalent*)					
General baccalaureate, advanced diploma	0.286	0.007	41.694	< 0.001	***
Higher education	0.392	0.007	59.891	< 0.001	***
Place of birth in the region (ref.: False)					
True	-0.096	0.006	-16.929	< 0.001	***
Family type (ref: Single)					
Single parent family (SPF) with 1 child	-0.254	0.011	-22.887	< 0.001	***
SPF with 2 children	-0.431	0.013	-32.828	< 0.001	***
SPF with 3 children or more	-0.575	0.022	-26.571	< 0.001	***
SPF with 4 children or more	-0.689	0.034	-20.356	< 0.001	***
Couple without children	0.286	0.008	36.910	< 0.001	***
Couple with one child	-0.051	0.008	-6.470	< 0.001	***
Couple with 2 children	-0.418	0.008	-52.756	< 0.001	***
Couple with 3 children or more	-0.474	0.009	-50.457	< 0.001	***
Building type (ref.: House)					
Apartment	-0.388	0.006	-62.240	< 0.001	***
Other	-0.335	0.029	-11.672	< 0.001	***
Tenure type (ref.: Homeowner)					
Tenant	0.934	0.007	138.283	< 0.001	***
Social housing tenant	-0.334	0.008	-43.851	< 0.001	***
Furnished	1.069	0.020	53.521	< 0.001	***
Other	0.412	0.013	30.784	< 0.001	***
Car dependence of the municipality of origin (ref.: Low)					
High	-0.295	0.043	-6.781	< 0.001	***
Combination of Household type/Car dependence of municipality of origin					
age from 25 to 39 / High	-0.236	0.037	-6.462	< 0.001	***

age from 40 to 54 / High	-0.126	0.037	-3.406	< 0.001	***
age 55 and more / High	-0.018	0.041	-0.438	0.661	
Intermediate professions / High	-0.030	0.016	-1.889	0.059	.
Employees / High	0.023	0.020	1.119	0.263	
Unskilled workers / High	-0.015	0.020	-0.727	0.467	
Unemployed / High	0.168	0.024	6.873	< 0.001	***
General baccalaureate, advanced diploma / High	0.009	0.017	0.542	0.588	
Higher education / High	-0.014	0.016	-0.849	0.396	
Birth in the region/ High	-0.020	0.013	-1.514	0.130	
SPF with one child / High	0.161	0.028	5.716	< 0.001	***
SPF with 2 children / High	0.384	0.031	12.255	< 0.001	***
SPF with 3 children / High	0.420	0.053	7.912	< 0.001	***
SPF with 4 children or more / High	0.420	0.094	4.487	< 0.001	***
Couple without children / High	-0.005	0.020	-0.248	0.804	
Couple with one child / High	0.026	0.020	1.307	0.191	
Couple with 2 children / High	0.091	0.020	4.617	< 0.001	***
Couple with 3 children or more / High	0.242	0.023	10.333	< 0.001	***
Apartment / High	1.287	0.016	80.852	< 0.001	***
Other building / High	0.132	0.072	1.844	0.065	.
Tenant/ High	0.063	0.017	3.716	< 0.001	***
Social housing tenant / High	0.076	0.022	3.434	< 0.001	***
Furnished / High	0.106	0.058	1.824	0.068	.
Other tenure type / High	-0.330	0.032	-10.320	< 0.001	***

McFadden's Pseudo-R^2: 0.176

For the first model explaining moves away from the municipality, the findings are interpreted for an individual under the age of 25, employed in a managerial position, living alone in their own home in a rural and highly car-dependent locality. The general trends of the model are unsurprising. We observe that the probability of moving diminishes with age, rises with education level, diminishes with the number of children, and that single-parent families are less mobile than others. The probability of moving is the lowest for social housing tenants, and greater for tenants than for homeowners and for people living in apartments rather than houses. Finally we observe that, overall, individuals living in highly car-dependent municipalities are very much less mobile than those living in municipalities with lower car dependence. Natives of the outer suburbs are less mobile than the others. These households generally possess mobility skills and a network of family and friends able to offset any vulnerabilities associated with car dependence (Morel-Broche and Motte-Baumvol, 2010).

The model confirms some of the hypotheses of our research. More households tend to leave highly car-dependent municipalities when they are unemployed (unemployed / strong). Likewise, more single-parent families tend to leave highly car-dependent municipalities. We have demonstrated the fact that the unemployed and single-parent families subject to car dependence tend to migrate: the link between cause and effect seems probable in this case. The effect of social housing on the probability of households leaving highly car-dependent areas. The effect is significant but small-scale. The probability of moving from highly car-dependent municipalities is greater when the purpose is to access social housing. It is difficult here to determine whether this is an effect of the low supply of social housing in highly car-dependent municipalities, whether it corresponds to a change of

municipality by a household already living in social housing or whether it is indeed a household escaping from car dependence because it has the possibility of accessing social housing.

4.3. The unemployed and single-parent families find it hard to escape high car dependence in their area of residence

We go further in our analysis by looking at where individuals go when they choose to move. For this purpose, we look solely at the population of individuals in the outer suburbs who move, and we try to determine whether they do so to settle in a highly car-dependent municipality or not. We therefore model the probability of an individual settling in a highly car-dependent municipality after moving. For this, we assume that the municipalities in Paris and the inner suburbs, like the rest of France, are not highly car-dependent.

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	-0.735	0.029	-25.402	< 0.001	***
Age (ref.: from 20 to 24)					
from 25 to 39	0.122	0.022	5.501	< 0.001	***
from 40 to 54	-0.111	0.023	-4.726	< 0.001	***
55 and more	-0.086	0.029	-2.988	0.003	**
Socio-professional categories (ref.: *Higher managerial and professional positions*)					
Intermediate professions	0.233	0.012	19.051	< 0.001	***
Employees	0.177	0.015	11.662	< 0.001	***
Unskilled workers	0.256	0.015	16.710	< 0.001	***
Employment status (ref.: People in work)					
Unemployed	0.113	0.018	6.318	< 0.001	***
Education level (ref.: *below Baccalauréat or equivalent*)					
General baccalaureate, advanced diploma	-0.003	0.013	-0.261	0.794	
Higher education	-0.189	0.012	-15.433	< 0.001	***
Place of birth in the region (ref.: False)					
True	0.207	0.010	20.608	< 0.001	***
Family type (ref: Single)					
Single parent family (SPF) with 1 child	-0.092	0.025	-3.711	< 0.001	***
SPF with 2 children	-0.276	0.029	-9.525	< 0.001	***
SPF with 3 children or more	-0.438	0.047	-9.235	< 0.001	***
SPF with 4 children or more	-0.683	0.084	-8.112	< 0.001	***
Couple without children	0.078	0.015	5.285	< 0.001	***
Couple with one child	-0.055	0.015	-3.545	< 0.001	***
Couple with 2 children	-0.232	0.016	-14.941	< 0.001	***
Couple with 3 children or more	-0.324	0.018	-17.799	< 0.001	***
Building type (ref.: House)					
Apartment	-2.076	0.012	-172.144	< 0.001	***
Other	-1.211	0.050	-24.329	< 0.001	***
Tenure type (ref.: Homeowner)					
Tenant	-0.036	0.012	-3.126	0.002	**
Social housing tenant	-0.834	0.019	-42.849	< 0.001	***

Furnished	-0.352	0.039	-9.042	< 0.001	***
Other	-0.251	0.026	-9.742	< 0.001	***
Car dependence of the municipality of origin (ref.: Low)					
High	0.832	0.052	16.012	< 0.001	***
Combination of Household type/Car dependence of municipality of origin					
age from 25 to 39 / High	0.158	0.037	4.273	< 0.001	***
age from 40 to 54 / High	0.328	0.040	8.223	< 0.001	***
age 55 and more / High	0.250	0.052	4.805	< 0.001	***
Intermediate professions / High	-0.073	0.024	-2.980	0.003	**
Employees / High	0.031	0.030	1.045	0.296	
Unskilled workers / High	0.097	0.030	3.212	0.001	**
Unemployed / High	-0.187	0.035	-5.392	< 0.001	***
General baccalaureate, advanced diploma / High	-0.246	0.024	-10.155	< 0.001	***
Higher education / High	-0.182	0.024	-7.645	< 0.001	***
Birth in the region/ High	0.007	0.019	0.385	0.700	
SPF with one child / High	0.296	0.043	6.852	< 0.001	***
SPF with 2 children / High	0.333	0.049	6.752	< 0.001	***
SPF with 3 children / High	0.689	0.085	8.126	< 0.001	***
SPF with 4 children or more / High	0.809	0.153	5.297	< 0.001	***
Couple without children / High	-0.099	0.028	-3.585	< 0.001	***
Couple with one child / High	0.182	0.030	6.129	< 0.001	***
Couple with 2 children / High	0.377	0.030	12.544	< 0.001	***
Couple with 3 children or more / High	0.474	0.036	13.086	< 0.001	***
Apartment / High	0.552	0.023	24.199	< 0.001	***
Other building / High	0.657	0.094	6.953	< 0.001	***
Tenant/ High	-0.136	0.023	-6.031	< 0.001	***
Social housing tenant / High	0.875	0.034	25.685	< 0.001	***
Furnished / High	-0.057	0.070	-0.812	0.417	
Other tenure type / High	0.037	0.048	0.762	0.446	

McFadden's Pseudo-R^2: 0.196

The model shows that overall, individuals who move to highly car-dependent municipalities are aged between 25 and 40, natives of the outer suburbs, childless, in non-managerial positions, and move to buy their own homes. As expected, therefore, they are young working first-time buyers looking to acquire a home in areas where housing prices are lowest. They correspond to the typical case described in the literature, of the periurban household settling in the outer suburbs (Berger, 2004; Cavailhès and Selod, 2003; Jaillet, 2004).

Households with a high degree of car dependence in the place of origin are more likely to settle in a destination municipality also with high car dependence. Car dependence is therefore probably largely a conscious choice. Nevertheless, the behaviours of households leaving highly car-dependent municipalities are slightly different from those of the other relocated households. In particular, vulnerable or disadvantaged families such as single-parent families are more inclined to move to other highly car-dependent municipalities. This suggests that these vulnerable households find it hard to escape car dependence, probably because it is difficult for single-parent families to obtain and afford housing in municipalities with low car dependence. In addition, these households look to

move short distances in order not to combine separation with uprooting from an area and from networks of family and friends, which affect both parent and children (Minodier, 2006). The assumption we make here is that there is a strong probability that municipalities close to highly car-dependent municipalities will have the same level of dependence. In fact, areas with high car dependence are rarely isolated and tend to form a single continuous whole interwoven with a few sparse enclaves of low car dependence (Figure 1).

By contrast with single-parent families, unemployed people leaving a highly car-dependent municipality are less likely to move to an equally car-dependent municipality. Probably because high car dependence is generally an obstacle to finding a new job and they consciously choose to move to other areas with more job opportunities. Nonetheless, areas with high car dependence continue to be attractive to the unemployed, largely those who were not yet settled there and find lower cost housing in these areas more suitable to their situation.

Thus, whilst the previous model showed that the unemployed and single-parent families migrate to escape car dependence, highly car-dependent municipalities continue to attract these vulnerable and disadvantaged families, probably because of the low cost of housing. Car-dependent municipalities are characterised by this dual combination of attraction and repulsion for vulnerable households.

5. DISCUSSION - CONCLUSION

In the suburbs, in particular in the most outlying areas, the average cost of higher mobility represents a larger proportion of the budgets of low-income households living there. The most exposed of these households – the unemployed and single-parent families, because this type of episode in the life-cycle has a lasting downward impact on income levels – experience increased residential mobility as a consequence of the cost of living in such places (housing + transport), which they find hard to bear. Our findings therefore clearly show that these two types of household are more likely to leave a highly car-dependent municipality.

However, although there is a greater probability of single-parent families leaving a highly car-dependent municipality, the move is often to one that is equally car-dependent. These areas continue to be attractive probably because of housing costs and also in order to avoid combining this difficult episode in the life-cycle with an uprooting from an area that will often be the centre of networks of friends and relations for both parent and children. For the unemployed, the finding is different. If they leave a highly car-dependent municipality, it is to move more deliberately to a municipality with low car dependence. The attraction of cheaper housing is probably offset by their knowledge and experience of the local job market and its opportunities. Conversely, unemployed households that did not live in these areas at the previous stage are more inclined to settle there. These households would seem to weigh the choice between cheaper housing and job opportunities differently because of their respective experiences.

Social housing is a significant factor in explaining moves from highly car-dependent municipalities. Whatever the previous tenure type, there is a greater likelihood of relocation for households that have access to social housing in the place of destination, whatever its location and level of car dependence. Conversely, social housing tends to be associated with a lesser degree of relocation

from municipalities with low car dependence. Nevertheless, although social housing prompts households to leave a highly car-dependent municipality, the move tends to be to an equally car-dependent municipality. This finding is counterintuitive and shows that there is a supply of social housing in highly car-dependent municipalities that helps to attract and retain a population of low-income households, notably single-parent families and unemployed households, in areas of high car dependence.

These findings show that residential mobility constitutes a way of regulating the number of households whose living standards are heavily restricted by the high cost of transport in strongly car-dependent areas. Nevertheless, the trends observed are not fully satisfactory in so far as many households relocate to other municipalities where mobility costs remain very high. In these cases, moving only brings about partial and/or temporary reductions in the transport budget – with greater geographical proximity to the workplace, and networks of family and friends – and these reductions remain under threat from rising energy costs. However, among the factors that contribute to maintaining households in a situation of high car dependence despite relocation, social housing plays a significant role. The fact is that social housing generally brings a substantial reduction in household accommodation costs, offsetting higher mobility costs. This instrument could be used more effectively and sustainably to influence car dependence, by focusing the construction of new housing in municipalities with low car dependence. This would combine reductions in accommodation costs with reductions in transport costs, which can remain a problem.

These residential mobility measures seem to be particularly appropriate as they reduce (but do not eliminate) the need to implement policies which facilitate day-to-day mobility. The latter have lower initial investment costs, but very high operating costs in these dispersed and hard-to-manage areas. When France experienced a significant increase in petrol prices in 2008, the solutions proposed were the creation of a transport voucher for car mobility (which was never actually implemented) and the reinforcement of public transport. Although public transport is costly and inefficient in these low-density areas, Fol et al. (2007,p.13) point out that “auto programs are too costly to be generalized” and would necessarily undermine public transport, which would lose its target market.

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