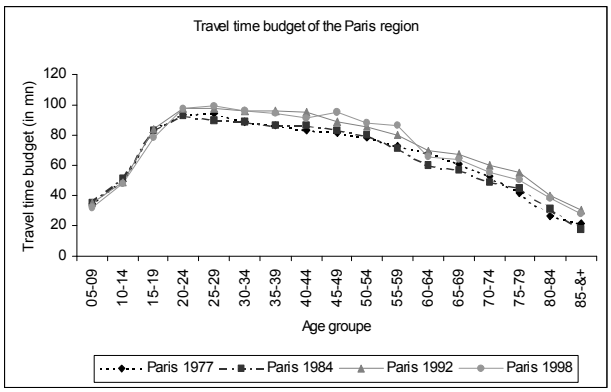

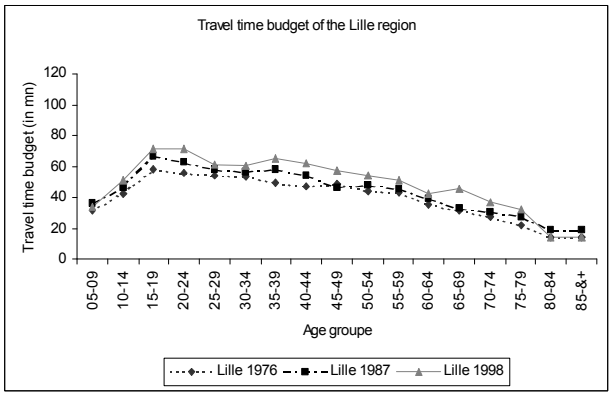

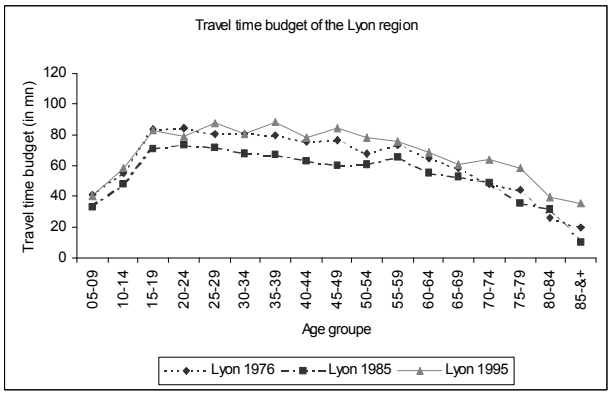

Long term trend of travel time budgets related to demographic factors: A comparative case study between 3 French large conurbations: Paris - Lyon – Lille

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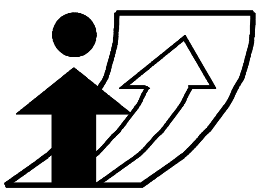

Moving through nets:
The physical and social dimensions of travel
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Long term trend of travel time budgets related to demographic factors: A comparative case study between 3 French large conurbations: Paris – Lyon – Lille

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Abstract

Since mid 1990 in France, urban mobility surveys have shown that time dedicated to transport has risen, despite the use of faster modes (car and train instead of walk and bicycle). We will see that an Age-Cohorts model is adequate to explain the time budget dedicated to transport and allows us to forecast at 2030 horizon. The main idea in our approach is to outline the variables of age (with its component of life cycle and generation), of gender, of spatial distribution, of motorization of the households. We also have calibrated an Age-Cohort model for daily distance travelled. Then it was possible to estimate average travel speed. The main result is that travel speed should grow from 2000 to 2030. This means that the gain in speed should be converted into a gain in distance travelled. A "week" version of Zahavi conjecture would be that there is more flexibility for trip distance than for trip duration.

Keywords

Travel time budget, demographic modelling, daily travel speed

Preferred citation

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1. Introduction

The hypothesis proposed by Zahavi is often presented as a law on the stability of time-budget. However, "... time and money budgets are not constant, but they are functions of several variables. For instance, the travel time budget is related to travel speed (level of service) available to travellers and also to car ownership or household income and possibly to urban structure." (Zahavi and Talvitie, 1980). The main objective of this paper is to consider some of these factors: car ownership and urban sprawl, but also gender, age and generation. Since mid 1990 in France, urban mobility surveys have shown that time dedicated to transport has risen, despite the use of faster modes (car and train instead of walk and bicycle). We will use an Age-Cohorts model to explain the time budget dedicated to transport and we will analyze the forecast at 2030 horizon.

2. Descriptive analysis of the population and travel time budget

2.1 Population characteristic

According to the 1999 census, the Paris conurbation is the most populated in France with its 10 millions of inhabitants, the conurbation of Lyon is the second largest (1.1 millions inhabitants) and the Lille conurbation is the fourth largest in France (0.9 million inhabitants).

The density of the population is highest in the central zones (cf. table 1). However in the Eighties (when the use of the car is standardised in the way of life in France), the evolution of the density shows a depopulation of the central city. This reduction of the population in the great urban areas appears by a growth of the number of the residents in the suburbs zones and a decline of inhabitants in the central city. Nowadays the density in the central city is stable and in the suburbs its increase slightly.

To model travel time budget, we used regional households transports surveys. For the Metropolitan Area of Paris, it includes households living in outer suburbs, while in Lille they have been included only since 1987 and they are excluded in Lyon. For the follow-up of the behaviour of cohorts, we have to keep a constant study area in each metropolitan area. That is why

outer suburbs are considered only for Paris. It is for this reason that we work only on two zones of residence for Lyon[1] (Central city and Inner suburbs) (cf. figure 1).

From the mid 70's until the year 2000, the growth of population seems to be the same in the conurbations of Paris and Lille (about 0.5% per year). As the population is stable in the central city, therefore the gain in population is in the suburbs (cf. table 1). Per year, the growth of population is in the "high density zone" 0.05% for Lille and 0.02% for Paris, these figures are in the "low density zone" 0.08% for Lille 0.15% for Paris.

During the last 25 years, the average age of population has increased in the 3 regions in 3 different ways. The ageing of the population is more severe in Lyon, where the average age was 36.3 years in 1976 and were 38.9 years in 1995. In the period 1976–1998 the average age of the population get 2.2 years in Paris and 0.2 year in Lille (cf. table 1). In the 90's, the population gets younger in Lille and Lyon because of an increase of the number of students, living mainly in the central city.

The motorization's dynamic is push by the multi-equipment. In the 3 areas the share of multi-motorized people (individuals living in an household with 2 or more cars) increased since mid 70's. In Paris region, there were 17.7% of multi-motorized people in 1977 and in 1998 this figure were 32.3%. In the conurbation of Lyon, from 1976 to 1995 the share of multi-equipment gain 16.3 points. Let us note that the area of Lille is the most motorized area in France, there were 19.7% of multi-motorized people in 1976 and they were 37.0% in 1998 (cf. table 1).

[1] For Lyon in 1976 very few household in the "low density area" were surveyed and if we kept these household in the Age-Cohort model this could bias the estimates.

Figure 1: Study area in the conurbations of Paris, Lyon and Lille.

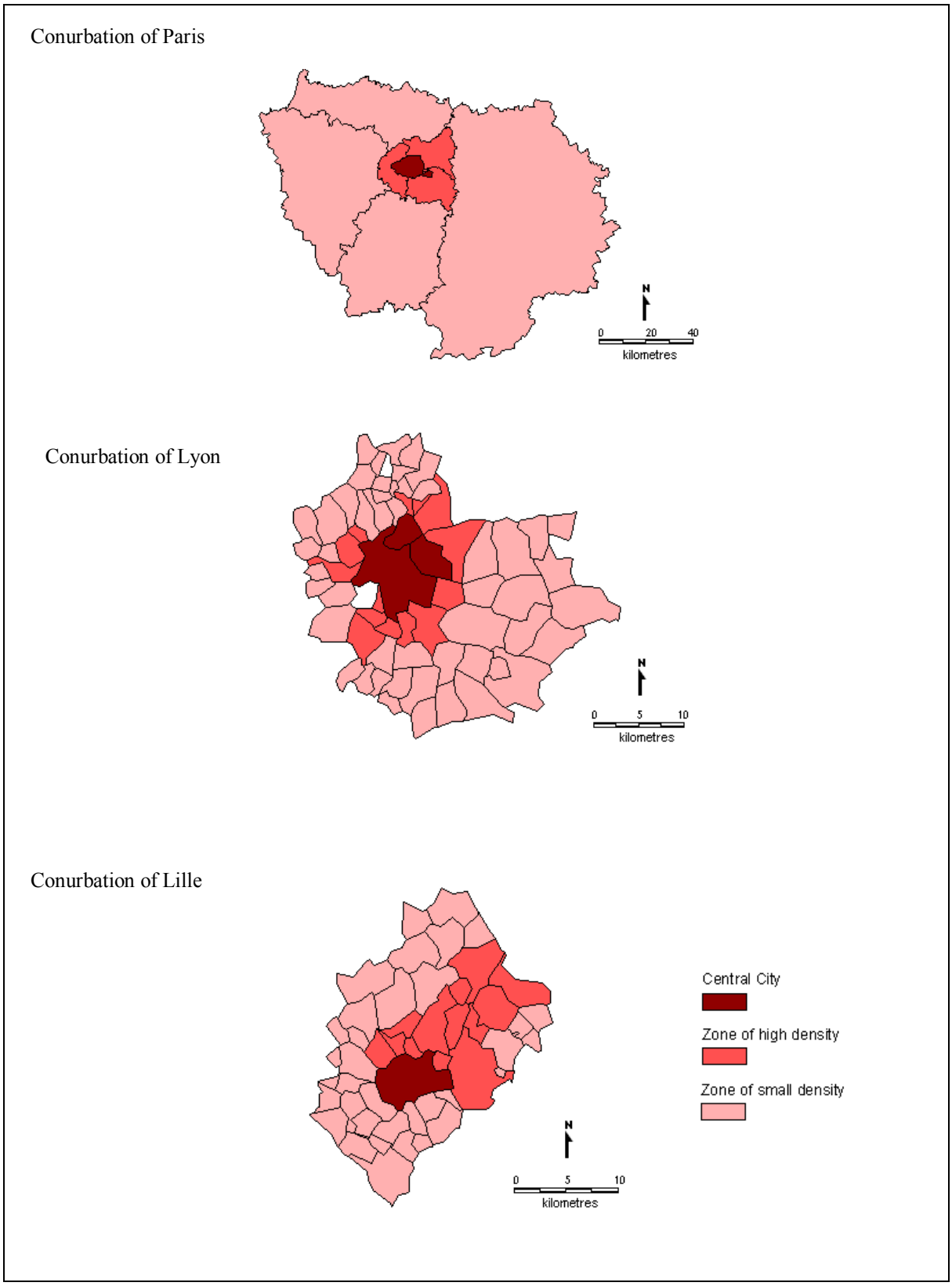


Table 1: Comparison of the three conurbations: Paris, Lyon and Lille regions in term of population

	Paris				Lyon			Lille		
Years of the surveys	1977	1984	1992	1998	1976	1985	1995	1976	1987	1998
Population (in 000)	8 686	8 953	9 511	9 838	881	794	866	804	831	891
Average age (years)	37.6	37.0	37.4	39.8	36.3	39.5	38.9	36.8	36.8	37.0
Population by zone of residence (in %)										
Central City	23.8	22.1	20.3	19.6	65.9	64.1	65.5	21.5	18.4	19.4
Zone of high density	39.6	38.5	37.6	36.6	34.1	35.9	34.5	49.4	51.0	49.5
Zone of law density	36.6	39.4	42.1	43.8	-	-	-	29.1	30.6	31.1
Total	100	100	100	100	100	100	100	100	100	100
Density of population by zone (000 inhabitants age of 5 or plus per km²)										
Central City	19.4	18.6	18.1	18.1	7.9	6.9	7.7	4.5	4.0	4.5
Zone of high density	5.1	5.1	5.3	5.4	2.5	2.4	2.5	3.3	3.6	3.7
Zone of law density	0.3	0.3	0.4	0.4	-	-	-	1.0	1.0	1.1
Total	0.7	0.7	0.8	0.8	4.5	4.1	4.5	2.0	2.1	2.2
Population according to the number of cars in the household (in %)										
Individual with 0 car	28.6	23.8	21.4	21.6	26.8	19.1	18.1	31.2	20.9	18.3
Individual with 1 car	53.7	52.0	47.4	46.0	55.0	51.7	47.4	49.1	50.9	44.6
Individual with 2 cars or plus	17.7	24.1	31.2	32.3	18.2	29.2	34.5	19.7	28.2	37.0
Total	100	100	100	100	100	100	100	100	100	100

Sources : Households transports surveys in Paris (1977, 1984, 1992 and 1998), Lyon (1976, 1985 and 1995) and Lille (1976, 1987 and 1998).

2.2 Travel time budget characteristic

During the last 25 years, time budget dedicated to transport evolve distinctly in the 3 regions. In Lyon, travel time budget from 1976 to 1985 felt from 69 to 60 minutes and then it's extend to 74 minutes in 1995. However, we can suspect that the low point in 1985 is due to an under-estimation of short trips (mainly walk trips), which represent a significant part of ttravel time budgets; since the initial (1976) and final (1995) points cannot be suspected, it should not bi-ase the estimate of long term trends. In Paris, the travel time budget was 74 minutes in 1976, in 1984 it rise to 80 minutes and stay stable after. In Lille, the travel time budget increase con-tinuously in the period 1976-1998 from 44 to 55 minutes (cf. table 2). These evolutions are also to moderate according to categories' of individual considered (gender, age, number of cars in the household, ...).

From 1976, the growth of travel time budget is pushed by women. The biggest expansion was in Lille, were the female added 13 minutes for their mobility and the male add only 8 minutes. In Paris, while for the male, travel time budget remain stable, the female increase their of 8 minutes. In Lyon both gender augment their travel time of about 5 minutes.

In the 3 regions and throughout times, more the density of population is high more the time dedicated to transport is important (cf. table 2). The presence of the public transport and the high congestion of road traffic in the central cities contribute to the raised value of travel time budget. In the Paris area at the end of the nineties, travel time budget reaches the same value in the city center and the inner suburbs. Indeed, it decreases by approximately 3 minutes in Paris and it grows one minute in the zone of dense suburbs.

In the three conurbations, people living in an household multi-equipped of cars, have important travel time budget, and those living in a non equipped household have shortest travel time budget. Generally, households multi-equipped are in the middle of the life cycle (45-54 years old) with two or more working people.

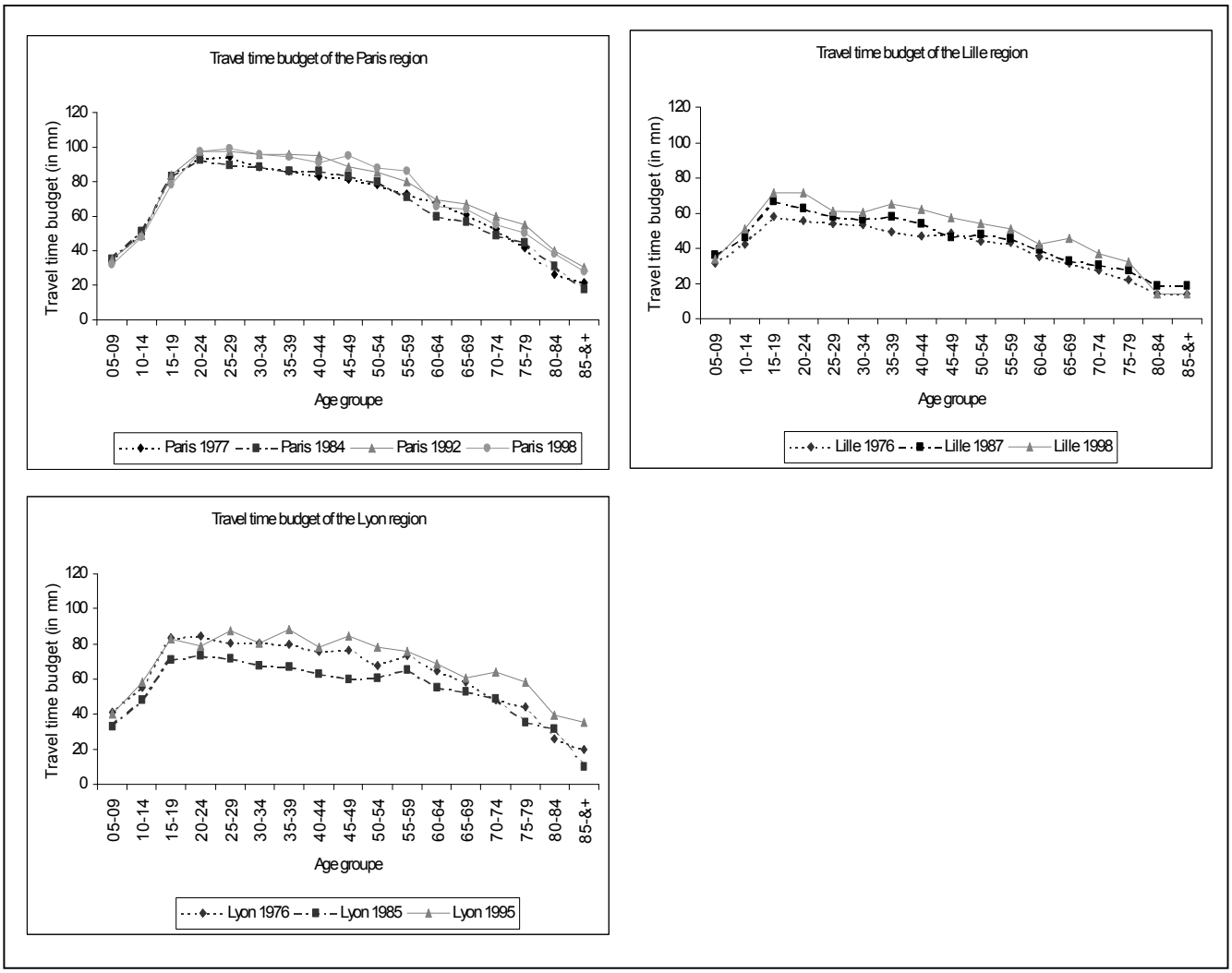
Travel time budget rises until the age group 20-24 year old and then it declines. Naturally, we found the lowest travel time budget at the end of the life cycle (old people). However, in the three areas, the travel time budget is growing for elderly (after 60 years old).

Table 2: Comparison of the three conurbations: Paris, Lyon and Lille regions in term of travel time budget

	Paris				Lyon			Lille		
Years of the surveys	1977	1984	1992	1998	1976	1985	1995	1976	1987	1998
Travel time budget (in mn)	74.2	74.0	80.2	78.7	68.9	60.0	73.6	44.4	49.4	55.1
Travel time budget by zone of residence (in mn)										
Central City	79.5	76.7	84.2	81.4	71.7	60.6	75.9	46.9	52.1	59.7
Zone of high density	73.6	75.1	80.2	81.1	63.4	59.0	69.3	44.5	49.6	53.9
Zone of law density	71.4	71.4	78.3	75.5	-	-	-	42.4	47.4	54.0
Travel time budget by motorization (in mn)										
Individual with 0 car	69.2	69.9	74.8	74.6	68.1	53.6	67.1	38.2	43.7	55.3
Individual with 1 car	75.6	74.4	79.9	77.4	67.0	60.8	72.6	45.6	50.1	53.0
Individual with 2 cars or plus	78.0	77.3	84.5	83.2	75.8	62.9	78.6	51.3	52.2	57.4
Travel time budget by gender (in mn)										
Male	85.1	83.4	88.1	85.2	75.1	66.5	80.0	49.1	52.9	56.9
Female	64.4	65.2	73.0	72.7	63.1	54.2	68.1	40.2	46.1	53.5

Sources : Households transports surveys in Paris (1977, 1984, 1992 and 1998), Lyon (1976, 1985 and 1995) and Lille (1976, 1987 and 1998).

Figure 2:Travel time budget in the three conurbations



Sources : Households transports surveys in Paris (1977, 1984, 1992 and 1998), Lyon (1976, 1985 and 1995) and Lille (1976, 1987 and 1998).

3. Long term forecasting with an "Age – Cohort" model

3.1 Presentation of the model

A demographic model with a longitudinal approach highlights the complex impact of age. In a dated temporal context, it consists of three interlinked dimensions:

- the " Standard Life Cycle Profile " which indicates the evolution of travel patterns (i.e. mobility) related to age and correspond to a stabilized pattern of behavior,

- the " Generation Gaps " which take into account the behavior of individuals born during the same period, and therefore sharing a common life experience, allow us to place this profile in a historical perspective,

- the " Period Effect " which indicates the impact of the global socio-economic context.

If we take the example of car ownership, which is a major factor affecting mobility, a longitudinal analysis applied to the French data at the national level (Madre & Gallez, 1992) showed the importance of gaps between successive generations, as well as the remarkable stability of the curves throughout the life cycle. Once the respective influences of age and generation have been isolated, it appears that the effect of the global economic context (petroleum crisis and post crisis, economic growth, recession, …) can be considered as residual.

We found similar results for mobility behavior, and we specified an "Age-Cohort" model for the travel time budgets, which can be treated as a model of analysis of variance with two factors :

$$\pi_{a,k} = \alpha_a + \gamma_k + \varepsilon_{a,k}$$

Where :

– $\pi_{a,k}$: measures a characteristic or behaviour (travel time budgets) observed at the date t=a+k (year of the survey), when the age of the individual who belongs to the generation k (defined by his date of birth) is equal to a;

– α_a : measures the behaviour of the generation of reference at the age a. This allows us to define a « Standard Profile » during the life cycle ;

– γ_k : measures the gap between the cohort g and the generation of reference γ_{k^0} ;

– $\varepsilon_{a,k}$: the residual of the model.

The main idea in our approach is to outline the variables of age (with its component of life cycle and generation), of gender, of spatial distribution (2 or 3 zones), of motorization of the households (household without a car, with one car, or with two or more cars). Data are collected by personal interview of individuals over 5 years for a typical week day. First, we will conduct a comparative analysis from the observed data, and then we will implement the forecast to 2030 horizon.

3.2 Adequation of the model

To compare the results between observations and model in a global way, we carried out a regression between the estimates of the surveys and the estimates of the model at the finest level, i.e. the crossing of the variables:

- zone of residence (3 zones in Paris and Lille and 2 zones in Lyon);
- motorization (0 car, only one car, and several cars in the household);
- gender (2);
- age groups (17);
- years of the data collections (3 or 4).

Table 3: The regression of data from surveys on results from Age-Cohort models

Travel time budgets	R^2	Slope		Intercept	
		Parameter estimate	t value	Parameter estimate	t value
Paris	0.89	0.98	98.8	1.00	1.3
Lyon	0.72	0.99	48.4	1.23	0.9
Lille	0.86	0.99	71.5	0.55	0.8

Sources : Calculations from Households transports surveys in Paris (1977, 1984, 1992 and 1998), Lyon (1976, 1985 and 1995) and Lille (1976, 1987 and 1998).

We have then about 1200 points in the Paris region, about 800 point in the Lille region and about 600 points in the Lyon conurbation to make the comparison of data from surveys versus results from models (see Armoogum, 2003). In the three conurbations, the Age-Cohort models on travel time budgets fit quite well data from surveys (cf. table 3). Indeed, for the regressions of data from surveys on results from Age-Cohort models, we find that:

- the R^2 is close to 1;
- the slope does not differ significantly to 1
- and the intercept does not differ significantly from 0.

3.3 Results of the model and comparison between the three conurbations

In Paris region, the travel time budget is higher than in the other urban areas. It is also higher for men than for women, but this difference is decreasing. People living in central cities and those living in motorised household have a longer travel time budget. In the future, because of a generation effect, the elderly should spend more time in transport than their are doing now.

We also have calibrated an Age-Cohort model for daily distance travelled. Then it is possible to estimate travel mean speed. The main result is that trips speed should still grow from 2000 to 2030. This means that the gain in speed is converted into a gain in distance travelled. A "week" version of Zahavi conjecture would be that there is more flexibility for trip distance than for trip duration.

3.4 Population characteristic

The population projection for the Paris region show a constant increase, but this augmentation is mainly due to the suburbs. In the two other areas (Lyon and Lille), the population should expand until 2015, then it should decline, reaching in 2030 the same level as in 2000. In the three areas, the ageing of the population is inescapable. A population can age by bottom (reduction of fertility rate), by the top (reduction of mortality rate) and by a shock wave upwards. France ages by bottom, but much more by the top. Therefore, the number of old people should increase considerably till 2030 (cf. table 4).

The number of cars should increase in the three agglomerations, this is manly due to the multi-equipped households. In the same time, the number of individuals belonging to multi-equipped households should rise. However, this growth slowed down in the Nineties, as we have seen in table 1.

3.5 Travel time budget characteristic

The common characteristic of travel time projection is that it should increase until 2030 (cf. table 5). The growth is very gradual in the three conurbations. A growth of approximately 3 minutes in Paris region and 4 minutes in the Lyon and Lille regions. The model estimates a declines of 2 minutes of travel time budget for the inhabitants of the city of Paris, and an augmentation of 7 minutes for those in the inner suburbs. In 2030, these estimates should lead to a higher travel time budget in the inner suburbs than in the city of Paris. Projections in

Lyon and Lille say that travel time budget should remain higher in the central city than in the suburbs. In the zones of lowest density, time budgets should not increase significantly in the long run.

Travel time budget projections according to motorization are contrasted in the area of Lille compared to the estimations in the others conurbations. In particular, an high growth of travel time budget is projected among the population without car (55 minutes in 2000 and 69 minutes in 2030), as well as a convergence of travel time budget around 57 minutes for multi-equipped people. Individual who does not have access to car in Paris region should keep their budget-time stable of 74 minutes and in the region of Lyon, the same group of individuals would lower of 3 minutes their travel time budget. In these two conurbations the individuals belonging to multi-equipped households should augment their travel time budget, respectively, of 2 and 3 minutes.

Travel budget time according to gender should increase of 5 minutes for the women in the Paris and Lyon area, this increase would be of 7 minutes in the Lille region. In the same period of time the men should rise their travel time budget of 5 minutes in the Lyon region and should be constant in the two other regions (cf. table 5).

Table 4: Long term projection of populations in Paris, Lyon and Lille regions

	Paris			Lyon			Lille		
Years of projection	2000	2015	2030	2000	2015	2030	2000	2015	2030
Population (in 000)	10 239	10 896	11 343	844	850	843	899	907	898
Average age (years)	38.6	40.5	42.3	39.4	41.4	43.6	36.9	39.6	42.4
Population by zone of residence (in %)									
Central City	19.6	17.8	16.1	68.1	70.9	74.2	19.3	19.4	19.9
Zone of high density	36.6	35.0	33.2	31.9	29.1	25.8	49.4	48.5	47.6
Zone of law density	43.8	47.2	50.7	-	-	-	31.3	32.0	32.6
Total	100	100	100	100	100	100	100	100	100
Density of population by zone (000 inhabitants age of 5 or plus per km²)									
Central City	18.9	18.3	17.2	7.8	8.2	8.5	4.5	4.6	4.6
Zone of high density	5.6	5.7	5.6	2.2	2.0	1.8	3.7	3.7	3.6
Zone of law density	0.4	0.5	0.5	-	-	-	1.2	1.2	1.2
Total	0.9	0.9	0.9	4.3	4.4	4.3	2.2	2.3	2.2
Population according to the number of cars in the household (in %)									
Individual with 0 car	19.5	17.0	16.0	18.4	14.9	14.3	17.7	13.9	12.7
Individual with 1 car	46.2	41.1	37.0	45.8	41.5	38.3	44.9	40.6	36.5
Individual with 2 cars or plus	34.2	41.9	47.1	35.7	43.7	47.4	37.4	45.5	50.8
Total	100	100	100	100	100	100	100	100	100

Sources : Inrets : Age cohort model on travel time budget onParis, Lyon and Lille.

Table 5: Long term projection of travel time budget in Paris, Lyon and Lille regions

	Paris			Lyon			Lille		
Years of projection	2000	2015	2030	2000	2015	2030	2000	2015	2030
Travel time budget (in mn)	80.3	82.2	83.1	69.4	72.0	74.0	54.9	57.3	58.7
Travel time budget by zone of residence (in mn)									
Central City	82.6	81.5	80.8	69.8	72.4	74.4	60.5	63.7	66.1
Zone of high density	81.6	85.5	88.2	68.4	70.8	72.6	53.9	56.4	58.5
Zone of law density	78.2	80.0	80.4	-	-	-	53.2	54.8	54.5
Travel time budget by motorization (in mn)									
Individual with 0 car	73.9	73.8	73.9	58.5	57.1	55.5	54.6	61.2	69.2
Individual with 1 car	78.9	79.3	80.7	67.9	68.7	71.8	53.8	56.1	57.9
Individual with 2 cars or plus	85.9	88.3	88.1	76.8	80.1	81.4	56.5	57.2	56.7
Travel time budget by gender (in mn)									
Male	87.5	87.8	88.0	75.1	78.1	79.8	56.7	57.8	57.5
Female	73.6	76.8	78.5	64.3	66.7	69.2	53.3	56.9	59.8

Sources : Inrets : Age cohort model on travel time budget onParis, Lyon and Lille.

In order to obtain a complete image of the evolutions, we will also project the daily distance traveled in the three agglomerations, and will see the result on the travel daily speed (ratio of daily distance traveled and travel time budget per day).

3.6 Long term projection of distance

Projection of daily distance traveled (according to the same methodology) show that they should increase of 2 km per day in Paris region and in the conurbation of Lille and of 1.5 km in the conurbation of Lyon. The cutting out of the area of study in two zones in Lyon explains the feeble progression of the distance traveled. The distances in Paris should remain constant throughout the period of projection, but they should enlarge in the two suburbs zones. The model shows a significant growth of distance traveled in the central city of the Lyon region and a stability in the suburbs. In the Lille region, the daily distance traveled should rise in the three zones. Motorized individuals should increase their daily traveled distance more than non-motorized individuals. The growth of distance travelled is stimulated by the growing proportion of categories who show the highest distance (multi-car households, people living in low density areas, etc.). The differences between the daily distance traveled by gender should reduce progressively, but in 2030 the men should still have an higher daily traveled distance (cf. table 6).

Table 6: Long term projection of daily distance in Paris, Lyon and Lille regions

	Paris			Lyon			Lille		
Years of projection	2000	2015	2030	2000	2015	2030	2000	2015	2030
daily distance (in km)	16.7	17.9	18.8	11.1	11.9	12.6	8.9	10.1	10.9
daily distance by zone of residence (in km)									
Central City	11.3	11.6	11.9	10.5	11.6	12.5	6.9	7.7	8.4
Zone of high density	14.0	15.2	16.0	12.3	12.7	12.9	8.2	10.1	11.0
Zone of law density	21.3	22.4	22.8	-	-	-	10.3	11.6	12.1
daily distance by motorization (in km)									
Individual with 0 car	9.5	10.0	10.6	6.2	6.2	6.4	4.1	4.1	4.6
Individual with 1 car	15.7	15.80	16.1	10.7	11.0	11.8	8.2	8.9	9.5
Individual with 2 cars or plus	22.1	23.20	23.6	14.1	14.7	15.1	12.0	13.0	13.4
daily distance by gender (in km)									
Male	20.2	21.0	21.6	13.0	14.0	14.7	10.0	11.1	11.8
Female	13.4	15.0	16.2	9.3	10.2	10.8	7.9	9.2	10.0

Sources : Inrets : Age cohort model on distance on Paris, Lyon and Lille.

3.7 Average Travel Speed

The ratio of the daily distance traveled on the travel time budget per day allow the estimation of the average daily travel speed. In the 3 areas of study we found that the daily travel speed should rise, from 12.5 km/h in 2000 to 13.6 km/h in 2030 for the Paris region. The gain of speed is lower in the region of Lyon due to the exclusion of low density zones from the study area. The daily travel speed is high when the population density is low and vice versa. In the central city the speed is below 10 km/h and it's up in the suburbs. In the three areas of studies, the daily travel speed is high when the motorization is important. The differences between the daily travel speed by gender should reduce progressively, but in 2030 the men should still have an higher speed (cf. table 7).

Table 7: Long term projection of daily speed in Paris, Lyon and Lille regions

	Paris			Lyon			Lille		
Years of projection	2000	2015	2030	2000	2015	2030	2000	2015	2030
daily speed (in km/h)	12.5	13.1	13.6	9.6	9.9	10.2	9.7	10.6	11.1
daily speed by zone of residence (in km/h)									
Central City	8.2	8.5	8.8	9.0	9.6	10.1	6.8	7.3	7.6
Zone of high density	10.3	10.7	10.9	10.8	10.8	10.7	9.1	10.7	11.3
Zone of small density	16.3	16.8	17.0	-	-	-	11.6	12.7	13.3
daily speed by motorization (in km/h)									
Individual with 0 car	7.7	8.1	8.6	6.4	6.5	6.9	4.5	4.0	4.0
Individual with 1 car	11.9	12.0	12.0	9.5	9.6	9.9	9.1	9.5	9.8
Individual with 2 cars or plus	15.4	15.8	16.1	11.0	11.0	11.1	12.7	13.6	14.2
daily speed by gender (in km/h)									
Male	13.9	14.4	14.7	10.4	10.8	11.1	10.6	11.5	12.3
Female	10.9	11.7	12.4	8.7	9.2	9.4	8.9	9.7	10.0

Sources : Inrets : Age cohort model distance and travel time budget on Paris, Lyon and Lille.

4. Conclusion

In our 3 case studies (the conurbations of Lille and Lyon, and the Metropolitan Area of Paris), like in many French urban areas, the mobility surveys conducted since the mid-90's have shown a slight but significant increase of the average travel time budget [CERTU, 2002], which means an amendment to the constance of time budgets conjectured by Zahavi. Through an age-cohort modelling approach taking into account the ageing of population, urban sprawl and increasing car ownership, we have shown that it corresponds to a long term trend.

The same approach implemented on the same surveys shows a faster growth for the distance travelled. Thus the average speed is increasing [Madre and Maffre, 1995], due to:

- the substitution of slow modes (walk and bicycle) by faster modes (car and rail public transport);
- an increasing proportion of car traffic made on motorways and in low density areas, because of infrastructure building and of urban sprawl.

This means that the gain in speed is converted into a gain in distance travelled. A "week" version of Zahavi conjecture would be that there is more flexibility for trip distance than for trip duration.

These changes, which have been rapid in the 70's and 80's, seem to be slowing down now. The rhythm of urban sprawl has decreased between 1990 and 1999 census compared to previous periods [Bessy-Pietri, 2001]. A simulation exercise conducted for Lille has shown that, inside the conurbation, urban sprawl has not very much impact on mobility [Armoogum et al., 2002]. Its main effect on car traffic is due to outer suburbs, and it is not more important than that of economic growth [Berri, 2001; Madre, 2002].

However, this slight increase of travel time budget is not homogeneous for all population groups:

- the growth is higher for women than for men, but a slight difference should remain between the two genders at the horizon 2030;
- the growth is faster for elderly, due to a generation effect (new generations of retired people travel more than those who had no access to car ownership).

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