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To cite this version:

Charles Raux, Ayman Zoubir. Who are bike sharing schemes members and how they travel daily? The case of the Lyon's "Velo'v" scheme . 2015. halshs-01193169

HAL Id: halshs-01193169

https://shs.hal.science/halshs-01193169v1

Preprint submitted on 4 Sep 2015

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Who are bike sharing schemes members and how they travel daily? The case of the Lyon's "Velo'v" scheme

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Abstract

This paper analyzes the socio-demographic profile and travel behavior of the "Velov" bikesharing scheme members in Lyon (France). This scheme started in 2005 and has now around 350 stations and 4500 bikes in operation, with more than 50,000 annual members. Thanks to a specific Internet-based survey more than 3,000 respondents were described by their detailed socio-demographic profile, their travel means and habits, a one-day activity-travel diary and additionally a seven days activity-travel diary log by around 700 volunteers. By this way the survey covers all travel modes and day-to-day variations in travel behavior beyond the sole use of shared bike. We analyze with a discrete choice model the socio-demographic and spatial factors affecting the probability of being an annual member of the Velov scheme. Then we explore with descriptive statistics their daily travel behavior involving as well bike sharing as other traditional modes. When possible this behavior is compared with the latest Household Travel Survey available in the Lyon area (2006). Velov annual members are rather younger and hold higher social positions when compared with the Lyon's reference population. An individual higher social position and the residential proximity to stations have both separate and positive effects on the probability of being an annual member of the service. Velov members are not captive from public transport, they have access to a car and they are fully multimodal in their day-to-day travel behavior. Velo'v bikes are used by them for any activity, not necessarily every day, like any other travel mode.

Keywords:

Bikesharing; Lyon; annual members; one week travel diary; discrete choice model; descriptive statistics

1 INTRODUCTION

Bike sharing schemes (BSS) in urban areas have sprawled around the world at an accelerated pace over the last years, and could announce unprecedented transformations in contemporary mobility and urban lives. The success of these schemes and numerous studies already published have provided significant knowledge gains regarding planning, operational management, public policy assessment and users attitudes or perceptions (Shaheen et al, 2010; Fishman et al, 2013) but only few regarding analysis of social transformations induced by this new kind of travel mode.

Most of the previous studies performed detailed analysis of anonymous bike flow data, yielding original insights on spatiotemporal patterns and dynamic performance of the systems. This is sometimes combined with some basic socio-demographic data recorded at the time of enrollment for annual subscribers but even these are limited (e.g. gender, age, home postcode, see e.g. Morency et al, 2011; Vogel et al, 2014). Some specific additional surveys targeting scheme members cover perceptions of their own modal shift by respondents (Shaheen et al 2013; Bachand-Marleau et al, 2012) or exceptionally compare BSS members with traditional cyclists (Buck et al, 2013).

Especially knowledge is still to be elaborated on the way this travel mode takes part in the daily travel behaviour of the individual user, how this mobility behavior is modified and more generally how urban practices are modified. One reason of this lack of knowledge may be that registration data and automatic data recording of the flows of bikes provide only limited information on the socio-demographic profile of the users and their overall daily mobility.

Moreover since the 1980's the research efforts for better understanding day-to-day variation of travel behaviour, i.e. intrapersonal variation, has gathered substantial results showing that there is a significant day-to-day variability in travel/activity behaviour (Pas and Koppelman 1986; Hanson and Huff 1982, 1986, 1988; Huff and Hanson, 1986; Jones and Clarke 1988; Pas, 1988; Pas and Sundar, 1995; Buliung et al. 2008; Schönfelder and Axhausen, 2010; Neutens et al., 2012). Schlich and Axhausen (2003) used the Mobidrive six-week travel diary dataset (Axhausen et al. 2002) to study the variability of day-to-day travel behaviour. They found that travel behaviour is more stable on weekdays than weekend. This accumulated knowledge motivated us to carry on a multiday survey on travel behaviour of Velov annual members.

In order to gain more information on users and uses of BSS we conducted a series of surveys on users of the BSS scheme named Velo'v in Lyon (France). This scheme started in 2005 and has now around 350 stations and 4500 bikes in operation, with approximately 50,000 annual registered members. It is an open scheme operating with fixed 24/7 dock stations where customers can use a variety of smart cards to retrieve a bike, including credit cards for casual users (one day or 7 days) who can register instantaneously at the dock station (fixed fee of respectively 1,5€ and 5€). The membership fee for an annual season-ticket amounts currently to 25€ per year with a reduced fee of 15€ for those between 14 and 25 years of age. All annual members then have a free duration use of 30 minutes for each Velov renting. For a greater duration of use within the same renting act there is an additional fee rising from 0.75€ to 2€ per additional half-hour. In all what follows with the expression "Velov annual members" we designate those who subscribe to the service with a one year period season-ticket.

The aim of this paper is to show whether annual membership to the bike sharing service is explained by socio-demographic profile or by spatial proximity to stations and how Velo'v users have a different travel behavior when compared with reference population.

We analyze with a discrete choice model the socio-demographic and spatial factors affecting the probability of being an annual member of the Velov scheme. Then we explore with descriptive statistics their daily travel behavior involving as well bike sharing as other (traditional) modes. When possible this behavior is compared with the latest Household Travel Survey of Lyon (2006).

The remainder of the paper is structured as follows. Section 2 describes the methodology of data collection and statistical analysis. Section 3 presents the results and section 4 the discussion and conclusion.

2 METHODOLOGY

First we present the context, the data collection and basic statistics on these. Second we set out the statistical methods implemented.

2.1 Data collection

As part of the empirical study a specific Internet-based survey was undertaken in September and October 2014 targeted at registered annual members of Velo'v (53,793 annual members who had a valid annual subscription in September 2014). The members were solicited by random mailing in the database: 25,500 mails were sent and finally 3,365 respondents (i.e. a response rate of 12%) completed a questionnaire where they described their socio-demographic profile, their travel means and their habits, and recorded a one-day travel diary whether it included a Velov trip or not. Additionally around 700 volunteers (with a specific financial incentive) accepted to complete a seven days travel diary log.

By this way the survey aimed at covering all travel modes (including intermodal uses within the same trip) and day-to-day variations in travel behavior (multimodal uses), beyond the sole use of shared bike Velov.

The Internet survey went off during the month October 2014 by successive mails sending and was closed on the 20th of October. The weather conditions are an issue regarding bike use and during this period the day temperature varied between 10° and 25° Celsius with generally a fine or overcast weather except with two days with heavy rainfall (between 50 and 70 mm per day).

As a reference of comparison we use the latest Household Travel Survey available in Lyon urban area which dates from 2006. This is a conventional travel survey which records on a representative sample of the inhabitants of the urban area of Lyon (approximately 1.2 million inhabitants) their socio-demographic profile and a one-day travel diary selected among the working days (from Monday to Friday).

More than 95% of the 350 Velo'v stations are settled in the center of the urban area, a center that we mark with the two adjacent cities of Lyon (divided into nine districts) and Villeurbanne having a total population of 642,625 in 2012 on 62.42 km². Table 1 shows some basic statistics on the area, including the Velo'v supply.

Table 1: General statistics on the area "Lyon-Villeurbanne" and Velo'v supply

Districts	Population 2012*	Area (km²)	Population density	Average annual income per household (€)**	nb Velov stations	Velov station density
Lyon 1	29 209	1.51	19 344	35 757	18	11.9
Lyon 2	30 958	3.41	9 079	47 693	30	8.8
Lyon 3	98 135	6.35	15 454	38 770	49	7.7
Lyon 4	36 240	2.93	12 369	42 414	18	6.1
Lyon 5	46 693	6.23	7 495	39 899	26	4.2
Lyon 6	49 479	3.77	13 124	53 251	28	7.4
Lyon 7	75 746	9.75	7 769	32 636	39	4.0
Lyon 8	81 454	6.7	12 157	30 418	35	5.2
Lyon 9	48 429	7.25	6 680	31 331	23	3.2
Villeurbanne	146 282	14.52	10 075	30 636	73	5.0
Total	642 625	62.42	10 295	-	339	5.4

*Source : Insee, Recensement de la population 2012
**Source : Insee-DGFiP Revenus fiscaux localisés des ménages

The correlations between these indicators (see Table 2) show that: population and area are positively correlated – as expected, but not with population density; population and area are positively correlated with the number of Velov stations, which shows that the supply is consistent with the potential demand; Velov station density is positively correlated with population density and negatively with the area, which reinforces the consistency of the supply; but there is no significant correlation of Velov supply with the indicator of average wealth by district.

Table 2: Correlations (Pearson)

Variables	Population 2012*	Area (km²)	Population density	Average annual income per household (€)	nb Velov stations	Velov station density
Population 2012*	**1**	**0.878**	-0.084	-0.503	**0.960**	-0.349
Area (km²)		**1**	-0.488	-0.602	**0.851**	**-0.640**
Population density			**1**	0.148	-0.115	**0.829**
Average annual income per household (€)				**1**	-0.357	0.409
nb Velov stations					**1**	-0.234
Velov station density						**1**

Values in bold are significant at 0.05

This is why we restrict the analysis to these two cities and select among the survey respondents those living in Lyon and Villeurbanne that is to say 2,858 respondents. The same restriction applies to the sample of the HTS 2006. Table 3 shows on the two samples the statistics of the variables used in the subsequent statistical analysis. Since the variables

stemmed from two different survey questionnaires some matching was required to make them comparable. This was possible for all variables except for diploma.

Due to individual privacy issue (legislation in force in France) and the risk of increasing the non-response rate, it is was not possible to record the accurate address of Velov annual members even if this is known from the Velov service provider. We only know if the residence is located in one of the nine districts of Lyon or in the town of Villeurbanne. This is why in the statistical analysis the Velov supply is represented by the density of stations per district which is a proxy to the average proximity of individual's residence to a Velov station. As we will see even this rough representation is statistically significant in the subsequent model estimation.

A similar privacy issue applies to income which is a sensitive question in French surveys and is known to significantly increase refusals to respond or stopping the questionnaire. This was an issue here since we wanted respondents to carry on with the travel diary log. This is why this specific question was avoided.

The choice of the variables shown in Table 3 is guided by preliminary descriptive analyses (not shown here) and some hypotheses. We already found that men are more represented than women in the population of Velov users and that these users are younger than the average population, thus we included gender and age. Another series of hypotheses relates to the travel capabilities, through the holding of a driver's license or a public transport season-ticket: is there any link of such capabilities with the probability of being registered to Velov? Finally, a lot of students use Velov but also working people, particularly those with higher social position. What is the effect of working status and social position on the probability of being registered? This is why we included status (working, not working, retired, studying) and an indicator of social position through occupation: self-employed, manager/professional, middle manager, employee, worker, no occupation, studying.

Table 3: Statistics on the sample of Velov annual members and HTS 2006

		Velov sample		HTS 2006 sample*	
		N	%	N	%
district of residence	Lyon 1	172	6	239	5
	Lyon 2	189	7	257	6
	Lyon 3	588	21	728	17
	Lyon 4	118	4	134	3
	Lyon 5	104	4	381	9
	Lyon 6	241	8	270	6
	Lyon 7	498	17	357	8
	Lyon 8	246	9	776	18
	Lyon 9	132	5	403	9
	Villeurbanne	569	20	828	19
	Total	2857	100	4373	100
gender	female	1247	44	2333	53
	male	1610	56	2040	47
	Total	2857	100	4373	100
driver's license	license_no	406	14	948	22
	license_yes	2451	86	3425	78
	Total	2857	100	4373	100
diploma	2-secondary	159	6	na	na
	3-A-level	458	16	na	na
	4-undergraduate	403	14	na	na
	5-university degree	1837	64	na	na
	Total	2857	100	na	na
status	1-working	1707	60	2199	50
	2-not working	186	7	497	11
	3-retired	130	5	1041	24
	4-studying	834	29	636	15
	Total	2857	100	4373	100
PT season ticket	seasonticket_no	1476	52	2871	66
	seasonticket_yes	1381	48	1502	34
	Total	2857	100	4373	100
occupation	2-self-employed	83	3	160	4
	3-manager/professional	1134	41	885	20
	4-middle manager	250	9	899	21
	5-employee	365	13	944	22
	6-worker	38	1	599	14
	7-no occupation	33	1	218	5
	8-studying	868	31	637	15
	Total	2771	100	4342	100
age class	1(<30)	1614	56	1196	27
	2(30-44)	647	23	1159	27
	3(45-59)	433	15	946	22
	4(60-74)	154	5	658	15
	5(>74)	9	0	414	9
	Total	2857	100	4373	100

* Inhabitants of Lyon-Villeurbanne, above 15 years of age

2.2 Statistical methods

The statistical analysis follows two directions, related to the questions set out in the introduction. In the first one we use a discrete choice model to estimate the role of various variables in the probability of enrolling in the Velov annual membership. In the second one we use descriptive statistical techniques to compare the mobility behavior of Velov annual members to the reference population and give an overview of their multimodal travel behavior.

The choice of being annually registered to the Velov service is modeled as a utility maximization problem. The model is based on the assumption of utility maximizing behavior by the decision maker n choosing between the various alternatives j (here two: to be registered or not). This utility, which is only known by the individual, is broken down into two parts, a "representative utility" V depending on the attributes of the decision maker and the alternative which are observed by the researcher, and an additional unknown term ε which is treated as random. Assuming that the ε values are identically and independently extreme value distributed for all j, we obtain the well-known discrete choice logit model (Train, 2009).

However there is an issue in our study regarding the sampling of decision makers who choose to be registered or not. Due to limited funding it was possible to perform only a survey on Velov annual members and not on the general population (those who are not registered). However this population can be addressed thanks to the latest Household Travel Survey available in Lyon area which dates from 2006. This survey is based on an exogenous representative sampling of the population of residents with a stratification based on residence location. Statistical weights are attached to each individual in order to represent the population of the geographical strata. We used these weights for comparison of mobility indicators between Velov users and the general population but not for the discrete choice modeling.

Our sampling method looks akin a choice based sample which aggregates the sample of respondents stemming from the Velov annual membership database (this population represents approximately 8% of the overall Lyon-Villeurbanne population) and the sample stemming from the HTS 2006. In 2006 the Velov service was only in the beginning and growing phase (the scheme started in 2005 with about 15,000 annual members) and we have no indication of Velov membership in the HTS survey. Our working assumption is to assimilate this last sample to those who choose to not being registered to the Velov service.

Strictly speaking, since our overall sampling is different from a conventional exogenous sampling (like in the HTS), we should not use the exogenous sampling maximum likelihood estimator conventionally used in logit models. However the literature (Manski and Lerman, 1977; Manski and Mc Fadden, 1981; Cosslett, 1981) shows that this estimator gives consistent estimates of attributes coefficients even in this case. This is not the case for estimates of the alternative specific dummies but they are not at stake in our analysis (and we know the share of annual members in other respects). Thus we used the exogenous sampling maximum likelihood estimator.

3 RESULTS

3.1 The probability of being a Velov annual member

Preliminary analyses (not shown here) indicate an effect of the current working status (working or not, retired, studying) but also an effect of socio-economic position through the job occupation whether currently at work or not. This is why a composite variable ("status.occupation") has been elaborated, based on interaction between current working status and job occupation.

Table 4 gives the results of logit model estimation. Being male increases the probability of being registered, while being older than 30 decreases this probability. These annual members are also significantly more holders of season ticket on public transport but also more holders of a driving license.

Regarding the effect of supply, the density of stations is significant (and more effective with a logarithm transformation). The direction is positive as expected.

The reference is "working:self-employed". Compared to this reference, one sees that the occupation "studying" has no significant effect while having "no occupation" at all decreases the probability of being registered. Being in the position of manager or professional, currently at work, increases significantly the probability of being registered. On the opposite being in the position of middle manager, employee or worker, whether or not currently at work or even retired, decreases significantly this probability.

Table 4: Logit model of the probability of being registered to the Velov service

Coefficients :	Estimate	Std. Error	t-value	Pr(>|t|)	
[T.1]	-0.849677	0.24321	-3.4936	0.0004766	***
gender[male]	0.254133	0.057462	4.4227	9.75E-06	***
age.class[2(30-44)]	-0.973779	0.082158	-11.8526	< 2.2e-16	***
age.class[3(459)]	-1.107077	0.089357	-12.3894	< 2.2e-16	***
age.class[4(60-74)]	-1.07347	0.192219	-5.5846	2.34E-08	***
age.class[5(>74)]	-3.230119	0.394602	-8.1858	2.22E-16	***
license[license_yes]	0.833332	0.08249	10.1023	< 2.2e-16	***
season.ticket[seasonticket_yes]	0.491362	0.059251	8.2929	< 2.2e-16	***
log(station.density)	0.252858	0.081602	3.0987	0.001944	**
status.occupation[working:manager / professional]	0.467109	0.172081	2.7145	0.006638	**
status.occupation[working:middle manager]	-1.099509	0.184979	-5.944	2.78E-09	***
status.occupation[working:employee]	-0.366082	0.181409	-2.018	0.0435923	*
status.occupation[working:worker]	-2.550641	0.278417	-9.1612	< 2.2e-16	***
status.occupation[not working:self-employed]	-0.291294	0.544412	-0.5351	0.5926069	
status.occupation[not working:manager / professional]	-0.024274	0.249555	-0.0973	0.9225139	
status.occupation[not working:middle manager]	-1.374532	0.324469	-4.2363	2.27E-05	***
status.occupation[not working:employee]	-1.113782	0.28252	-3.9423	8.07E-05	***
status.occupation[not working:worker]	-2.473627	0.430414	-5.7471	9.08E-09	***
status.occupation[retired:self-employed]	-1.747851	0.578734	-3.0201	0.0025267	**
status.occupation[retired:manager / professional]	-0.102929	0.277958	-0.3703	0.7111568	
status.occupation[retired:middle manager]	-1.072132	0.310729	-3.4504	0.0005598	***
status.occupation[retired:employee]	-2.332199	0.379376	-6.1475	7.87E-10	***
status.occupation[retired:worker]	-2.228635	0.415212	-5.3675	7.99E-08	***
status.occupation[no occupation]	-1.251591	0.240445	-5.2053	1.94E-07	***
status.occupation[studying]	-0.188367	0.183978	-1.0239	0.305903	
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					
Log-Likelihood: -3812.9					
McFadden R^2: 0.20175					
Likelihood ratio test : chisq = 1927.3 (p.value = < 2.22e-16)					

3.2 The travel means and mobility behavior of Velov annual members along the week

85% of annual members living in Lyon-Villeurbanne hold a car driver's license. Moreover, as shown in Table 5, during the working days (Monday to Friday) nearly half of them have access to a car for their sole use (44% + 4%, see Table 5). To this add 20% who

can have access to a car some time (but depending on arrangements with relatives) while only 31% of annual members have no access to a private car at all. This means that the majority of them are not captive of public transport.

Table 5: Availability of a private car during the working days (Velov annual members)

I have a car for my sole use	44%
I have a company car	4%
I can have a car (shared with my relatives)	20%
I have no car	31%
other	1%
Total	100%

We turn now to daily travel behavior of Velov annual members. A sample of volunteers have recorded their daily mobility during one week in order to give an overview of their day-to-day mobility. This week diary allows an analysis of variability of behavior from day to day and especially of "multimodality" that is to say the use of various travel modes for different trips. 671 Velov annual members have completed a full 7-days diary. From this diary we exclude Saturdays and Sundays which show as expected very different travel behaviors with in general no mandatory activities like work or university. Thus we stick to classical working days (Monday to Friday). Moreover this allows comparison, when possible, with the Household Travel Survey in 2006 which recorded travel of Lyon's inhabitants only on working days.

Firstly we analyze the use of travel modes by Velov annual members for their trips. We use the conventional definition of a trip which is a switch from one activity (which is not travel) to another with a change of location. For this we elaborated the "main travel mode" based on a series of rules as follows. First we put together some modes: bus, tramway, metro and regional train are all considered as the same mode designated as public transport (PT); "car as a passenger" and "car as a driver" are put together as "car". Then "walk" mode is the main mode when the entire trip is performed by walking otherwise when walk is combined with at least one mechanized mode it is ignored. When only one mechanized mode is used (even with connections) this is the main mode. When Velov is used in combination with another mode (such as PT or the car) then "Velov" is designated as the main mode. When PT is used in combination with another mode (such as the car) then "PT" is designated as the main mode. Other combinations are attributed to "other". The same rules were applied to HTS 2006 based on our own data processing.

As shown in Table 6, Velov annual members perform on average fewer trips per day than the general population (inhabitants of Lyon-Villeurbanne, above 15 years of age) in 2006: 3.3 trips per day vs 3.7. Regarding the main travel mode of their trips over a five working days period Velov annual members use Velov for only 22% of their trips: this is a first indication that Velov is for them only one mode among others and not the main or preferred one (recall that there were only two days of heavy rainfall during the three weeks of recording). They use more public transport (PT, 30%) than the general population in 2006 (20%) but less walking mode (23% vs 38%) and car (17% vs 38%). These two last modes are partly replaced by Velov.

The same Table 6 shows the distribution of trips according to purpose at destination. Velov annual members commute more to work or study than the general population in 2006 (resp. 31% and 11% vs 22% and 7%). On the opposite they travel less for leisure, shopping or personal matters, and dropping or picking someone else. Moreover if we restrict the distribution of trips per purpose to those made with Velov mode during the week, we see that there is no significant difference with the distribution of trips per purpose when all modes are considered, apart from a higher share of commuting to work with Velov. This confirms that regarding travel purpose Velov is used as every other travel mode.

Table 6: Mobility indicators for Velov annual members from Monday to Friday

	Velov survey		HTS 2006 survey*
Trips per main travel mode	Nb trips/Mo-Fri	%	
Walk	2537	23%	38%
Velov	2387	22%	na
PT	3278	30%	20%
Car	1862	17%	38%
Other	993	9%	4%
Total	11057	100%	100%
Nb individuals	671		499,692
average period Mo-Fri	16.5		na
average daily	3.3		3.7
	Velov survey		HTS 2006 survey*
Trips per purpose (Mo-Fri)	Mo-Fri all modes	Mo-Fri Velov	
Home <--> Work	31%	38%	22%
Home <--> Study	11%	12%	7%
Home <--> Leisure	13%	14%	18%
Home <--> Shopping/Personal	14%	14%	21%
Home <--> Dropping/Picking	3%	2%	10%
Home <--> Other	0%	0%	1%
not linked to Home	27%	21%	21%
Total	100%	100%	100%

* Inhabitants of Lyon-Villeurbanne, above 15 years of age, with statistical weights

Then we go further to the multimodal behavior of Velov annual members along the week. For each individual we computed the number of times each of the five main travel modes was used during the five working days. Thus we obtained a table of 671 observations and five columns, accounting for the intensity of use of the five modes by each individual. Principal component analysis (PCA) is particularly relevant for such a table. The main results are given in Table 7. The first two factors (F1 and F2) account for more than half of the variance (resp. 27.6% and 24%) while the third one (F3) accounts for 22.2%, slightly more than the average for five factors (20%). The weak decrease of variance percentage accounted for by each factor indicates that the observations are rather homogenously dispersed across the five dimensions of the statistical cloud. This means an overall tendency of Velov annual

members to use any set of travel modes during the week, with no preference for anyone in particular.

Table 7: PCA results on the use of travel modes by Velov annual members from Monday to Friday

Variable	Min	Max	Mean	Std dev	
Walk	0	24	3.78	4.47	
Velov	0	19	3.56	4.03	
PT	0	33	4.89	5.11	
Other	0	33	1.48	3.85	
Car	0	28	2.77	4.26	
Correlation matrix (Pearson) :					
Variables	Walk	Velov	PT	Other	Car
Walk	1	-0.006	-0.094	-0.036	-0.140
Velov		1	-0.366	-0.164	-0.176
PT			1	-0.188	-0.215
Other				1	-0.096
Car					1
Eigenvalues					
factors	F1	F2	F3	F4	F5
Eigenvalue	1.378	1.201	1.112	0.964	0.346
%	27.6	24.0	22.2	19.3	6.9
% cumul.	27.6	51.6	73.8	93.1	100.0
Correlations between variables and factors :					
Walk	-0.179	-0.464	0.262	0.819	0.119
Velov	-0.781	-0.322	-0.299	-0.312	0.317
PT	0.855	-0.333	-0.168	-0.113	0.342
Other	-0.061	0.257	0.909	-0.234	0.222
Car	-0.041	0.839	-0.315	0.360	0.255

However the first factorial plane (F1 and F2) accounts for more than half of the overall variance of the observations (51.6%). Figure 1 shows the correlations between the axes and the variables. There is an opposition along the first axis between Velov and public transport (PT). This means that users having a more intense use of Velov use less PT and vice versa. The second axis is correlated with the intensity of car use, and by nature uncorrelated with the first axis and its associated variables. This indicates that Velov annual members may use intensively or not the car independently of their use of Velov or public transport.

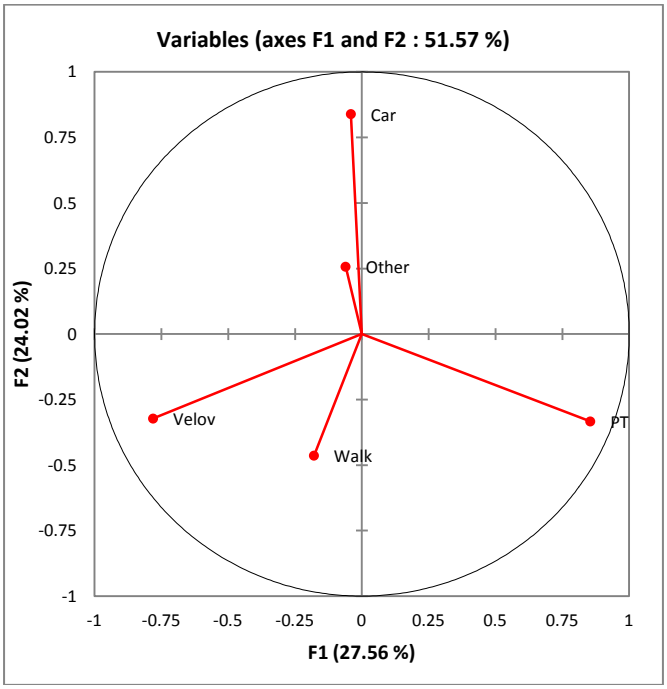

Figure 1: PCA first factorial plan on the use of travel modes by Velov annual members from Monday to Friday

4 DISCUSSION AND CONCLUSION

The analysis of the profile of Lyon's Velov annual members has shown that they are rather male, under 30 years of age, holders of a public transport season-ticket and a car driving license. Moreover, rather than being students they are working on higher social positions such as managers or professionals, opposite to middle managers, employees or workers.

This age profile is also observed in Montreal Bixi scheme (Morency et al, 2011) or in Washington Capital Bikeshare scheme (Buck et al, 2013). However in Washington CaBi users are rather female and have lower household incomes, but compared with Washington DC area cyclists (a sample we don't have in Lyon).

This last finding regarding income could be seen in opposition with ours (recall that we could not record income but we have a proxy to income with the job social position). A question then arises whether the individual registers to the service because of either her higher social position (or income) or her residential location next to a station, or even because stations are rather located in wealthy area.

Our results can give at least partial answers to this question. Firstly the proximity to stations has a significant positive effect on the probability to register to the service, a finding which is line with that of Bachand-Marleau et al (2012) for Bixi Montreal. Secondly, as shown previously the Velov station density per district is not correlated with the average wealth of Lyon's districts. From this we can reasonably conclude that the individual and the

spatial effects can be separated. An individual higher social position *and* the residential proximity to stations have both separate and positive effects on the probability of being an annual member of the service.

When it comes to travel means and behavior, we have seen that Velov annual members are not captive from public transport even if they hold a PT season ticket in higher proportion compared to the reference population. The majority of them hold a car driving license and furthermore nearly half of them have a car for their sole use, not counting those who can get access to a private car some time on working days.

In their day-to-day travel behavior Velov is one travel mode among others, not necessarily the preferred one. When comparing Velov annual members to the general population both Velov and public transport appear on average as substitutes to car or walk. Considering travel purpose, Velov is used as any other travel mode, and even in a higher proportion for commuting. This is an indication that for Velov annual members Velov has become a feature of everyday life.

Finally, when it comes to the multimodal behavior of Velov annual members along the working days there is an overall tendency of members to use with a similar intensity all the modes available. In the same time there is a trade-off between Velov and public transport, independently of the intensity of car use. This latter behavior is probably based on opportunities available at the time of each trip – and of course weather conditions.

To sum up, even if Velov is an everyday life travel opportunity for its members, it would convey a picture of a travel mode attached to higher social positions when opposed to other positions. The proximity to stations does not do everything for joining the service. Given the low cost of the annual membership, one can presume a kind of social or psychological barrier hindering access to the service.

One of the main perspectives of this research would be to compare these findings with other cities with bike sharing schemes where data on socio-demographic profiles and multiday travel behavior would be available.

ACKNOWLEDGEMENTS

We acknowledge the financial support of the French “Agence Nationale de la Recherche” (Grant ANR-12-SOIN-0001). We also thank our colleagues Bruno Faivre d’Arcier and Nicolas Ovtracht for their contribution to the elaboration of the questionnaire and the operator JCDecaux-CycloCity for their support.

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