

Mobility habits of the cross border commuters in Geneva: Who uses public transport?¹

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Summary

This paper describes mobility habits of cross border commuters and its determinants in the canton of Geneva, with special emphasis on the use of public transports. At least one fifth of Geneva's labour force is composed by cross border workers coming from France. Our first findings show that the car is the main mean of transport used to go to work by this population. The main point is that, even though the canton of Geneva has a relatively good network of public transport, its use by cross border commuters remains minimal. Moreover, the "park & ride" system, combining car and public transport is used only by a very little proportion of cross borders. The propensity to use the car increases as the distance from home to work decreases, while the propensity to use public transport decreases significantly when people have to do more than one change. Our estimations clearly suggest that men are less likely to use public transport, and that public transport cannot be considered as a normal good for cross border commuters.

Keywords

Mobility, cross border commuters, Geneva, transport choice, public transports

Résumé

Ce papier présente les résultats d'un sondage réalisé au printemps 2007 auprès d'une population d'environ 600 pendulaires dont une très large majorité sont des frontaliers actifs sur le marché du travail du canton de Genève, et ce afin de pouvoir décrire leurs habitudes de déplacement lorsqu'ils se rendent à leur lieu de travail. Les informations récoltées nous permettent d'identifier et de tester certaines hypothèses quant au comportement d'une population qui a quasiment doublé entre 2002 (entrée en vigueur des bilatérales) et fin 2008. Genève étant le centre d'une agglomération (franco-valdo-genevoise) dont la démographie en termes de population et d'emploi de ces dernières années est la plus élevée des régions et cantons de France et de Suisse.

Sans surprise, la voiture est le principal mode de transport utilisé. Malgré un réseau de transports publics genevois dense et de qualité, connecté aux réseaux des transports publics de l'Ain et de la Haute Savoie, les frontaliers n'utilisent ceux-ci que de manière minime, avec toutefois une différence marquée entre les hommes et les femmes. Plus étonnant, seule une part minime des frontaliers utilise le système de « park & ride » (P+R) : 4% chez les hommes contre 10% chez les femmes.

Le tableau ci-dessous résume les principaux résultats obtenus par le biais d'une analyse économétrique. Il montre l'impact marginal de chacune des variables considérées sur la probabilité (propension) à utiliser les transports publics comme principal moyen de transport pour se rendre à son lieu de travail. Nos résultats montrent :

- que les femmes utilisent plus fréquemment les transports publics que les hommes : +10% à parité d'autres choses) ;
- le fait d'être à moins de 30 minutes en voiture de son lieu de travail diminue la probabilité d'utiliser les transports publics de 24.5% ;
- alors que le fait de ne pas avoir à faire de changement ou un seul au maximum lorsque l'on utilise les transports publics augmente la probabilité d'utiliser ces derniers de 48.7% ;
- les frontaliers provenant du département de l'Ain ont une propension à utiliser les transports publics qui est 16.3% plus élevée que celle des frontaliers ayant habité en Haute Savoie.

D'autre part, les transports publics ne peuvent être considérés comme un bien normal pour les frontaliers actifs à Genève : l'effet négatif du revenu salarial sur leur propension à utiliser les transports publics s'explique en partie par le fait que tout accroissement de leur salaire accroît de fait leur probabilité d'avoir une voiture (ou plus) dans le ménage. De manière générale, on observe également que la satisfaction vis-à-vis des transports publics (en termes de prix, de fréquences et d'aires desservies) accroît considérablement la probabilité d'utiliser ces derniers. C'est donc essentiellement par un accroissement de la qualité du réseau des transports publics (fréquences, aires desservies) que l'on peut diminuer l'effet négatif de la croissance du revenu (moyen) des frontaliers sur leur propension à utiliser les transports publics pour se rendre à leur lieu de travail.

Variables	Impact marginal (en % et <i>toutes choses égales par ailleurs</i>)
Distance en temps inférieure à 30 minutes en voiture	-24.5
Au maximum un changement en transports publics	+48.7
Satisfait avec le niveau des prix pratiqués par les transports publics	+11.6
Satisfait avec les fréquences de passage	+15.9
Satisfait avec les aires desservies	+18.5
Homme	-10.0
Faible salaire (< CHF 3'000.- nets mensuels)	+14.3
Haute Savoie	-16.3

1. Introduction

Geneva's geographic situation is singular. This Swiss little urban canton shares over 100 km of frontier with France (i.e. the departments of Ain-01) and Haute-Savoie - 74), and only 4 km with the neighboring Swiss canton of Vaud (i.e. the region of Nyon). Therefore Geneva has always known a high number of cross border commuters among its labour force (counting almost 310'000 people). This fraction has raised since the economic upturn in 1998 and more significantly since 2002 when the Agreement on the Free Movement of Persons (AFMP) between Switzerland and the European Union (EU) entered into force. In the middle of 2007, there were 52,000 cross border workers, the highest number up to now. Between 2001 and 2007, the growth of cross border workers has reached by more than 60 percents.

Actually, the canton of Geneva is the centre of an agglomeration of almost 800'000 people which creates jobs at noticeably higher rates than the figures associated to both France and Switzerland. Since 2001, employment for example has increased by more than 10% in the canton. Demography rates have been also very important for the agglomeration as a whole these past years, but more particularly in its center. However, the "initial" gap in terms of housing prices between both the french departements and Geneva has been sufficiently high to stimulate the "migration" from the center to the french periphery increasing consequently the number of cross border commuters². Issues related to cross border commuting has thus become a central question for local authorities, particularly in Geneva, given the intensification of road traffic in its centre as well as in its periphery.

This paper presents the results of an empirical analysis based on a survey counting initially almost 600 cross border commuters from France to Geneva. It was conducted in order to know more about the ways these people commute to their workplace in the canton of Geneva and about their perception of daily trips and of public transport service quality. This survey reflects some aspects of the regional sustainable development linked to the quality of life, the reduction of pollution by adopting "light" means of transport. It also raises some issues proper to the Geneva agglomeration such as the smallness of the city, its borders and questions related to the behavior of workers whose vast majority commutes by car. The Swiss Federal Statistical Office carried out a census in 2000 on the commuters and the urban areas. It gives a first idea of the situation, although no specific studies about cross border commuters has been conducted. This synthesis puts the light on the modification of the cities' structure as well as the mobility habits. Two surveys (2002 and 2005) done by *the Cantonal Department of Regional Public Transports* focus on commuters in

² Actually, the number of cross border commuters is larger than the 52'000 people working in a regular basis in the canton of Geneva in 2007, and even larger than the almost 60'000 cross border permits officially delivered by the canton, because many people having migrated to the French periphery still prefer the fiscal and/or administrative conditions offered in Geneva.

Geneva (from the Swiss canton of Vaud and from France). The mobility is increasing, in particular the car traffic. The part of commuters using public transport is also increasing. But a more attentive look at the situation shows a huge difference of utilization between commuters from Vaud and commuters from France. The public network between France and Geneva's city centre remains indeed unsatisfying. Its improvement is therefore a priority in the local political agenda, particularly the implementation of the CEVA rail project³. This will obviously offer more choices for cross border commuters, particularly for those coming from the departement of Haute-Savoie.

Actually, however the choice offered to cross border commuters coming from France is quit limited, in the sense that there is no real choice about public transport in and around the canton of Geneva: buses and tramways are essentially complementary, and there is only one fare for both means of transportation. It is therefore not possible to build a model, for example, as the one used by Asencio (2002), who studied the mode choice by commuters to Barcelona by using a two-step methodology in order, first, to determine whether or not commuters choose public transport and, secondly, which type of public transport (i.e. train or bus) they take.

Beside the fact that we can not analyse the effects of fares, the questionnaire related to the survey we use was not originally built to make a complete analysis of the demand for public transport in and around the canton of Geneva (see for example the survey of Paulley et al., 2006 for a complete view of factors affecting the demand for public transport). However, the survey provides enough information on public transport quality perception, journey times and socio-economic variables to analyse some important determinants of the use of public transport by cross border commuters. Due to the fact that little qualitative data is available on that specific topic, the first goal of our paper is to give a statistical description of mobility habits of surveyed cross border commuters and, secondly, to analyse the determinants of the choice related to the mode of transport using maximum likelihood models and social economical variables, journey variables, as well as perception of public transport quality service variables.

In order to extract maximum information from our sample, we made three types of estimations which fundamentally differ from the explained variable. In the first one, the explained variable is a non-ordered categorical variable describing which type of transportation mode is mostly used by cross border commuters. In the second one, the explained variable is an ordered categorical variable describing how intensively public transport is used by cross border commuters. In the last one, we simply use the binary information on the use of public transport.

³ (CEVA : Cornavin-Eaux-Vives-Annemasse). This project will linked the main's Geneva train station (north of the city) to the French city of Annemasse which is closed to the south-east border of the canton of Geneva.

The paper is organized as follows: Section 2 presents a description of the data. Section 3 gives the models used for the different estimations. In Section 4 the results are presented and discussed. The last section concludes.

2. Description of the data

The data base used in this study was collected by the LEM (Laboratoire d'études de marché) of the Geneva School of Business Administration during the spring of 2007. The survey was conducted on the basis of face to face interviews which took place, either at different borders between France and the canton of Geneva or at the cross-borders' workplace. Almost 600 questionnaires were collected. Once unavailable interview-sheets have been discarded and observations for which one or more main variables were missing have been eliminated, our final sample contains 469 observations. Concerning the socio economic characteristics, the sample contains 53% of men; one out of two surveyed cross borders is between 25 and 50 years old; 72% live in the department of Haute-Savoie; 82% work full-time; and a large majority (70%) earns a monthly net labour income lower than CHF 5500.⁴

Table 1 summarizes all the variables used in this paper, and gives a brief definition of each of them. To describe the mobility habits we focus only on three categories of means of transport: 1) cars (and other motorized vehicles), 2) public transport (and the others light means of transport), and 3) a mix of both⁵. No particular attention has been paid to motorbikes and pushbikes. They are included either in the first category (if it is a motorbike or a scooter) or in the second (if it is a bike). Indeed, there were too few observations⁶ to add two more different groups for the two wheeled means of transport (motorized or not). The related variable of interest is the main mean of transport used.

Table 2 summarizes the means of the main variables, by sex; the mobility habits vary considerably in accordance with. The most common and used mean of transport is without any doubt the car: 58% of women use it against 79% of men. Such a difference has been already founded in previous studies or others censuses; Geneva's case doesn't seem to be an exception.⁷

Although 28% of women use public transport against 17% of men, the difference between genders is relatively higher among people using more frequently a mix of car and public transport: 13.7 % for women and only 3.6% for men.. We used a chi-square test to define more specifically the relationship between these two variables.

⁴ Comparing with official statistics at the cantonal level (e.g. 62% of cross borders are men, 74% are between 25 and 50 years old, 79% comes from the department of Haute-Savoie), we can see that our sample has a relatively good representativeness.

⁵ This category is usually associated with what is generally called "park and ride" (P+R). The principle is that you can enjoy a reduced price by combining car parking and public transports.

⁶ The sample has only 39 motor bikers and 8 bikers.

⁷ See, for example, Haug and Schuler (2003) or Hensher (1998).

This test assesses the null hypothesis of independence between the two variables. The result indicates a statistically significant relationship. Women take more public transport and combine more public transport with cars than men.

Table 1: Variables definition

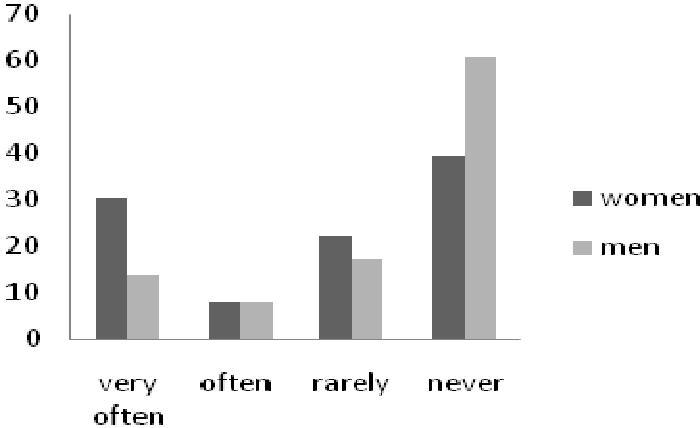
Variable	Definition
Statistic descriptive variables	
Mean of transport	Most frequently mean of transport used =1 if the mean of transport is a car (or a motorbike) =2 if the mean of transport is public (or light) =3 if the mean of transport is a mix of both ("park & ride")
Social economical variables	
Man	=1 if it is a man; =0 if it is a woman
Age	=1 if the commuter is over 25 years old; =0 otherwise
Full time	=1 if the commuter has a full time job ($\geq 90\%$); =0 otherwise
Low income	=1 if the monthly labour income is less than CHF 3'000; =0 otherwise
Haute-Savoie	=1 if the commuter lives in Haute Savoie; =0 otherwise (Ain)
Journey variables	
Less than 30 minutes trip	=1 if the trip is less than 30 minutes using an individual motorized vehicle; =0 otherwise
Number of changes	Number of changes you may have if you take public transport =1 if the number of change is one or none; =0 otherwise
Perception variables	
The public transport's price	=1 if the commuter is satisfied; =0 otherwise
The public transport's frequencies	=1 if the commuter is satisfied; =0 otherwise
Areas served by public transport	=1 if the commuter is satisfied; =0 otherwise

Table 2: Descriptive statistics (mean), N = 469

Variable	Women	Men	Total
Mean of transport			
Use of car	0.578	0.790	0.684
Use of public transport	0.284	0.173	0.223
Use of a mix	0.137	0.036	0.087
Social economical variables			
Low income	0.351	0.234	0.286
Haute Savoie	0.720	0.722	0.721
Journey variables			
Car: Less than 30 minutes trip	0.393	0.504	0.453
Public transport: One or no change	0.398	0.242	0.314
Perception variables			
The public transport's price	0.351	0.234	0.286
The public transport's frequencies	0.351	0.262	0.303
The public transport's areas	0.336	0.250	0.290

Figure 1 hereafter shows the frequency of the degree of utilisation of public transport by sex. The gap between men and women is the biggest at the extremes, which are for the answers *very often* and *never*. It is very clear that women use public transport more frequently. And nearly 60% of the men say they never use them.

Figure1: Use (%) of public transport



In order to measure the impact of the daily trip on mobility choice and then in particular on the decision to use the public transport, we use two journey variables. The variable measuring the duration of the trip is associated to the following precise question:

“How much time it would take you to commute from home to your work by using a car?”

We then suppose that people have relatively good perception of the alternative mean of transport they generally use. We make almost the same assumption when we ask people about the number of changes they (would) have to do if they use(d) public transport to commute from home to their workplace.

The number of changes people may have to make when taking public transport is different between men and women. However, the survey presents always a possibility of bias and here it comes from the interviewed cross border commuters’ subjectivity. This huge difference can not be explained. Obviously men and women do not live separated into specific areas. Therefore, this result suggests rather a perception than a fact. This unexpected outcome finds also an explanation in the inclusion of public transport user (they know exactly the number of changes they have to make) as well as non users in the sample answering the question. We suppose anyway a positive impact of both variables (duration of the trip and the numbers of changes) for the light mobility choice and for the use of public transport. If the commuters live near the border of the canton and/or if the trip is direct, they should be more likely to use light modes of transport.

The perception variables differ also considerably between men and women. These variables give the opinion of the cross border commuters on different aspects of public transport service quality (public transport prices, frequencies and covered areas). In average, 27.6% of men and 31.6% of women are satisfied. In a general point of view, which means for different aspects of the Genevan public transport, women are always more satisfied than men. We expect to find also a positive impact. It seems coherent to use more often public transport if you acknowledge the quality of these different services. After a decomposition of the result concerning the use of public transport in order to capture a “real” perception of the public transport service quality, the results are very clear. The perception is more positive among the public transport users. It is interesting enough to see that the negative perception comes essentially from the commuters who do not use public transport⁸.

Figure 2: Distribution (%) of monthly labour income and mode of transport

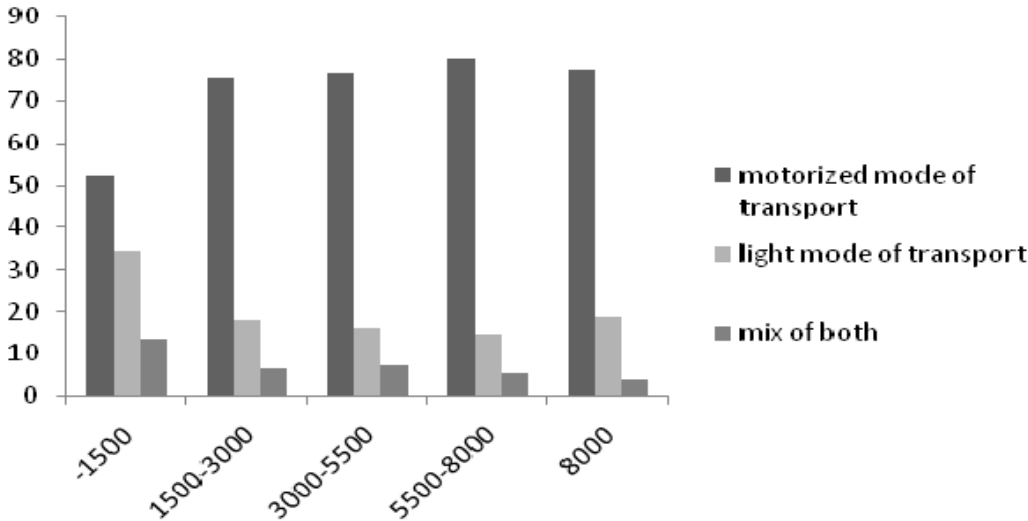


Figure 2 shows the distribution of the cross border commuter’s monthly labour income. The outline of the distribution is almost the same for men and women, with a peak for the income between CHF 3’000 and CHF 5’500 per month⁹. However, as it is generally observed, men’s distribution of labour income is more skewed to the right compare to women. The proportion of women earning less than CHF 3’000 per month is nearly 50 percent higher than men. Beyond the difference between men and women, Figure 2 shows the potential link between the labour income and the mean of transport used to commute to the center.

⁸ One question of the survey provides this information.

⁹ 1 euro = CHF 1.50 approximately

Assuming that public transport is a normal good, an increase in income leads to an increase in public transport demand. However, an increase in car ownership leads to a reduction of the public transport demand. The negative impact of income on public transport appears only through this relation. As car ownership growth slows and reaches saturation, this negative effect will diminish. It will also vary depending on the level of income. Income is therefore the key determinant of car ownership¹⁰. The question to test using maximum likelihood is to know whether and how income differences affect the propensity to use public transport among cross border workers

3. Modeling choice

In our intent to analyse the determinants of mobility habits of cross border commuters, we choose to use all the possible measures extracted (directly or indirectly) from the sample survey. Because the sample is basically non random, we use three variables that are different in nature; the first is multinomial, the second ordered and the last binary.

The first step concerns the determinants of the mode of transportation choice, which requires the use of a multinomial probit. As Mc Fadden (1974) in his seminal paper, we model the individual choice of mean of transport as a maximisation utility problem. Cross border commuters have three possible means to commute from home to their workplace (anywhere in the canton of Geneva):

- $m = 1$: by individual motorized vehicle (mainly car¹¹);
- $m = 2$: by using a light mean of transport (mainly public transport: bus and/or tramway)¹²;
- $m = 3$: by using a mix of individual motorized vehicle and public transport ("Park and ride" system).

The individual choice is supposed to be motivated by a random utility model. Hence, for the i th cross border commuter faced with a multiple choice, the utility he benefits from choosing m is U_{im} , and we assume that is the maximum among the m possible utilities. Statistically, we thus suppose that the model is driven by the probability that choice m is made, which is:

$$Prob(U_{im} > U_{ik}) \text{ for all other } k \neq m \quad [1]$$

The determinants of this probability are the socio-economical variables, journey variables and perception variables as defined in Section 2. This model is called Model I.

¹⁰ In the last twenty years, income and car ownership growth are becoming the key factors that have shaped personal travel (cf. Pauley et al., 2006).

¹¹ This group includes, as mentioned before, 39 cross border commuters using a motorbike.

¹² This group includes, as mentioned before, 8 cross border commuters using a bike.

In the second estimation, we analyse the outcomes of the question: « How frequent do you use public transport? ». The responses describe therefore how intensively public transport is used by cross border commuters. Given that the outcomes are ordinal in nature (as very often in the opinion surveys), we use in this case an ordinal probit model, which allows to take into account multiple ranked categories. We suppose that there is a latent variable, y^* , which is unobservable and has the following form:

$$y^* = X\beta + \varepsilon \quad [2]$$

where X is the vector containing the explanatory variables (i.e. socio-economical variables, journey variables and perception variables) and ε is the error term. Let y_i be the observable ordinal variable that is the responses obtained from cross border commuter i . It takes the value $j=1\dots 4$ ¹³ according to the following scheme:

$$y_i = j \Leftrightarrow \mu_{j-1} < y_i^* \leq \mu_j \quad [3]$$

where $\mu_0 = -\infty$ and $\mu_4 = +\infty$ and the others μ are the cut points. This model is called Model II.

Finally, in order to focus on the use of public transport, we estimate a simple bivariate probit model. We transform the ordinal variable, y_i , explained in Model II, as z_i in the following way:

- $z_i = 1$ if $y_i = 1$ or $y_i = 2$; and
- $z_i = 0$ if $y_i = 3$ or $y_i = 4$.

We thus have:

$$z_i = \begin{cases} 1 & \text{if the commuter } i \text{ usually uses public transport;} \\ 0 & \text{if the commuter } i \text{ does not usually use public transport.} \end{cases}$$

And the probability to use public transport is:

$$P(z_i = 1|x_i) = P(z_i > 0|x_i) \quad [4]$$

Where x_i is the values of vector X (see Equ. [2]) for commuter i . The probit regression model is in this case given by:

$$y_i = 1 [x_i'\gamma + \varepsilon_i < 0] \quad [5]$$

The interpretation of the coefficients included in the vector γ of this model is very tricky (same for Model I and Model II) because they measure the change in unobservable dependent variable associated with a change in one of the explanatory variables. Only the statistical significance and the signs of the estimates can be interpreted directly. We thus decide to transform the parameters associated to this

¹³ Where 1=very often, 2=often, 3=seldom, 4= never.

vector (and the same for the vectors of parameters in Model I and Model II) in order to obtain the marginal effects that are the discrete changes in the probabilities for dummy variables¹⁴. The following section presents the results of the marginal effects associated to the three models presented.

4. Results

The estimation results of the three models discussed before are shown in Table 3. As mentioned previously, we focus on the marginal effects related to each determinant considered in the different models. The estimated effects are mostly statistically significant and for almost have the expected sign. Furthermore, by comparing Model II and Model III, we can see that there is a certain consistency in what concerns the signs of the estimates.

In Model I, the effects related to the category of car vehicle and to the one associated to public transport always have an opposed sign, but not the same magnitude. This means, for example, that the probability to choose the car decreases by, *ceteris paribus*, 39% when taking public transport would or does not imply more than one change. Although, in the same situation, the probability to take public transport is “only” 27% higher.

When the trip is no longer than 30 minutes, the probability to use a car is higher and the contrary, but in a less extent, is observed in what concerns the probability to use public transport. This result is quite surprising in the sense that appears to be counterintuitive in spite of the significance of the estimates. One possibility is that the use of a car is not be linked (or at least not only) to the trip duration, it can also be explained by the fact that one third of cross border commuters requiring less than 30 minutes to go to their workplace enjoys there a private carplace.

¹⁴ Note that all the explanatory variables used in the different models we estimate are dummy variables.

Table 3: Probit results

Variables	Model I : multinomial probit “What mean of transport do use more frequently?”			Model II: ordered probit “How frequent do you use public transport?”				Model III: binomial probit “Is public transport your first choice to commute work?”
	Car	Public transport	Mix of car and public transport	Very often	Often	Seldom	Never	=0 : no =1 : yes
Car: Less than 30 minutes trip	0.225***	-0.160***	-0.642***	-0.117***	-0.050***	-0.045***	0.211***	-0.245***
Public transport: One or no change	-0.391***	0.271***	0.119***	0.361***	0.089***	0.010	-0.459***	0.487***
Public transport: Agree with the prices	-0.146**	0.123**	0.024	0.063**	0.024*	0.017**	-0.104*	0.116**
Public transport: Agree with the frequencies	-0.222***	0.195***	0.027	0.115***	0.042***	0.025***	-0.181***	0.159**
Agree with the areas				0.087**	0.033**	0.021**	-0.140**	0.185***
Man	0.108**	-0.080*	-0.028	-0.100***	-0.040***	-0.032***	0.172***	-0.100**
Low income	-0.110*	0.109*	0.002	0.093***	0.035***	0.021***	-0.149***	0.143**
Haute Savoie	0.186***	-0.155***	-0.030	-0.086**	-0.032***	-0.020***	0.138***	-0.163***
Age	0.153**	-0.103*	-0.050					
Full time	0.002	0.079*	-0.082**					
N		459				469		469
Log likelihood		-251				-463		-175
Pseudo R2		----				0.237		0.403

Notes: *** statistically significant at the 0.01 level, ** statistically significant at the 0.05 level, * statistically significant at the 0.1 level.

Interestingly enough, the fact that agreement with public transport's prices and frequencies has a bigger impact (1.4 times) on the probability to use a car than on the probability to use public transport.

The estimates show that the probability of using a car is 11% higher among men than for women. This result consolidates the descriptive statistics; mobility behaviour clearly differs between genders. As found by Mackett (1990), such a difference between men and women could be explained by the fact that men tend to have higher fares elasticity than woman in what concerns public transport. The age has a positive (negative) impact on the probability to use a car (public transport).

Only one quarter of cross-border commuters came from the department of Ain. They have a higher propension for both public transport and the mix of car and public transport than cross borders coming from the other department, Haute Savoie.

The income class also has a significant impact. It influences choices between transport modes. The probability to take public transport when you earn less than 3'000 Swiss francs per month increases by 11%. The income effect is clear, suggesting that public transport is an inferior good for cross border commuters. We can suppose that when the median income of this population increases (as in recent years), car ownership increases, reducing therefore their probability to use public transport. In a simple way, we can deduce that people use public transport when their income is relatively low and then, when it grows, they switch for a car. This result is supported by Liu (2007), who shows that the bicycle, the bus and the subway are inferior goods.

It is more complicated to give a conclusion for the latest outcome of this first model. Only three variables are significant for the determination of the choice of using a mix of car and public transport. However, having a trip duration lower than 30 minutes reduces by 64% the probability to use such a mix. An effect almost three times larger than for the probability to use a car.

In Model II, the results of the ordered probit give the expected estimates. We clearly see the difference between the answers on the one hand of *very often*, *often*, *seldom* and on the other hand of *never*. In order to know if we really have four categories of outcomes, we test the three cut point¹⁵ to see if they are significantly different from each other, and it is the case.

However the easyness with which one can read and interpret the results is not optimal because of these four outcomes. In the optic to have direct, easy and apparent results, we estimate a simple bivariate probit model. As discussed previously, we regroup the results for *very often* and *often* and them for *seldom* and *never* on the other side. The last column of Table 3 gives the marginal effects of this regression.

Concerning the journey variables, the number of changes always has the biggest impact. The duration of the trip gives the same result of Model I and we can clarify it

¹⁵ In our case, $\mu_1 = -0.018$, $\mu_2 = 0.790$ and $\mu_3 = 1.190$

with the same explanations. The perception variables give the expected results, in the sense that if commuters agree with the price, the frequencies and served areas, they are more likely to use public transport. The probability to use public transport increases, for example, by almost 16% when commuters agree with public transport frequencies. As noted, the men's probability to use public transport is 10% smaller than for women. Low class income have a higher propensity to use public transport. Thus the assumption that public transport is not a normal good for cross border commuters is then reinforced.

5. Conclusion

Today, Geneva is the centre of an agglomeration counting almost 800'000 inhabitants, which creates jobs at noticeably higher rates than the figures associated to both France and Switzerland. Geneva and, in a less extent, the two French departments (i.e. Ain and Haute Savoie) composing this agglomeration have a relatively large public transport's network. The population of cross border commuters coming from France and working in the canton of Geneva is almost one fifth of its total labour force. With the help of a survey sample, our analyze tries to understand the determinants of the mobility choice of this population.

The first result is that cross border commuters use in a large majority their car to go to work. Only a minority use public transport in a regular way. Indeed, it is quite surprising how the system "park and ride" (P+R) offered by the Geneva's public transport is seriously underused by cross border commuters: actually, less than one out of fifteen use this facility to commute.

Actually, to answer our main question: "Who is the cross border worker commuting by public transport?", the profile of this user according to our survey is a woman who is a low-wage earner, who has a relatively good perception of the public transport network offered by the canton of Geneva and who is living in the department of Ain. The propensity to use the car increases as the distance between home and work decreases, while the propensity to use public transport decreases significantly when the user has more than one change to do.

Globally, our study gives a partial but first picture of mobility habits of cross borders commuters coming from France in the canton of Geneva regarding the mean of transport they more frequently use to commute from home to work. However, it could be interesting to develop studies based on travel-to-work data (as used for example in the paper of Vega and Reynolds-Feighan, 2008) and/or studies integrating price differentials in the housing market in order to aquire a better understanding of the dynamics characterising the mobility habits in an highly dynamic agglomeration which is rapidly approaching the million of inhabitants.

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