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Are commuters in Lugano ready to leave the car? Evaluating conventional and innovative solutions to facilitate the switch.

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Abstract

Nowadays society exhibits an increasing dependence on private car use for commuting: city paralysis, pollution and resources waste are main effects of this conduct. In spite of technological innovations, it is necessary to reduce the volume of individual motorized means in order to improve environmental quality and to decrease congestion. However, are people ready to live in a post-car world? Which conditions would encourage them to do so? In this study, we examine through a stated preference (SP) experiment to what extent new generations are willing to accept new possibilities for mobility and spatial development. Specifically, we include car-sharing, car-pooling and a new public transportation system named moving walkway. *Travel time*, *cost* and *move or being moved* (a sort of transport system density measured in walking km needed to cover the distance work-home) are the attributes that describe all the alternatives. The research is based on data collected among students at Università della Svizzera Italiana (USI) and Scuola Universitaria Professionale della Svizzera italiana (SUPSI) through a structured survey.

Keywords

Stated choice experiment – commuting – moving walkway

1. Introduction

Nowadays more and more people decide to use a private car for their own transfers: in Switzerland, approximately 65% of transfers per year (independently from the reason) is done using an individual motorized transport mean (car and motorbike). Commuting is the second reason (24%) for travelling after leisure and the most preferred mean is an individual motorized one (from almost 55% in Zurich to 83% in Ticino) (Bundesamt für Statistik, 2010).

In addition to pollution, the excessive car use is causing several problems for the quality of urban life and the accessibility of destinations. In order to restrict congestion and improve environmental quality, we should reduce the volume of individual motorized means. It would be useful to understand which reasons underlie the car use so that policy measures could aim at these factors.

Our purpose with this work is to investigate to what extent new transportation solutions could be accepted by young generations exploiting discrete choice modelling (McFadden, 1984) (Ben-Akiva, Lerman, 1985).

2. Literature review

This research is undertaken in the general context of sustainable transport. An important amount of research and literature in this field has been produced over the last 20 to 30 years (for a recent overview see e.g. Schiller et al. 2010; Enoch 2012). This literature is mostly based on a mix of normative assumptions and projections of empirical research. A typical statement to be found in this literature is “There is now broad agreement that the present trends in world transport are not sustainable.” (Greene & Wegener 1997, p. 177). However, there is less agreement on how sustainability in transport can be achieved. The dominant policy orientation across all contexts (urban and rural, short and long distance, commuter and leisure traffic) consists in various combinations and measures of promoting public transport on the one hand and restricting car traffic on the other.

Several authors highlighted the need of policies that can reduce private transport dependence as well as the need for driving by providing alternatives to driving rather than imposing new taxes on gasoline that seem to have no relevant effect. According to many authors and policymakers (for instance Gärling, Schuitema, 2007), an improvement in the public transport service promoting a shift to slower and clean modes, could reduce the attractiveness of car use. While this recipe seems to work in some urban context, the overall result is often a general increase in traffic – both public and private.

In effect, despite the increasing fuel price and tolls, the growing congestion and the limited access to the city center, car use is still growing: that is why it seems not only dependent on instrumental factors as flexibility, comfort, independence. Indeed, symbolic (car is a mean to express your social position) and affective (emotions evoked by driving a car) factors play an important role in choosing the car for a travel (Steg, Vlek, Slotegraaf, 2001): feelings of power, freedom, superiority, prestige and arousal are manifestations of these factors. Particularly, people are inclined to commute more often by car when

they judge its symbolic and affective functions more favorably (Steg, 2005). Young respondents valued the symbolic and affective function of car use more strongly than the other age groups did (Steg, 2005).

Including specific psychological predictors explains a significant proportion of variance in people's mode preferences across situations (Klöckner, 2011). For this reason, travel choice policy interventions should aim at the inclusion of both structural and psychological factors: indeed, socio-structural contexts and individual's problem awareness, attitudes, norms are important components of travel decisions (Noblet, Thøgersen, Teisl, 2014).

The research presented here is motivated by the basic dilemma inherent in intergenerational redistribution, i.e. to forego own current benefits in favor of others future well being. If the future is to be shaped by sustainable transport solutions, a relevant research question regards factors that hinder the implementation of such policies. This is the issue we tackle in the project presented here.

This work tries to investigate the effect on commuting of a futuristic transportation solution, like moving walkway, and recent solutions, like car-sharing and car-pooling, as well as the extent to which they can help leaving the car. An instrument used for this purpose is the willingness to pay: in fact, a crucial issue in choosing transport mode is the *value of the travel time*. Several decisions in transport sector are an effect of savings that people can achieve in travel time. Any travel time saved during the working day realizes an economic value represented by a shift from unproductive to productive time (DETR, 2000). Traditionally, travel demand is considered as an entirely derived demand: it just concerns the need to reach a destination. However, some theoretical or empirical investigations highlight the "intrinsic utility of travel": ideal commuting time does not tend to zero (Young, Morris, 1981); it is not unequivocally a disutility to be minimized, but rather there is an optimum to be achieved, which can be violated in either direction (Redmond, Mokhtarian, 2001). For commuters, travel time is not only a cost, but often considered very worthwhile (Lyons, Jain, Holley, 2007). It brings to the conclusion that some people do not only drive their car because they need to go somewhere, but also because they love driving (Beirão, Sarsfield Cabral, 2007). Therefore, it should be studied how this latent construct hinders the switch from the car to "non-driving" modes.

3. Data and design

3.1 Data and sample description

The present work belongs to a project granted by SNF started in December 2013 at which "Università della Svizzera Italiana", "École polytechnique fédérale de Lausanne" and "*Eidgenössische Technische Hochschule Zürich"* collaborate*.* The survey is conducted through a paper questionnaire consisting in three sections*:* the first one regards ideal transportation mode choice for commuting; the second section is referred to the attitudes towards car use and the last section concerns socioeconomic characteristics. So far, we collected 210 questionnaires at USI and SUPSI.

The majority of respondents are male (56%) and the average age is 21.5 (9% of the sample is over 25). Given their student status (88%), 81% of the sample earns less than 30k CHF/year (see Fig. 1).

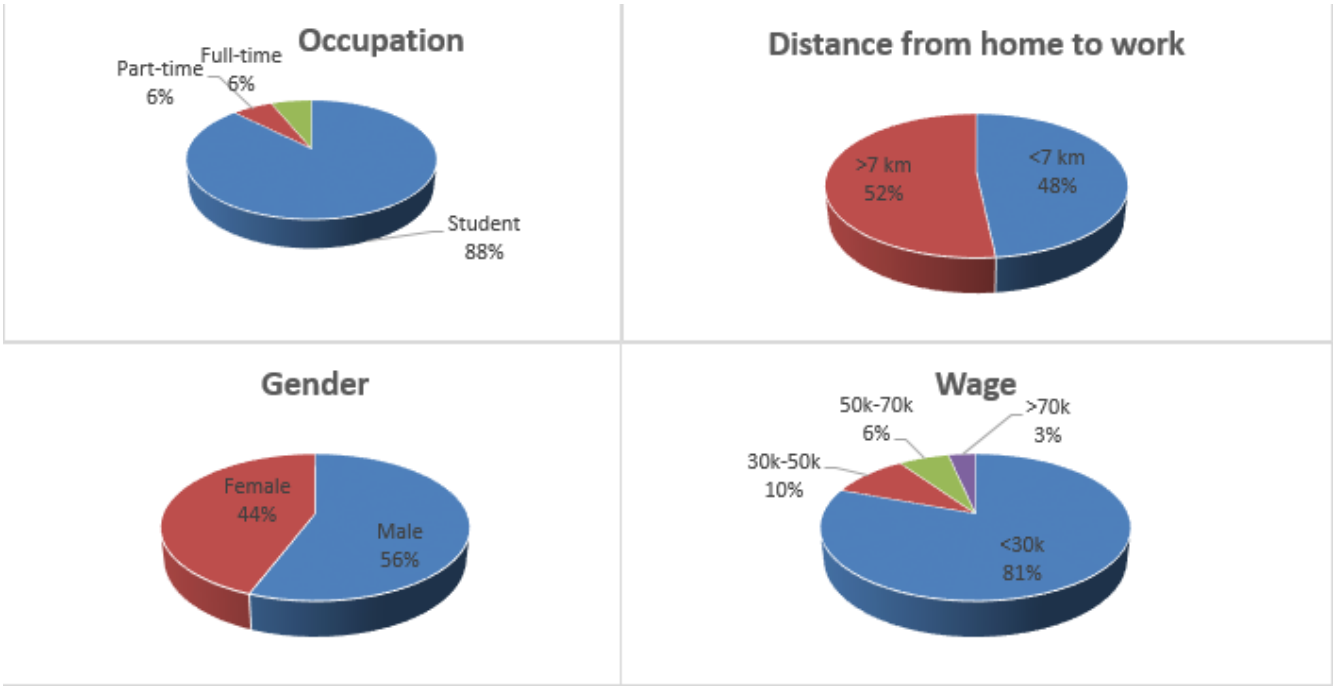

Fig. 1: descriptive statistics

More than half of the respondents actually choose to commute by Public Transport (52%) and just 20% by car or motorbike. Regarding the results of our experiment on stated choices (see details below), a steep decrease of the public transport share (from 52% to 10%) in favor of car and motorbike (from 20% to 39%), and a huge increase of bike/e-bike (from 3% to 36%). Note that 52% of respondents actually live more than 7 km from the university/workplace, making commuting by bike impossible, while in the stated experiment the distance is fixed to 2.6 km (see Table 1).

	PT	Bike/E-bike	Walking	Car	CS	CP	Moto	
Actual	52%	3%	23%	15%	1%	1%	5%	
	PT	Bike	MW	Car	CS	CP	Moto	E-bike
Stated	10%	19%	11%	25%	0%	4%	14%	17%

Table 1: Actual e stated choices

3.2 Design

As concerns the mode choice, respondents had to envisage their life in a forthcoming future in which they have a work coherent with their education and a workplace into the city center. Through a filter question, they choose which private means they guess having in this future working situation (six different combination are shown below). In addition to private means (car, bike, e-bike and motorbike),

respondents can choose public means like bus (or train or tram), moving walkway (innovative transportation mode settled on the city main sidewalks, totally free and uncovered, similar to one that is positioned into the airports), car-sharing, car-pooling (only as a passenger). In Table 2 we showed attribute levels: *travel time* is referred to one way trip from home to university/workplace; *monthly cost* includes purchase and maintenance for private means (for private car even a parking into the city center) in addition to travel expenditures; *move or being moved* is a sort of system density representing walking km needed to cover the distance work-home. Note that the value of this attribute for bike, e-bike and motorbike does not vary among choice tasks since parking is close to both home and workplace.

	Travel time			Cost			Move or being moved		
Public Transport	14 min	20 min	26 min	35 CHF/month	45 CHF/month	55 CHF/month	0,5 km	1 km	1,5 km
Bike	6 min	8 min	10 min	4 CHF/month	6 CHF/month	8 CHF/month		0 km	
Electric bike	6 min	8 min	10 min	15 CHF/month	20 CHF/month	25 CHF/month		0 km	
Moving Walkway	15 min	19 min	23 min		free		0,5 km	1 km	1,5 km
Private Car	10 min	14 min	18 min	210 CHF/month	235 CHF/month	260 CHF/month	0,2 km	0,4 km	0,6 km
Car-sharing	16 min	20 min	24 min	170 CHF/month	190 CHF/month	210 CHF/month	1 km	1,5 km	2 km
Car-pooling (passenger)	13 min	17 min	21 min	70 CHF/month	80 CHF/month	90 CHF/month	0,3 km	0,5 km	0,7 km
Motorbike	8 min	12 min	16 min	19 CHF/month	23 CHF/month	27 CHF/month		0,1 km	

Table 2: attribute levels

Through Ngene software (ChoiceMetrics, 2014) we run a different efficient design (with blocking) for the following alternative combinations:

1. Private car + public means
2. Motorbike + public means
3. Electric bike + public means
4. Private car + motorbike + public means
5. Private car + electric bike + public means
6. Conventional bike + public means

Each design created six choice tasks considering some constraints on *move or being moved* and *travel time* levels (i.e. exclude for any alternative low level for *travel time* and high level for *move or being moved*). An example of choice task is shown below (Table 3).

If in the future you guess having a private car, which mode will you choose for commuting?

Monthly wage: 7500 CHF						
A B 1 S 11	Public Transport	Conventional bike	Moving Walkway	Private car	Car-sharing	Car-pooling
Travel time	20 min	6 min	15 min	14 min	24 min	17 min
Monthly Cost	55 CHF/ month	4 CHF/ month	free	210 CHF/ month	170 CHF/ month	70 CHF/ month
Move or being moved	1.0 walking km	Whole route by bike	1.0 walking km	0.6 walking km	2.0 walking km	0.7 walking km
Choice	☐	☐	☐	☐	☐	☐

Table 3: choice task example

In the second section of the questionnaire, 24 statements referring to attitudes towards car, car-sharing and car-pooling are measured on a seven point Likert scale.

3.2 Model specification

Data collected for the pilot study were analyzed through a mixed multinomial logit with generic coefficients and a random coefficient for *Travel time* in order to capture the taste variation of individuals. Moreover, we added two error components (*motorized* and *private*) in order to capture respectively the correlation between Public Transport, Private Car, Car-Sharing, Car-Pooling, Motorbike and Bike, Car, Motorbike, E-bike. Design has been updated inserting coefficients estimations as new priors.

We are now conducting the estimation for the data collected with the last version of the questionnaire and we have not yet a definitive model. According to a parameterization of the variable *cost*, two different groups of models are now under analysis. In the first group, *cost* is not modified except for some cases in which we considered two different coefficients: *cost for public means* and *cost for private means*. In the second group, we created a new variable as *monthly cost/monthly wage *100* measuring the percentage of wage spent for transportation. For a model belonging to this group, we considered two separate coefficients for public and private as well.

4. Preliminary results

In Table 4 and Table 5 we present preliminary results for the two groups. In all the models, coefficients signs (when significant) are conform to the expected ones: *travel time* (mean), *cost* and *move or being moved* are negative meaning that an increase in these attributes leads to a decrease in the perceived utility for any alternative. As concerns the random parameter *travel time*, note that the standard deviation is usually large with respect to the mean: it implies that a significant share of the respondents (from 8% in M8 to 29% in M3) have a positive coefficient for the *travel time*.

We draw two different parameterizations for an alternative specific constant for each alternative (therefore 8 ASCs), *Private car* is always preferred to *PT* (everything else being equal). When entering only two ASCs for private or public modes, *private* means are always preferred to *public* ones (everything else being equal).

It is interesting to note that in all the models, error components *motorized* and *private* are significant meaning that some alternatives share unobserved attributes.

First group

	M1	**M2**	**M3**	**M4**
ASC Public Transport	Reference	-	-	-
ASC Bike	1.99	-	-	-
ASC Moving Walkway	2.66	-	-	-
ASC Private Car	n.s.	-	-	-
ASC Car-sharing	n.s.	-	-	-
ASC Car-pooling	n.s.	-	-	-
ASC Motorbike	3.05	-	-	-
ASC Electric bike	4.00	-	-	-
ASC private modes	-	1.64	n.s.	1.6
ASC public modes	-	Reference	Reference	Reference
Travel Time (m)	-0.0512	-0.0381	-0.025	-0.0829
Travel Time (sd)	0.0484	-	0.0433	0.112
Cost (m)	-	n.s.	-	-0.0023
Cost (sd)	-	0.013	-	-
Cost Public	n.s.	-	-0.0273	-
Cost Private	-0.0108	-	n.s.	-
Move or being moved	-2.15	-1.84	-2.19	-1.12
EC motorized	-2.81	3.37	-3.3	-3.5
EC private	2.17	-2.6	2.28	2.19
Rho	0.494	0.389	0.483	0.302
Rho bar	0.488	0.385	0.48	0.298

Table 4: Group 1 results

Second group (transformation cost/wage * 100)

	M5	**M6**	**M7**	**M8**
ASC Public Transport	Reference	Reference	-	Reference
ASC Bike	-3.00	-1.84	-	-1.91
ASC Moving Walkway	-1.47	-0.744	-	-0.861
ASC Private Car	4.33	2.91	-	2.93
ASC Car-sharing	n.s.	n.s.	-	n.s.
ASC Car-pooling	-1.41	-1.74	-	-1.72
ASC Motorbike	n.s.	n.s.	-	n.s.
ASC Electric bike	n.s.	n.s.	-	n.s.
ASC private modes	-	-	n.s.	-
ASC public modes	-	-	Reference	-
Travel Time (m)	-0.133	-0.135	-0.0883	-0.14
Travel Time (sd)	-	0.104	-0.095	-0.107
Cost/Wage (m)	-2.03	-1.06	-	-1.07
Cost/Wage (sd)	1.24	-	-	-
Cost/Wage Public	-	-	-1.95	-
Cost/Wage Private	-	-	-0.241	-
Move or being moved	-2.03	-1.99	-1.25	-2
EC motorized	-2.8	-3.14	-3.69	3.22
EC private	2.24	-2.2	-2.17	2.19
Rho	0.489	0.389	0.351	0.377
Rho bar	0.483	0.382	0.347	0.37

Table 5: Group 2 results

For the models for which was possible to compute the willingness to pay (Antoniou, C., Matsoukis, E., Roussi, P., 2007), the value of 5 minutes savings per way is in the range 25 – 80 CHF extra monthly expense for transportation (considering models with no distinction between private and public cost coefficients). Moreover, considering two separate coefficients for *cost* (public and private), the willingness to pay is higher for the private means.

5. Conclusions and future advances

A preliminary concluding remark concerning young people from Lugano regards the basic preference for the car, postponing for the moment the post-car world. However, low sample size and the homogeneity of the respondents do not guarantee reliable results.

In order to get a more heterogeneous sample, one of the next steps is to enlarge the sample collecting data from professional schools and young workers in Lugano. Then, we will distribute questionnaires into other cities in Switzerland: in particular, a medium and a big city from the French speaking Switzerland (Neuchatel and Lausanne) and German speaking Switzerland (Luzern and Zurich).

Moreover, we plan to analyse preferences and constraints regarding new modes of moving considering sociocultural indicators and degrees of attachment to the car (in the questionnaire we asked to evaluate several statements regarding environmental, individual and physical aspects of the car). Psychological and attitudinal factors obviously influence the choice: if people are car addicted and they love driving, it will be harder to persuade them leaving the car, even with the most comfortable and futuristic transportation mean. Therefore, the latent construct "*pleasure of driving*" is investigated as a possible hindrance.

In order to include the psychological non observable constructs into the standard choice model approach, we will use a hybrid choice framework where the Latent Variable (LV) and the Discrete Choice Model (DCM) are jointly estimated simultaneously.

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