

# Measuring the dynamic behavioural responses due to the introduction of a new tram line by using panel survey: preliminary analysis

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## Background

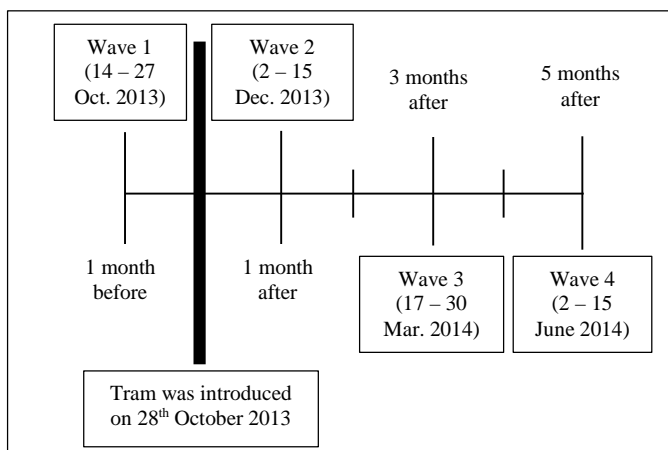
When new transport options are introduced to the market or existing transport service are modified, it is found that travel demand responses are not instantaneous but evolve over time [1]. The behavioral change of users to transport policy interventions is important to be explored because it can lead to better understanding of the dynamic impacts of transport policy interventions and improved the accuracy of transport forecasting tools. Due to these reasons, a long term panel observations of individual activity-travel patterns and attitudes were collected among residents who live along the new tram corridor connecting Solna Centrum and Alvik in Stockholm, Sweden. The aim is to seek greater understanding about the dynamic behavioural responses to the opening of this new tram service and the factors that influence individuals to adopt the new service. The final objective is to develop individual activity-travel behaviour model for dynamic tram use, which includes the individual learning process overtime, in a changing travel environment. Thus, the main research questions are; what are the factors influenced individual to adopt the new tram service, and secondly, what are the effects of the new tram service to individual's activity-travel behaviours? Hence, this article describes both the design and construction of the panel, and present some results based on a preliminary analysis of its first two waves (before and after).

## Methodology

To date, cross-sectional data are widely used in travel demand models. It is no doubt that this type of data structure can allow researchers to gain information on individual's choices in the given observed time, but it is difficult to gain information on how this choices will vary over time (i.e. policy response) if the system changes and/or if the external and internal conditions of the travelers change [2]. Therefore, panel data, which is pioneered by Heckman is good in examine the temporal effects because in this data structure, same individuals are observed in several points of time resulting information on the dynamic behavioural responses [3].

100 participants are targeted to involve in this study with 20 percent of them are the individuals who are living far from the tram line and act as a control group (130 participants were recruited to anticipate the dropout during the survey period). Meanwhile, the main group consists of individuals who live approximately 500 metres from along the new tram line. This study implements 4-wave panel survey (see **Figure 1**) which takes seven months to complete and the design is similar as in the study by Chatterjee and Ma but with additional instrument [1]. The instruments involved are a set of questionnaire in each wave which done through online survey approach and, 2-week self-reported travel diary in each wave which is posts to the participants with pre-stamped envelope provided for their convenience in submitting the diary. The questions asked in a questionnaire are; psychological questions by adapting TPB model [4],

awareness, travel needs, habits, past travel information and personal and household information. As for the 2-week travel diary, the design is similar to the *Mobidrive*, 6-week Travel Diary which has been implemented in two big cities in German which are in Karlsruhe and Halle during the fall of 1999 [5]. It contains the origin and destination details, mode choice details, trip purpose, departure and arrival time, estimated travel time, estimated travel distance, travel expenses including costs for parking, types of season ticket used and long journey details. A face validity check by the experts is done for both the questionnaire and the travel diary before being distributed.



**Figure 1:** Implementation of panel survey

## Results

The response rate in this study is considered high which is 98% (wave 1) and 92% (wave 2) for the online survey. Meanwhile, as for the travel diary, the response rate is 100% and 87% for wave 1 and wave 2 respectively. The participants are mainly female which accounted approximately 70% in both waves. Most of the participants are at the age of 31 to 35 and above 65 years old, and more than 30% has full time employment job. Approximately 41% of the respondents are married and the proportions of participants who have children and who do not have children are half. Meanwhile, more than 70% of the participants have a driving license and more than 60% have a public transport season ticket in both waves. The number of participants who have a driving license are increased about 4.2% in wave 2 and, the number of car owned is also increased

about 0.5% (owned 1 car) and 0.6% (owned 2 cars) in wave 2.

The interesting results obtained in a psychological question in wave 1 reveals that 44.3% of the participants have intention to use the new tram service sooner, which is within 1 week after its introduction and the results obtained in wave 2 indicates that 65.6% already tried the new tram with 22.2% of them were using the new tram sooner. In addition, 16.9% of this faster-user answered ‘*just for fun*’ as the main purpose to use the new tram for the first time.

Based on the analysis of the 2-week travel diary, the participants have a fairly static routine before and after the introduction of the new tram line based on the travel activities as shown in **Table 1**. This is in line with the study by Yáñez *et al.* [2] on *Santiago Panel* and also a study by Cherchi and Cirillo [6] on the 6-week panel from *Mobidrive*. There are some changes occurred in terms of modal split before and after the introduction of the new tram line. The percentage of car driver increase about 1.4% and 1.8% and the percentage of tram use is also increased about 0.3% and 1.3% for control and main sample respectively. The increased use of car in wave 2 is parallel to the increased number of participants who have a driving license and also the number of car owned in wave 2 as mentioned previously.

**Table 1:** Type of travel activities

	Wave 1 (%)		Wave 2 (%)	
	Main	Control	Main	Control
Pick-up or drop-off somebody	6.7	5.5	5.1	7.2
Private business	5.9	5.8	6.3	7.8
Professional business	0.4	0	0.2	0.3
School/education	3.2	2.6	2.5	3.6
Working	17.9	23.6	17.0	19.8
Shopping daily needs	4.6	5.5	5.3	4.5
Shopping long-term needs	2.8	1.8	3.7	3.0
Go back home	39.3	44.5	41.6	46.2
Leisure	18.1	10.2	17.1	7.5
Other	0.9	0	1.2	0
No answer	0.3	0.5	0	0

## Conclusion and Future Work

We have describe the design and methodology, and presented some descriptive analysis results of

before and after the introduction of the new tram service. Although the sample size is small but it has some contribution to the existing literature. To our knowledge, this is the first attempt in the world that the 2-week travel diary are collected up to 4 waves for the same individuals and thus may give a better information on the dynamics of individuals' travel patterns. Hence, for the future work, the objective factors and subjective factors over time (of all waves) will be examined so that the final objective to develop panel data models for dynamic tram use in a changing travel environment can be established.

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