

The role of the Theory of Planned Behavior in explaining the departure time choice

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Extended abstract

Urban congestion still represents one of the most relevant problems of the modern societies. According to The Forum of Municipalities (2008) within the Greater Copenhagen Area (GCA) the traffic volumes have increased the recent years by more than 10% annually. In addition, that study revealed that congestion in the GCA has caused the average speed to drop below 20 km/h on some parts of the road network, hence leading to more than 130.000 hours (i.e. 6 billion Danish Crowns, approximately 1 billion USD) wasted daily. Copenhagen, like many other cities, is facing road congestion problems. Among several factors that play a role in traffic congestion the departure time is the most important travel dimension. A number of studies have shown that people are more likely to change their departure time to address the problem of congestion rather than changing mode or even less change work and residential location. Although there are already evidences on departure time choices, as highlighted in Ortúzar et al. (Forthcoming), more research is still needed.

Departure time has mainly been studied from a microeconomic perspective, assuming that individuals make a rational choice based on the tradeoff between travel time, departure time and the early or late delay with respect to their preferred arrival time at destination. One of the most popular methods is the Scheduling Model (SM) originally formulated by Small (1982). The basic concept of the SM is that travelers who choose to reschedule their departure time to avoid congestion (and thereby experience the benefit of a shorter travel time) will experience a delay “penalty” by arriving later or earlier at the destination compared to their preferred arrival time. Later works extended the SM to also include travel time reliability (Small, Noland & Koskenoja, 1995, Koster & Verhoef, 2012, Arellana et al., 2012, Arellana, Ortúzar & Rizzi, Forthcoming) that accounts for uncertainty about the actual travel time along a journey (i.e. the unexpected delay). These works assume that the choice of departure time depends on the objective attributes of alternatives and eventually socio-demographic characteristics of individuals. At the best of our knowledge Arellana et al. (2012) are the only ones who account also for individuals’ attitude in the departure time choice.

Within the transportation literature (though as mentioned not in the departure time context) starting with the work of Walker (2001), several studies have incorporated latent variables to better explain the discrete choice. However, most studies usually focus only on attitude, few on other effects such as social norm, and very few include more than one latent effect at a time, see e.g. Paulssen et al. (2013) among the most recent and advanced works in the field. Moreover, typically these works study the direct effect of the latent variables in the choice. The psychological literature clearly shows that the underlying process is much more complex than what can be explained by one or two latent constructs. Theory of Planned Behavior (TPB) formulated originally by Ajzen (1991) and then expanded later by many other authors, shows that the intention to behave in a given way is explained by several underlying processes such as Attitude (towards short travel time, being flexibility, and being on time), Social Norm (SN), Personal Norm (PN), Perceived Behavioral Control (PBC), and Perceived Mobility Necessities (PMN). To our knowledge, no one studied the influence

of the full TPB in the discrete choice. Unfortunately, integrating all these effects in the typical discrete choice framework is a complex task.

The objective of this paper is to study the effect of the Theory of Planned Behavior in the preference for departure time. We envisage that the Theory of Planned Behavior would play an important role in shaping individual preferences in the context of departure time models. Understanding and quantifying these effects is of particular relevance when assessing transport policies to avoid overestimating the demand elasticity in response to crucial intervention such the implementation of congestion pricing schemes.

Data were collected specifically for the purpose of this study. The sample consists of workers who commute during the morning peak in the metropolitan area of Copenhagen. The survey included 1) a stated preference experiment customized on the real trips declared by the respondents in a 24-hour trips diary, 2) detailed information about the flexibility of the all trips reported in the trip diary, and 3) a full set of questions to measure eight latent construct as in the theory of planned behavior, plus 4) socioeconomic information.

In order to include the theory of planned behavior in a microeconomic framework, we used Hybrid Choice Models. In particular in our model we explicitly model the effect of the latent constructs in the intention and the effect of intention in the final choice. Several different structures were tested for the TPB and the relation of the TPB with the discrete choice models. Firstly several hybrid choice models using only one latent variable at a time were estimated in order to check carefully for the attributes that explain each LV and to check whether each construct has an effect on the choice directly and/or indirectly through the intention. We also check carefully for empirical identification. We found that the best structure was the one were Attitude (towards being on time), Social Norm, and Perceived Behavioral Control influence intention, and the intention influenced the choice, similar to the TPB formulated by Ajzen (1991).

Hence, our results show that the TPB does play a role in the decision making process for departure time. More specifically, we found that the latent variables Attitude, SN and PBC all have a significant and positive influence on the latent variable Intention, which then again have a significant influence on the choice. In particular we found that individuals who scored high on Attitude, SN, and PBC with respect to “arrive at work on time” also were more likely to have a high intention towards arriving on time. And similar, individuals that highly intended to be at work on time dislike to reschedule their departure time to earlier or (even worse) later departure times slots.

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