

3rd Conference on Sustainable Urban Mobility, 3rd CSUM 2016, 26 – 27 May 2016, Volos, Greece

Factors affecting the propensity to cycle - the case of Thessaloniki

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Abstract

Societies today invest in transport sustainability by investigating and promoting smarter and greener transport solutions such as intelligent transport systems, electric vehicles, cycling and walking through targeted strategies. An indicator of the success of such strategies is their uptake from the travellers/users. Under this light, this paper investigates the factors affecting travellers' propensity to cycle in the city of Thessaloniki, the second largest city in Greece. A questionnaire survey has been developed to investigate citizens' attitudes concerning cycling including questions on current trip patterns and characteristics of the respondents, opportunities and barriers for cycling, preferences regarding cycling infrastructure and attitudes considering the transport mode in general. A stated preference experiment is also included in the questionnaire. In the later, the propensity of the respondent to cycle is explored under specific scenarios for different trip purposes, trip lengths and supporting cycling infrastructure. Discrete choice analysis is performed, and a random-effect ordered probit model is developed describing the contributory factors for cycling amongst the population. Results indicate that the trip purpose, trip distance and cycling infrastructure are among the determinants that influence cycle use, as well as specific participant characteristics and attitudes.

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Peer-review under responsibility of the organizing committee of the 3rd CSUM 2016.

Keywords: bicycle; infrastructure; questionnaire; stated preference

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1. Introduction

Societies today invest in transport sustainability by investigating and promoting alternative, smarter and greener transport solutions and creating safer conditions for travelling (European Commission, 1999). The bicycle, whether used as a mode of transport or as a mode of physical activity creates benefits not only for the cyclists, but also for the community as a whole (Martens, 2004). As a result cycling plays a predominant role in transport policies that embed principles of sustainable mobility, with cities that promote cycling and walking focusing on the design of targeted infrastructure and public bicycle networks (Banister, 2008).

Thessaloniki, is the second largest city of Greece and has a population of about 790,824 inhabitants (as per the 2011 national census) which corresponds to 9.4% of the total population. It is a densely populated city and the majority of the resulting trip distances are not long. Having in mind that it also has Mediterranean climate, its inhabitants would be expected to have a strong propensity to cycle. However, cycling can only be supported if specific preconditions are met including appropriate cycling infrastructure and proper behavior of the road users. The main disadvantages of the cycling network of Thessaloniki are its total length (about 12 km's) and the fact that the different cycleway sections

are not well connected so as to form an integrated cycling network. As it is, the existing cycling network serves primarily those who live and work at the city centre.

The propensity to cycle depends on several variables including cyclist characteristics, trip characteristics and available cycling infrastructure (Hensher, 1994; Witlox and Tindermans, 2004). Hence, as the effectiveness of transport policies that implement bicycle use is dependent on inhabitant propensity to cycle, the relationship between propensity to cycle and the aforementioned characteristics needs to be established (Heinen et al., 2010). Cycling infrastructure (cycleways, parking spaces and other dedicated facilities) has been found to affect cycling propensity, especially cycleways have been found to promote cycling and the wider the network the higher the probability for cycling (Pucher and Buehler, 2008; Pucher et al., 2010). Cyclists expose themselves in risky conditions, especially in urban areas where the probability of traffic conflicts is high (Rissel, 2011). Hence the position of a cycleway is a significant parameter, and several studies indicate that segregated cycleways have the highest impact (Vernez-Moudon et al., 2005; Wardman et al., 2007; Akar and Clifton, 2008, DfT, 2016). Cycleway surface quality and width have also been found to affect cycling use (Antonakos, 1994; Sener et al., 2009; Li et al., 2012). Parking space availability, security of parking areas and proximity of parking areas with public transport terminals increase cycling (Noland and Kunreuther, 1995; Hunt and Abraham, 2007). Last, within the term infrastructure dedicated services such as showers and lockers at specific locations (universities, workplaces) also increase cycling use (Abraham et al., 2002).

Trip distance is another contributory factor, with both short and long trips discouraging bicycle use. Xing et al. (2009) noted that a possible threshold for short distances is a distance that can be travelled on foot within 20 minutes; in this case walking is preferable to cycling. Keijer and Rietveld (2000) set the limit at 2 kilometers. On the other hand, long distances discourage cycling use as they require longer exposure to uncomfortable and unsafe travelling conditions (van Wee et al., 2006, Fraser and Lock, 2010).

Traveller characteristics have also been found to affect cycling. In particular, older people (>60 years old) have been found to cycle less due to the deteriorating physical condition, as cycling is a physically demanding task (Shafizadeh and Niemeier, 1997). The majority of studies indicate that cycling declines with age (Pucher et al. 1999; Moudon et al., 2005; Dill and Voros, 2007; Sener et al., 2009). In other studies however, age does not have a significant effect on cycling (de Geus, 2007; Wardman et al., 2007). The effect of gender on cycling propensity is also ambiguous. Several studies indicate that men ride more than women (Banister and Gallant, 1999; Moudon et al., 2005; Dill and Voros, 2007; Garrard et al., 2008). On the other hand, for specific gender groups (working population) Wardmann et al (2007) and Witlox and Tindermans (2004) have found that women ride more than men. Garrad et al. (2008) concluded that in countries where cycling is popular gender does not affect cycling use, whereas in countries with low cycling percentages men cycle more than women.

Other traveler characteristics that have been found to influence propensity to cycle include income (Witlox and Tindemans 2004; Plaut, 2005; Stinson and Bhat, 2005; Dill and Voros, 2007; Pucher and Buehler, 2008), status (Pucher et al., 1999; Moudon et al., 2005), profession (Dieleman, et al., 2002), attitudes towards the environment and other environmental factors such as elevation (Winters et al., 2010) and weather conditions (Buehler, 2012).

As such, scientific findings (even the non-contradictory ones) cannot be generalised prior to targeted investigation. Specificities of the investigated cycling population, as well as supporting cycling infrastructure may elicit different behaviours. The objective of this research is to determine the parameters that affect the propensity to cycle in Thessaloniki using a stated preference questionnaire through the employment of discrete choice analysis and the estimation of suitable random-effects ordered probit models. Section 2 presents the methodological components that were used in this research, including the experimental design and the analysis. The results are outlined in Section 3, presenting the sample characteristics and the model estimation results. Last, the findings of the study are discussed in Section 4.

2. Methodology

2.1 Experimental design

The approach undertaken in this study involves a stated preference questionnaire survey distributed to inhabitants of Thessaloniki, and no specific quota was applied to the survey sample. The factors that have been found in the

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