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## Factors influencing bicycle use: a binary choice model with panel data

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### Abstract

Cycling has been commonly neglected in urban transport planning. In the same fashion, there is a shortage of available data on cycling mobility, especially in countries with low rates of bicycle share. Nevertheless, a modal shift towards soft modes such as cycling appears to be one of the keys for progressing towards a sustainable urban mobility paradigm. Understanding the factors that influence bicycle choice is necessary for implementing efficient *probike* transport policies. This research identifies the main factors affecting bicycle choice for commuting. It analyses an ad-hoc panel survey conducted in Vitoria-Gasteiz, a medium-sized city in northern Spain where cycle rate has rocketed in few years. Data from commuters, either workers or students, were collected in 2012, 2013 and 2014. An unbalanced binary panel model includes both objective – such as gender, age, occupation, car availability, or trip distance – and subjective variables – as attitudinal beliefs towards cycling–. The research confirms the importance of individual's perceptions on cycling for understanding their modal choice and identifies main factors related to higher bicycle use likelihood.

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*Keywords:* Bicycle choice, panel survey, cycling promotion

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### 1. Introduction

Cycling has been commonly neglected in urban transport planning. In the same fashion, there is a shortage of available data on cycling mobility, especially in countries with low rates of bicycle share. Nevertheless, a modal

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shift towards soft modes such as cycling appears to be one of the keys for progressing towards a sustainable urban mobility paradigm.

In this aim, policy-makers need to recognize the most relevant factors affecting bicycle choice in order to promote cycling with the most effective –and less expensive– measures. Moreover, the conditions could differ significantly from one city to another, regarding the natural and built environment but also the culture context of the city. Researchers demand prudence when transferring conclusions or policies from one context to another (Dufour, 2010; Marsden and Stead, 2011). Many of the studies on cycling come from cities with an established cycling culture but there is research to be addressed particularly on cities with lower bicycle-friendly stages.

Therefore, it is essential to further study what moves people to choose the bicycle as their mode of transport in different locations. But research on cycling for utilitarian purposes requires not only considering the classical time and cost aspects but also including subjective variables that were not (Muñoz, 2016; Willis et al., 2015). And longitudinal analyses are among the research challenges on cycling mobility (Handy et al., 2014).

This research proposes a model to better understand bicycle choice, based on a panel survey conducted in Vitoria-Gasteiz (Spain). This paper is structured as follows. After the introduction hereby, the next section sets the base to discuss the factors influencing bicycle choice. The third section introduces the city of Vitoria-Gasteiz in terms of cycling. The fourth one describes the data collected and the methodology used for its analysis. Its results are interpreted in section number five. Finally, the conclusions and further research are included in the sixth section.

## 2. Bicycle choice

Traditionally when modelling the modal choice, travel was considered a derived demand and it was simplified mainly to time and cost, on a maximization of utility approach. The need of modelling bicycle choice besides modelling other modes of transport appears as they are understood to obey a different range of factors from other modes.

Psychological approaches, distinctly from utility maximization approaches for modal choice, focus on identifying and defining key psychological and social variables which are meant to determine behaviour. Willis et al. (2015) review focus on the importance of such variables, which are increasingly included in recent research. The most known of such theories, the Theory of Planned Behaviour (TPB) (Ajzen, 1991), identifies beliefs as determinant. Ajzen proposes three constructs to determine the intention to perform the behaviour (commuting by bicycle in our case), and the intention in turn to determine the behaviour itself. Those constructs are the attitude towards the behaviour – beliefs predisposal towards commuting by bicycle –, the subjective norm – the support or rejection of the social environment – and the perceived behavioural control – the perceived feasibility of perform such trip by bicycle because of my own ability or external conditions to overcome–.

Travel habits and cycling experience appear as key elements in cycling consideration in several researches as well. Research results have been significant when using cycling familiarity and type of previous cycling experiences (commuting versus non-commuting) as segmentation criteria (Kroesen and Handy, 2014; Rondinella, 2015).

Regarding socio-demographic characteristics, strong connections to cycling have been found out, particularly on gender and age. Nevertheless, different results are figured out in different studies. Differences on bicycle use by gender vary notably with the cycling culture (Garrard et al., 2008). One of the main indicators of many low-cycling contexts is finding unequal proportions of men and women cycling, with men being likely to cycle more than women. In turn, in places where cycling is more normalised the participation of both genders tends to be even or even higher for women (Dill and Voros, 2008; Heinen et al., 2010). In the same fashion, the age profile of cycling users tends to be associated to younger people in many low-cycling contexts, but this difference attenuates in strong cycling cultures (Aldred et al., 2015; Simons et al., 2014; Winters et al., 2015). The influence on cycle use of other socioeconomic variables, as the household income or the study level, is not clear, but the family size seems to be positively related to bicycle use. Higher levels of motorization appear to be negatively related to bicycle choice; on the other hand, access to a bicycle is logically positively related to bicycle use (Muñoz, 2016). This aspect is also treated from the public bicycle systems approach (Fishman, 2015).

Natural issues as non-usual weather conditions or steep slopes may discourage bicycle use (Dill and Voros, 2008; Menghini et al., 2010). But the built environment of the city is also important. Urban form and urban design of spaces can directly affect bicycle use; in particular, a dense urban development mixing different activities and land

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