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Analyzing the transition from a public bicycle system to bicycle ownership: A complex relationship

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ABSTRACT

Despite the success achieved by Public Bicycle Sharing Systems (PBSS) across the world, several researchers provide evidence on their limitations and constraints in a medium-long term, and bicycle ownership may be considered as a complementary tool to promote a 'bicycle-culture'. This paper aims to cover the gap about the interaction between both systems (public bicycle/private bicycle) and which are the key aspects to explain the bicycle-buying decision. After a fieldwork based on surveys conducted in Seville (Spain), one of the cities currently acknowledged worldwide for its successful policy of promoting cycling, we apply a Discrete Choice Model. Our findings show that among the socio-demographic factors that favor the move from the PBSS to the private bicycle are: having a higher level of education, being more progressive ideologically-speaking, and being a resident of the city itself; while age and gender do not appear to be conclusive. Experienced users, for whom the bicycle is a part of his/her healthy lifestyle, state a greater willingness to buy a bicycle. And the main obstacles to make the jump from the PBSS to the private bicycle, and that any action plan to support private bicycle usage should take into account, are: the lack of proper parking at the origin/destination, and fear of theft.

Introduction

Rising motorization rates in developed countries since the second half of the 20th century have helped to improve citizens' quality of life, but at the same time have caused negative externalities, such as energy dependency, traffic congestion, and harm to the environment and public health (Rietveld, 2001). On the other hand, as a growing number of research studies have shown (Castillo-Manzano and Sánchez-Braza, 2013a, 2013b; Krizek, 2007; Martens, 2007; Moudon et al., 2005; Sener et al., 2009, amongst others), non-motorized means of transport, such as the bicycle, have come to be regarded as synonymous with health and energy savings and efficiency.

In their reviews of actions implemented by governments around the world to promote bicycle use Pucher et al. (2010) and Yang et al. (2010) highlighted the *Public Bicycle-Sharing Systems* (PBSS). Originating in northern European countries, such as the Netherlands and Denmark, PBSSs have become very popular in recent years around the European fringe, and have acquired the status of an integrated urban mode of transport (Anaya and Castro, 2012).

According to Shaheen et al. (2010), the PBSS represents a successful transportation policy not only as it encourages cycle usage, but also due to its great potential, its adaptability to different sized cities, and its ability to provide emission-free

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transportation (Vogel et al., 2011), although, to date there has been limited research into its environmental benefits. PBSS also alleviate the high costs of new transportation systems efficiently, e.g., the subway, tram and light rail, especially in medium sized cities (Castillo-Manzano and López-Valpuesta, 2009), where bike sharing can fill a possible market niche in urban transportation relatively inexpensively and quickly: short journeys.

Nevertheless, some research restricts the benefits of PBSS in the short term; as authors such as Bouf and Hensher (2007), Castillo-Manzano and Sánchez-Braza (2013a, 2013b), Fishman et al. (2012, 2013), Lin and Yang (2011) state, once the investment has been made and initial expansion starts to wane, demand can stagnate, resulting in major drawbacks. The most important of these are: poor quality of service due to a lack of comfort and units in a poor state of repair; docking stations inappropriately located for intermodality; non-competitive cost; an inflexible schedule; a lack of agility in the granting of loans and the return of deposits; an oversubscribed or congested system; break-downs and damage caused by vandalism; issues with redistribution from full to empty docking stations; time and space restrictions on the user, who cannot take bicycles outside the designated area or exceed the time limits on usage and/or legal constraints (e.g. compulsory helmet use).

Authors such as Lin and Yang (2011), Lin et al. (2013) and Nakamura and Abe (2014) analyze other drawbacks of PBSS linked to urban planning (especially in city centers), the need for sufficient available space to install the number of docking points required to cover the demand for bicycles, and other disadvantages that they might have in preventing or obstructing other leisure activities.

According to Anaya and Castro (2012), all these circumstances shroud PBSSs in uncertainty, especially in the current framework of budgetary constraints. So, although public bicycle use may boast many advantages over private bicycle ownership (users do not need to worry about their own bicycles being stolen or vandalized, the lack of a place to park their bikes at the point of origin or destination, or bicycle maintenance; see Fishman et al., 2012 and Rietveld and Koetse, 2003), they alone are not sufficient for the bicycle to be unreservedly called an urban transportation system. In fact, previous studies such as Aldred and Jungnickel (2013) and Maness (2012) provide evidence that bicycle ownership could be a proxy indicator of a trend towards journeys being made by bicycle more frequently, meaning that the private bicycle could be regarded as a complementary tool for promoting a "bike-culture".

A literature review shows that the topic of bicycle ownership has only been studied to a limited extent and that research has usually focused on bicycle use (Xing et al., 2010) rather than the widespread interest aroused by PBSS (Fishman et al., 2013; Pucher et al., 2010; Shaheen et al., 2010; Yang et al. 2010).

Handy et al. (2010) find links between the determinants of both bicycle ownership and bicycle use on three levels:

(1) the user's individual profile: with a broad analysis of socio-demographic characteristics, such as age, gender, education and income level by Emond et al. (2009), Owen et al. (2010) and Pinjari et al. (2009), and to a lesser extent, personal preferences and attitudes, such as lifestyle, health- and environment-related issues or economic aspects have been studied by authors such as Geus et al. (2008) and Moudon et al. (2005).
(2) social structure, cultural norms, ideologies, habits and traditions that might encourage/discourage cycling: e.g., Gatersleben and Haddad (2010) explain how promoting public cycling has changed social perception of bicycle use; Beck and Immers (1994) consider the issue of bicycle theft; McCarthy (2011) examines the "*anti-bike culture*"; and Delbosc and Currie (2013) analyze the falling numbers of young people taking out their driving licenses in developed countries.
(3) infrastructure and the physical environment: from the obstacles that the urban area presents and the correct adaptation of the PBSS to the area (by Heinen et al., 2010; Larsen et al. 2013; Sallis et al., 2013; Snizek et al., 2013) to the installation of facilities for cyclists at journey origin/destination (lockers, changing rooms, showers) considered by, e.g., Hunt and Abraham (2007) and, above all, safe bike-parking and storage (Salleh et al., 2014) in public/private places (Aldred and Jungnickel, 2013) and facilitating intermodality with other means of urban transportation (Rietveld, 2001).

Although the cited studies provide conclusions as to the determinants of both bicycle ownership and bicycle commuting, we agree with Chatterjee et al. (2013) and Fishman et al. (2013) that this is still a relatively new topic with major drawbacks. One of these is clearly the interaction between PBSS and private bicycles. In fact, the only precedent found is the analysis by Buck et al. (2013) of user profiles for the two systems, although the study does not address the relationship between the two. Finally, Bouf and Hensher (2007) report on the possible *expansive effect* of the PBSS in the city of Lyon, which has resulted in higher sales and greater use of private bicycles.

The motivation for this paper is, therefore, to fill the knowledge gap surrounding users' (registered PBSS members') opinions and attitudes to the obstacles and facilitators that lead them to decide to purchase a bicycle or not. User perception may determine this trend according to Damant-Sirois et al. (2014) and Handy et al. (2014). We therefore believe that specific field study-based analyses using interviews to collect data on demographics, mobility patterns and journey preferences could shed some light on the possible indirect impact of PBSSs on the bicycle purchase decision.

In short, our paper takes a new approach to analyzing the relationship between public and private bicycle use; from the point of view of PBSS users. First, specific data are provided as to Seville PBSS users' preferences regarding the use of private bicycles. Second, the factors are addressed that influence the decision of PBSS users who do not own private bicycles to purchase one. Subsequently, the barriers that deter public bicycle users from transferring to private bicycle ownership are