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'I want to ride my bicycle': delimiting cyclist typologies

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ABSTRACT
Based around fieldwork in Seville (Spain), our article provides an empirical analysis with the aim of determining whether different typologies of cyclists exist depending on the type of bicycle for urban commuting (public bicycle/private bicycle). Our findings show that users of public bicycles are predominantly male, young, with a high level of education, and basically use the public bicycle for subsistence trips due to its easy intermodality; while private bicycle riders are mainly females who regularly make nonsubsistence trips and prefer a more flexible bicycle for their daily needs.

KEYWORDS
Trip purpose; bicycle ownership; public bicycles; discrete choice models

JEL CLASSIFICATION
R40; R42

I. Introduction

A number of studies address the influence of personal characteristics and perceptions on cycling decisions (Vogel et al. 2014). However, little distinction has been made between Public Bicycle Sharing Systems (PBSS) and private bicycle users. The literature mostly focuses on individual determinants of bicycle ownership (Handy, Van Wee, and Kroesen 2014) while, as far as PBSS are concerned, we find studies on the impact of subjective perceptions of their features and quality (Bordagaray et al. 2015) since, as Hekman and Deisenroth (2013) state, choice behaviour and demand is clearly influenced by product quality.

Our article aims to identify cyclist profiles for two cycling systems (PBSS/private bicycle) in the Spanish city of Seville, and to provide an empirical analysis of the influence of personal and environmental elements on the choice of bicycle type.

The article is organized as follows. After this introduction, Section II presents the database and methodology. Results are discussed in Section III. The conclusions are set out in Section IV.

II. Data set and methodology

Two waves of surveys were randomly conducted among PBSS (*SEVici*) and private bicycle users in Seville during March–April, 2014. We obtained 1395 surveys from SEVici users and 451 from private bicycle users who were asked three types of questions based on covariates from prior literature (Table 1):

(a) *Socio-demographic factors*.

(a1) *age* (Fernández-Heredia, Monzón, and Jara-Díaz 2014): using binary variables: *Age1520*, *Age2135* and *Age3649*. A value of 1 is taken when the cyclist's age corresponds to the figures in brackets [15, 20], [21, 35] and [36, 49].

(a2) *gender* (Dill and Voros 2007): binary variable for male (1)/female (0).

(a3) *level of education* (Castañon, Castañon, and Santos 2012): with 5 categories: (1) no primary education, (2) primary education, (3) secondary education, (4) three-year undergraduate degree, (5) higher education. The variables *study_medium* and *study_high* take a value of 1 when the *level of education* variable is 3–4 or 5, respectively.

(a4) *occupation* (Handy and Xing 2011): with 6 categories: (1) employed, (2) self-employed, (3) homemaker, (4) unemployed, (5) student, (6) retired. The *occupation_employed* and *occupation_self_emp* variables take a value of 1 when the *occupation* variable has a value of 1 or 2, respectively.

(b) *Travel preferences* variables linked to journey frequency (Buck et al. 2013), purpose of cycle usage/time patterns (Corcoran et al. 2014).

(b1) *bicycle_public* (y) variable: takes a value of 1 (journey using SEVici) or 0 (journey using private bicycle).

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Table 1. Descriptive statistics.

Variable	Mean	SD	Minimum	Maximum
bicycle_public	0.756	0.430	0	1
hour	12.971	2.829	8	20
station_origin	1.026	0.694	5.65E-02	3.326
station_destination	1.079	0.687	5.65E-02	3.326
frequency_route	5.316	3.210	1	47
other_mode	0.174	0.379	0	1
age	29.530	11.551	15	74
gender	0.623	0.485	0	1
level of education	3.650	1.043	1	5
purpose	2.142	0.943	1	5
occupation	3.909	1.520	1	6

(b2) *hour* at which the trip is made. Two binary variables depending on observation distribution: *hour11_15; hour16_20*.

(b3) *frequency_route* per week.

(b4) *purpose*, with 5 categories: (1) work, (2) studies, (3) leisure, (4) sport, (5) other. The *purpose_work* and *purpose_study* variables take a value of 1 when the *purpose* variable has a value of 1 or 2, respectively.

(c) *PBSS characteristics*: number of PBSS stations/per capita at origin/destination, and intermodality with other means of urban transport (Bachand-Marleau, Lee, and El-Geneidy 2012).

(c1) *other_mode* variable: takes a value of 1 if the cyclist makes intermodal changes during the trip, 0 otherwise.

(c2) *station_origin* and *station_destination*: density of SEVici docking stations (racks/thousand inhabitants) in the city district where the journey originates/ends.

We use binary logit models. The observed variable to explain (y) is the cyclist's choice between the private bicycle ($y = 0$) and the public bicycle ($y = 1$). Using this formulation, the likelihood that an individual i might choose a public bicycle is expressed:

$$P(y_i = 1|x_i) = \frac{\exp(\alpha + x_i'\beta)}{1 + \exp(\alpha + x_i'\beta)} \quad (2)$$

where α is a coefficient, β a vector of coefficients and x_i a vector of variables. In order to account for the choice-based sampling design, the unknown α and β parameters are estimated using the weighted endogenous sampling maximum likelihood estimator, which provides consistent estimates (Manski and Lerman 1977).

Table 2. Estimated parameters[a].

Variable	Coefficient	*t*-statistic	Effects on $P(y = 1)$ of changes in x[b]
constant	−3.297	−8.398***	
hour11_15	0.306	2.115**	Δ0.076
hour16_20	−0.615	−3.502***	∇0.149
station_origin[c]	0.901	9.734***	Δ0.090
station_destination[c]	0.579	5.993***	Δ0.090
frequency_route	−0.068	−2.969***	∇0.017
other_mode	0.678	4.312***	Δ0.163
age1520	0.787	2.904***	Δ0.187
age2135	0.111	0.494	Δ0.028
age3649	−0.139	−0.573	∇0.035
gender	0.392	3.287***	Δ0.097
study_medium	0.857	3.547***	Δ0.202
study_high	0.484	1.963**	Δ0.119
purpose_work	0.627	2.788***	Δ0.152
purpose_study	−0.120	−0.63	∇0.030
occupation_employed	0.545	1.658*	Δ0.133
occupation_self_emp	−0.124	−0.497	∇0.031

[a]* $p < .10$, ** $p < .05$, *** $p < .01$. No relevant multicollinearity was found.
[b]The baseline individual (an individual that presents a 0 value in all dummy variables) was considered.
[c] One unit increase in the number of docking stations available in the most frequent district.

III. Results and discussion

Table 2 gives the estimated coefficients and the effects of unitary changes of variables on choosing the public bicycle.

Regarding *age*, cyclists in the 15–20 age bracket are more likely to use the public bicycle, which is consistent with Fuller et al. (2011).

Concerning *gender*, males are more likely to use PBSS. Cycle usage in Seville is a quite recent phenomenon, so this result corroborates Fernández-Heredia, Monzón, and Jara-Díaz (2014), who find a more balanced ratio between male and female cyclists in countries with a well-established cycling culture. Eyer and Ferreira (2015) explain that females tend to be responsible for transporting their children and household responsibilities, and consider that public bicycles do not suit their urban mobility needs.

A higher *level of education* seems to determine the choice of PBSS (corroborating Fishman, Washington, and Haworth 2013), perhaps because, as Bachand-Marleau, Lee, and El-Geneidy (2012) state, it could be considered to be more fashionable.

The significance of *occupation_employed* suggests that salaried employees are more likely to use PBSS, perhaps because the private bicycle is more inconvenient (e.g., lack of parking at the workplace) (Bordagaray et al. 2015).

Two peaks were found related to the *hour* variable. Taking the 8–10 time bracket as the baseline,

the likelihood of using PBSS is greater in the 11–15 time bracket, and lower in 16–20 time bracket, probably, due to productive and educational activity (Corcoran et al. 2014).

The *frequency_route* is significant and negative, i.e., the greater the frequency with which a cyclist uses a route, the less likely it is that he/she will use PBSS (following Buck et al. 2013).

The positive significant *purpose_work* and *purpose_study* variables show that it is more likely that a cyclist will use PBSS for *subsistence trips* (as in Buck et al. 2013).

Both the *station_origin* and *station-destination* variables are significant and positive. As Bachand-Marleau, Lee, and El-Geneidy (2012) state, the greater the density of PBSS stations at the origin/destination, the 'nearer' the system is perceived to be and, therefore, the more likely its use.

Finally, the positive and significant *other_mode* variable shows that cyclists opt for public bicycles whenever they need to make intermodal changes (Chatterjee, Sherwin, and Jain 2013).

IV. Conclusions

We conclude that differences can be found between PBSS/private bicycle user profiles in Seville that depend on age, gender, level of education, occupation, hour/frequency of cycling, trip motivations and PBSS characteristics.

Compared to *private bicycle riders*, cyclists who choose *PBSS* are predominantly very young males with a high level of education who mainly use the public bicycle for subsistence trips (work or study) during class time or trading hours and are motivated by intermodal needs and the existence of a high number of docking stations within close reach. On the other hand, private bicycle use is more widespread among females who are also quite young, but less so, who use the bicycles to make regular trips that are considered to be nonsubsistence and that do not require their use in combination with any other means of transport.

From a practical point of view, these results could help to guide urban transportation policy by identifying the profiles of the two segments of cyclists which, as we have seen, present significant differences. In fact, without disputing the PBSS' unquestionable success, the conclusion can be drawn that urban policies that seek to promote and generalize bicycle use should also envisage certain specific elements to facilitate private bicycle use. For example, measures could be implemented to lessen the likelihood of private bicycles being stolen or to facilitate their intermodal use, especially in conjunction with public transport. This is an issue that has still not been addressed in cities like Seville, where bicycles have not been a traditional or widespread means of transport.

These results would also justify any improvements made to the design of PBSS bicycles to make them lighter and more ergonomic; anything to bridge the gap between the usually lightweight and agile private bicycle and the heavy, difficult-to-handle public bicycle used in many cities, including Seville (the multinational JCDecaux Company's standard model). Making any such improvements would be difficult in the short term, however, as they would have to be compatible with 'tedious' measures to counter theft and vandalism that have to be part and parcel of public bicycles.

Disclosure statement

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