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The hedonic value of railways terminals. A quantitative analysis of the impact of stations quality on travellers behaviour

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ABSTRACT

Transit services quality has long been recognized as an important factor in influencing travelers behaviour and terminals quality is certainly part of it. As a matter of fact a number of transit promotion policies explicitly based on qualitative factors and specifically high architectural standards are being adopted in designing new railways stations and several examples of remarkable architecture applied to railways stations can be found all round the world. In spite of this, the literature in transportation modelling has not yet analyzed the impact of the hedonic quality on travelers' behaviour quantifying whether and by how much it increases their propensity to use rail services.

A binomial logit model, simulating the choice between a traditional rail line and a new line open in 2009 in the northern area of Naples – Italy (high architectural and aesthetic standards railways) was specified and estimated for trips having both routing options between the same origin–destination pair. The model was specified with serial correlation in residuals and estimated using RP–SP data for different users' segments. The main difference between the two alternatives in the real scenario was the stations architectural quality as all other attributes, including travel time, frequency, access and egress times, trains and riding comfort, security, were basically the same. In Stated Preference experiments several scenarios were presented to users with four levels of level of service attributes and factorial fractional design.

The results show a significant impact of stations architectural quality on users' choices and allow to estimate reciprocal substitution coefficients with respect to other level of service attributes. The average monetary "value of stations quality" was quantified in 35 Euro cents/trip for students and in 50 Euro cents/trip for commuters (+43%). Alternative-specific waiting time coefficients showed a context effect for both students and commuters (respectively 31% and 35% lower values for traditional stations) but they did not explain entirely the preference for high architectural railways line. It also resulted that female travelers showed a significant preference for stations quality (+33% with respect to male). Other results related to access and egress time suggest that, if everything else being equal, the high architectural line have a larger "catchment area" with respect to a traditional rail of approximately 400 meters by walking.

The results of this research should be compared with those from other contexts as they have a potential impact for railways planning showing that architectural quality of stations should be considered as an explicit design variable and could be compared with other, possibly more expensive, improvements (e.g. frequency increases, accessibility improvements) and poses new challenges for modelling user behaviour and quality-related measures.

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1. Introduction

Transit services quality has long been recognized as an important factor in influencing travellers behaviour and terminals quality is certainly part of it (e.g. TRB, 1999, 2003). Terminals, and more specifically, railways station quality can be further decomposed into several attributes including ease to access, cleanliness, subjective (perceived) and objective security, lighting, climate control, information availability and, last but not least, aesthetic quality. The latter can be defined as the pleasure that travellers receive from being in an environment transmitting pleasurable sights, ranging from art pieces, to internal and external station architecture (such as shapes, colours and space distribution). In the context of this paper we will refer to "*hedonic value*" of stations, or in alternative to the *value of stations quality*, as the aggregate of all elements related to travellers pleasure or well being in using the station including aesthetic quality as well as other attributes quoted above.

As a matter of fact a number of transit promotion policies explicitly based on qualitative factors and specifically high architectural standards are increasingly being adopted in designing new railways stations both for intercity, High Speed Railways and for regional or metropolitan lines. With respect to the latter aesthetic aspects of railway stations are at the core of the so-called "Station Renaissance" (e.g. Edwards, 1997; Kido, 2005; Tenner, 2001), a trend recently developing in Europe to satisfy customers' expectations with respect to landscape, aesthetic and functional station spaces, as well as the introduction of a new image of railway travel. Examples abound and the stations in Paris (e.g. The Arts et Métiers and Auber stations), London (e.g. Westminster Underground and North Greenwich stations), Stockholm (e.g. Stadion and T-Centralen stations), Rotterdam (e.g. Metrostation Wilhelminaplein station), Naples (e.g. Toledo and Università stations) can be quoted among many others. Similarly in the United States the new approach to station design has been coded in the "*Context Sensitive Design for Railways*" (e.g. Holgate, 1992; Otto, 2000; Kido, 2005). High architectural standards can be found also in a number of metro stations in other Countries such as in China (e.g. Hong Kong Wan Chai Station or Shanghai South Railway Station), Singapore (Expo Station) and Taiwan (Kaohsiung Central Station).

In spite of the increasing number of railways and metro stations designed following this approach, and the higher construction and maintenance costs typically involved, the literature in transportation modelling has not yet analyzed the impact of the hedonic aesthetic quality on travellers behaviour and on their willingness to pay to be used in Cost–Benefit analyses or other assessment techniques of alternative options.

In the transportation literature the problem of railways service quality has been investigated especially with respect to traditional attributes such as regularity, ride comfort and level of crowding; while only few papers analyse stations quality attributes such as lighting (e.g. Lee and Lam, 2003), thermal condition (e.g. Ampofo et al., 2004; Deb and Ramachandraiah, 2010) and security (e.g. Cozens et al., 2002; Ceccato et al., 2013). However to the Authors' knowledge there are no applications explicitly considering the role of aesthetic quality of stations in perceived quality measures of public transport.

As for the methodology, there is an ongoing debate in the scientific community about what is the best definition of public transport service quality and how it should be measured. Several definitions and measurement methods have been proposed both as objective indicators (e.g. Transportation Research Board, 1999, 2003; Nathanail, 2008; Cascetta and Cartenì, 2014) and subjective or behavioural utility-based indicators (e.g. Hensher and Prioni, 2002; Hensher et al., 2003; Gatta and Marcucci, 2007; Rojo et al., 2012; for a review see Eboli and Mazzulla, 2008). It seems appropriate to define both objective and subjective measures of transit quality, since they are relevant to different purposes. The former are direct measures of indicators perceived as significant by the customers (e.g. in-vehicle time or percentage of services departing/arriving early/late). By contrast, subjective measures are based on direct (statements) and indirect (choices) customer perception of service quality. In the literature many techniques for measuring subjective indicators have been proposed using both RP and SP surveys (e.g. Ben Akiva and Morikawa, 1990; Bradley and Daly, 1991; Cascetta, 2009).

The aim of this paper is to propose a quantitative analysis of the perceived hedonic value of stations for railways travel, as compared to more conventional service variables such as waiting, on-board and access times, service frequency and monetary cost. The hedonic value, or station quality, is, as said, the aggregate of all elements related to travellers pleasure in using the station, where the architectural quality in our case study is arguably the most visible and representative attribute.

A binomial logit with serial correlation, simulating the choice between a traditional rail line (traditional stations) and a new line open in 2009 in the northern area of Naples – Italy (high architectural and aesthetic standards for the new stations), was specified and estimated for actual trips having both routing options, using RP–SP data for different users' segments. The experimental setting is particularly appropriate for estimating the impact of hedonic value (in the follow *the value of stations quality*), since all other elements related to both the stations typologies (e.g. information, cleanliness, objective safety) and the connections (e.g. travel times, service regularity, ticket price, number of transfers) are, for the specific origin–destination pair selected, substantially comparable between the two alternative routes.

The methodology proposed in this paper for the estimation of the *value of stations quality* is similar to the one used in Gaker and Walker (2013) for assessing the "*value of green*" that is how much travellers are willing to pay in order to reduce the CO2 associated with their travel.

The problem of considering SP surveys for estimating the effects of context or background in users perception and choice in transportation has already been discussed by Oppewal and Timmermans (1991). However, few applications of these concepts are present in the literature to date (e.g. Cullinane and Toy, 2000; Bos et al., 2004; Molin and Timmermans, 2010; van Exel and Rietveld, 2010; Arentze et al., 2012) and not related to the architectural/aesthetic quality of terminals.