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Hedonic value of high-speed rail services: Quantitative analysis of the students' domestic tourist attractiveness of the main Italian cities

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ABSTRACT

High-Speed Rail (HSR) is a transport mode that operates significantly faster than traditional services, using integrated and specialized rolling stock, and often dedicated tracks. These rapid transit services have profoundly impacted mobility habits on medium-long range journeys, and have also brought about social, economic, and environmental changes in the geographical areas involved. HSR has become a successful "brand", including not only faster trains, but also a number of other on-board services that increase rail attractiveness (e.g. restaurants, wi-fi connection, free newspapers, cinema, business areas and relaxation lounges).

Starting from these considerations, in this research we investigated the conjecture according to which a traveler, in choosing an HSR service to reach a destination (against a traditional rail service, or other competing transport modes), is not only influenced by its original peculiarity as a "faster train" service, but also takes into account the presence of all the "hedonic" characteristics of the service. That said, the literature in transportation modeling has yet to analyze the impact of hedonic quality on travelers' behavior by quantifying whether and to what extent it increases their propensity to use HSR services.

Aim of this research was twofold: *i*) to quantify, for the first time in the literature, the hedonic value of an HSR service related to a domestic tourist trip, as compared to more conventional levels of service and attractiveness attributes; *ii*) investigate the domestic tourist attractiveness of the main Italian cities, evaluating which attributes influence the perception of a city as a domestic tourist destination. The application case study consists in the supply of current rail services (HSR vs. traditional) between the 11 main Italian cities in terms of tourist destination. On the basis of an RP&SP survey, carried out among university students at national scale, a binomial logit model was specified with serial correlation in residuals, estimating whether or not the cities in the panel were perceived as possible destinations for a domestic tourist trips made by train.

The estimation results show that city-specific attractiveness attributes (entertainment and restaurant rate; number of sites of interests; crime rate), and level of services variables (e.g. travel time and cost; HSR brand) significantly influence the perception of a city as a possible destination for a domestic tourist trip by train. Furthermore, the average monetary value for the "*pure preference*" for the HSR brand (faster trains, high frequency, and on-board services) is about 22 Euros/trip, while the hedonic value relative only to on-board services is about 12 Euros/trip , underlining that the "faster train" is only one of the perceived attributes of HSR services. Overall, the willingness to pay for an HSR ticket is up to 40% greater than that for a traditional one. Furthermore, tourists are willing to

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spend 2.2 h more travelling on an HSR train to reach their destinations. The estimation results show that there is also a "*distance traveled effect*"; the pure preference for HSR services increases in value from 9 Euros/trip to 13 Euros/trip (+44%) for distances traveled greater than 400 km. If confirmed, these results allow the conclusion to be drawn that the "catchment area" of cities on HSR networks is larger than that served by traditional rail.

1. Introduction

High-Speed Rail (HSR) provides a transport service that operates significantly faster than its traditional counterpart, using integrated and specialized rolling stock, and often dedicated tracks. Since there is no single worldwide standard, all the railway lines on which speeds exceed 200–250 km/h are commonly considered HSR. That said, there are some exceptions in which much lower-speed services (e.g. 160 km/h) may sometimes be considered HSR, especially in areas for which these speeds still represent significant improvements (European Commission, 1998).

Though usually designed for passenger transport, there are also cases in which HSR services for freight are discussed (e.g. Pazour et al., 2010; Rowangould, 2013) or tested (e.g. a few special TGV trains previously used by the French postal service for mail transportation).

The first example of high-speed train can be ascribed to the inauguration, over 40 years ago, of the HSR *Shinkansen* (known as the bullet train) between Tokyo and Osaka in Japan, able to reach speeds of up to 210 km/h. Since then, HSR networks have been built in many countries, and the train has become one of the most widely used transport modes for medium distance trips. Many examples can be found worldwide, for example in: Austria, Belgium, China, France, Germany, Italy, Japan, Poland, Portugal, Russia, South Korea, Spain, Sweden, Taiwan, Turkey, United Kingdom, United States and Uzbekistan.

Construction of a new HSR line can be considered the type of transportation intervention over medium-long distances which generally causes a considerable change in the system itself, just like the start of a new airline, the building of a new highway, or the development of a new shipping service. Clearly, HSR services have profoundly impacted mobility habits regarding medium-long range journeys, also entailing (as discussed in the next section) social, economic and environmental changes for the geographical areas involved.

Offered HSR services are quite heterogeneous worldwide. Jointly with faster trains, in some countries, HSR attractiveness is increased by a number of high-quality services which are actually converting "*HSR*" in a brand. These services consist in increasingly comfortable and spacious trains, but also free newspapers, bar, cinema, business areas and relaxation lounges. For examples, in Spain there are on-board babysitting area, in Germany, France and Italy a strong Wi-Fi connection is supplied, and an Italian HSR operator has even started to offer menus from a starred restaurant and a cinema area. The same occurs for pre-trip services, with the presence in stations of dedicated comfortable waiting rooms for HSR travelers, where drinks and snacks can be consumed and newspapers read while waiting for departure. Furthermore, in many cities the frequency of daily HSR services is becoming higher than traditional railway services, a benefit to be included in the "*HSR brand*". This means that a traveler, choosing an HSR service (against traditional ones, or other competing transport modes), inevitably takes into account, in addition to its original peculiarity of "*faster train*" services (lower travel times), also the presence of all these other "*hedonic*" characteristics of the HSR service. The term "*hedonic*" is here intended as the set of all the traveler's pleasures in using an HSR service, of which the train's high speed is only the most visible and investigated attribute.

Among the impacts related to the introduction of a new transport service, the effects of its hedonic value on mobility choices have been treated only marginally in the literature (e.g. Cascetta and Cartenì, 2014). By contrast, such effects appear to be relevant in a decision-making contexts where the choice of a mode/destination is made not only on the basis of level of service attributes (e.g. travel time, frequency and ticket price) but also on its attractiveness attributes (e.g. number of activities/opportunities, socio-economic attributes). In particular, there are not evidence in the literature about models estimation of the "*pure preference*" of an HSR service.

Starting from these considerations, the main originality of the proposed case study consists in estimating, through a quantitative analysis, for the first time in literature, the hedonic value (the "*pure preference*") of an HSR service for a domestic tourist trip, as compared to more conventional service variables such as travel time, service frequency and monetary cost. In summary, the aim of this research is twofold: *i*) investigate the conjecture according to which HSR services are perceived as an overall "*brand*" where high speed represents only one of the attributes; *ii*) investigate the domestic tourist attractiveness of the main Italian cities, evaluating which attributes (and with which weight) influence the perception of a city as a domestic tourist destination.

To do this, a computer-assisted telephone interviewing (CATI) survey was conducted at a national scale. The questionnaire was based on two main sections: an Revealed Preferences (RP) survey, to ascertain the travel habits of a sample of university students living in major Italian cities; an Stated Preferences (SP) survey to investigate the perception that these students have of the main Italian cities as possible tourist destinations for a trip by train. A binomial logit model with serial correlation in residuals was proposed for estimating whether or not the cities in a panel were perceived as possible destinations for such trips by train. This experimental setting was particularly appropriate for the aim of this research because