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RESEARCH ARTICLE

The Effects of Investments in New Transport Technologies such as HSR on the Tourism Industry

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Abstract:

Background:

The transportation industry and the tourism market are related to each other. Specifically a place with an efficient transportation system can be in general considered a good tourist destination.

Objective:

In this manuscript, the objective is to demonstrate whether the presence of High Speed Rail can affect tourists' choices of a given destination for their holidays. The case study of Italy has been taken into account.

Methods and Results:

An empirical analysis has been carried out with the help of a dataset containing information both on tourism and transport.

The results, in the case of the number of overnights, spent both by Italians and foreigners, show that the main variables having an impact are the HSR and Attraction ones.

Conclusion:

This paper has found evidence of a relationship between High Speed Rail and tourism outcomes in terms of the choice of this transport mode by tourists as well as an effect is registered on the number of overnights spent by them.

Keywords: High Speed Rail system, Tourist behavior, Overnights, Tourism market, Tourism industry, Transportation industry.

1. INTRODUCTION

The determination of the impacts of an infrastructure on tourism is extremely important for governments intending to promote this type of intervention. The coordination among the different stakeholders is crucial for making a given destination competitive with respect to others. For this motivation, an infrastructure has to be coordinated with other aspects such as destination promotion, image, coordination of local stakeholders and marketing on local tourism and community. On the other hand, understanding tourists' needs is becoming increasingly complex since today they have easy access to information and they are more focused on the quality–price equilibrium. Moreover, information technologies are shaking up the decision making processes since they have opened the access to more demand targets and have allowed new forms of

web-specialized organizations, like internet providers, which have become market leaders [1]. Moreover, globalization is another important aspect, making competition higher since each organization has to compete with many others at the international level.

The transportation system is made upon the demand system, *i.e.* users/passengers' demand to move in different parts of the territory and the supply system, comprising the transport infrastructures, services and rules. Tourists represent a particular category of users, travelling for the purpose of tourism. It is a common wisdom that a country with an efficient transportation system can be considered a tourist destination. Indeed, a highly accessible destination to transport facilities can become an attraction for tourists [2, 3].

During the centuries, the means of transport have been changing according to the development of technology. There is no doubt that the transportation system is undergoing a change

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and the traditional transportation market aims at understanding this new approach. The introduction of new transportation innovations has been extensive in the recent years, and this growth promises to continue in the coming years. This new trend perfectly follows the above phenomenon.

Since the origin of railways in Europe during the Industrial Revolution at the beginning of the 19th century, the speed of passengers, trains represented a sign of technological development of the most advanced countries at that time [4]. The Shinkansen High Speed Rail (HSR) inaugurated in Japan in 1964, represented a real breakthrough in transport technologies due to the increase in speed. Major investments on High Speed Rail systems have been recently carried out all around the world. Europe, together with Asia, is the leader in HSR systems.

The theoretical framework of this contribution is based on the identification of the significance of the role of the transportation system, and in particular of HSR, as a factor in the development of a tourist destination [5]. Indeed if the ability of tourists to travel to preferred destinations is inhibited by inefficiencies in the transportation system, there is some likelihood that they will seek alternative destinations. The fact the transport industry and tourism market are strictly related to each other is clearly highlighted in the nine Kaul's postulates [6]. Among them, the evolution of tourism is a function of the development of the means of transport; tourism is a mass phenomenon, calling for transport and other facilities suitable for each category; the quality of transport services offered influences the type of tourist flow. Moreover, the planned development, maintenance and operation of transport infrastructure under a well conceived overall transport policy, to meet the present and future technology demand and requirements, is the key to the success of the transportation system contributing to the growth of tourism. A book [7], on transport for tourism, provides a novel and stimulating assessment of the effects of tourism and travel and the challenge this poses to transport planners, providers and policy makers in the 1990s. The book covers key topics such as the role of government policies, supply and demand relationships, quality control systems, health and sustainability, and environmental impact. A range of international case studies, including transport in Bermuda, Singapore airways, British airways and Japanese transport systems, provide insight into these issues. The interdisciplinary approach ensures a holistic treatment of this important topic.

In their book, Hall *et al.* [8], a comprehensive global examination of the relationship between public transport and tourism is provided as well as exploring other sustainable transport modes. It offers a unique view by analysing tourism through the view point of public transport and *vice versa*. The volume provides an account of how the public transport experience can be improved for tourists so that its value can be maximised and a greater number of people can be encouraged to shift modes. It features a wide range of case studies and examples showing how the tourism industry, as well as regional economies, com-munities and the environment, benefit when public transport is widely used by tourists.

It is on these aspects that the present paper manages to provide a contribution to the international literature, focusing on the recent investments in HSR systems that several countries are now undertaking. Indeed HSR is changing travelers' behavior, thanks to its power of shrinking space and thus increasing the accessibility to a given destination. Masson and Petiot [9] stated that the introduction of HSR can improve tourists' utility and thus reinforce the attractiveness of a territory.

The structure of the paper is as follows. In section 2, the case study of the High Speed/High Capacity Rail system in Italy has been considered together with the methodology. Section 3 reports the results, while section 4 provides the conclusions and further perspectives.

2. THE CASE STUDY

The High Speed/High Capacity (HS/HC) Rail project in Italy has been taken into account as case study. The first section was inaugurated in 1992 with the "Direttissima" Roma-Firenze and today the network is of 1,400km. It serves big metropolitan cities, while the South of Italy has not benefited from any intervention in this new technology.

In 2015, Italy showed positive travel and tourism trends due also to the EXPO event in Milan, which provided an increase of tourists [10].

The transportation system and tourism market in Italy are expected to provide a positive performance and continue to grow [11].

3. THE METHODOLOGY

An empirical analysis has been carried out with the help of a dataset containing information both on tourism and transport for 77 Italian provinces, during the 2006-2013 period. The dataset is composed of 615 observations (77 cities x 8 years). The number of provinces considered here is the ones of the Italian regions excluding Basilicata, Puglia, Calabria, Sicilia and Sardinia regions, which did not experience any investment in HSR. The variables chosen are:

- ITALIAN_Tourists: no. of Italian Tourists (dependent variable, Census data);
- FOREIGN_Tourists: no. of Foreign Tourists (dependent variable, Census data);
- ITALIAN_Overnights: no. of nights spent by Italian tourists in tourist installations (dependent variable, Census data);
- FOREIGN_Overnights: no. of nights spent by Italian tourists in tourist installations (dependent variable, Census data);
- HSR: dummy equal to 1 if HSR is available, 0 otherwise (independent variable);
- POPULATION: no. of residents (independent variable, Census data);
- LOW-COST: no. of operating low-cost airlines bases (independent variable);
- GDP: is the Gross Domestic Product (independent variable, Census data);
- HUB: is a binary variable taking value 1 if the airport is a hub of a network carrier; 0 otherwise;
- %UNEMPLOYMENT: percentage of unemployment

in the province (independent variable, Census data);

- Attraction: no. of museums in a given destination (independent variable, Census data).

Two steps characterize the proposed methodology, *i.e.* the pre-processed testing and the multivariate analysis. In the first step, the impact of HSR (*i.e.* presence of HSR) on the four dependent variables has been studied, starting with the trend of their distribution functions.

In order to evaluate the difference between the distribution functions, *i.e.* one for the Before HSR and the other for the After HSR scenarios, for each of the four dependent variables, two inference tests, *i.e.* the Kolmogorov–Smirnov and Mann–Whitney ones, were performed. For both of them, the null hypothesis is rejected when the *p*-value is lower than $\alpha = 0,05$, meaning that between the two distribution functions there is a statistically significant difference [12].

In Table **1** the results of the tests have been carried out. As the computed *p*-value is lower than $\alpha = 0,05$, the null hypothesis is rejected, otherwise, the alternative hypothesis is accepted, this means that there is a difference and therefore the increase of tourists (both Italians and Foreigners) and the number of nights (spent both by Italians and Foreigners) have been affected by the presence of HSR.

Table 1. Test results.

Variable/Test	Mann-Whitney	Kolmogorov-Smirnov
ITALIAN_Tourists	< 0.0001	< 0.0001
FOREIGN_Tourists	< 0.0001	< 0.0001
ITALIAN_Overnights	< 0.0001	< 0.0001
FOREIGN_Overnights	< 0.0001	< 0.0001

The second step of the methodology concerns the multivariate analysis, which strengthens the preliminary statistical results.

In this study, the dependent variables can assume non-negative integer values. Moreover, they have been modeled through a Poisson distribution, where the probability of a given province i having y_{it} number of tourist per year is given by [13, 14]

$$P(y_i) = \frac{\lambda_i{}^{y_i} e^{-\lambda_i}}{y_i!} \qquad (1)$$

where $P(y_i)$ is the probability of province i having y_i tourist per year and λ_i is the Poisson parameter for province i. In order to investigate the relationship between HSR systems and the tourism market, Poisson regression models have been calibrated. This is a special class of the Generalized Linear Models (GLMs). Furthermore, the data consider measurements over time for the same cities, combing cross-sectional and time-series characteristics, known in literature as panel data. Panel data allows to consistently estimate treatment effects without assuming ignorability of treatment and without an instrumental variable, considering that the treatment varies over time and is uncorrelated with time-varying unobservable affecting the response [15]. Panel data usually give the researcher a large number of data points, increasing the degrees

of freedom and reducing the collinearity among explanatory variables – hence improving the efficiency of econometric estimates [16]. Modeling this type of data raises new specification issues, such as heterogeneity, which, if not explicitly accounted for, may lead to model parameters that are inconsistent and/or meaningless. A second issue is the serial correlation of the disturbance terms, which occurs in time-series studies when the disturbances associated with observations in one time period are dependent on disturbances from prior time periods. To avoid such errors, the Generalized Estimating Equations (GEE) have been used to analyze panel data [17].

The model parameters have been estimated using Maximum Likelihood Estimation (MLE). The significance of each variable has been tested with the t-student statistic, therefore a coefficient is significant when t is greater than 1.96. The goodness of fit has been measured by $R^2_{marginal}$.

3. RESULTS

In the international literature on the relationship between the transport and the tourism industries, it is reported that new transport alternative modes, such as HSR, need the coordination of other factors like destination promotion, image, destination management and marketing on local tourism and community [18 - 21]. Moreover, it emerges that HSR can, in some cases, contribute to the development of tourism since, in general, the inauguration of HSR service generates high expectations [22 - 24].

For example, an increase of tourist flows was highlighted in Taiwan [25] and in China, where some cities benefited from a HSR service [26]. Provinces served in China "*are likely to have approximate 20 percent additional numbers of foreign arrivals and 25 percent greater tourism revenues than provinces without such systems*" [27]. In Japan, the Shinkansen had significant impacts on tourism. Specifically, Kurihaaa and Wu [28] showed that that arrivals increased mainly in cities connected by the extended HSR.

In Spain, as in France, Urena *et al.* [29] argued that large intermediate cities served by HSR as Lille, Zaragoza or Cordoba registered growth in urban and business tourism.

Delaplace *et al.* [30] studied the relationship between HSR and the choice of theme parks in France. Specifically, the Disneyland Paris and Futuroscope Parks, which are served by HSR. Results showed that in the case of Disneyland, tourists appreciated the presence of HSR; while for Futuroscope, it was not considered a real alternative transport mode.

However, if an HSR service allows a faster travelling , at the same time, it facilitates to return quickly, minimizing the economic impact [31]. This idea has been extensively treated in the book by Hall especially referring to daily-travelers [32]. The analysis conducted by Bazin *et al.* [33], in some small and medium-sized cities in the North, Atlantic and Eastern Europe served by the TGV (Train à Grande Vitesse), showed that, despite an improvement in the accessibility, even in cities with a tourist heritage, the increase in tourists due to the HSR service was small. For cities of intermediate size, positive effects were registered on condition that they were "equipped" with tourist amenities, corresponding to a "basket of goods" among which tourists could choose. City size is also an

important factor to consider for the analysis of the relationship between the TGV and the tourism dynamism [34].

Albalate and Fageda [35] and Albalate *et al.* [36] demonstrated, for the case study of Spain, that HSR effects on the tourism market were not so significant. It is interesting to highlight the variety of situations, referring to specific cases, which underlines the importance of their contextualization. Indeed, HSR and its effects cannot be analysed independently on the socioeconomic characteristics of the areas they serve.

In line with the findings [37, 38], this manuscript provides an original contribution in terms of the methodology and the results obtained. First of all the proposed methodology, as previously stated, considers panel data since they have the advantage to analyse the dependent variables (in this case the ones related to tourists and overnights) for every province from both the cross-sectional and time-dependent perspectives. Specifically, the added value of this manuscript is that panel data allow analyzing the same sample of cities over time, and thus provides multiple observations for each city. Panel data generate more accurate predictions for the single city than time-series data alone. Moreover, they give the possibility of learning a city by observing the others, in addition to the information on the city itself. The GEE methodology over-comes the limitations of the classical models concerning heterogeneity and correlation. The models have been fitted by using population-averaged Poisson models and assuming that the coefficients of correlation decay exponentially over capture time.

From the analysis of the coefficients 'estimates, it is possible to observe that the variable representing the presence of an HSR station, *i.e.* HSR, has a positive impact on the number of Italian tourists. This result is in line with some case studies above reported. The Low-Cost variable, indicating the easy access to the plane alternative mode, with its positive and significant coefficient, affect Italian tourists' choices. The Attraction variable is positive and significant having an impact on Italian tourists' destination choice. The unemployment variable is negative and significant, representing, as expected, a negative impact on the number of Italian tourists (Table **2**), since they are not attracted by poor places. The variable HSR has also a positive impact on the number of foreign tourists as well as the Attraction variable. Moreover, foreigners are attracted by cities with a high GDP, which is connected with the services provided (Table **3**).

Table 2. Italian tourists.

Variable	Coefficient (*t*- student)
LOW-COST	0.735 (4.22)
HSR	0.15 (1.98)
%UNEMPLOYEMENT	-0.103 (4.12)
ATTRACTION	0.513 (2.06)
Constant	2.94 (10.21)
No. of observations	615
R^2	0.2

Source: Authors 'elaborations based on STATA

Table 3. Foreign tourists.

Variable	Coefficient (*t*-student)
HSR	0.017 (2.42)
Attraction	0.777 (6.26)
GDP	0.006 (4.38)
Constant	1.604 (5.68)
No. of observations	615
R^2	0.58

Source: Authors 'elaborations based on STATA

The results, in the case of the number of overnights, spent both by Italians and foreigners, show that the main variables having an impact are the HSR and Attraction ones. The socioeconomic POPULATION and GDP variables have a positive effect only on the number of overnights spent by Italian tourists. On the other hand, it is not surprising if the variable has a positive effect on the number of overnights spent by Foreigners (Tables **4** and **5**).

Table 4. Overnights spent by Italians.

Variables	Coefficient (*t*- student)
HSR	0.015 (2.15)
POPULATION	0.017 (3.05)
GSP	0.007 (3.59)
Attraction	0.651 (7.91)
Constant	3.664 (13.56)
No. of observations	615
R^2	0.74

Source: Authors 'elaborations based on STATA

Table 5. Overnights spent by Foreigners.

Variable	Coefficient (*t*-student)
HSR	0.027 (4.99)
Attraction	0.953 (8.68)
Low-Cost	0.022 (3.02)
Constant	2.798 (10.32)
No. of observations	615
R^2	0.72

Source: Authors 'elaborations based on STATA

CONCLUSIONS AND FURTHER PERSPECTIVE

Investments in transport infrastructures and services, such as HSR, can bring an increase in employment and then a growth of the economy of a country. On the other hand, marketing decisions and strategic planning of tourism need to know the factors having an impact on this choice and the forecast of tourism flows. The development and equipping of terminal and en-route facilities the systematic improvement in infrastructure, the absorption and adoption of new technology and appropriate mass marketing techniques in transport would have a pervasive impact in the continued growth of future world tourism.

Therefore, it is interesting to study how holidaymakers select their holiday destinations and investigate which factors are determining their choices. This has been the focus of this paper, where it has been demonstrated that the transportation

system plays an important role in tourists' choices. This is confirmed by the HS/HC Rail project in Italy, where both the number of Italian tourists and overnights are affected by the HSR infrastructure. The Mann-Whitney and Kolmogorov-Smirnov tests show that before and after the HSR inauguration the variables related to tourism are statistically different and thus an effect is registered. This outcome has been reached through the proposed methodology. Indeed, panel data have the advantage to analyse the dependent variables for every province from both the cross-sectional and time-dependent perspectives. Moreover, they give the possibility of generating more accurate predictions than cross section or time-series ones. However, the main disadvantage of this approach is that these data are correlated, thus the classical regression models cannot be used. To overcome this limit, Generalized Estimating Equations have been chosen to estimate the relationship between the tourism related dependent variables with the other independent variables. The independent variables finally considered are statistically significant, and they have been chosen by forward stepwise procedure.

Further research perspectives will consider the collection of more data. Indeed the data set should be enriched by extending the analysis to the regions and therefore to the provinces, excluded from this analysis. Specifically, the main provinces of Calabria, Basilicata, Puglia, Sicilia and Sardinia regions should be part of the future investigation, even though they are not directly served by the HSR system.

Data should be updated also from a temporal perspective, *i.e.* information should be at east collected till 2017, the last available year for which ISTAT (*i.e.* the Italian Census) provides information on tourism. New data will be soon available analyzing the question at the level of cities, *i.e.* at a more detailed level.

Another interesting aspect to analyse is to capture the heterogeneity of the independent variables, with respect to each province, with the Geographically Weighted Poisson Regression (GWPR) modelling technique. The latter, never applied in the context of tourism, represents a geographically weighted regression model, which allows measuring the relationships between independent and dependent variables w.r.t. space.

AUTHOR CONTRIBUTIONS

Francesca Pagliara has supervised, edited and written the whole paper.

Filomena Mauriello has gathered the data, specified the model and calibrated it, using STATA SOFTWARE.

CONSENT FOR PUBLICATION

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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