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Competition on fast track: an analysis of the first competitive market for HSR services

Ennio Cascetta[a], Pierluigi Coppola[b,*]

[a] *Dept. of Transportation Engeneering - University of Naples "Federico II", Via Claudio 21- 80125 Napoli (Italy)*
[b] *Dept. of of Enterprise Engineering University of Rome "Tor Vergata", Via del Politecnico 1, Roma 00133, Italy*

Abstract

This paper gives an overview of the dual effects of the opening, in Italy, of the new HSR line with a single operator (between 2005-2012) and the effects of a new operator entering the HSR market (2012-onward), on supply, demand and prices, thus inferring the effects of competition in this typically monopolistic market. The analyses are based on source data (laws and regulations, business plans, timetables, prices) as well as ad hoc extensive surveys, such as on-board counts on the HSR and intercity trains, retrospect surveys, and RP/SP interviews. In addition, an integrated modeling system has been developed to forecast the effects of competing timetables/services/prices in terms of different HSR operators, competing modes (air/ auto/railways), services (1st class/2nd class, etc.) and newly generated trips.

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Keywords: long-distance travel demand; modal competition; induced demand; travel time demand elasticity.

1. Introduction

High Speed Rail (HSR) network have largely expanded in the last decades. In Europe, following the LGV (Ligne à Grande Vitesse), launched in the early 80's between Paris and Lyon (420 Km), HSR services are nowadays diffused in Spain (AVE), Germany (ICE), Benelux (Thalys) and Italy (TAV) for a total of about 6.500 kilometers. New projects are under discussion or are in progress in Sweden, UK, Portugal, Russia and Turkey. On the other hand, in the Far-East, the pioneer Tokaido-Shinkansen HSR line (launched in 1964 for the Tokyo Olympic Games, between Tokyo and Osaka) has nowadays been joined by 5 new HSR lines for a total network extension of about 2300 Km for 353 million of annual passengers. As of 2011, China is the country with the

* Corresponding author. Tel.: +39-06-72597059; fax: +39-06-72597053
E-mail address: coppola@ing.uniroma2.it

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more extended routes in service including more than 3.500 km of rail lines at 300 km/h operating speed, and the network is expected to largely expand in the next years.

Different typologies of HSR operational models can be distinguished (see also Campos and de Rus, 2009), depending on the use (exclusive or mixed) of the HSR infrastructure. The Japanese case, for instance, is an example of exclusive HSR infrastructure with single operator: the High Speed Railways is entirely separated from the rest of the railways network and the High Speed trains run only on such infrastructure. On the other hand, the French operation model is characterized by HS trains using both HSR and non-HSR (duly potentiated) infrastructures. From the operations perspective, there are cases with a single operator in charge of the infrastructure and of the operations, as in Japan, where each of the 6 Shinkansen lines (infrastructure and service) is managed by a different private operator, or as in Spain and France where there is a single national operator in charge of the infrastructure and the service; and cases in which there is a distinct owner of the infrastructure and a different service operator, as it is in Germany, in Italy, and in Benelux for the Thalys, whose trains run on the HS infrastructure of different National Railways (Netherland, Belgium, France). In Italy, owing to the European open access regulatory framework, starting from April 2012 the new HSR private operator "Nuovo Trasporto Viaggiatori" (NTV) enters the HSR market, competing with the incumbent public-owned "Trenitalia". This is the first case in the World of pure competition among HSR operators (NTV and Trenitalia) on the same line (i.e. a single infrastructure managed by the State-owned company "RFI").

This paper presents an overview of the dual effects of the opening of the new HSR lines with a single operator (between 2005-2012) and the effects of a new operator entering the HSR market (2012-onward) on supply, demand and prices thus inferring the effects of competition in this typically monopolistic market. The paper is organized as follows. In section 2 the Italian HSR case study is presented starting from the characteristics of the current network. In section 3 empirical evidences of the evolution of the inter-province travel demand in the study area (in-scope demand) are discussed in terms of overall travel demand growth, modal shares and travelers' characteristics, before and after the new HSR line operations, including the impacts on the HSR market due to the competition among Trenitalia (the incumbent HSR operator) and NTV (the new competitor) in the first months of operation (April- September 2012). The analysis is based on an extensive survey campaign consisting of on-board counts and on a retrospect survey, gathered between the years 2008 and 2012 . In section 4 some direct elasticity values of HSR demand with respect to travel time, both in absolute terms and in modal shares, are estimated based on the observed passenger volumes and passenger-km's values of years 2010 and 2009. Finally, conclusions and current research areas are reported in section 5.

2. The regulatory framework of Rail Transport in Italy

Since the early nineties, Europe's rail transport sector has been characterized by a process of liberalization and privatization aimed at rationalizing the market and introducing competition into a sector traditionally characterized by monopolistic positions and a strong presence of public incumbents.

The European Commission (EC) has initiated a regulatory reorganization aimed at overcoming those who had been identified as a major obstacle to the development of the sector, in particular the absence of a competitive market. A number of EC Directives followed in the first (EU Directive 91/440) second (Directive 2004/51/EC) and third railway packages (Directive 2007/58/EC) (as of January 2013 the fourth railway package had been adopted by the European Commission but not yet been approved by the European Parliament), giving open access for all international passenger services across the railways of the European Union.

Each state has embarked on its path towards the liberalization of the Rail market, achieving different degrees of opening. Each country has chosen the model of competition that it deemed appropriate to achieve a double objective. On the one hand, raise the railroad in terms of traffic volumes, efficiency and quality of services offered and, on the other hand, continue to meet the demand for services with high social content, but not attractive to the free market.

In Italy, the European directives and the legislation that ensued, led to the separation of the various branches of activity within the previous competence of the incumbent Ferrovie dello Stato (FS). The management of the passenger service was given in charge to Trenitalia Spa while the management of the railway lines (formerly FS) were assigned to the Infrastructure Manager, i.e. Rete Ferroviaria Italiana (RFI). RFI has among its main tasks of maintenance, traffic management, the allocation of rail capacity (in terms of train paths or slot), the collection of rights of movement and control activities of operating rail services companies with regard to road safety. Trenitalia and RFI are 100% owned by FS.

Trenitalia and other (national or regional rail service) companies operating on the rail sections are required to pay charges for the use of lines and services to the infrastructure manager (i.e. RFI). A body of the Ministry of Infrastructure and Transport, the Office for the Regulation of Rail Services, in charge of overseeing competition in rail transport and to resolve any disputes.

Italy is now a best practice at international level, as it is the first country in which, following the liberalization of the passenger market, a trader entirely private, Nuovo Trasporto Viaggiatori Spa (NTV), provides services to high-speed transport in competition with the 'offer of the incumbent Trenitalia.

Trenitalia and NTV offer HSR passenger transport services that refer to a market open to free competition, where the services offered are not regulated under the tariff profile and are not subsidized. In this way they can be exploited to the maximum benefits for travelers, arising from the competition in terms of:

- schedules and frequency,
- stations of origin and destination services, and intermediate stops;
- differentiation of tariff levels;
- level of comfort and other on-board services ;
- ancillary services.

3. The Italian HSR network and services

In Italy, the first HSR service was launched in 1992 between Firenze and Roma with the so called “direttissima”, allowing trains to run at 230 Km/h and covering the 254 Km between Roma and Firenze in about 2 hours. The project of the “direttissima”, however, dated back to 1970. As a matter of fact, the new-generation HSR (i.e. with trains running at 300 Km/h maximum speed) was launched in December 2005 between Roma and Napoli (205 Km) and Milano and Bologna (182 Km). The project had a second step onward in December 2009 when the Milano-Torino (125 Km) and the Bologna-Firenze (79 Km) lines were completed, as well as the urban penetration in the cities of Roma and Napoli. As a matter of fact, from 2010 the backbone of the Italian HSR network is fully operative.

Today the service includes several city pairs at distances in between 100-250 Km, e.g. Roma-Napoli (205 Km in 1 hour and 10 minutes), Milano-Torino (125 Km in 54 minutes) and Roma-Milano (515 Kilometers in 3,5 h and, with a direct service (i.e. no stops in bologna and Firenze) in 3 hours. The HSR service frequency on the HSR network ranges from 1 train/h to 4-5 train/h in the peak period on the sections between Roma, Firenze and Bologna (Fig. 1).

The Italian HSR project is still under development. The station-to-station travel times, which have already been reduced, depending in the OD pair, of about 20-40% (Cascetta et al., 2013), are expected to be further reduced with the completion of the new underground bypass-stations in Bologna and Firenze that will allow to speeding up the service in such dense urban areas. Moreover, Trenitalia has announced the launch of new-generation HS trains running at 360 Km/h as of 2015, which would reduce the travel time from Roma to Milano down to 2 hours and half. Several extensions of the current network are in progress, such as the Milano-Venice and the Torino -Lyon, or are being discussed (e.g. the Napoli-Bari and the Milano-Genoa segments).

Between 2009 and 2012, the supply of HSR services in Italy has seen a sharp increase. On the one hand, thanks to the completion the infrastructure, services have been increased on the HSR infrastructure between Naples, Rome and Milan with extensions to / from Turin and Salerno (Figure 1). On the other hand, the entry of the new operator NTV into the HSR market, has led to an increase of the HSR services to Venice and Padua, new services to Rimini and Ancona (along the Adriatic corridor), HSR services in new stations as in Rome (Tiburtina and Ostiense) and Milan (Rogoredo, and Porta Garibaldi).

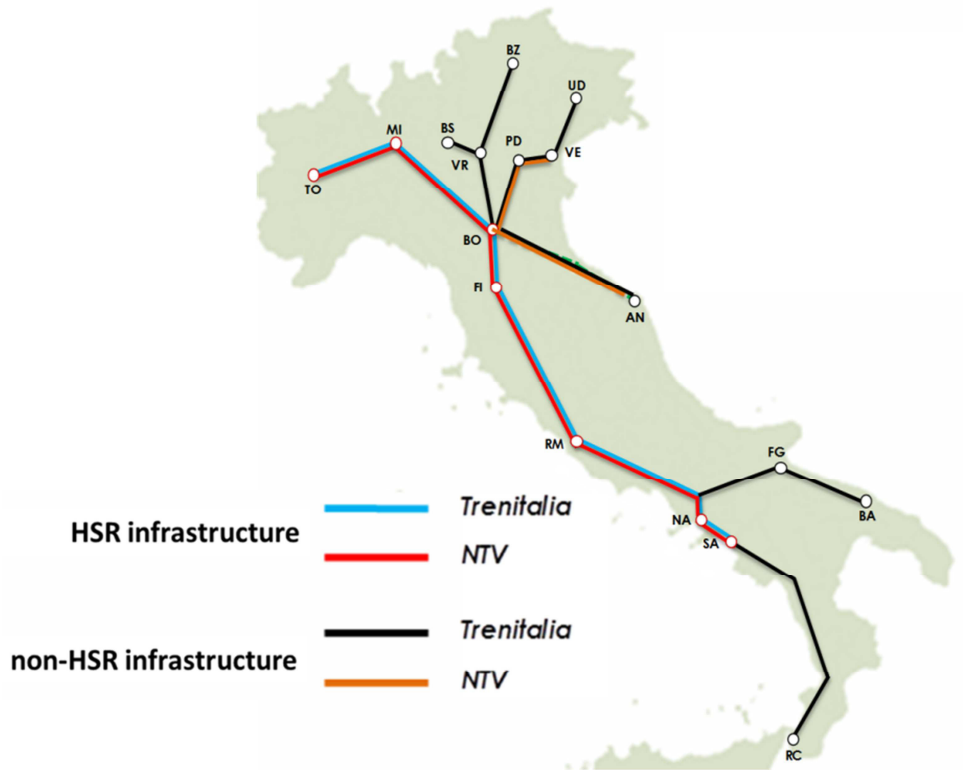

Fig. 1. Italian HSR infrastructure and services

Along the main line Milan-Rome-Naples, the supply of services AV Trenitalia has grown from 71 daily departures in 2009, to 89 runs/day in 2012 (Table 1). In terms of train-km, thanks to the service extensions in Salerno and Turin, the increase is even more significant: treniKm 40,800 / day in 2009 to 61,850 treniKm / day in 2012, about 50% of treniKm more in four years .

Table 1. distances and travel times by Rail before and after the HSR on selected OD Pair.

	TRENITALIA								NTV	
	2009		2010		2011		2012		2012	
Line	n. runs	Trains km (000)	n. runs	Trains km (000)	n. runs	Trains km (000)	n. runs	Trains km (000)	n. runs	Trains km (000)
TO-MI-RM-NA-(SA)	71	41	86	57	91	61	89	62	38	28
(NA)-RM-VE	24	14	26	14	29	15	37	19	6	3
TOTAL	**95**	**55**	**112**	**71**	**120**	**76**	**126**	**81**	**44**	**31**

The competition also triggered a virtuous competition in the overall reorganization of the service, including a range of ancillary services for travelers, both on board (entertainment, WI-FI, …) and on local access-egress transport (parking facilities at the station, parking reservation, integrated local public transport tickets, etc.), as well as in the form of agreement with local museum, hotels and other tourism attractions (Table 2).

Table 2. new services on HSR induced by operators competition.

	new services
on board	entertainment silence area
access-egress mobility	car renting parking reservation local public transport ticket integration
tourism	agreements with local museum, hotel, etc.

4. Evidences on HSR demand

Since 2008 a vast campaign of surveys has been carried on monitoring the evolution of the national demand of passenger transport, compared to the modification of HSR services, in terms of total trips, modal split between long distance transport modes, individual trip frequency, travelers' daily routine and life-styles. The available data were gathered by means of on-board counts and RP/SP surveys carried on between May 2009 and March 2013. The counts were used to update the existing outdated OD matrices of Eurostar and Intercity trips, and to estimate the total inter-province OD flows on HSR.In addition O-D matrices were acquired on highways and between airports to evaluate the effects on the HSR competing modes.

The results in terms of passengers travelling HSR are impressive, even more when contextualized in the overall long-distance passenger demand market shrinking due to the crisis. The approximately 55,500 travelers / day of 2009 have grown steadily to about 85,000 in 2012 with an increase of 52%. (Fig 3). The rise in passengers has been matched by an even more substantial increase, 79% in terms of passenger-km. This phenomenon is due to the increase in mileage. It is interesting to note that even Trenitalia has further increased HSR patronage in 2012, despite the entry into operation of the competitors NTV.

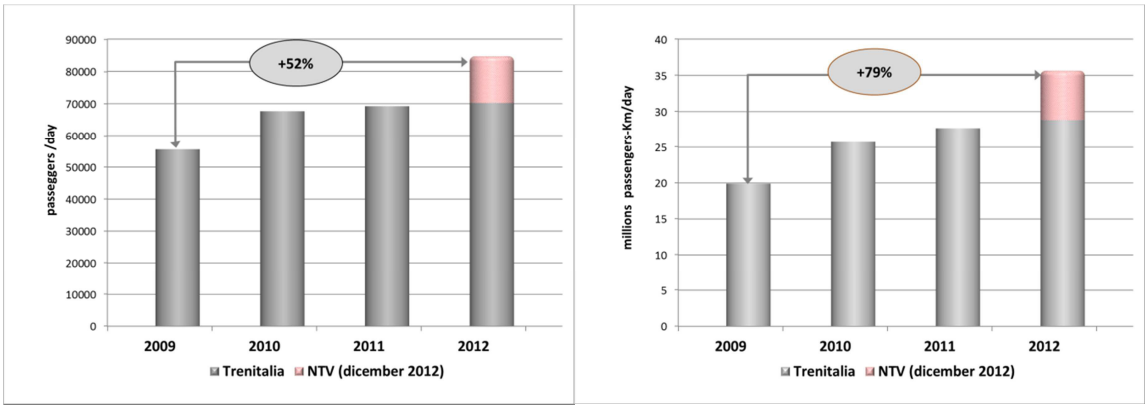

Fig. 2. HSR demand trends in Italy (passenger and passenger-Km's).

Using the source data available on domestic Air transport (ENAC 2009,2010) and on highways traffic (AISCAT 2009, 2010), an analysis of domestic travel demand has been carried on. Comparing the trends in long-distance demand by transport mode (Auto, Air, Rail), year 2009 in which HSR along the Naples-Milan section comes into operation, marks up a turning point for rail transport. Despite the economic crisis continues to burden on the country's economy, an extraordinary +37% growth in the number of passengers on HSR offsets the reductions on other rail services to medium and long distance, i.e. Intercity and Eurostar (-43%), leading to a increase between 2009 and 2012 in the HSR core area of +21% by Rail. In addition, for the plane, on a national basis the movement increased by 1%, while in the area served by the HSR (i.e. "core area") decreased by 21%. Long distance motorway traffic decreased by 9% on a national basis and by 18% in the HSR core area. A differentiated reduction of air and auto travel can be estimated respectively of 22% and 9% (Figure 3).

The above analysis shows that the demand by Auto and by Air modes between the OD pairs not served by the new HSR services have varied at a significantly different rate with respect to the demand between OD pairs within the HSR core area. In other words, the introduction of the new HSR services has a direct impact on the modal split of the long-distance travel demand. Moreover, it can be observed that the outstanding increase of the HSR trips is mainly concentrated in the first year of operations (i.e. year 2010), but this is still significant also in 2011 due to a "time-lagged" effect which is due to be taken into consideration when doing economic analysis. It, finally, had a further increase on after the incoming of the new HSR operator in year 2012.

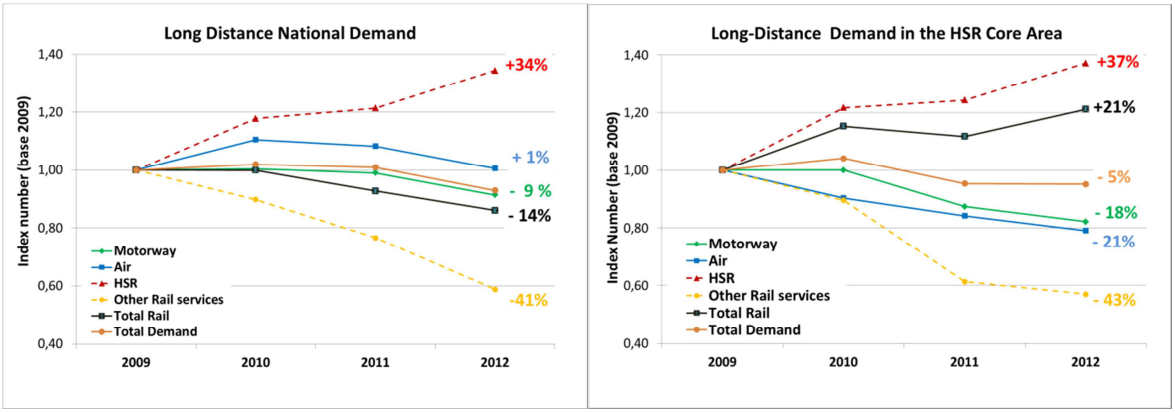

Fig. 3. demand trends by modes in Italy and in the HSR core area (index numbers).

Between 2009 and 2012, the modal share of HSR passengers demand in the core area increased from 27% to 39% (in terms of passenger-km by 39% to 55%), compared to a reduction of highway modal share from 56% to 48% (in terms of passenger-km respectively from 28% to 21%) and Air from 10% to 8.5% (in terms passenger-km respectively from 26% to 21%) (Figure 4a).

Contrary to other studies which describe "High Speed Trains as a Substitute to Aircrafts" (as quoted in Givoni, 2006), the reduction of modal shares here reported, i.e. higher by car than by air, can be explained by the configuration of the Italian HSR network, which, due to the topography of the Country, mainly connects population and activities at distances in between 100-250 km's where Air demand is negligible, and, the induced demand effects are higher. This is confirmed by the fact that if we consider city-to-city trips at distance above 500 Km, such as Rome-Milan OD pair, HSR modal share has increased from 45% in 2009 to 68% in 2012, with a sharp reduction in the modal share of air from 45% to 26% and a negligible decrease of highway (Figure 4b).

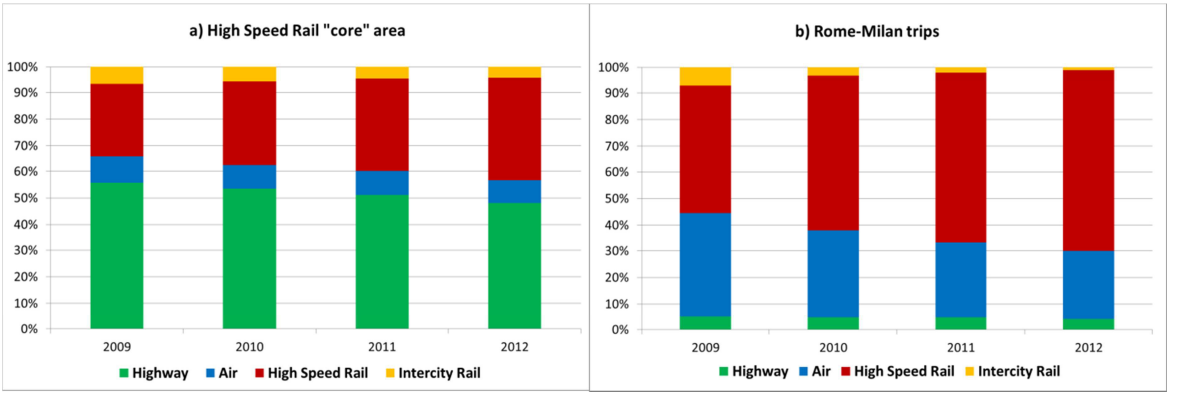

Fig. 4. modal shares in the HSR core area and on the Rome-Milan OD pair.

The +37% increase of HSR demand between 2009 and 2012 in the core area, corresponds to about 5 million more passengers for Trenitalia, and to about 2 million passengers carried by NTV in 2012. These can be split in principle split into three components: diverted demand, which derives from the travelers' mode choice diversion toward HSR either from other modes (e.g. auto, air) or other rail services (e.g. intercity); economy-based demand growth, which is linked to the trends of the National and International economic systems, under the assumption that the more the people are wealthy the more they travel; and induced demand, consisting of travelers that before HSR did not travel at all or that have increased the frequency of their trips thanks to HSR .

To further investigate who are the above 7 millions of passenger demand a comprehensive modeling system have been estimated (Cascetta and Coppola, 2012) based on two RP-SP surveys were carried on during May 2009 and October 2010, and based on panel data started in 2012 (Pragma, 2012). According to the model simulations, it was estimated that approximately 3.1 million (44%) are demand diverted from other modes (2.2 million from Air and 0.9 million from highway); 2 million travelers (29%) in diversion from other rail services to medium and long distance (mostly Intercity) and the remaining 1.9 million (27%) are induced demand (Figure 5).

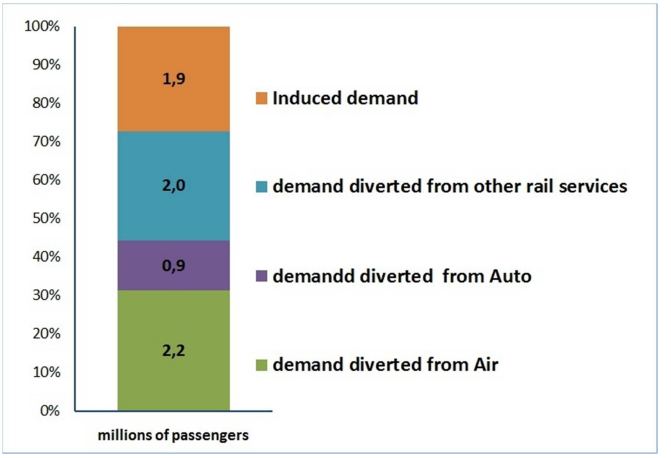

Fig. 5. taxonomy of the generated demand on HSR (between 2009 and 2012).

Induced demand depends either, in the mid-short period, "directly" on the generalized travel cost, i.e. changes in travel choices such ad trip frequency , destination or activity pattern ,e.g. the trip becomes more frequent because traveling with HSR is faster, cheaper and/or more comfortable, or, in the long period, "indirectly" due to modifications of the travelers' mobility or lifestyle choices, e.g. travelers start commuting (i.e. making more frequent trips) due to the relocation of the residence or of the workplace, and partly due to changes in land use, e.g. new residents, jobs and activities interconnected thanks to HSR.

The characteristic profile of these travelers, conducted through a sample of NTV users, show that it is mainly of users moving over short distances and for vacation. It should not be, however, neglected the rate of "new HSR commuters" i.e. those users who, thanks to the fast connections, were able to change their lifestyle, changing place of residence or study, or even working , starting to commute daily or weekly on high-speed trains between the new home and the place of work or study, and vice versa. Evidences from the Customer Satisfaction carried on by NTV in 2012, show that about 23% of NTV passengers changed their zone of residence in the previous year and 7% due to introduction of the new HSR services.

Finally, it is worth mention the demand of tourists on HSR trains that has increased significantly thanks to the network of art cities (Rome, Florence, Venice) created by the new HSR links. Evidences from a study on the travel demand of international tourist in Italy (Pragma, 2013) show that against an increase of 6% of the total number of tourist in Italy in the last two years (2010-2012), the number of tourists visiting the HSR cities increased by 23%.

5. Evidences on HSR tariffs

The competition in the HSR had a direct impact on the HSR fare structure and on the on-board services offered: from a simple base tariff with two classes (1st and 2ndclass), in 2011 the layout of the trains have been revamped to offer up to four different way of travel (i.e. Executive, Business, Premium and Standard); moreover a new pricing structure base on three different fares (i.e. Base, Economy and Super-Economy) for each class have been introduced (Table 3).

Table 3. evolution of tariff structure and ambient of travel induced by HSR competition.

	2009-2010	2011	2012
HSR tariffs	BASE	BASE mini	BASE Economy Super-Economy /Low-Cost
classes	1st class 2nd class	Executive /Club Business /Prima Premium Standard /Smart	

The new pricing structure and availability of promotional offers has led to a substantial reduction in the average price per passenger by about 30% (Figure 6), but has also expanded greatly the "gap" of tariffs, allowing low-income segments to approach for the first time High Speed Rail services, with an effect similar to the introduction of low-cost flights in the Air market.

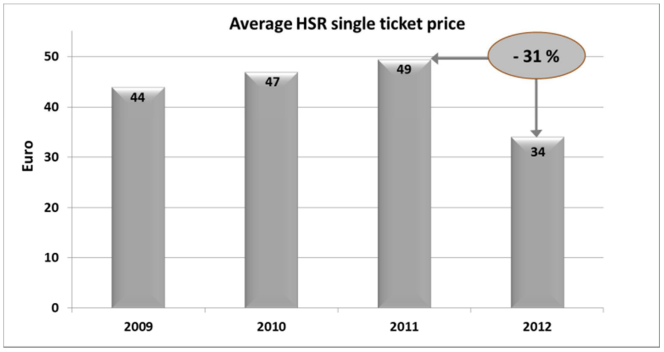

Fig. 6. evolution of average single ticket price by HSR from 2009 to 2012.

6. Conclusions

The empirical evidences from the Italian HSR market, presented in this paper, show an outstanding increase of HSR passenger between 2009 and 2012. This is partly due to the opening of the new HSR lines and partly due to the competition effects of a new operator entering the HSR market in 2012 (i.e. NTV) competing with the incumbent Trenitalia.

As a result, HSR modal share in the HSR core area increased from 27% to 39%, compared to a reduction of highway from 56% to 48% and Air from 10% to 8.5%. The reduction of modal shares higher by car than by air, can be explained by the configuration of the Italian HSR network, which, due to the topography of the Country, mainly connects population and activities at distances in between 100-250 km's where Air demand is negligible, and, the induced demand effects are higher.

The rise in passengers has been matched by an even more substantial increase, in terms of passenger-km. This phenomenon is due to the increase in the average travel distance.

The increase of HSR demand between 2009 and 2012 corresponds to about 5 million more passengers for Trenitalia, and to about 2 million passengers carried by NTV in 2012. . It is interesting to note that even Trenitalia has further increased HSR patronage in 2012, despite the entry into operation of the competitors NTV.

The above 7 millions of trips consist of 3.1 million trips (44%) diverted from other modes (2.2 million from Air and 0.9 million from highway); 2 million trips (29%) in diversion from other rail services on medium and long distance (mostly Intercity); the remaining 1.9 million (27%) are induced demand

Induced demand consists mainly of users moving over short distances and for vacation. It includes, however, a number of users (i.e. the new "HSR commuters") who, thanks to the fast connections, were able to change their lifestyle, changing place of residence or study, or even working , starting to commute daily or weekly on high-speed trains between the new home and the place of work or study, and vice versa.

Due to the competition HSR services expanded over the rail network and in new stations of Rome and Milan (i.e. the main metropolitan area of the Country). Moreover an increase of on-board services offered has been observed, as well as an overall reduction of the HSR fares (-31%) thanks to the new pricing structure and availability of promotional offers.

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