

The impact of open access on intra- and inter-modal rail competition. A national level analysis in Italy.*

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Abstract

During 2012, the Italian passenger market experienced the entry of a new operator, *Nuovo Trasporto Viaggiatori* (NTV), in direct competition with the incumbent, *Trenitalia*, on the high speed rail (HSR) segment of the market. This is a unique situation among European countries: nowhere else two companies compete directly for HSR services on open access basis. In this paper we empirically explore the competitive effects of this entry in the passenger market tackling two issues. First, we explore price and capacity effects of the stemming *intra-modal competition*. Second, we measure the effect of *inter-modal competition* by HSR on airline pricing behaviour. The results shows that the two railway companies engage in strategic pricing, although to a different degree on different routes and that capacity and frequency are strategic variables. We also find that, when flights are in direct competition with HSR services, airlines significantly reduce fares.

Key words: intra-modal competition, inter-modal competition, airline pricing, railway pricing.

JEL Codes: L11; L92; L93

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1. Introduction

In the last decades, competition among rail and air transport for the short and medium-haul passenger markets has steadily increased. Before the introduction of high-speed rail (HSR) services in the second half of the 20th century, rail and air companies were not competing with each other, given the huge differences in travel time. Nowadays, the provision of HSR services notably reduced the gap in the travelling time from city-centre to city-centre. The *Union Internationale des Chemins de fer* (UIC) identifies HSR services as those running at a minimum of 250km/h (155mph). Indeed, González-Savignat (2004) argues that HSR services can be even seen as a new form of railway transport.

Until now, the expansion of HSR services has stimulated mainly the analysis of inter-modal competition effects. By improving the quality of services over the traditional train services, HSR generate significant competitive pressures on airline companies over specific travelling distances. According to the UIC (2010) the “HSR services being less rapid than air still can hold the majority of market shares when the travel time ranges between 2h and 3h30” and there is evidence in many European countries of a significant substitution effect between HSR services and airline connections.¹ However, the new services stimulated also overall rail demand. As a matter of fact, in Europe, over ten years, demand increased sevenfold passing from 15.23 million pax/km in 1991 to 110.35 million pax/km in 2011. Furthermore, the share of HSR services has increased from 15.9% in 1991 to 27.1% in 2011, more than one percentage point per year.^{2,3}

More recently, the expansion in demand, coupled with the increasing liberalisation of the rail market, is starting to attract the interest of new investors and to promote intra-modal (on-track) open competition. The Italian market is a perfect case for analysing the impact of HSR on the sector as, not only inter-modal competition between rail and airline companies (both traditional and low cost) is mature, but also, it is the first and sole case in which two railway companies compete on the open access basis for HSR services in Europe.

In April 2012, in fact, *Nuovo Trasporto Viaggiatori* (NTV) started the HSR services on the Rome-Milan connection, in direct competition with the incumbent *Trenitalia*. Since then, NTV entered also other two city-pair markets, namely Rome-Venice and Rome-Turin and more recently the Salerno-Napoli-Rome and the Milano-Ancona route. There is, thus, a situation in which we can observe, contemporarily, inter and intra-modal competition due to the outcome of open access regulation in the railway market and to the effect of competition between the incumbent, Alitalia, and the low cost carriers in the airline business. As a matter of fact, in 2008, when the HSR services were initially introduced on the Rome-Milan city-pair market, the rail market share was 36% as opposed to the 51% of airline market share.⁴ At the end of 2011, passengers using *Trenitalia* services were over 56% (see Longobardi, 2013). In 2012, with the entrance of *NTV* and the reaction of *Trenitalia*, the share of HSR services on the Rome-Milan route went up to 68% while airlines' share stopped at 26% (*Ministero delle Infrastrutture e dei Trasporti* (MIT), 2013 and *NTV*, 2013).

¹ On the Paris-Brussels connection - which is about 320 km, corresponding to 1 hour and 15 minutes of travel time - the modal shift has lead to a reallocation of traffic. After the introduction of HSR, the demand has passed from 25% to 50% for rail services and from 61% to 43% for air services. The impact has been even more relevant for the Madrid-Seville connection, having a length of almost 500 km, corresponding to 2 hour and 15 minutes of travel time. Before the introduction of the HSR services, trains had just about one third of total demand. Thereafter, trains account for over 84% of the demand. Clearly, the impact was not uniquely due to the passengers' reallocation but also to the substantial increase in the demand.

² Statistical Pocketbook DG Mobility and Transport (2013).

³ An ample body of literature explains the effects of the introduction of new services on transport demand. See, among the others, Gutiérrez et al. (1996), Gutiérrez (2001), Willigers and van Wee (2011) and Cao et al. (2013).

⁴ In 2008 the road transport held the 13% of market share.

The penetration of *NTV* on the market has been very fast: in 2012 it transported just over 2 million passengers (against the 25million of *Trenitalia*; Longobardi, 2013 and *Trenitalia*, 2012) while in 2013 *NTV* reached a share of 25% of the market with about 7 million passengers (*NTV*, 2013).

Most of the past contributions focussed either on the effect of air-related competition on fares⁵ with regard to the role of low cost carriers (LCCs)⁶ or on the airline pricing behaviour when carriers face competition from HSR services. Indeed, a number of studies on inter-modal competition mainly analyse the actual or the potential modal shift between air and rail due to the entrance of HSR operators.

Given the peculiarity of the Italian market, we are able to analyse these two complementary issues together. On the one hand, we explore price and capacity effects of *intra-modal competition* among HSR companies; on the other hand, we measure the effect of *inter-modal competition* on airline pricing behaviour. In this work, in fact, we attempt to verify whether there is a strategic interaction in fare and capacity choice between *Trenitalia* and *NTV* on all the competing routes. We also explore the effect of inter-modal competition on airline pricing behaviour on the Rome-Milan city-pair market. Indeed, HSR services on the Rome-Milan route are an effective alternative to flights as the total journey time is below the three hours. Therefore, we believe that the entrance of *NTV* in the HSR sector has stimulated competition, not only with the former incumbent *Trenitalia*, but also with the airlines. The competitive pressures have diverted a substantial share of passengers from air transport to rail transport⁷, but have also exerted a significant influence on fares, especially of LCC. Further, more generally, understanding the pricing behaviour of competing railway companies on the same routes with comparable services and the impact that their presence has on the pricing behaviour of airline carriers, could yield useful policy insights. In such a differentiated-products framework, characterized by an oligopolistic structure, firms are competing both in terms of prices and product characteristics. Here we focus on price competition assuming that, in the short run, product characteristics are fixed.

The dataset we use to address the research questions is unique. Data on one-way fares were retrieved from railways and airlines' websites by simulating reservations. Fares are collected daily, starting at sixty booking days before departure. As already mentioned, the intra-modal competition analysis is conducted on all the Italian domestic routes where *Trenitalia* and *NTV* compete. The inter-modal competition analysis focuses on the Rome-Milan connection as air and rail travelling times are similar and, thus, the transport services can be considered substitutes.

The results show that the intra-modal competition has led to an overall increase in the supply of services and, thus, to a greater utilization of the network. Indeed, the appearance of *NTV* has not induced *Trenitalia* to cut on its supply. Actually, analysing the daily frequencies, it appears that *Trenitalia* has increased the capacity by over the 30% from the year previous to *NTV* entry. Specifically, the overall capacity on the Rome-Milan connection has increased by over 56%. Furthermore, the two railway companies are found to engage in strategic pricing, although to a different degree on different routes. The incumbent's tariffs are, on average, 29.92% to 34.67% higher than the newcomer's, thus there is no evidence of predatory pricing or of a particularly aggressive pricing behaviour by *Trenitalia*.

⁵ Gaggero and Piga (2010, 2011) focus on the effect of intra-modal competition on fares. Bergantino and Capozza (2014) explore the airline pricing behaviour in context where inter-modal competition is very limited or even absent.

⁶ Consumers benefit from the increased supply of services, especially on point-to-point connections, but especially from fares' reduction due to the competitive pressures exerted by LCCs on legacy carriers (see, for instance, Bergantino, 2006; Bergantino and Ponti, 2006; Fageda et al. 2011).

⁷ According to *NTV* (2013), more than 2 million passengers only on the Rome-Milan route were diverted from airlines between 2009 and 2012.

The results of our study have relevant implications for antitrust policy as a number of cases have been levied to the Italian Competition Authority (*Autorità Garante della Concorrenza e del Mercato*, AGCM) by *NTV* against *Trenitalia*, *Rete Ferroviaria Italiana (RFI)* - the infrastructure manager -, and their mother company, *Ferrovie dello Stato Italiane SpA (FSI)* for discriminating behaviour⁸. Furthermore, on the 28th of May 2013, the AGCM started an investigation on *Trenitalia*'s pricing strategies on the route Rome Termini-Milan Centrale, since *NTV* complained accusing the incumbent operator of dumping and cross subsidization. In the specific, *NTV* claimed that *Trenitalia* set under-cost prices for HSR services, compensating with the subsidies received from the Regions and the local authorities under the public service obligations (PSO) contracts. Nowadays, the latter investigation is still open.

Finally, the inter-modal competition from HSR services is found to affect the airline pricing behaviour. The presence of inter-modal competition reduces fares, on average, up to 13.26 Euros. These findings have to be carefully taken into account by policy makers also when evaluating the investment decisions regarding the development of HSR infrastructure. From our results, it emerges, in fact, that there is an important positive spill-over effect in terms of consumer welfare as the inter-modal competition induces airline companies to decrease fares. This can be considered as an indirect benefit of HSR services that should be incorporated in the cost-benefit analysis of HSR infrastructure investments.

The remainder of the paper is organized as follows. In Section 2 we survey the relevant literature. In Section 3 we analyze the liberalization process in the European Union and in Italy, with a focus on the appearance of intra-modal competition in the rail sector. In section 4 we describe the data and the collection methodology. In Section 5 we show the analysis of the intra-modal competition while in Section 6 we carry out the empirical analysis on the inter-modal competition. Finally, in Section 7 we draw some conclusions and policy implications.

2. Literature review

The first study on the inter-modal competition between HSR and air transport was conducted by Janic (1993). He claims that HSR transport could compete with the air transport over a relatively large range of distances, between 400 and 2,000 km. Indeed, González-Savignat (2004), using a stated preferences model, predicts a high substitutability between air and rail services on the Madrid-Barcelona connection, arguing that HSR was expected to achieve 40% of market shares in the business segment and almost 60% in the leisure segment. Similarly, Roman et al. (2007), relying on a stated preferences analysis, explore the potential competition between HSR and other transport modes in the corridors Madrid-Zaragoza and Madrid-Barcelona. Their results show that travellers' willingness to pay seems to be even higher for HSR services than for air transport services. Consistently, Martin and Nombela (2007), focusing on Spanish domestic connections, predict that if the rail infrastructures is upgraded in order to be suitable for running HSR services, there would be an important modal shift in favour of HSR. Specifically, they forecast that, after the

⁸ The liberalization process was not so straightforward. In March 2011, in fact, *NTV* complained that the infrastructure manager, *Rete Ferroviaria Italiana (RFI)*, was hindering its entrance by making last-minute changes to the network statements. The holding *Ferrovie dello Stato Italiane (FSI)* and some of its controlled companies were also accused of abuse of dominant position, with reference to the slots' concession to *NTV* on the Rome-Milan route. *Trenitalia*, in turn, when *NTV* received the authorization to operate, accused the newcomer to do cream-skimming and cherry picking in the Italian rail market. On 12th of March 2014, the AGCM close the investigation for the abuse of dominant position declaring *FSI* to be not guilty. However, *FSI* was required to guarantee a fairer behaviour towards competitors (for a review of the cream-skimming practices in the railway industry, see Alderighi and Bergantino, 2011 and 2013).

lines' upgrade, the HSR would gain the 22.8% of passenger market share, which could even tripling in ten years.

Some papers focus on both the intra- and inter-modal competition between airline and railway companies. Antes et al. (2004) study the entry of low-cost airlines in the German passenger transportation market, finding that, both air and rail companies are induced to reconsider their pricing strategy as long as the competitive pressure of LCCs increases. Ivaldi and Vibes (2005) propose a framework to explore the intra- and inter-modal competition on the connection Cologne-Berlin. On this city-pair, the flag carrier Lufthansa competes with three LCCs, namely DBA, Germanwings and Hapag-Lloyd Express, and the rail incumbent Deutsche Bahn AG. Using a game theoretical approach, the authors derive the market equilibrium and simulate hypothetical scenarios in order to evaluate the effects of both structural and regulatory changes on that market, such as the entry by a new rail operator or the introduction of a kerosene tax. Overall, they provide theoretical and empirical evidence that a small number of competitors is enough to create a high degree of intra- and inter-modal competition. Focusing on competition and complementarities between rail and air transport, the study conducted by Steer Davies Gleave (2006) for the European Commission shows that HSR is able to capture a relative large market share and, as a consequence, airline fares could even drop below that of HSR services. Furthermore, when travel time is significantly reduced thanks to the opening of a HSR connection, the rail operator can even increase prices to maximize profits, without losing a significant market share since the journey time is the most important determinant of travellers' demand. Campos and de Rus (2009) provide different examples on the effect of inter-modal competition around the world. One of the most meaningful refers to the Korean passenger markets. Actually, the HSR services, since their appearance in 2004, have beaten the domestic air travel in two years. Further, HSR on the London-Paris route was able to steal passengers from competing modes and also attracted new travellers, reaching, overall, the 70% of the market share. Either Behrens and Pels (2012) examine the London-Paris market. They estimate the degree of the inter-modal competition by using elasticity measures of market share and define the conditions under which HSR services are a suitable alternative to flights. The empirical results shows that HSR is an effective competitor for both FSCs and LCCs. Some FSCs are even pushed out of the market when they encounter a strong competition by HSR.

Dobruszkes (2011), focusing on five European city-pairs, Paris-Metz, Paris-Brussels, Brussels-London, Paris-Marseilles, and Cologne-Munich, provide evidence about the importance of the travel time for HSR to successfully compete with airplanes. Also, other factors, such as frequencies, fares and geographical structures, play a role as they influence the waiting time or the access time to the transport service. Jiménez and Betancor (2012) examine the air carriers' reaction to the opening of the HSR services in Spain. They test whether the HSR affects the airline travel frequencies and market shares and they find out that the presence of the HSR service reduce, on average, the number of air operations by 17%, although the flag carrier Iberia does not seem to be affected by HSR competition. Yang and Zhang (2012) explore airline and rail pricing behaviour with respect to the airport access time. Airfares decrease in the airport access time, whereas rail fare increases. In addition, airline fares are found to be decreasing in rail speed when the marginal cost of HSR is not too large.

Differently from the aforementioned contributions, some papers consider the potential for cooperation rather than competition between HSR and air transport. Givoni and Banister (2006) demonstrate that airlines can use rail services as an additional spoke in their network, when this is more economically convenient. Actually, as Dobruszkes (2011) mentioned, on the Paris-Brussels connection, Air France initially reduced its supply, thereafter it even cut its services in favour of an

agreement with Thalys, the HSR operator, that, in turn, reserved one or two carriages on the connection from Brussels to the rail station of the Paris Charles De Gaulle Airport, which serves as hub for Air France. Similarly, Behrens and Pels (2012) predict that both British Airways and Air France would be better off by integrating HSR in their networks instead of competing with. Finally, Preston (2012), evaluating the pros and cons of HSR investments in Great Britain, states that there could be competition *or* cooperation among transport modes depending on the presence of a HSR link to London Heathrow Airport and whether rail and airline companies would sign an agreement.

3. The liberalization process from the EU to Italy: the appearance of intra-modal competition in the HS rail sector

In the last twenty years the Commission has been very active in restructuring the European rail transport market and strengthening the position of railways with respect to other transport modes. The opening up of the national freight and passenger markets to cross-border competition has been a major step towards the creation of the integrated European railway area that breaks down barriers in favour of a more competitive rail sector, along with better connections between the European Union and the neighbouring markets.⁹

Prior to 1991, there was very little European legislation that applied to railways, basically only regulations of the European Economic Community (EEC) No. 1191/69 and 1107/70, dealing with public service obligations and subsidy payments. These two regulations were superseded only in 2007, by the regulation of the European Commission (EC) No. 1370/07.

Starting in 1991 with the 91/440/EEC Directive,¹⁰ a series of EC directives, regulations and other legislative initiatives have been adopted to support the liberalization and market opening process. Notably the three railway packages were introduced in 2001, 2004 and 2007.

The 1st Railway Package, introduced in 2001, provided more comprehensive access rights for freight. Since March 2003, any railway operator licensed within the European Community had the right to obtain the access, on an equal and non-discriminatory basis, to the national sections of the so-called Trans European Rail Freight Network (TERFN). In 2008, the entire European Rail Network has been opened-up to competition for international freight.

The 2nd Railway Package, introduced in 2004, required that the liberalization of domestic freight services and the opening of the market for international rail freight services should be accomplished by the 1st January 2006. The final date for completing the opening of all rail freight services, including *cabotage*, was the 1st January 2007. Thanks to the measures of this package, the entire rail freight market in Europe was formally open to competition. However, it was not the same for the passenger market.

For the latter, in fact, it was necessary to wait for the 3rd Railway Package, introduced in 2007. In the official documents was stated the right for railway operators to pick up passengers at any station

⁹ An overview from the economic perspectives of the European Union railway reform initiatives is provided by Holvad et al. (2013). Further, a review on the beginning of the liberalisation process in Italy is contained in Ponti and Erba (2002) and in Ponti and Beria (2009).

¹⁰ The 91/440/EEC can be considered as the *Magna Carta* for the liberalisation of the railway sector in Europe. According to it, there should be a distinction between infrastructure managers, who run the network, and the railway companies that use it for transporting passengers or goods. The rationale for this was the separation of the essential functions, such as the allocation of rights or rail capacity (train paths), infrastructure charging and licensing, from the operation of transport services. Moreover, it prescribed that public funds granted either for the realization of the infrastructure essential for the supply of PSO or for the supply of transport services under PSO (the so called "compensation funds") could not be used to finance transport operations in the unregulated market. This in order to avoid distortions of competition and to grant new rail operators a fair access to the market.

located on an international route and take them to any another, including stations located in the same member state, thereby providing for *cabotage* in any member states (Holvad et al., 2013). Some member states, in applying the Directive went a step further. Italy, for instance, opened up competition in the high-speed internal market to any licensed operator.

Recently, the EC proposed the 4th Railway Package, with the purpose of further boosting the market opening to domestic passenger services and enhance the independence of infrastructure managers from railway operators. Before being adopted, the last package needs to be approved by the European Parliament and member state governments and this step, however, is still to come.

This regulatory framework led to different sub-models of European railway organization within member states, which, according to Holvad and Godward (2013), can be summarized into four models:

1. The Swedish model, with fully separated railway undertakings and infrastructure managers;
2. The French model, with fully separated railway undertakings but infrastructure managers influenced, but not controlled, by former incumbent railway undertaking;
3. The German model, with a holding company split with “Chinese walls” between railway undertaking and infrastructure manager;
4. The Irish model, with vertical integration (it was allowed since its network was not connected to any other European railway network);

To this spectrum needs to be included the English model, with fully privatized services and network.

In Italy, the liberalization process in the railway sector started with the adoption of the 91/440/EEC Directive (Presidential decree 277/98) and the adoption of the 95/18 and 95/99 Directives (Presidential decree 146/99). The framework was further defined by the Decrees 188/03 and 15/10 which liberalized the access to the railway infrastructure and the supply of railway services, both for freight and passenger segments. The Italian liberalization process followed the German model. On the 1st June 2000, the two main divisions, service and infrastructure, of the Italian railway company, were separated. Nowadays the rail tracks and infrastructure are managed by *Rete Ferroviaria Italiana* (RFI), while the train and the passenger sections are managed mostly by *Trenitalia*.¹¹ Both are *Ferrovie dello Stato Italiane* (FSI) subsidiaries and entirely publicly owned.

The Italian legislation allowed competition for HSR services, provided, as they appear today, by *Trenitalia* since 2008 and by NTV since April 2012. The latter is an Italian privately owned company¹² which is Europe's first private *open access* operator of 300 km/h (190 mph) high speed trains.

Nowadays NTV and *Trenitalia* compete, mainly, on three routes:

- Rome-Milan, since April 2012;
- Rome-Turin, since October 2012;
- Rome-Venice, since December 2012.

All these routes are connected to the southern Italy with Salerno and Naples. Since December 2013, NTV started operations on the Adriatic corridor, linking Ancona to Milan and Turin. Also on these routes it competes with *Trenitalia*.

¹¹ Managing more than 9,000 trains per day and moving more than half a billion of passengers and 80 millions of tons of goods every year. *Trenitalia* is the primary rail operator in Italy.

¹² NTV is, actually, partly publicly owned as a share (20%) is of the French State Railway Company (SNCF) and of the controlled SNCF Voyages Développement S.a.S.

A step towards the creation of an independent regulatory body is the set up of the National Authority for Transport in July, 2013. The Authority is in charge of regulating the access to the infrastructure and related services, on the basis of fair and non-discriminatory conditions, by defining the criteria for the access charges and analysing the efficiency of the separation between the infrastructure manager and the train operating companies. Actually, the first intervention of the National Authority for Transport, on the 6th of March 2014, consisted in opening the procedure for the adoption of specific regulatory measures to ensure the conditions for the fair and non-discriminatory access to the rail infrastructure, with the aim of encouraging competition, production and cost efficiency.¹³ It is still too early to say how its presence will impact the market.

4. Data collection

The dataset we use to explore the effects of intra-modal and inter-modal competition is unique. Data on one-way fares were retrieved directly from railways and airlines' website by simulating reservations. Fares are observed daily, starting, generally, at sixty booking days before departure. We always chose the lowest fares among those offered by railways and airlines for different travel classes, in the same slot. Further, data on the number of rail daily services and airline daily flights are taken from official companies' timetables.

The analysis on intra-modal competition among HS services concerns the following connections:

- Rome Termini - Milan Centrale and return, served by *Trenitalia*;
- Rome Tiburtina - Milan Porta Garibaldi and return, served by NTV;
- Rome Termini - Turin Porta Nuova and return, served by *Trenitalia*;
- Rome Tiburtina - Turin Porta Susa and return, served by NTV;
- Rome Termini - Venice Santa Lucia and return, served by *Trenitalia*;
- Rome Tiburtina - Venice Santa Lucia and return, served by NTV.

Further, the analysis on inter-modal competition among HS trains and airlines focused on the connection Rome-Milan. On this routes the travelling times are similar, and thus the transport services can be considered substitutes. Moreover, the dimension of the two markets considered, being Rome and Milan the greatest cities in Italy and among the major agglomerates in Europe, supports the specific focus on this connection.¹⁴

Specifically, airline routes included in the analysis are:

- Rome Fiumicino (FCO) - Milan Linate (LIN) and return;
- Rome Fiumicino (FCO) - Milan Malpensa (MXP) and return.

Airlines providing those connections are *Alitalia* and *EasyJet*. A full service carrier (*Alitalia*) and a low cost carrier (*EasyJet*). The dataset comprises 9,089 observations on the connection Rome Fiumicino (FCO) - Milan Linate (LIN) and *vice-versa* and 1,098 on the connection Rome

¹³ Autorità Nazionale per i Trasporti (2014).

¹⁴ With more than 5,300,000 passengers travelling by plane between Rome and Milan (Eurostat, 2011), this connection is one of the most important in Europe. Thousands of people daily travel between the two main Italian cities for many reasons: while Rome is Italy's political capital, Milan is the country's economic and financial heart. With 2.8 million residents in 1,285.3 km² Rome is also the country's largest and most populated city and fifth-most populous city in the European Union by population within city limits, while Milan's urban area is the 5th largest in the EU with an estimated population of about 5.2 million. The province of Milan generates approximately 9% of the national GDP (estimated in €132 billion in 2010), while the economy of the Lombardy region generates approximately 20% of the Italy's GDP (estimated in €325 billion in 2010). The city of Rome, instead, produces 6.7% of the national GDP, more than any other single city in Italy). For all these reasons this connection represents an important link not only for the Italian economy, but for the EU.

Fiumicino (FCO) - Milan Malpensa (MXP) and *vice-versa*. The data were collected on various dates in the month of February, on four different time slots covering the whole day (05.00-08.30; 13.00-15.00; 17.00-19.00; 19.00-21.00).¹⁵ Table 1 reports the main characteristics of the connections considered.

Table 1: Characteristics of the connections.

<i>Route</i>	<i>Operator/Carrier</i>	<i>Average travelling time (min)</i>	<i>Distance (Km)</i>
Rome Fiumicino - Milan Linate	Alitalia/EasyJet	70	470
Rome Fiumicino - Milan Malpensa	Alitalia/EasyJet	75	511
Rome Ciampino - Milan Bergamo	Ryanair	65	489
Rome Termini - Milan Centrale	Trenitalia	187	567
Rome Tiburtina - Milan Porta Garibaldi	NTV	195	578
Rome Fiumicino - Venice Marco Polo	Alitalia/EasyJet	75	412
Rome Termini - Venice Santa Lucia	Trenitalia	220	528
Rome Tiburtina - Venice Santa Lucia	NTV	215	524
Rome Fiumicino - Turin Caselle	Alitalia/Blu-Express/Meridiana	85	529
Rome Termini - Turin Porta Nuova	Trenitalia	260	716
Rome Tiburtina - Turin Porta Susa	NTV	255	706

Source: Authors' elaboration.

5. The analysis of intra-modal competition

The analysis of intra-modal competition focused on the three main HSR routes currently connecting Rome to the north of Italy. We analyse the behaviour of the rail operators with respect to capacity and pricing choice, using the data collected from the companies' official websites. To the best of our knowledge, this is the first attempt to analyze railway companies' behaviour when competing on *open access* connections, as, it is the only case in Europe where a private railway company competes against the publicly owned incumbent on HSR connections.

5.1 Capacity

The Rome-Milan connection is one among those with the highest number of passengers in Europe. It has been the route on which, in the past years, *Trenitalia* tested different pricing and service quality strategies. Indeed, in December 2004, *Trenitalia* started to operate a 'low-cost' Eurostar service by using the brand "TrenOK". This service, with only the second class, was run once a day and operated by the first generation tilting Eurostar trains. The journey time was the same as the standard Eurostar but the train departed and arrived in the secondary stations. The fare for this service was 37 Euros cheaper than a second class ticket on the standard Eurostar. Then, in November 2005, an additional Eurostar service, named "TBiz", was introduced with the objective of capturing business passengers. Such service was run twice a day for each direction and had a higher quality level and a 20% higher price. In 2008 *Trenitalia* started the regular HSR services as they appear today. *Trenitalia* runs HSR branded "FrecciaRossa" on the Rome-Milan connection every hour between 6 am and 8 pm. It provides also non-stop trains every hour between 6 a.m. and

¹⁵ The time slots used diverged slightly on the routes which originated in Rome from the ones originating in Milan, Turin and Venice, in order to allow for credible time schedules.

7 p.m. with a larger supply on peak times. On this connection, the supply of the incumbent operator comprises also conventional services branded “FrecciArgento”, “FrecciaBianca”, “Intercity” and “IntercityNight”. The travel time with this type of services is much higher than the one with HSR. It goes from 4 hours and 15 minutes with FrecciArgento to 7 hours and 30 minutes with IntercityNight. *Trenitalia* provides services from the main stations in Rome and Milan (namely Rome Termini and Milan Centrale), but also from and to secondary stations (Rome Tiburtina, Milan Porta Garibaldi and Milan Rogoredo).

The supply of services offered by *Trenitalia* in the last four years has not dramatically changed. It has, however, definitely improved in the speed. The number of HSR is increased from 30 in 2009 to 38 in 2013, with a 26.7% increase, while the number of conventional services dropped from 9 in 2009 to 7 in 2013 with a reduction of 22%. It seems that *Trenitalia* is implementing an entry deterrence strategy to occupy the market as *Alitalia* did on the same route in order to keep its slots in use. The increase in HSR services had a peak in 2011/2012 (+6 daily services), just before the entrance of NTV.

The newcomer NTV provides, instead, only HSR services, with the possibility of purchasing non-stop trains and services with intermediate stops. The newcomer serves only secondary stations, linking Rome Tiburtina and Rome Ostiense with Milan Porta Garibaldi and Milan Rogoredo. It runs one train per hour during off-peak times and two train per hour during peak-times.

The AGCM (2012) observed that when *Trenitalia* started running the non-stop service between Rome and Milan, the number of passenger using the train increased, and also the average revenues per passenger. This latter consequence was mainly driven by the substitution of Intercity and Eurostar trains with HSR services, which cost more to consumers. At the same time, *Alitalia* registered a reduction in the average revenue per passenger and a small drop in the number of passengers. Between 2009 and 2011, the average number of daily passengers using air services on this route dropped from 3,000 - 6,000 to 2,000 - 4,000 (10 - 20%). In the same period, the number of passengers using non-stop *Trenitalia* services increased from 3,000 - 6,000 in December 2009 to 5,000 - 10,000 in December 2010 (10 - 30%). However, this could also be due to the elimination of a large number of conventional services (Intercity).

Besides Rome-Milan connection, there are other connections, as Rome-Turin and Rome-Venice, where both the incumbent operator and the newcomer provide rail services. Specifically, the newcomer NTV started to provide HSR services on the Rome-Venice route in October 2012 and on the Rome-Turin route in December 2012. Again, *Trenitalia* provides services connecting the main train station, namely Rome Termini, Venice Santa Lucia and Turin Porta Nuova, whereas NTV provides services using the secondary train stations for Rome, connected through Tiburtina station, and Turin, connected through Porta Susa station. On these connections, also traditional services provided by the incumbent operator are available, although they require up to twice the travel time of HSR.

In Table 2 we summarize the provision of the rail services on these connections, looking at number of daily connections. Overall, from 2009 to 2013 there has been a substantial increase of the supply of services.

Table 2: Rail service provision.

	Trenitalia						NTV		
	2009/2010		2011/2012		2013		2013		
	No. of services	Time (h)	No. of services	Time (h)	No. of services	Time (h)	No. of services	Time (h)	
ROME-MILAN									
FrecciaRossa (NoIStop)	16	3	17	3	17	2.55	ItaloNoStop	3	3.03
FrecciaRossa	14	3.30	19	3.30	21	3.20	Italo	13	3.30
FrecciArgento					1	4.15			
FrecciaBianca	1	6.40	2	6.40	1	6.40			
IntercityNight					2	7.30			
Intercity	5	6.40	4	6.40	3	6.40			
Espresso	3	7.10		7.10					
Total	39		42		45			16	
ROME-TURIN									
FrecciaRossal(lessIstops)	6	4.20	10	4.20	8	4.05	ItaloI(lessIstops)	3	4.10
FrecciaRossa					6	4.30	Italo	2	4.17
FrecciaBianca					1	6.45			
Intercity	3	7.10	2	7.10	1	7.15			
IntercityNight					1	10.04			
Espresso	4	8.00	1	8.00					
Total	13		13		17			5	
ROME-VENICE									
FrecciaArgento	13	3.50	18	3.50	17	3.45	Italo	5	3.35
Intercity					2	6.05			
Total	13		18		19			5	

Source: authors' elaboration based on operators' timetables

The services' supply on the Rome-Milan connection increased significantly between 2009/2010 to 2013 passing from 39 daily connections to 61 (+56.4%). The connections in the HSR segment (within 3h30) passed from 30 to 54 (+80%) in three years. Notwithstanding the increase in supply introduced by *Trenitalia*, NTV reached in a year of operation just less than 29.63% of the market share calculated in terms of frequency.

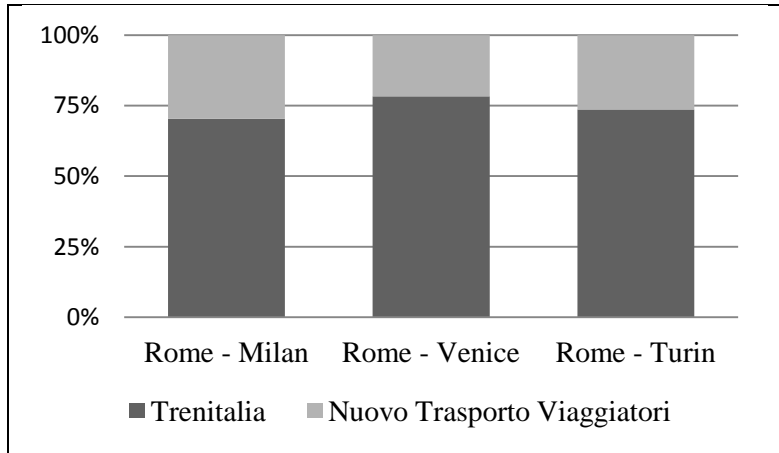
Further, the services' supply on the Rome-Turin connection also increased between 2009/2010 to 2013. The greatest increase concerns the period 2011/2012 to 2013 in which the total number of daily connections passed from 13 to 17 (+30.8%). Focusing on the HSR segment, the supply is characterized by an even greater increment: from 6 to 14 (+133%) services a day in three years.

On the connection Rome-Venice, the supply increased by 46.15%, passing from 13 to 19 daily connections in three years, while the HSR supply increased by 30.76% passing from 13 to 17 daily connections in three years.

The considerations above are confirmed also by looking at the overall market share on the other main long-distance routes in which it operates: Venice and Turin.

The market share is defined as the average share of the daily services operated by an airline at the two endpoints of a city-pair.¹⁶ As shown in Figure 1, comparing frequencies on the Rome-Milan route with the other connections, NTV has a market share of about 26.32% on the Rome-Turin route and 21.74% on the Rome-Venice route.¹⁷

Figure 1: Market shares on selected HS routes in Italy.



Market shares are calculated on the basis of the frequency of services in a normal working day (2013).

Source: Authors' elaborations based on data from operators' websites.

Trenitalia continues to maintain the largest market share, managing more than 70% of the total services on the selected routes. In assessing market shares for HSR we should remember that almost all of them have intermediate stops and so a proportion of seats are used for passengers travelling to intermediate destinations.

Indeed, we should consider that the trainsets used by the two operators have different capacities (Table 3) and we need to assume the same average load factor for both of them.

Table 3. Trainsets' capacity.

Operator	Brand	Train Class	Route	Number of seats
Trenitalia	FrecciaRossa	ETR500	Rome-Milan	574
	FrecciaRossa	ETR500	Rome-Turin	574
	FrecciArgento	ETR600	Rome-Venice	432
NTV	Italo	ETR475	Rome-Milan	451
	Italo	ETR475	Rome-Turin	451
	Italo	ETR475	Rome-Venice	451

Source: www.railfaneurope.net and official operators' websites.

The trainsets' capacity can be assumed to be fixed in the short run, meaning that it is very difficult to change the supply of seats in each class (for example by adding or removing a wagon) according

¹⁶Market shares are calculated following Bergantino and Capozza (2014), which are defined for city-pair instead of station-pair being almost all the operators monopolist on a given route.

¹⁷ Shares are updated to the month of September 2013.

to demand, while it could be possible to manipulate it – the supply – by making on-going promotions in order to inject into the market at any time low-cost fares.

5.2 Fares

Trenitalia and NTV are offering 15 and 11 “level of services”, respectively. By proposing differentiated services, the operators target different segments of the consumers. The product differentiation is due to the fact that passengers have different evaluations for the services offered by operators, and these are used strategically by competitors to avoid a fierce price competition. The main reason of this detailed segmentation, mainly driven by the price, is that operators try to know which is the maximum amount that every consumer is willing to pay for that particular service. By knowing the willingness to pay, operators are able to absorb the entire consumers' surplus and transform it into revenues. Since operators are not able to perfectly know the exact reservation price of each consumer (first degree of price discrimination) they try to induce the consumer to identify himself in order to use this as a proxy for its willingness to pay. In this differentiated-products framework, standing in an oligopoly structure, firms are competing both in terms of prices and product characteristics. Our focus is on price competition, assuming that, in the short run, product characteristics are fixed.

Trenitalia and NTV offer a set of combinations, differentiated by the flexibility and the comfort levels. Their supply is quite similar, with *Trenitalia* offering a larger number of combinations for the *business* users. Basically, consumers can choose between three levels of flexibility (no change - no refund / limited change and refund / unlimited change and refund) and several levels of comfort. In Table 4 we provide descriptive statistics on *Trenitalia* and NTV average fares across routes, using data retrieved from the railways companies' websites (see Section 4).

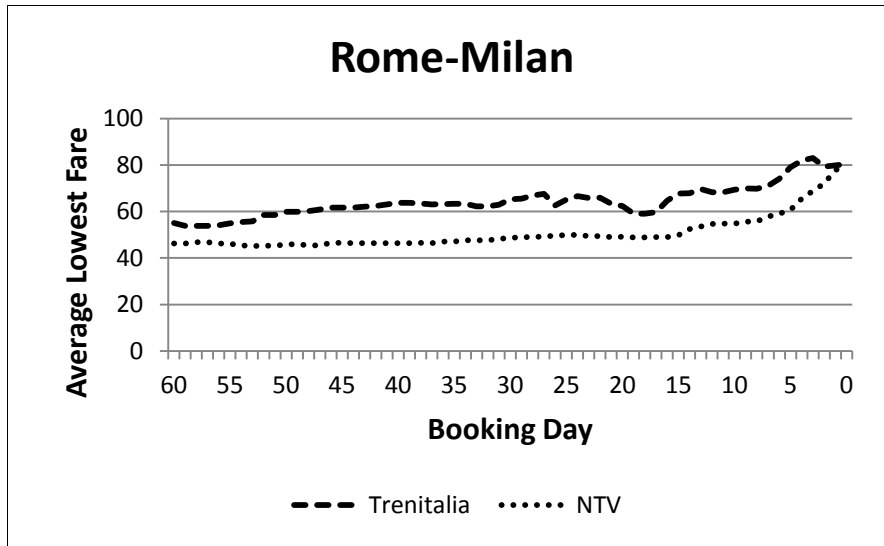
Table 4: Descriptive statistics.

Connections	Operator	Mean	Std. Dev.	Min	Max
Rome-Milan	<i>Trenitalia</i>	64.55	7.03	53.86	83.01
	<i>NTV</i>	50.86	7.67	45.12	79.96
Rome-Venice	<i>Trenitalia</i>	58.14	8.71	49.00	77.42
	<i>NTV</i>	44.55	7.86	38.83	75.50
Rome-Turin	<i>Trenitalia</i>	66.29	11.62	53.58	90.00
	<i>NTV</i>	43.31	6.01	38.00	50.00

Overall, *Trenitalia*'s average posted fares are higher than those posted by NTV. Specifically, *Trenitalia* is found to price higher average fares on both Rome-Milan and Rome-Venice routes by 29.92% and 30.50%, respectively. The difference is even more pronounced on the Rome-Turin connection, where *Trenitalia* is found to have a 34.67% higher average fare compared to NTV.

Figure 2 displays the temporal profile of the average lowest available fare collected for Rome-Milan connection starting from the sixty days prior to the departure.

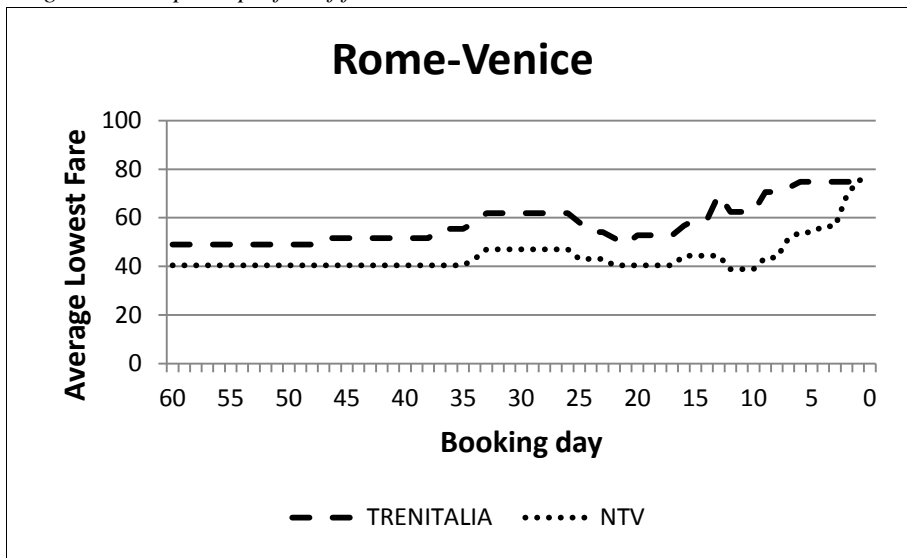
Figure 2: Temporal profile of fares on Rome-Milan.



Source: Authors' elaborations based on data from operators' websites.

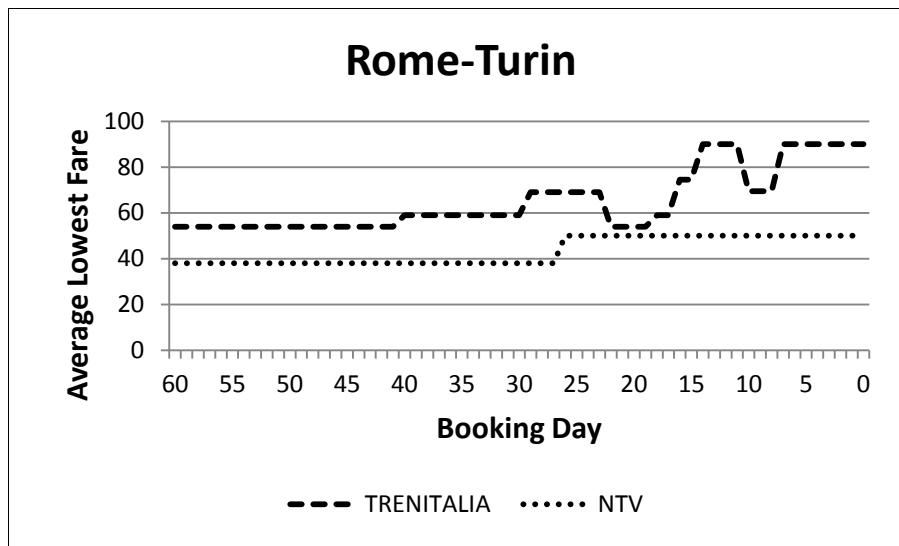
From a preliminary graphical analysis, the pricing strategies of the two operators do not seem completely unrelated, although the trend varies. Indeed, after the first five days in which fares are posted on the website, pricing strategies by competitors tend to diverge. Then, starting from 15 days before departure, fares are gradually increased by both operators as usually happens when the departure is approaching. They tend to converge at departure.

Figure 3: Temporal profile of fares on Rome-Venice.



Source: Authors' elaborations based on data from operators' websites.

Figure 4: Temporal profile of fares on Rome-Turin.



Source: Authors' elaborations based on data from operators' websites.

Figure 3 and Figure 4 report the temporal profile of fare for Rome-Venice and Rome-Turin. Again, pricing policies seem to be more correlated when considering the last part of the fares' distribution over time, although the correlation seems lower for Rome-Turin.

In order to carry out a more precise analysis and further explore the relationship between fares posted by *Trenitalia* and those posted by *NTV* to see whether there is an effective strategic reaction on the newcomer to incumbent's pricing behaviour or *vice versa*, we compute correlations among competitors' average fares, which are reported in Table 5, accounting for different time intervals.

Table 5: Correlation among *Trenitalia* and *NTV* average fares.

Connection	Full sample	Booking days			
		60 - 31	30 - 0	20 - 0	15 - 0
Rome-Milan	0.872	0.382	0.888	0.879	0.863
Rome-Turin	0.770	0.867	0.729	0.721	0.726
Rome-Venice	0.692	0.131	0.233	0.715	0.740

The Rome-Milan is the connection that exhibits more correlation, about 87% over the 60 days, whereas Rome-Venice shows the lowest correlation (69.2%).

It is worthwhile verifying whether correlations differ according to the booking day, as one might argue that when departure approaches, competitors might be more likely to take account of rival's pricing behaviour. Indeed, this seems to be true for the connections Rome-Milan and Rome-Venice, where the correlation among *Trenitalia* and *NTV* fares increases when the departure date approaches.

As it can be seen, for the Rome-Milan connection, the correlation index varies between 38.2% between the 60th and the 30th day before departure and 86.3% in the last fifteen days to departure (+58.1 points); for the Rome-Venice connection, the correlation index varies between 13.1% between the 60th and the 30th day before departure and 74.0% in the last fifteen days to departure (+61 points). *Trenitalia* and *NTV* seem to adopt pricing policies which diverge as time passes on

the Rome-Turin route, where the relationship weakens as departure approaches, passing from 86.7% to 72,6% (-14.1 points).

In order to verify whether *Trenitalia* and NTV, when planning pricing strategies, take into account not only the fares posted the same day by the rival, but also fares posted in the previous days, we compute the correlation among lagged fares. In left-hand side of Table 4 we report correlation of the NTV average fare at time t with *Trenitalia* average fare considering three time lags ($t-1$, $t-3$, $t-5$). In right-hand side of Table 6 we show correlation of the *Trenitalia* average fare at time t with NTV average fare considering the same time lags.

Table 6 - Correlation among *Trenitalia* and NTV average lagged fares.

Connection	<i>Trenitalia</i>			NTV		
	$t-1$	$t-3$	$t-5$	$t-1$	$t-3$	$t-5$
Rome – Milan	t 0.883	0.884	0.787	t 0.861	0.859	0.863
Rome – Venice	NTV t 0.774	0.793	0.781	Trenitalia t 0.727	0.616	0.375
Rome– Turin	t 0.692	0.698	0.659	t 0.682	0.664	0.690

Correlations with lagged fares of the rival would suggest that, overall, NTV do take into account past pricing policies of *Trenitalia*, especially for the connections Rome-Milan. The fares set by NTV at time t are correlated with the fares set by *Trenitalia* at time $t-1$ and the correlation index shows a correlation of 88.3%. There is a substantial correlation also for the connections Rome-Venice (the fares set by NTV at time t are correlated with the ones set by *Trenitalia* at $t-1$ at 77.4%) and Rome-Turin (the fares set by NTV at time t are correlated with the ones set by *Trenitalia* at $t-1$ at 69.2%). Also *Trenitalia* fares show a high degree of correlation with NTV fares, considering three different lags, especially on the Rome-Milan connection (up to 86%). To sum up, the analysis carried out on railway fares seems to suggest that *Trenitalia* and NTV adopt pricing policies in response to the rival's behaviour which differ across route. However results do not allow to state about who is the price leader and/or the follower.

6. The analysis of inter-modal competition

The empirical evidence on airlines pricing behaviour is, nowadays, quite wide. However, there is a lack of studies which explicitly focus on the role of inter-modal competition. We attempt to quantify the role and the magnitude of the presence of HSR services on the relevant routes, also on comparative terms with respect to the other factors.

6.1 Empirical strategy

We define the following equation to estimate the effect of the presence of HSR on airline pricing behaviour:¹⁸

$$\begin{aligned} \ln(P_{ijkst}) = & \beta_0 + \beta_1 \text{Market Share}_{ijks} + \beta_2 \text{Intermodal Competition}_{ks} \\ & + \beta_3 \text{Booking Day}_t + \beta_4 \text{Booking Day}_t^2 + \beta_5 \text{Off Peak}_s \end{aligned} \quad (1)$$

¹⁸ The empirical model is drawn of Bergantino and Capozza (2014).

$$+\theta_5 \text{Control Dummies}_{ijk_s} + u_{ijkst}$$

where i indexes the route, j the carrier, k the travel date, s the time slot. The time t is set daily, i.e. t is the day in which a given fare is observed before departure time (it goes from 1 to 60).

The dependent variable is the log of the lowest fares, across travel classes, charged by a given carrier j on a specific route i for the date k in the time slot s .

Market Share is the average share of the number of daily flights operated by an airline at the two endpoints of a city-pair. It accounts for the level of market concentration on the connection and it is expected to have a positive sign as a higher market share gives to the airline the power to set higher prices. Following Stavins (2001) who, in a seminal paper on price discrimination of airlines, claims that elements such as "entry barriers prevent new carriers from entering city-pair routes (e.g., limited gate access, incumbent airlines' hub-and-spoke systems, and scale economies in network size)", we assume that the market share is exogenous.¹⁹ Our hypothesis is further supported by the fact that in the European Union "grandfather's rights" imply that an airline, holding and using a slot in the previous year, is entitled to maintaining the right to use that slot the next year in the same season. Therefore, in the short run the market structure can be assumed to be fixed. In addition, Bergantino and Capozza (2014), using the econometric methodology developed by Boreinstein (1989), empirically prove the exogeneity of airline market structure in the very short-run.

Inter-modal Competition is the variable that capture the effect of the presence of HS rail services on airfares. It is defined as a dummy variable which takes value 1 if a given flight is in direct competition with HS trains, given the time slot; 0 otherwise. We expect this variable to have a negative sign since competition with HS trains should exert a downward pressure on airfares. Our hypothesis is, in fact, that HS rail services are close substitutes of airline connections on this specific route, and that their presence would lead to substantial welfare gains for passengers.

In order to test for other factors which we know from theory and from previous empirical analysis that might influence airline fares, we include in the equation the following explanatory variables:

- *Booking Day* captures the effect of inter-temporal price discrimination (IPD).²⁰ It is, basically, a time trend which ranges from 1 to 60. To account for the potential non-monotonicity of *Booking Day*, we add the square of *Booking Day* to the model (see Bergantino and Capozza, 2014).
- *Off Peak* is a dummy variable which takes value 1 if a given flight takes off during late morning and early afternoon, 0 otherwise. We expect a negative sign since those flights are more likely to be purchased by leisure travellers rather than business travellers. The latter are mainly concentrated, in fact, on morning and evening flights.

Within the *Control dummies* we introduce a set of variables for avoiding model misspecification:

- *Route dummies*, to capture route-specific effects, demand and cost (or price) differences;
- *Carrier dummies*, to account for carrier specific differences in pricing;
- *Month dummies*, to capture further differences in demand occurring during the period prior to departure.

¹⁹ Stavins follows the approach of Graham et al. (1983).

²⁰ For an extensive review of IPD see: Stockey (1979) for theoretical setting and Gaggero and Piga (2010, 2011) for an empirical analysis.

Finally, $u_{ijkst} = \alpha_{ijks} + \varepsilon_{ijkst}$ is the composite error term, where α_{ijks} is the unobserved heterogeneity and ε_{ijkst} is the idiosyncratic error term. Standard errors are clustered at route-level to account for the potential correlation of fares over time and within the same route.

We want to estimate coefficients of time-invariant variables, therefore we use the Random Effects (RE) Generalised Least Square (GLS) estimator. The RE GLS estimator to be consistent, requires the assumption that the right-hand side variables are not correlated with the unobserved heterogeneity α_i . Performing the Robust Hausman specification error test using the method of Wooldridge (2002), after each regression, we can test the validity of that assumption and, hence, the consistency of RE GLS estimates.²¹

6.2 Results

In Table 7 we report regressions' results. Estimated coefficients seem to support our initial hypothesis on the effect of intra- and inter-modal competition on airline fares.

Table 7: Regressions results.

Variables	Rome (FCO) Milan (LIN)	Rome (FCO) Milan (MXP)
<i>Market Share</i>	0.004** (0.002)	0.037*** (0.003)
<i>Inter-modal Competition</i>	-0.155** (0.079)	-0.290*** (0.028)
<i>Booking Day</i>	-0.046*** (0.005)	-0.045*** (0.004)
<i>Booking Day</i> ²	0.001*** (0.000)	0.001*** (0.000)
<i>Off Peak</i>	-0.072 (0.166)	0.071 (0.047)
Robust Hausman Test	1.137	1.511
p-value	0.286	0.219
Observations	9,089	1,098

Cluster-robust standard errors at route-level in parentheses

*** p<0.01, ** p<0.05, * p<0.10

As expected, the market share has a positive and highly significant impact on fares. Holding constant other variables, a 10% increase in the market share leads to 4% higher fares for the connection Rome Fiumicino - Milan Linate (and *vice versa*) and to 37% higher fares for the connection Rome Fiumicino - Milan Malpensa (and *vice versa*). The impact in percentage needs to be contextualized with the average fare on each connection. The average fare on the Milan Linate

²¹ See Wooldridge (2002), pp. 290-91.

routes is about 2,5 times the one on the Malpensa routes (€85.59 versus €34.61). Given the different average fare values on the two connections and the estimated coefficients, a 10% increase on the market share leads to an increase of €34.23 on the connection Rome Fiumicino - Milan Linate (and *vice versa*) and an increase of €9.90 on the connection Rome Fiumicino - Milan Malpensa (and *vice versa*).

The variable *Inter-modal Competition* has always a negative and highly significant coefficient. When flights are in direct competition with HS services, airlines are found to price 15.5% lower on the connection Rome Fiumicino - Milan Linate (and *vice versa*) and 29% lower on the connection Rome Fiumicino - Milan Malpensa (and *vice versa*). On average, thus, the inter-modal competition from HS train services leads to an average saving for consumers of €13.26 on the connections on the route Rome - Linate and return and of €9.90 on the connection Rome - Malpensa and return. Overall, thus, the empirical evidence is in favour of the effectiveness of inter-modal competition in exerting a downward pressure on airline fares.

The relationship between *Booking Day* and fares is non-monotonic.²² In fact, the coefficient of *Booking Day* is negative and significant, whereas the coefficient of *Booking Day* squared is positive and highly significant. This implies that *Booking Day* has a negative effect of fares until the turning point is reached. From the analysis we can identify the turning point at the 23th day before departure. Beyond that day, fares begin to increase as departure date approaches. Finally, the variable *Off Peak* is not significant.

In the bottom of Table 7 we report the results of the robust Hausman Test which lead not to reject the null hypothesis that RE GLS estimator is consistent. Indeed the validity of the assumption of zero-correlation between right-hand side variables and the unobserved heterogeneity is confirmed.

7. Concluding comments

In this work we explore the competitive effects of HSR entry in the passenger market. Despite the relevance of the issue in terms of both regulatory and policy implications, the literature on the impact of competing HSR services is very scanty. We deal with two issues. First, we explore the price and capacity effects of *intra-modal competition* among HSR. Second, we measure the effect of *inter-modal competition* by HSR on airline pricing behaviour. Our focus is on the Italian market since this is the first and sole where two railway companies compete on the open access basis. Actually, in 2012, *Nuovo Trasporto Viaggiatori* (NTV) started to supply its service on the Rome-Milan connection and, in the following years, on the Rome-Turin and Rome-Venice connection.

The results on the intra-modal competition would suggest that the appearance of NTV did not induced *Trenitalia* to cut on its supply. From the data on daily frequencies, it appears, instead, that *Trenitalia* increased the capacity deployed on the lines by over 30% from the year previous to NTV's entry, and that the presence of the newcomer led to the increase of the overall capacity on the Rome-Milan connection by over 56%. The intra-modal competition resulted in a greater utilization of the network. Given the relevance of the costs of providing HSR connections, and the amount of public investment which is currently being destined to new or to the upgrading of traditional lines, the benefit for the community seem to be relevant.

We also find that the two railway companies do engage in strategic pricing, although to a different degree on different routes. We do not find, however, confirmation of predatory pricing by *Trenitalia*. In fact, its tariffs are, on average, between 29.92% and 34.67% higher than NTV's.

²² Consistently with Bergantino and Capozza (2014).

Therefore, from our study, it emerges no evidence of aggressive pricing behaviour towards NTV capable of signalling predatory pricing. Furthermore, it seems that in fixing tariffs, both rail companies do take into account, in general, rival's behaviour. In particular, NTV seems slightly more careful in considering past pricing behaviour of *Trenitalia* when fixing its tariffs.

It took about two years for NTV to definitely begin to operate on account of various difficulties encountered in obtaining the required slots and authorizations. Furthermore, there is still relevant discrimination with respect to the spaces that NTV is allocated within the railway stations.

All these considerations lead to think about the role of the State, at the same time regulator and owner of the infrastructure and somehow also client and planner.

The results on the inter-modal competition show the effectiveness railway services in exerting a downward pressure on airline pricing strategies. Specifically, we provide a measure for the effect of the presence of HSR on airline fares on the Rome-Milan routes. After controlling for inter-temporal price discrimination, airline market share and other flight characteristics, we obtain that the presence of inter-modal competition, on the same time-slot, reduces, on average, fares by up to 13.26 Euros.

These findings shed a new light on the role of competition in HSR services. It not only has a direct effect on rail services (frequency and fares), but also a significant impact also on the airline market. On a route where airline market intra-modal competition is quite limited due also to Antitrust exemption granted to *Alitalia* when it merged with *Airone*, the presence of HSR services is a valuable tool for controlling airfares. Competition among rail operators has, thus, indirectly benefitted also those consumers who are captive to air services.

In defining policy interventions in the railway market more attention should be given also to these indirect effect. It can be affirmed that consumers of transport services on the Centre-North routes benefit significantly from HS services and, in particular, from both intra- and inter- modal competition. These indirect effects would be even more important for the citizen living in the South of Italy, where a HSR network is lacking. Besides the effect of price stabilization, the presence of HSR services promote accessibility with positive spillovers on all the Italian area. The cost of supplying HS services should be measured also against the savings due to the competitive pressures activated in the airline markets. Obviously, should *Alitalia* be again the object of public intervention, the beneficial effect of competition should be balanced out against the public subsidies that are devolved to *Alitalia* to cover losses.

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