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High-speed rail, inter-modal substitution and willingness-to-pay. A stated preference analysis for the 'Bari-Rome'

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Abstract

We study the demand and the willingness-to-pay for a new High-Speed (HSR) line on the Bari-Rome route, and its indirect effect on the connected Brindisi-Rome line, when competing with other existing transport modes. We carry out a discrete choice experiment over a significant number of respondents. We find that reductions in access and egress (A/E) time are more valued than in-vehicle travel time if HSR is available (faster services) while, when only traditional services are available, the opposite is true. This confirms that fragmented journeys, for faster connections, yield greater disutility and this would be the greater competitive advantage of HSR services. We also explore the heterogeneity among respondents, by studying the relationship between in-vehicle, and A/E travel time considering different population segments, i.e. different income levels, travel habits (frequent or occasional), and travel purposes, in order to profile potential users. We also study the patterns of the inter-modal substitutability. We find that increasing the travel distance by 120 km (to Brindisi) still guarantees large substitution between HSR and air transport mode.

Keywords: inter-modal substitution, stated choice, transport, willingness-to-pay, high-speed rail, travel time

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1 Introduction

The relationship between access and egress (A/E) time and in-vehicle travel time is becoming increasingly relevant in shaping the competition among different modal alternatives, and mainly between airlines and train operators. While in-vehicle travel time depends on the performances of each transport mode, A/E time depends on where rail stations, bus terminals, and airports are spatially located relative to the travellers' location (Martín et al. 2014). As noted by Givoni & Dobruszkes (2013), it follows that is the total travel time that affects travellers' modal choices *ceteris paribus*. In Italy, airports are often distant from the city centre and reaching them can be pricey in terms of additional time spent travelling. Rail stations, instead, are, *usually*, more accessible to users and localized within the boundaries of the city, close to the central business district (CBD), and with a lower impact of A/E time, see e.g. Givoni & Banister (2007). The area surrounding the rail stations is also often used as a junction point for modal interchange, offering a wide range of alternatives. In these cases, accessibility to rail stations and bus terminals may favor ground transport modes. However, while this is true for most of the cities, the locational competitiveness of HSR over air transport should not be always taken for granted. Some international experiences show that the poor accessibility of rail stations can even deter people from using HSR, see Chang & Lee (2008) for the Korean case, and Chou et al. (2011) for Taiwan.

When rail stations are relatively more accessible, i.e. close to CBDs, the implementation of high-speed rail (HSR, hereafter), and the subsequent reduction of in-vehicle travel time,[1] exerts a competitive pressure on airlines.[2] In Italy, such competitive threat led to changes in the market structure and to the exit of some operators. For instance, the introduction of HSR on the Rome-Milan line forced Ryanair, a low-cost carrier (LCC), to leave the Rome-Ciampino - Milan-Orio al Serio route, i.e. A/E time account for 40 and 60 minutes respectively[3]. On that line, recent data (ART 2015), have shown that, considering also changes in the market size, the train mode (traditional and HSR) grew from 36% of the market shares in 2008 to 58% in 2012, and to 65% in 2014, while the market share of the air transport mode diminished from 50% in 2008 to 32% in 2012, and to 24% in 2014.

Despite their relevance, the assessment of how A/E time shape the competitiveness of one modal alternative over one another yet remain to fully explored. To date, the contribution to the analysis

[1] According to the Directive 2008/57/EC of the European Parliament and of the Council on the interoperability of the rail system, HSR is defined as those lines with speeds equal or greater than 250 km/h and those lines upgraded for speeds of 200 km/h.

[2] For example, using Italian data, Capozza (2016) finds that airline operators increased their fares as rail travel time increases, while Kappes & Merkert (2013) report that airline managers ranked the presence of a HSR link on the route as the second most effective barrier to entry, preferring cooperation rather than competition. In a theoretical work, Yang & Zhang (2012) demonstrate that the price charged by airlines decreases with the access time to the airport, whereas the effect is the opposite for high-speed rail operators, which react by increasing their fares.

[3] Orio al Serio is a secondary airport close to Bergamo (5 km), mainly used by LCCs, but located at approximately 50 minutes to Milan. Orio al Serio is the fourth airport in Italy in terms of number of passengers (10.404.625 in 2015 according to ART (2016)), with a strong presence of Ryanair. Competition on the route became intense also because of the intra-modal competition between the state-owned incumbent Trenitalia and the newcomer Nuovo Trasporto Viaggiatori (NTV). For the effect of the liberalization policy in Italy and Europe, see Bergantino et al. (2013), Bergantino (2015) and Bergantino (2017).

of their impact is still limited. While Martín et al. (2014), using a discrete choice experiment, recognize their relevance and show how accessibility and relative distance are crucial, Dobruszkes et al. (2014), in their ex-post evaluation, show that where HSR is spatially located has no impact on the strategies pursued by airlines (i.e. number of flights or seats). While this may be related to the definition of "central" and "peripheral" location of HSR, on the other hand this might suggest, as claimed by the authors, that A/E time to get to HSR stations are not so relevant.

Complementing these studies, our work aims to contribute to the understanding of the relationship between A/E time for air transport mode and in-vehicle travel time, considering a competitive environment where several modal alternatives, including rail and HSR, are considered. The analysis is conducted by exploiting heterogeneity among passengers. Travellers are not only differentiated according to the purpose of their journey, i.e. business and leisure, as the literature usually assumes but also according to their travel habits and their income. For instance, A/E time to get to the airport may impact negatively more on those travellers working during their journey, experiencing, therefore, a higher disutility from fragmented activities. Likewise, frequent travellers may experience greater disutility from A/E time than occasional travellers, e.g. repeated fragmentation of the journey may be a source of stress. The presence of detailed individual data and the number of observations allows us to enrich the analysis by examining these different segments of the population and distinguishing between *time-sensitive* and *cost-sensitive* passengers for different components of the journey time. Indeed, we contribute to the current literature by measuring the willingness-to-pay for A/E time reduction as compared to in-vehicle travel time[4].

The second contribution provided by this work is to show how the impact of A/E time and the value of time savings change depends on whether HSR is available. Because HSR reduces the average in-vehicle travel time, subsequently increasing the portion of the total travel time represented by A/E time, travellers may have different sensitivities. As a result, the value of time savings may not be the same before and after the introduction of HSR. Indeed, we provide a comparison between the two scenarios demonstrating that the introduction of HSR may change travellers' preferences. To the best of our knowledge, there are no previous studies investigating how the different components of the total journey time change because of HSR.

Understanding this is relevant to inform policy-makers and help them for designing their policies and perhaps motivating the construction of infrastructures connecting faster airports and rail stations. This can be important also to promote strategic complementarity or integration between airlines and HSR operators, as demonstrated by a recent and growing literature (e.g. Givoni & Banister (2006)). In addition, an analysis of the *pre* and *post* the implementation of HSR might be beneficial for transport operators to *behaviourally* understand how travellers' preferences change and under what conditions.

Third, according to literature it seems that HSR has a competitive advantage over air transport for distances up to 600-800 km, with the potential demand peak at approximately 400 km (Janić

[4]Notice that only for the air transport mode, in-vehicle travel time also accounts for the time spent for security-checks, and waiting time at the gate.

1993, Vickerman 1997, Gleave 2004, Rothengatter 2010). We test this hypothesis by studying the patterns of inter-modal substitution, and the willingness-to-pay for A/E and in-vehicle time reductions for a longer travel distance and journey time. We compare two locations: i) the planned location (Bari), with a travel distance from Rome of approximately 450 km; and ii) Brindisi, a potential location, which can indirectly benefit from the introduction of HSR to Bari, and whose location is at approximately 570 km from Rome[5]. Such a comparison is possible because both locations share the same types of modal alternatives (and sometimes services, as shown in Section 3), and are characterized by the presence of airports, with daily flights to Rome.

The analysis is pursued by using a *Stated Preference* approach and considering the planned introduction of HSR over the Bari-Rome route. We consider all currently available alternatives, i.e. air transport, conventional train, coach, private car and car-pooling the car and the car-pooling, and then we introduce the future HSR. Differently from Román et al. (2010), Martín et al. (2014), Li & Sheng (2016), we only consider A/E time explicitly for the air transport, while we set it to zero for the other alternatives. This simplifies the analysis with little loss of generality since in Rome, Bari and Brindisi (that is, the cities covered in this study), shuttle bus serving the city airports have their terminals in front of the rail stations where, in Bari and in Rome, also direct train connections are available for the airports (air-train integration). This situation implies that, for most travellers, A/E time differentials exist only for the air alternative. Only the car mode (regardless of whether private car, taxi, or carpooling) might have differentiated A/E times, but these would be extremely difficult to model, being individual specific.

This remainder of this work is organized as follows: in Section 2 we survey the previous literature; in Section 3 we provide a background of HSR in Italy and the market characteristics of the routes considered; Section 4 reports the description of the presented alternatives, attributes and levels as well as the characteristics of the sample population; Section 5 illustrates the econometric strategy. Section 6 reports the main results from the Multinomial Logit and the Mixed Multinomial Logit, whereas Section 7 the calculated mean-willingness-to-pay for reduction in travel time. Section 8 contains concluding remarks and the future research agenda.

2 Literature Overview

This study relates to several streams of literature in transport economics. First, it is close to those studies using discrete choice experiments for the evaluation of passengers' preferences for A/E and in-vehicle travel time. For instance, Román et al. (2010) estimate the willingness-to-pay (WTP) for access and egress time reductions by considering whether the sum of both is lower or greater than 60 minutes. For all modal alternatives, they show that the WTP for one-hour reduction of A/E time is greater when these account for more than 60 minutes. In other words, one minute of A/E time is not the same when the access and egress time is larger than one hour. They also find that A/E time is more relevant for the air transport relative to HSR and, ultimately, to the bus.

[5]This is approximately the distance between Rome and Milan, where HSR led to an increase in traffic supply and demand.

Moreover, similar to our results, for Román et al. (2010), the value of travel time savings is lower than the value of access and egress time savings. Li & Sheng (2016) study air-HSR integration in China, finding that the willingness-to-pay for en-route time reduction is higher than for reduction in A/E time when using airlines, while lower when using HSR.

By exploiting travellers' heterogeneity, this paper also complements some previous studies on population heterogeneity in valuation. Hess et al. (2007) verify that the WTP for reductions in the schedule delay and improved on-time performances is greater for business travellers compared to holiday-and-VFR (Visiting Friends and Relative) travellers. They also verify that all respondents, with the exception of holiday travellers, were more sensitive to early than late arrivals. Gonzales-Savignat (2004) verify that self-employed travellers are more sensitive to fare changes than employees, whose journey is often paid by the company. Román & Martín (2014) study integration between air and HSR, surprisingly finding that those travelling for business purposes experience a greater disutility from connection time and travel time than A/E time. By contrast, Li & Sheng (2016) find that, for business travellers, the WTP for en-route time reduction is greater than that for A/E time reduction. They also find that connection time for air-HSR integration is valued more than twice higher for business travellers relative to non-business travellers. The former result contrasts with our findings when HSR is introduced, while is consistent with ours when HSR is absent. In this sense, our study provides novel insights, by showing how A/E time is more or less negatively perceived depending on the introduction of the HSR alternative, which in turn reduces the average length of the journey.

This work is also related to the literature on the transport market structure and on the strategic behaviour of airlines when HSR is introduced. Here ex-post analyses have shown interesting patterns. Jiménez & Betancor (2012) study nine different routes connected to Madrid over the period between 1999 and 2009. They find that the introduction of HSR led to a 17% reduction in the number of airlines' operations, and thus on their market shares (mainly on the Madrid-Barcelona line). Albalate et al. (2015), using data for France, Germany, Italy and Spain over the period between 2002 and 2009, show that airlines responded to the introduction of HSR by reducing the number of seats provided but not the overall number of flights (data runs to 2010). They also verify that the reduction of the number of services was greater for hub-airports, and even more for those airports without on-site HSR stations. Over the Paris-London route, Behrens & Pels (2012) show instead that a 1% reduction in the Eurostar travel time led to an increase of 1.09% and 0.44% of the HSR market share for the business and leisure segments respectively.

Moreover, Dobruszkes et al. (2014) find that HSR travel time affected mainly the presence of air services, both in terms of provided seats and flights and to a lesser extent the frequency. De Rus & Nash (2007) report that the introduction of HSR on the route between Madrid and Sevilla determined a 50% reduction of the air transport demand, affecting mainly the market shares of the Sevilla Airport, the main beneficiary of this traffic. A similar reduction in the air transport volume share is observed by Park & Ha (2006) for the Paris-Lyon. Clewlow et al. (2014) assess the impact of HSR lines and the presence of LCCs on the volume of air passengers in Europe, concluding that the introduction of HSR reduced the air passenger demand in the domestic market, and that airlines reallocated their traffic towards medium- and long-haul distances. On the Chinese domestic market, Wang et al. (2017) find instead that LCCs are more likely to leave the market in highly populated corridors, where the head-to-head competition with HSR is more intense. Similarly, Wan et al. (2016) compare the introduction of the HSR entry in China with the impact on other two most-developed Northeast Asian countries, i.e. Japan and South Korea. The authors verify that the introduction and the expansion of the HSR network led to a greater drop in the number of seats of air operators in China relative to Japan and South Korea.

Few papers have instead investigated the case of Italy, where intra- and inter-modal competition coexist from 2012, when Nuovo Trasporto Viaggiatori (NTV) entered into the HSR market, in regime of *open access*. Bergantino (2015) show that airlines fares reduced in presence of HSR competition up to 13.26 euro on average, determining an indirect benefit for consumers. They also find that the intra-modal led to an increase in the total number of services in the market. Bergantino & Capozza (2015) examine airline pricing in Southern Italy, where the extent of the HSR competition is limited, and verified that increasing market concentration by 10% led to 5.7-6.4% higher fares. In addition, they found that more competitive markets make airlines more likely to engage in inter-temporal discriminations. More recently, Bergantino et al. (2017) investigate the strategic pricing decisions undertaken by air and rail companies, showing that the price leadership depends on the characteristics of the city-pairs. Intra-modal competition for shorter distances is analyzed also by Cascetta et al. (2011). On the Naples-Rome line, they find that the demand induced by the introduction of the HSR was 22% in 2007, at two years from its launch, with existing rail services continuing to ensure 69% of the overall demand in a particular context of lack competition and alternatives, i.e. the car (8%) was the only real alternative to the conventional train choice. They also verify that travel time and its quality represent the main reasons for choosing HSR services and that HSR travellers are less sensitive to changes in travel time for increasing number of HSR journeys provided. On the same route, Givoni & Dobruszkes (2013) investigate the ex-post effects of the introduction of HSR, finding that the modal shift after 2-4 years of its launch was 10-20%, whereas the remaining share was a modal substitution, mostly from the existing rail service.

On a somewhat different note, Bergantino & Madio (2017) use Stated Preference data to conduct an ex-ante analysis of the socioeconomic determinants and the origin of the modal change towards the planned HSR on the Bari-Rome route. The authors verify that HSR demand is more likely to be derived from air transport modes and conventional rail services, with inter-modal substitution more pronounced between flights and HSR.

While the above studies are mainly concerned with inter-modal substitution and competition, the economic benefits from cooperation and integration between HSR and air transport modes can be even greater (Givoni & Banister 2006). Complementarity and integration between these alternatives also emerge from recent theoretical studies, see Socorro & Viecens (2013), Xia & Zhang (2016, 2017), Jiang et al. (2017). Discrete choice experiments on travellers' preferences have shown the conditions under which integration between HSR and air transport can exist. On the Bejing-

Guangzhou corridor, Li & Sheng (2016) find that, when the travel time is too short, HSR is the best alternative, whilst air-HSR integration becomes competitive when the range is 1200-1600 km. Instead, according to Martín et al. (2014), the viability of an integrated alternative would depend on the abatement of connection time between air transport and HSR, which creates a disutility even larger than that created by A/E time. For instance, they show that when private transport is used and price competition is fierce enough, there exists a support for a relative competitiveness of the air transport over the HSR.

3 Background

Italy has the third rail network in Europe after Germany and France, with a total of 24,299 km of rail track, of which 923 km classified as HSR (1.350 km if considering double tracks), and exploiting travel speed greater than 250 km/h (ART 2016). Most of the current network was built over the period of 2006-2009, costing around 32 billion of EUR, but new lines are still under construction[6]. Currently, the network takes the form of the "T", connecting the North West (Turin) to the North East (Verona) and crossing Italy over the Milan-Rome-Salerno axis (Beria et al. 2016). The demand for HSR in Italy has shown an increasing trend, with the total traffic on services operating in the regime of open access (mostly HSR) reaching the quota of 15 billion of passenger-km in 2014 (ART 2016)[7].

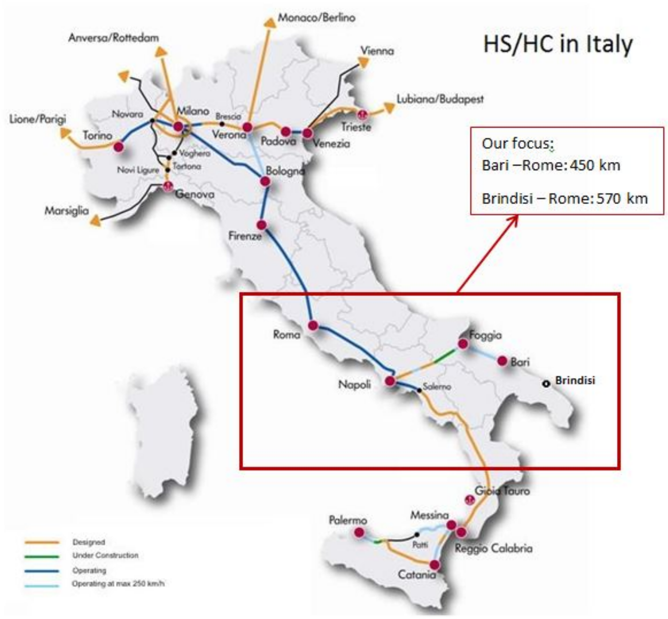
However, the greater popularity of the Italian HSR has been circumscribed to Central and Northern Italy. As shown in Figure 1, the current HSR network suffers a geographical bias which, with the exclusion of Salerno (the current end of the line, on the Tyrrhenian Coast), marginalizes the rest of the South. The long-term poor infrastructural problem of this large area has been only partially compensated with the advent of low-cost airlines. In 2014, the Italian government, with the "Unlock Italy" bill, decided to sustain the development of the railway in Southern Italy, through the realization of a new HSR line on the Bari-Naples. This new line will connect directly two densely populated metropolitan areas in less than 2 hours[8] This project is part of the TEN-T (Trans-European Network of Transport) Strategy for the implementation of the Scandinavian - Corridor, and it is funded with 6.2 billion of euro. The works for building the infrastructure started in 2016 and it is expected to be fully operating in 2026[9]. Both Brindisi and Bari are connected to

[6] In December 2016, new 39.6 km (Treviglio-Brescia) over the Milan-Venice route (245 km) were opened to HSR traffic, whereas the line is expected to fully operate in 2020. In September 2016, Ferrovie dello Stato announced its Industrial Plan 2017-2026, with 24 billion of euro allocated for the HSR network. See: http://www.fsitaliane.it/fsi/Investor-relations/Piano-Industriale/Piano-Industriale-2017-2026. *Last Access: 7 November 2016.*

[7] The increased demand can be ascribed to both inter- and intra-modal competition, arising in the Italian passengers market. Specifically, the inter-modal competition refers to a greater substitutability between air and rail transport modes, whereas intra-modal competition arises as a consequence of the market liberalization, and of the entry of the new competitor NTV. According to ART (2016), NTV experienced a growth of 5.7% in 2014 relative to the previous year and an even greater growth rate for 2015 (39.5%), reaching a total of 9.1 million of passengers. The public incumbent grew by 7.2%, reaching 31.2 million of passengers in 2015.

[8] At the moment, there are no direct connections between the two cities, with the exclusion of bus services. To reach Naples from Bari by train today, it is necessary to change line at Caserta. The shortest connection takes about four hours.

[9] See https://www.napolibari.it. *Last Access: 7 November 2016*



Source: Ferrovie dello Stato Italiano. Authors' modification.

Figure 1: Extension of High Speed/High Capacity in Italy

Rome by the same set of alternatives, see tables A1, A2, and A3.

4 Methodology

4.1 The Design

Our design considers all the currently available alternatives: flights, existing/traditional rail services, bus, car-pooling, private car and the planned HSR. The number of the chosen alternatives is also consistent with Flügel et al. (2015), i.e. a Stated Preference analysis needs to have at least three alternatives. For the definition of the attributes, previous studies rely on fares, travel time and access time. Román et al. (2007), who analyze a competition between two different modal alternatives (air-air vs. air-HSR), add the presence of baggage integration. Pagliara et al. (2012) report the provision of checkpoints within airports as a factor affecting the modal choice. Park & Ha (2006) control for toll fees and the frequency of connections, with the latter also considered by Flügel et al. (2015). Burge et al. (2011) add delays, waiting time and the presence of interchanges. de Dios Ortúzar & Simonetti (2008) use the travel time, fares, comfort (class of the trip) and delay in a Mixed RP-SP model. This method is also used by Román et al. (2010) on the Madrid-Zaragoza-Barcelona corridor, assessing both the actual market and the introduction of the new HSR service on the basis of the following attributes: travel cost, in-vehicle travel time, access and egress time, frequency, reliability and comfort.

To avoid information overloading and fatigues, similar to Román et al. (2010), we use four attributes[10]: in-vehicle time (which, only flight alternative, takes into account the in-vehicle time plus the time spent for baggage controls, identification, check-in, waiting time as well as the minimum time needed for handling baggage and reaching the gate[11]), the number of daily connections (i.e. frequency), the travel cost (business vs. standard), and the reliability of the service, namely the probability to respect the scheduled arrival time. Only for the air transport mode, we add A/E time. Although placing A/E time equal to zero for the other transport modes might be a simplifying assumption as we are well aware that accessibility to these places may be crucial in some cases Martín et al. (2014), we think that, in this specific context (Bari, Brindisi, Rome), given that, as stated above, all the shuttles/train services to the airport/city center depart from (arrive to) the train/bus terminal, only the additional time (differential time) to access/egress the airport is relevant. This is generally so in many Italian cities, given the organization of the transport services to the airports.[12].

Each attribute has three levels. In this manner, we allow for non-linear effects (Rose & Bliemer 2009), and we minimize the number of potential combinations of parameters. Alternatives, attributes and levels are reported in tables A4 and A5. We use an *Orthogonal Design*, assuming additive effects. Other than practical reasons, previous studies (Louviere 1988, Greene & Hensher 2010) found that most of the variance (around 80%) is captured by main-effects, whereas second-order interactions can explain 3-6% of the whole variance, and higher-order interactions explained even less of that share. In order to reduce the number of possible combinations, we use a *Fractional Factorial Design with randomized treatment combinations* (Hensher et al. 2005), which, in our case, yields a subset of 27 treatment combinations and a *blocking column*[13].

4.2 The Data

Interviews were conducted in local airports, bus and rail stations in November and December 2015. A pilot took place in November to verify potential fatigue arising from the submission of nine scenarios per questionnaire and the interest of respondents. Each interview took approximately 15 minutes, and consisted in two parts: the first part was related to Revealed Preferences information (socioeconomics data, usual modal choices, trips per year on the route, etc.); the second part

[10] According to the theory, 4-6 attributes are required to generate an effective representation of the investigated choice behaviour, such that all economic features are satisfied and the respondent is not affected by fatigue, which is found to increase with the number of attributes. Hensher et al. (2005) suggested that the probability of considering more attributes increases as the number of attribute decreases. Willis et al. (2005) added that with a large number of factors, the respondent increasingly starts to concentrate its choices on a limited number of factors, and in the presence of time-constraints, 4-5 is the maximum number of factors able to satisfy non-satiation, transitivity, continuity, IIA.

[11] This time is likely to be increasing in the dimension of the airport. However, both the Bari and Brindisi airports are not sufficiently big. The average waiting time for baggage control was 8 minutes in 2014 (ART 2016).

[12] Note that respondents were aware that A/E time were considered only for air transport mode, and this was stated in the introductory page of the questionnaire.

[13] According to Hensher et al. (2005), when a *Fractional Factorial Design with randomized treatment combinations* is used, it is crucial to have the randomized columns not assigned next to the original treatment combinations, so as to avoid perfect collinearity. The blocking column allows to create three subsets of questionnaires, each containing 9 scenarios.

Table 1: Descriptive Statistics

	N. Individuals			N. Valid Observations		
	Bari	Brindisi	Total	Bari	Brindisi	Total
Travellers	249	116	365	2,241	1,044	3,285
Non-Travellers	152	103	255	1368	927	2,295
Total	401	219	620	3,609	1,971	5,580
of which						
Women	41%	42%	41%			
Business trip	42%	33%	39%			
More than 5 trip per year	38%	30%	35%			
Income (Ref: < 1000 EUR/month)						
1000 - 2000	38%	27%	34%			
> 2000	23%	27%	24%			

Modal choices (RP/SP)

	Air	Train	Bus	Car-Pooling	Car	HSR
Revealed Preference Current/Usual Modal Shares						
Bari	21%	30%	10%	30%	9%	-
Brindisi	31%	54%	2%	9%	4%	-
Total	25%	40%	6%	22%	7%	-
Stated Modal shares without HSR						
Bari	40%	32%	7%	8%	13%	-
Brindisi	64%	21%	4%	5%	6%	-
Total	49%	28%	6%	7%	10%	-
Stated Modal shares with HSR						
Bari	27%	25%	7%	7%	8%	26%
Brindisi	45%	16%	3%	5%	3%	28%
Total	33%	21%	5%	7%	7%	27%

consisted on nine different scenarios, with respondents required to make their optimal choices under the current set of alternatives with five alternatives (without HSR), and in that adding also the HSR and including six alternatives[14].

Table 1 describes the sample population, consisting in 401 respondents from Bari and 219 from Brindisi. Both current *travellers* and *non-travellers* were interviewed: the former were individuals currently travelling to Rome, and interviewed while waiting for their transport mode at the local bus stations, airports and rail stations; the latter were people that travelled at least once in the last year on the routes considered. Non-travellers were interviewed to obtain additional information on individuals usually travelling by private car or using car-pooling systems, whose decisions were not *directly* observable to us. Using these nine choices per individual, we obtained a total of 5580 observations. Table 1 reports the stated modal shares for both locations, showing that HSR are more likely to capture the demand for "air" and "conventional train".

[14] An example of a choice-set for those interviewed in Bari is presented in the Figure A1 in the Appendix.

5 The Econometric Strategy

The utility of individuals derived from recurring to the transport modal alternatives j is given by $U_{ji} = V_{ji} + \epsilon_{ji}$, where $V_j = \alpha_j + \sum \beta x_{ji}$, with α_j is a vector for the alternative-specific constants, capturing the average of all unobserved factors affecting each transport mode; β is a vector of parameters to be estimated; x_{ji} is the a of attributes for individual i and alternative j. Indeed, V_{ji} represents the non-stochastic utility function, whereas ϵ_{ji} is the random components.

The Multinomial Logit model (MNL) allows to measuring the probability that a given alternative is preferred to another, and provides a closed-form solution. However, its use is not free of limitations due to the IIA (Independence of Irrelevant Alternatives Assumption) property, affirming that the odd of two alternatives does not depend on the characteristics of other alternatives. We also estimate use the Mixed Multinomial Logit (MXL), which relaxes these assumptions and makes taste heterogeneity to arise from different distributional forms. In other words, random coefficients vary across respondents according to some parameters (e.g., socioeconomic characteristics, etc.). More specifically, consider the individual $i = 1...I$ choosing among a set of $j = 1...J$ alternatives in a given choice-set $k = 1...K$. The utility function can be written as $U_{jik} = V_{ijk} + \epsilon_{ji} = \alpha_j + \beta^{'}_{ji} X_{jik} + \phi^{\prime}_j Z_i + \epsilon_{jik}$, with β_{ji} being the vector of the parameter coefficients (attributes): it is defined as $\beta_{ji} = \beta_j + \eta_i$ for the random parameters (access, egress and in-vehicle travel time), and $\beta_{ji} = \beta_j$ for fixed parameters (fare, reliability, frequency); Z_{ji} is the vector containing alternative-specific socioeconomic characteristics, such as the self-evaluation of the flight security, gender, departure location and age bands ($<$30, 30 - 50, $>$50 years old); ϵ_{ji} is the random error component[15].

6 Results

Table 2 shows the main results from the Multinomial Logit. In all of the model specifications, the reference alternative is the air transport mode. By examining the attribute means, the sign is compliant with our expectations, except for the frequency when HSR absent. In other words, when the average in-vehicle travel time benefits from the introduction of faster connections, such as HSR, individuals care more about other parameters, and frequency loses significance. Indeed, it is irrelevant how many connections are provided when it is possible to benefit from a reduced in-vehicle travel time. Interestingly, when HSR is absent, increasing the supply of services without intervening on in-vehicle travel time can be even detrimental to passengers. To put it differently, having many *slow* services does not make passengers happier. This is a strong result as may inform operators about passengers' preferences, suggesting where to intervene. On average, with and without HSR, in-vehicle and access/egress time are valued in the same way, ranging from -0.005 to -0.007. Punctuality is always relevant and positive, suggesting a positive contribution to the utility of travellers. The average effect of ticket prices is always negative, and characterized by a

[15]The assumption of independent and identically distributed (iid) error terms is relaxed when, under some circumstances, correlation across alternatives is considered. In the last case, the lower triangular variance-covariance matrix is part of the model.

greater coefficient in absence of HSR. All alternative specific constants are highly significant except for HSR.

Table 3 presents results achieved with the MXL. To determine the right functional form, we test different distributions and we select the best performing model using the Akaike selection criteria (AIC)[16]. The coefficients of in-vehicle time and A/E time parameters are always significant and negative. The magnitude of the A/E time coefficient is greater in presence of HSR, compared to the case in its absence (-0.034 vs. -0.007, regardless of the location; -0.037 vs. -0.017 for Bari). This trend also affects the standard deviation (0.053 vs. 0.030 and 0.057 vs. 0.034). The findings show that A/E time coefficients are greater than those associated to in-vehicle time in the scenario considering HSR (-0.034 for A/E time vs. -0.023 for in-vehicle time, in presence of HSR), whereas the effect is reversed in absence of HSR (-0.007 for A/E time vs. -0.022 for in-vehicle time). Because the introduction of HSR reduces the average in-vehicle time and A/E time no longer represent a marginal component, therefore getting increasingly relevant. This result is also achievable when considering Bari (-0.037 for A/E time vs. -0.023), indicating a shorter travel distance, compared to the full sample including observations from Brindisi. Here in absence of HSR, the coefficients of in-vehicle time and of A/E time are equal. However, it is noteworthy that, while in-vehicle time is averaged across all alternatives, A/E time coefficients only refer to the air transport mode. This considered, in presence of HSR, the disutility of A/E time is even more relevant, with an increased (negative) effect. A potential explanation is that the fragmentation of the journey may appear more stressful when in-vehicle time is smaller. This finding is also consistent with the recent experience on the Rome-Milan route, with Ryanair and Easyjet exiting from the market after the introduction of HSR. Passengers moving from Milan to Rome (or vice-versa) saved time to get to and from the airport, without fragmenting considerably their journey time (door-to-door, or CBD-to-CBD). It also implies that people working during their journey need to interrupt repeatedly their activity. This, along with other factors, such as the possibility to use electronic devices, mobile data and WI-FI, affects the attractiveness of the HSR, compared to the flight alternative (Nash 2015). For instance, it is still not possible to use mobile data on all flights, although the access to the Internet is progressively becoming available, especially on long-haul trips. Likewise, working activities can be interrupted by the fragmentation of the journey, waiting time, as well as by the impossibility to use laptops during taxi, take-off and landing. Furthermore, the magnitude of the fare coefficient assumes a lower value for those travelling from Bari, compared to that computed by pooling all observations.

[16]The distributional form check is performed only on the full sample for both the case, with and without HSR: T-MXL identifies such MXL models with triangular distribution for the random parameters, characterized by a symmetric bounded distribution with a single peak; U-MXL identifies models with uniformly distributed random parameters; N-MXL presents models under normal distribution. As shown by AIC, the N-MXL model performs slightly better than all other model specification (13,167 for T-MXL, 12,711 for U-MXL and 12,632 for N-MXL) in presence of HSR. Similar results apply in absence of HSR. The normal distribution provides the smaller standard deviations for the β-coefficient associated to the two random parameters (in-vehicle and access/egress time), and better goodness of fits (Mc Fadden R^2 or $PseudoR^2$). Additionally, the MXL is always performance-enhancing as compared to the MNL (AIC 15,532). Therefore, throughout the paper, we rely on normally distributed random parameters. See Appendix, Table A6.

Table 2: Multinomial Logit Model

	All		Bari	
	With HSR	Without HSR	With HSR	Without HSR
Attribute means				
Fare	-0.022***	-0.014***	-0.018***	-0.010***
	(0.001)	(0.001)	(0.001)	(0.001)
In-vehicle Time	-0.007***	-0.005***	-0.007***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
A/E Time	-0.007***	-0.005***	-0.007***	-0.006***
	(0.001)	(0.001)	(0.002)	(0.001)
Reliability	0.007***	0.010***	0.011***	0.012***
	(0.001)	(0.002)	(0.002)	(0.002)
Frequency	-0.004	-0.009**	-0.005	-0.012**
	(0.004)	(0.005)	(0.005)	(0.005)
Controls (Ref: Flight)				
T: Brindisi	-0.443***	-0.498***		
	(0.095)	(0.082)		
B: Brindisi	-0.797***	-0.779***		
	(0.159)	(0.150)		
CP:Brindisi	-0.564***	-0.536***		
	(0.141)	(0.136)		
C:Brindisi	-0.733***	-0.824***		
	(0.151)	(0.125)		
HSR:Brindisi	-0.108			
	(0.078)			
T: ASC	-0.380**	-0.337**	-0.356*	-0.396**
	(0.156)	(0.146)	(0.193)	(0.176)
B: ASC	-2.175***	-2.449***	-2.129***	-2.544***
	(0.263)	(0.255)	(0.314)	(0.301)
CP: ASC	-0.419**	-0.586***	-0.342	-0.572**
	(0.195)	(0.191)	(0.236)	(0.225)
C: ASC	-0.760***	-1.385***	-0.884***	-1.646***
	(0.200)	(0.187)	(0.239)	(0.221)
HSR: ASC	0.067		0.018	
	(0.141)		(0.175)	
Other controls	Yes	Yes	Yes	Yes
Observations	5,580	5,580	3,609	3,609
McFadden R2	0.119	0.109	0.096	0.086
Log-Likelihood	-7,731.061	-6,412.668	-5,341.157	-4,547.612

Note: *p<0.1; **p<0.05;***p<0.01
The reference alternative is the Flight; B is the Bus service; C is the private car; HSR is High Speed Rail; T is the current Train service; CP is the Car-pooling. Other controls include age, subjective evaluation of air transport mode, gender dummy.

Table 3: Mixed Multinomial Logit

	All		Only Bari	
	With HSR	Without HSR	With HSR	Without HSR
Random Parameter means				
In-vehicle Time	-0.023***	-0.022***	-0.023***	-0.017***
	(0.001)	(0.001)	(0.002)	(0.002)
A/E Time	-0.034***	-0.007***	-0.037***	-0.017***
	(0.002)	(0.002)	(0.003)	(0.003)
Random Parameter s.d				
In-vehicle Time	0.031***	0.066***	0.036***	0.027***
	(0.001)	(0.001)	(0.001)	(0.001)
A/E Time	0.053***	0.030***	0.057***	0.034***
	(0.002)	(0.001)	(0.002)	(0.002)
Fixed Parameters				
Fare	-0.047***	-0.067***	-0.041***	-0.032***
	(0.001)	(0.002)	(0.002)	(0.002)
Reliability	0.014***	0.025***	0.018***	0.019***
	(0.002)	(0.002)	(0.002)	(0.003)
Frequency	-0.001	-0.019***	0.00003	-0.015**
	(0.006)	(0.006)	(0.006)	(0.007)
Controls (Ref: Flight)				
T: Brindisi	-0.740***	-0.155		
	(0.125)	(0.125)		
B: Brindisi	-0.786***	1.340***		
	(0.227)	(0.225)		
CP:Brindisi	-1.031***	-0.205		
	(0.183)	(0.185)		
C:Brindisi	-0.949***	0.201		
	(0.191)	(0.171)		
HSR:Brindisi	-0.444***			
	(0.112)			
T: ASC	-0.078	1.550***	-0.200	0.046
	(0.219)	(0.225)	(0.269)	(0.268)
B: ASC	-3.195***	-2.400***	-3.380***	-3.035***
	(0.338)	(0.347)	(0.399)	(0.404)
CP: ASC	-0.570**	1.207***	-0.667**	-0.392
	(0.266)	(0.279)	(0.320)	(0.326)
C: ASC	0.407	2.214***	0.086	-0.487
	(0.263)	(0.262)	(0.317)	(0.313)
HSR: ASC	0.800***		0.508**	
	(0.201)		(0.248)	
Other controls	Yes	Yes	Yes	Yes
N.	5,580	5,580	3,609	3,609
McFadden R2	0.284	0.257	0.277	0.293
Log-Likelihood	-6,279.021	-5,348.250	-4,273.006	-3520.111
AIC	12,632	10,758	8,610	7094

Note: *p<0.1; **p<0.05;***p<0.01
Mixed Logit based on 1000 Halton draws. Other controls include age, subjective evaluation of air transport mode, gender dummy.

Arriving on time matters, with high significance and slight larger coefficients for those people travelling from Bari. Frequency, instead, negatively affects passengers' utility function, but this effect is verified only when HSR is absent. This is consistent with the results in Table 2. Notice that we analyze a generic coefficient, whereas differences can arise according to each modal alternative: we leave this aspect to a further analysis. The model is also estimated accounting for correlated parameters. The results are consistent with previous findings, see Table A7 in the Appendix. Relative to the previous results, new elements are introduced, namely the elements of the lower triangular variance-covariance matrix. To test for the presence of correlated parameters, we use a Likelihood Ratio Test (LR Test) to reject the null hypothesis ($H0$) of the absence of correlation.

6.1 Controlling for Travel Purposes

Because travellers differ in their behaviour, we segment our sample population, according to their travel purposes: business and leisure journeys (Table 4). The former accounts for approximately 40% of all individuals. As in Pels et al. (2003), the disutility of both access, egress and in-vehicle travel time is higher for those travelling for business, and remains greater than that associated to in-vehicle travel time even in absence of HSR. The mean-coefficient for in-vehicle time is -0.033 and -0.029 for business travellers, respectively in presence and absence of the new alternative, whereas it is equal to -0.016 and -0.08, for leisure travellers. The A/E time mean-coefficient is even higher for business travellers in presence of HSR (-0.051), whereas it shrinks to -0.018 when HSR is absent. In contrast, the coefficient is halved for leisure travellers when experiencing the benefits of the introduction of HSR (-0.022), but it is not significant for leisure travellers in absence of HSR. Business travellers, thus, are more interested in minimizing in-vehicle time, even at a greater cost, and in reducing the fragmentation of the journey (A/E time), which turns out to affect the possibility to work in-vehicle during the travel. For the standard deviation, we manage to further verify the presence of a sample taste heterogeneity, with a significant effect in both categories. We find that leisure travellers are sensitive to price increases, with a greater negative effect in both scenarios: -0.060 for leisure travellers, compared to -0.030 for business travellers, when HSR is considered; -0.069 and -0.016, respectively, in its absence. Reliability is particularly important for those travelling for business purposes, compared to leisure passengers: business journeys are often associated with a scheduled meeting, being *time sensitive*. Frequency is almost never significant.

6.2 Controlling for Frequency

According to Gonzales-Savignat (2004), the disutility of access, egress and in-vehicle travel time is greater for frequent travellers. Because 62% of respondents from Bari and 69% from Brindisi made fewer than 5 journeys per year on the route of interest, we distinguish between occasional and frequent travellers. The latter are those travelling to Rome at least five times per year. Results are reported in Table 5, showing that these are not unambiguous, as in the previous cases, and often the coefficients are not significant at 10% (Bari). This is likely to affect the computation of the willingness-to-pay. Overall, we still find that A/E time impact more when HSR are considered, whilst in-vehicle time is more relevant in absence of HSR but this happens more for occasional travellers. A more precise evaluation is left to the analysis of the willingness-to-pay, in Section 7.

Table 4: N-MXL segmented by travel purposes

	All				Bari			
	Business		Leisure		Business		Leisure	
	With HSR	Without HSR	With HSR	Without HSR	With HSR	Without HSR	With HSR	Without HSR
Random Parameter means								
In-vehicle Time	-0.033***	-0.029***	-0.016***	-0.008***	-0.034***	-0.030***	-0.018***	-0.013***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
A/E Time	-0.051***	-0.018***	-0.022***	0.0003	-0.050***	-0.018***	-0.030***	-0.014***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)
Random Parameter s.d								
In-vehicle Time	0.039***	0.033***	0.025***	0.043***	0.040***	0.034***	0.033***	-0.024***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
A/E Time	0.063***	0.041***	0.043***	0.036***	0.063***	0.040***	0.049***	-0.026***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
Fixed Parameters								
Fare	-0.030***	-0.016***	-0.060***	-0.069***	-0.029***	-0.016***	-0.054***	-0.045***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Reliability	0.028***	0.025***	0.006***	0.015***	0.028***	0.025***	0.008***	0.017***
	(0.003)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Frequency	-0.003	-0.013	0.004	-0.013*	-0.004	-0.014	0.007	-0.011
	(0.011)	(0.011)	(0.007)	(0.007)	(0.010)	(0.011)	(0.008)	(0.008)
Controls (Ref: Flight)								
T: Brindisi	-0.633**	-1.144***	-0.888***	-0.060				
	(0.283)	(0.242)	(0.154)	(0.155)				
B: Brindisi	0.164	-0.904*	-1.282***	0.117				
	(0.519)	(0.513)	(0.264)	(0.265)				
CP:Brindisi	-0.756*	-1.505***	-1.381***	-0.456**				
	(0.427)	(0.416)	(0.222)	(0.220)				
C:Brindisi	0.160	-1.042***	-2.006***	-0.321				
	(0.310)	(0.295)	(0.345)	(0.242)				
HSR:Brindisi	-0.009		-0.459***					
	(0.206)		(0.151)					
T: ASC	0.257	1.027**	-0.150	0.167	0.159	0.827*	-0.462	-0.020
	(0.424)	(0.431)	(0.267)	(0.276)	(0.420)	(0.425)	(0.341)	(0.340)
B: ASC	-1.805***	-0.833	-3.673***	-3.547***	-1.813***	-1.019	-4.245***	-3.653***
	(0.644)	(0.657)	(0.422)	(0.435)	(0.634)	(0.645)	(0.514)	(0.520)
CP: ASC	0.422	1.356**	-0.988***	-0.885***	0.317	1.119**	-1.291***	-0.838**
	(0.523)	(0.537)	(0.323)	(0.341)	(0.513)	(0.526)	(0.404)	(0.409)
C: ASC	0.838*	0.854*	0.231	0.316	0.836*	0.657	-0.262	-0.790*
	(0.481)	(0.484)	(0.349)	(0.336)	(0.476)	(0.477)	(0.424)	(0.409)
HSR: ASC	0.210		1.219***		0.192		0.703**	
	(0.375)		(0.249)		(0.372)		(0.317)	
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N.	2,169	2,169	3,411	3,411	2,169	2,169	2,106	2,106
McFadden R2	0.320	0.349	0.284	0.265	0.318	0.348	0.276	0.284
Log-Likelihood	-2,214.812	-1,732.304	-3,771.869	-3,214.584	-2,222.458	-1,734.872	-2,461.876	-2,053.982

Note: *p<0.1; **p<0.05;***p<0.01
Mixed Logit based on 1000 Halton draws. Successful convergence for all estimation. Optimization through BFGS maximization.

6.3 Controlling for Differences in Income

Table 6 reports result from the Mixed Multinomial Logit model, by examining income differences. In this case, however, we do not include socioeconomic variables to facilitate the convergence, but we estimate a model with only attributes (random and non-random) and alternative specific constants. Generally, the impact of access, egress and in-vehicle travel time increases with income. This is also consistent with Van Ommeren & Dargay (2006) who show that high-income commuters prefer using faster travel modes (in their analysis the term of reference is the car as opposed to public transit).

Table 5: Mixed Multinomial Logit segmented by yearly travel frequency

	All				Bari			
	<5 per year		>5per year		<5 per year		>5per year	
	With HSR	Without HSR	With HSR	Without HSR	With HSR	Without HSR	With HSR	Without HSR
Random Parameter means								
In-vehicle Time	-0.020***	-0.013***	-0.030***	-0.021***	-0.021***	-0.014***	-0.009***	-0.004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
A/E Time	-0.026***	-0.006**	-0.052***	-0.020***	-0.039***	-0.014***	0.001	0.010**
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)
Random Parameter s.d								
In-vehicle Time	0.031***	-0.021***	0.038***	0.048***	0.036***	0.025***	0.092***	0.078***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.005)	(0.005)
A/E Time	0.054***	-0.022***	0.071***	0.036***	0.056***	0.026***	0.095***	0.072***
	(0.002)	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.005)	(0.005)
Fixed Parameters								
Fare	-0.054***	-0.048***	-0.049***	-0.056***	-0.046***	-0.037***	-0.036***	-0.026***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.004)
Reliability	0.014***	0.019***	0.016***	0.017***	0.017***	0.020***	0.020***	0.018***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.005)
Frequency	-0.009	-0.020***	0.010	-0.011	-0.002	-0.017**	-0.009	-0.022*
	(0.007)	(0.007)	(0.010)	(0.011)	(0.008)	(0.008)	(0.011)	(0.011)
Controls (Ref: Flight)								
T: Brindisi	-0.456***	-0.108	-0.209	0.323				
	(0.174)	(0.168)	(0.216)	(0.208)				
B: Brindisi	-0.199	0.041	-0.127	1.820***				
	(0.310)	(0.303)	(0.402)	(0.396)				
CP:Brindisi	-1.004***	-0.584**	-0.622*	-0.198				
	(0.240)	(0.232)	(0.352)	(0.350)				
C:Brindisi	-0.750**	-0.488*	0.202	0.713**				
	(0.300)	(0.257)	(0.344)	(0.283)				
HSR:Brindisi	-0.313*		0.419**					
	(0.170)		(0.203)					
T: ASC	0.140	-0.628**	-0.636*	0.283	-0.427	-0.694**	0.443	0.307
	(0.295)	(0.303)	(0.364)	(0.368)	(0.314)	(0.323)	(0.443)	(0.467)
B: ASC	-2.699***	-3.488***	-4.452***	-4.483***	-3.923***	-4.083***	-2.147***	-2.360***
	(0.456)	(0.467)	(0.603)	(0.610)	(0.493)	(0.507)	(0.646)	(0.687)
CP: ASC	-0.470	-1.422***	-2.502***	-1.904***	-1.342***	-1.739***	-0.500	-0.523
	(0.360)	(0.374)	(0.452)	(0.462)	(0.374)	(0.391)	(0.539)	(0.571)
C: ASC	0.739**	-0.364	0.323	1.063**	0.096	-0.815**	1.732***	1.253**
	(0.360)	(0.347)	(0.418)	(0.416)	(0.367)	(0.363)	(0.507)	(0.528)
HSR: ASC	2.035***		1.051***		1.298***		1.955***	
	(0.269)		(0.321)		(0.284)		(0.397)	
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N.	2,709	2,709	1,881	1,881	2,241	2,241	1,368	1,368
McFadden R2	0.261	0.266	0.272	0.263	0.250	0.250	0.215	0.263

Note: *p<0.1; **p<0.05;***p<0.01
Mixed Logit based on 1000 Halton draws. Successful convergence for all estimation. Optimization through BFGS maximization.

Table 6: N-MXL segmented by income levels

	All						Bari					
	Income <1000		1000 - 2000		Income >2000		Income <1000		1000 - 2000		Income >2000	
	With HSR	Without HSR	With HSR	Without HSR	With HSR	Without HSR	With HSR	Without HSR	With HSR	Without HSR	With HSR	Without HSR
Random Parameter means												
In-vehicle Time	-0.014***	-0.001	-0.025***	-0.022***	-0.042***	-0.052***	-0.011***	-0.002	-0.026***	-0.022***	-0.039***	-0.044***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.004)	(0.005)	(0.002)	(0.002)	(0.003)	(0.003)	(0.005)	(0.006)
A/E Time	-0.023***	0.010***	-0.027***	-0.012***	-0.055***	-0.022***	-0.037***	0.007	-0.031***	-0.018***	-0.055***	-0.023***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.007)	(0.006)
Random Parameter s.d												
In-vehicle Time	0.023***	-0.016***	-0.032***	0.030***	0.039***	0.043***	0.031***	0.044***	0.035***	-0.033***	0.039***	0.046***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.004)
A/E Time	0.041***	-0.014***	-0.052***	0.028***	0.070***	0.025***	0.056***	0.059***	0.051***	-0.035***	0.076***	0.026***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.005)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.007)	(0.004)
Fixed Parameters												
Fare	-0.063***	-0.085***	-0.045***	-0.031***	-0.025***	-0.005	-0.063***	-0.070***	-0.040***	-0.021***	-0.018***	0.002
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)
Reliability	0.010***	0.015***	0.012***	0.021***	0.034***	0.020***	0.011***	0.018***	0.014***	0.023***	0.050***	0.023***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)	(0.007)	(0.007)
Frequency	-0.013*	-0.023***	0.0004	-0.014	0.044**	-0.003	-0.012	-0.017*	0.004	-0.015	0.040**	-0.016
	(0.007)	(0.007)	(0.009)	(0.010)	(0.017)	(0.019)	(0.009)	(0.009)	(0.010)	(0.011)	(0.021)	(0.022)
T: ASC	0.409	-0.089	0.975***	0.794**	0.143	1.308**	0.003	0.043	1.516***	1.075**	-0.252	1.329**
	(0.287)	(0.280)	(0.336)	(0.349)	(0.515)	(0.547)	(0.391)	(0.393)	(0.400)	(0.423)	(0.621)	(0.652)
B: ASC	-1.416***	-2.597***	-1.374***	-1.566***	-5.069***	-3.596***	-2.267***	-2.461***	-0.906	-1.319**	-4.739***	-3.080***
	(0.409)	(0.396)	(0.486)	(0.505)	(0.819)	(0.854)	(0.546)	(0.564)	(0.559)	(0.598)	(0.979)	(1.008)
CP: ASC	-1.161***	-1.970***	-0.672*	-0.829*	-3.108***	-1.329*	-1.524***	-1.689***	-0.012	-0.326	-2.943***	-0.873
	(0.340)	(0.335)	(0.407)	(0.429)	(0.684)	(0.705)	(0.446)	(0.459)	(0.475)	(0.518)	(0.812)	(0.829)
C: ASC	0.137	0.581*	1.709***	0.753*	1.390**	1.581**	-0.205	0.113	2.133***	0.688	0.439	1.272*
	(0.345)	(0.335)	(0.393)	(0.394)	(0.604)	(0.628)	(0.462)	(0.461)	(0.467)	(0.472)	(0.739)	(0.766)
HSR: ASC	1.731***		2.431***		2.166***		1.092***		2.620***		1.442***	
	(0.266)		(0.304)		(0.415)		**(0.372)**		(0.364)		(0.519)	
N.	2,313	2,313	1,908	1,908	1,359	1,359	1,413	1,413	1,377	1,377	819	819
McFadden R2	0.231	0.202	0.257	0.275	0.310	0.359	0.235	0.208	0.229	0.259	0.289	0.320
Log-Likelihood	-2,771.912	-2,455.918	-2,227.236	-1,764.434	-1,147.755	-834.991	-1,721.643	-1,542.413	-1,744.489	-1,401.428	-762.347	-610.543

Note: *p<0.1; **p<0.05;***p<0.01
Mixed Logit based on 1000 Halton draws. Successful convergence for all estimation. Optimization through BFGS maximization. Socioeconomic covariates not included.

The only exception is represented by those travelling from Bari with an intermediate income level. They show a small reduction (-0.031) relative to low-income travellers (0.037). However, given the size of the standard errors, these coefficients are not statistically significant from each other as they lie in overlapping confidence intervals. The effect of the fare coefficient is the opposite, ranging from -0.063 (and -0.085 in absence of HSR), for low-income earners (<1000 euro/month), to -0.045 (-0.031), for intermediate-income earners (1000-2000 euro/month), and to -0.025 (-0.005 but not significant at 10%), for those people earning more than 2000 euro per month.

The greater the income level, the greater the attention paid to the reliability of the transport mode. There are, however, a few exceptions: for middle and high-income earners, in absence of HSR, coefficients are similar or not statistically different from each other. Likewise, in presence of the HSR, the magnitude of the punctuality coefficient is similar for low- and intermediate-income categories (0.010 for low-income earners, and 0.013 for intermediate-income earners, in presence of HSR), but is three times higher for high-income travellers (0.034). This effect is also confirmed in absence of HSR, but the magnitude is always greater than in the presence of the new service for low- and intermediate income-earners, but not for high-income earners. We can, therefore, deduct that low-and intermediate-income travellers pay more attention to punctuality when in-vehicle time is, on average, longer, as a consequence of the unavailability of the new service. By contrast, high-income travellers care more about the reliability of transport mode when the HSR is introduced.

Perhaps surprisingly, we find that, when considering low-income travellers in absence of HSR, the coefficient of A/E time is positive, although not always significant at 10%. Because A/E time only refers to the air transport alternative, this might suggest that low-income travellers are more willing to sacrifice part of their time when they can travel by air, perhaps exploiting a cheaper fare, e.g. low-cost airlines. In other words, this can be related to a higher elasticity to price and a lower elasticity to time of low-income respondents. In examining the number of daily connections, the coefficient is not always significant: it is relevant for high-income earners (0.044), but only in presence of HSR, whereas the effect is negative for low-income travellers. To sum up, all these results suggest the presence of different elasticities among respondents, with high-income respondents evaluating more the amount of time spent travelling and less the price paid for reaching their preferred destination.

6.4 Testing the degree of competition as a function of distance

One of the purposes of this study is to test the degree of competition as a function of the travel distance. We find some slight contrasting results, according to different model specifications. As summarized in Table 7, under Multinomial Logit and Mixed Multinomial Logit model with correlated parameters, we find no significant differences between Bari and Brindisi, relative to the choice of HSR. The coefficient is equal to -0.108 in the first case, and -0.188 in the second case, but it is not significant at 10%l. All other alternatives are, instead, less likely to be chosen, compared to the air transport. Because the competitive advantage of HSR decreases with the travel distance, we might expect that the longer is the travel distance, the lesser is the competitive pressure exerted by HSR, and airlines are more likely prevail. Our results found support for an effective inter-modal substitution between airlines and HSR rail operators, even when the travel distance increases by additional 120 km relative to the baseline case.

Table 7: Effects on inter-modal competition (Ref. Bari / Flight)

	Multinomial Logit	Mixed Multinomial Logit					
	MNL	Base	With corr	Business	Leisure	Occasional	Frequent
*Reference (Flight*Bari)*							
HSR*Brindisi	-0.108	-0.444***	-0.188	-0.009	-0.459***	-0.313*	0.419**
	(0.078)	(0.112)	(0.120)	(0.206)	(0.151)	(0.170)	(0.203)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *p<0.1; **p<0.05;***p<0.01.
This table provides a summary of different estimates. The table summarizes the effect of HSR from Brindisi as relative to those choosing flights from Bari. Occasional travellers make less than five trips per year on the Bari-Rome route. Frequent travellers use the route more than five times per year.

In contrast, when parameters are not correlated but mixture models are still used, we now find a significant and negative impact, though not intense in its magnitude (-0.444) for HSR services relative to the air transport mode, but it is significant at 1%. Compared to other alternatives, HSR yield the smallest coefficient, indicating that there is a large degree of inter-modal substitution. This result indicates that an extension of the line to Brindisi would still be able to generate inter-modal substitution from airlines to HSR.

However, the size and the significance of this effect change across segments of the population. We report the results from the Mixed Multinomial Logit (without correlated parameters), considering those travelling for business and leisure purposes: there is no effect for the former category; instead, we find that those travelling for leisure purposes using HSR from Brindisi experience a reduction in their utility, compared to those travelling by flight from Bari. This effect is significant, and other things being equal, leisure travellers are less likely to choose HSR from Brindisi, compared to those choosing flights from Bari.

The greater substitutability of HSR for business travellers from Brindisi might be explained by the greater disutility of A/E time, which might interrupt their current work. Additionally, the absence of internet connection, as well as the possibility to have calls during the trip, can still affect the modal choice and make HSR more appealing. Thus, there is perfect substitutability among services even when distances increases. However, this is not the case of leisure travellers, for which, instead, the coefficient is negative (-0.459) and significant at 1%.

Another differentiation arises when evaluating travel habits: occasional travellers from Brindisi seem to prefer airline carriers to HSR operators (-0.313), with 10% of significance, whereas frequent travellers are more likely to rely on the new alternative. This might be explained by the fact that frequent travellers are more aware of the disutility experienced by fragmenting their journey time to reach the airport and from the airport to the final destination. This result also indicates that frequent travellers from Bari are less likely to choose the HSR relative to the airlines, showing forms of stickiness that might be related to the presence of both travel habits and the use of proper discounts (Bergantino & Madio 2017).

7 Willingness to Pay (WTP)

Because the magnitude of coefficients does not allow to actually determine the real impact of each attribute, we derive the willingness-to-pay (WTP) for in-vehicle time reductions. The WTP is defined as the marginal change in the utility driven by changes in some attributes. Consider the random parameter χ, identifying A/E or in-vehicle time, whose coefficient is defined by β_{χ}, the mean-WTP is given by the negative ratio of expected value of the random coefficient and the travel cost, where the expectation of the β in the denominator allows to considering the average coefficient given the distributional form of the random parameter.

$$E(WTP) = \frac{\partial V/\partial \chi}{\partial V/\partial fare} = -\frac{E(\beta^{\chi})}{\beta^{fare}} \tag{1}$$

We focus only on the mean-WTP for travel and access/egress time; this implies the computation of the mean-WTP to obtain the amount the average individual is willing to pay for reducing in-vehicle travel time (or A/E time) by one unit of time. The estimates for the Multinomial Logit model do not allow to disentangle the differences in the perception of access, egress and in-vehicle time evaluation by providing a coefficient which is almost the same in all model specifications[17]. Table 8 shows that, when the Mixed Multinomial Logit model is used, the mean-WTP for reductions in access/egress time becomes more valuable compared to a reduction in in-vehicle time, i.e. 43.40 versus 29.36 for the N-MXL model. The result is particularly true for Bari, where the WTP for A/E time reductions is 54.15 euro/hour (versus 33.66 euro/hour). This is consistent with Román et al. (2010) and can be explained by the disutility experienced by travellers when they have to break their journey, moving to the airport and from the airport to the final destination. Moreover, when HSR is not available (status-quo), the reduction of in-vehicle time becomes slightly more valuable than a reduction in A/E time. However, this result holds for the full sample population (19.70 vs. 6.27 euro/hour), but not for Bari, where the WTPs are equal (31.88 euro/hour). This finding is consistent with previous arguments, such that the average travel distance from Bari is shorter, and thus A/E time represent a non-marginal component of the journey. Similar results apply when we use the model with correlated parameters.

[17] The only difference is the mean-WTP for in-vehicle travel time savings Bari, which is 30 euro/hour, whereas the respective for savings for A/E time is 36 euro/hour.

Table 8: Willingness-to-pay for In-vehicle and A/E Travel Time Savings

Model Specification	All With HSR	Bari With HSR	All Without HSR	Bari Without HSR
	Mean-WTP for In-vehicle Travel Time Savings			
MNL	19.09***	23.33***	21.43***	30.00***
N- MXL	29.36***	33.66***	19.70***	31.88***
N- MXL - Corr	30.00***	34.29***	26.34***	31.88***
	Mean-WTP for A/E Time Savings (EUR/hour)			
MNL	19.09***	23.33***	21.43***	36.00***
N- MXL	43.40***	54.15***	6.27***	31.88***
N- MXL - Corr	36.25***	44.29***	16.10***	31.88***

Note: *p<0.1; **p<0.05;***p<0.01. MNL refers to the Multinomial Logit model with a generic coefficient. N-MXL refers to the results from the Mixed Multinomial Logit model with normally distributed random parameters. N-MXL - Corr presents those results in presence of correlated parameters.

Table 9: Willingness to Pay for In-vehicle and A/E Travel Time Savings by Segments

	Yearly Frequency				Income Levels						Travel Purpose			
	All		Bari		All			Bari			**All**		**Bari**	
	Occasional	Frequent	Occasional	Frequent	<1000	1000-2000	>2000	<1000	1000-2000	>2000	Business	Leisure	Business	Leisure
	Mean-WTP for In-vehicle Travel Time Savings (EUR/hour)													
With HSR	22.22***	36.73***	27.39***	15.00***	13.33***	33.33***	100.80***	10.48***	39.00***	130.00***	66.00***	16.00***	70.34***	20.00***
Without HSR	16.24***	22.50***	17.87***	9.23	0.71	42.58***	624.00	1.71	62.86***	1320.00	108.75***	6.96***	112.50***	17.33***
	Mean-WTP for A/E Time Savings (EUR/hour)													
With HSR	28.89***	63.67***	50.87***	1.67	21.90***	36.00***	132.00***	35.24***	46.50***	183.33***	102.00***	22.00***	103.45***	33.33***
Without HSR	7.50*	21.43***	22.70***	23.08*	-7.06***	23.23***	264.00	6.00	51.43***	690.00	67.50***	0.26*	67.50***	18.67***

Note: *p<0.1; **p<0.05;***p<0.01.

Table 9 shows that, as in Hess et al. (2007) and Behrens & Pels (2012), business travellers have a greater mean-WTP than leisure travellers, which have often small enough values. Remarkably, business travellers are more willing to pay for reductions of in-vehicle travel time when HSR is not available than when it is, i.e. 108.75 vs. 66.00 euro/hour, for *all* and 112.50 vs. 70.34 euro/hour for *Bari*. Likewise, business travellers care more about A/E time savings than about in-vehicle travel time savings with HSR relative to the current situation without HSR, i.e. 102.00 vs. 66.00 euro/hour, for *all* and 103.45 vs. 70.34 euro/hour for *Bari*). Moreover, regardless of their travel purpose, respondents are more willing to pay for reductions in A/E time than for reductions in-vehicle time with HSR, while the opposite holds in absence of HSR.

Table 9 also presents the mean-WTP by segmenting the sample population according to travel habits. In general, the value of time savings seems to be increasing with the number of journeys undertaken per year. However, this is not always true when considering the subsample of travellers from Bari, for which most of the estimated mean-WTP are not significant at 5% or 10%. Occasional travellers (i.e. <5 journeys per year on the route of interest) are, on average, willing to pay approximately 16-22 euro/hour of in-vehicle time saving, whereas frequent travellers even more: around 22-37 euro/hour, depending on the availability of faster train services. Similarly, depending on the availability of faster train services, A/E time savings are more valuable than in-vehicle time savings. In the latter case, the mean-WTP ranges from 28.89 euro/hour for occasional travellers to approximately 64 euro/hour for frequent travellers. These findings indicate the greater willingness to pay for reductions of in-vehicle travel time for frequent travellers, which might be explained by the greater impact of the time subtracted to other activities (leisure, work, etc.), over the whole time-horizon we consider (i.e. one year). We discuss, thus, only the mean-WTP which provide significant estimates. The willingness-to-pay for in-vehicle travel time savings ranges from 13.33 euro/hour (low-income) to 100.80 euro/hour for high-income travellers with HSR, with intermediate-income earners willing to pay 33.33 euro/hour on average. Also in this case, when faster trains are available, the willingness-to-pay for reductions of A/E time outweighs that one for reductions of in-vehicle time. Interestingly, this effect is verified for all income levels and regardless of the departure location. We also find that for A/E and in-vehicle, the mean-WTP increases with the income of the travellers. When the faster train is not available, results are not always reliable: we find that for low-income travellers, the mean-WTP is even negative (-7.06) suggesting that A/E time may not create disutility for this segment of the population.

8 Conclusions

This study investigates the relationship between in-vehicle and A/E travel time before and after the introduction of HSR. It also analyzes the patterns of inter-modal substitution and exploits heterogeneity among travellers. From a welfare point of view, the study of the optimal modal choice, both in the absence and in the presence of HSR, allows us to verify the changes in travellers' time evaluation for different average travel distances (using two locations) and for different average travel time (using two scenarios). In particular, we find that, when HSR is introduced, A/E time are evaluated more than in-vehicle travel time, confirming, as in Román et al. (2010), that fragmented journeys yield a greater disutility. Instead, absent HSR, travellers tend to prefer weakly more reducing in-vehicle time than A/E time. Notably, we find significant heterogeneity across the sample population. A/E time matters more than in-vehicle travel time (when HSR is a feasible option) for business, high-income and frequent travellers. For frequent travellers, however, this is not true when the origin of the trip is Bari. Similarly, we find that business travellers are more sensitive to reliability and travel and A/E time. Consistently with Hess et al. (2007) and Behrens & Pels (2012), these results indicate a smaller price elasticity and higher willingness-to-pay.

Our analysis yields also insights on possible managerial strategies. Because travellers behave differently, it becomes relevant for HSR companies to target those individuals less likely to choose the new alternative due to its costs. This implies introducing pricing strategies based on classes (Standard versus Business) and/or inter-temporal price discrimination, which we show to be effective for attracting reluctant customers.

The results indicate that the competition between airlines and HSR operators would still be intense when considering Brindisi as the departure location. This finding is consistent with the potential (stated) demand for the new service, which is approximately 26% of journeys from Bari and 28% from Brindisi. The attractiveness of HSR for longer distances and its large degree of substitutability with the air transport mode is even more evident when considering different segments of population: business and frequent travellers are more likely to choose the HSR from Brindisi, as compared to the air transport mode. This is a consequence of the possibility to work in-vehicle, which becomes less appealing for leisure and occasional travellers. The willingness-to-pay for the service and for A/E time savings for these travellers is reduced significantly.

Future research should be devoted to investigating whether our results on individual-specific A/E time are confirmed also taking into consideration the specific residence of respondents within the urban area (the distance from the transport node, i.e. the train/bus station). Further research might be targeted also to introduce within-class heterogeneity, i.e. Mixed-Mixed models (Keane & Wasi 2013) and to analyzing alternative-specific willingness-to-pay. This could lead to further policy implications and to assess potential market-scenarios, determining changes in terms of market shares depending on the composition of the attributes. Finally, attribute non-attendance is a further line of research that could be explored. This is, in fact, one of the limitations that might lead to estimation biases when using a Stated Preferences framework.

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Appendix

Analysis of the current market structure

Here we overview the current market configuration on the Bari-Rome and Brindisi-Rome routes.

The "Bari-Rome" line

The main operator for bus services is Marozzi Srl, which provides a total of six daily connections on the route Bari-Rome, with an average price for passengers of 34.50 euro. The direct competitor is Baltour Autolinee, which supplies only a single daily connection, with different intermediate stops, greater travel time and a price of 38 euro. In general, the travel time differs depending on whether or not intermediate stops occur during the journey.

Regarding the conventional rail services, there are four daily connections, three of which are "Frecciargento" and one "Intercity", all of which are supplied by Trenitalia, the state-owned rail company. The travel time ranges from four hours with "Frecciargento" to approximately six hours, with the slowest "Intercity". Fares are differentiated according to the classes (First or Second) and the booking-time, with the presence of different alternatives (SuperEconomy, Economy and Base). The "Intercity" is the option with the lowest price according to its longer travel time, whereas the First Class - Base (77 euro) and the Second Class - Base (54 euro) are those associated to the highest prices.

Relative to the air transport alternative, there are two operators[18]: Alitalia, the FCC (Full Cost Carrier) incumbent on the route, provides five daily flights and exploits alliances with other carriers. The LCC (Low Cost Carrier) Ryanair, which formerly used the secondary airport of Rome-Ciampino but now flies to Rome Fiumicino for many domestic flights, currently provides two daily connections (one early in the morning and one in the afternoon).

The "Brindisi-Rome" line

Some of the services provided in Brindisi are shared with Bari (e.g. bus and train). The main bus operator is Marozzi Srl, with four daily services, which are characterized by different travel time and fares (the lowest fare of 39.50 euro and the highest and faster one of 42.50 euro). Trenitalia is the monopolist for long-haul routes, providing up to three daily "Frecciargento" (as many as on the Bari-Rome route), with an average travel time of approximately 5 hours. As in the previous case, booking in advance might lead to a substantial discount associated to the Super Economy option (around 39 euro), whereas the maximum price charged on that route is 66 euro for the Second class - Base, and 96 euro for the First Class - Base. Additionally, there is a total of 6 daily flights, four of which provided by Alitalia and two by Ryanair.

[18] Vueling left its route from and to the Rome Fiumicino Airport during the first months of 2015.

Table A1: Existing Autobus connections on the route Brindisi-Bari-Rome

	Bari - Rome line						
	MR 2061R	MR 06	MR 16R	MR 827R	MR 05R	MR 05R	Baltour
Departure/Arrival	00.40 - 06.30	5.15 - 11.20	8.35 -14.15	12.55 - 18.30	17.00 - 22.30	23.59 - 6.30	16.45 -1.20
Travel time	05:50	06:15	05:40	05:35	05:30	06:30	08:35
Fares in euro	34.50						38
	Brindisi - Rome line						
	MR 165R			MR 827R	MR 05R	MR 2061R	
Departure/Arrival	10.50 - 17.30			11.00 - 18.30	15.05 - 22.30	22 .00 - 06.30	
Travel time	06:40			07:30	07:25	08:30	
Fares in euro	42.50			39.50	39.50	39.50	

Note: *The destination is the Rome Tiburtina Bus Station, few metro stops to Rome Termini Station.

Table A2: Existing Air connections on the route Brindisi-Bari-Rome

	Ryanair		Alitalia				
	(1)	(2)	(1)	(2)	(3)	(4)	(5)
				Bari - Rome			
Departure/Arrival	06.35 - 07.40	18.30 - 19.35	06.50 - 07. 50	08.00 - 09.00	12.10 - 13.15	15.30 - 16.35	19.15-20.20
Travel Time	01:05	01:05	01:00	01:00	01:05	01:05	01:05
ONE WAY: Min. Fare - Standard	12.99 euro (Standard)				78.11 euro (Economy)		
ONE WAY: Min. Fare - Business	67.44 euro (Business Plus)				373.11 euro (Flex)		
ROUND TRIP: Min . Fare - Standard	12.99 euro (Standard)				31.10 euro (Light)		
ROUND TRIP: Min. Fare - Business	67.44 euro (Business Plus)				46.10 euro (Economy)		
ROUND TRIP: Min Fare - Flex	-				373.10 euro (Flex)		
				Brindisi - Rome			
Departure/Arrival	06.25 - 07.40	22.00 - 23.15	7.05 - 8.15	11.55 - 13.00	16.30 - 17.40	19.05 - 20.15	
Travel Time	01:15	01:15	01:10	01:05	01:10	01:10	
ONE WAY: Min. Fare - Standard	12.99 euro (Standard)			59.21 euro (Economy)			
ONE WAY: Min. Fare - Business	67.44 euro (Business Plus)			377.21 euro (Flex)			
ROUND TRIP: Min . Fare - Standard	12.99 euro (Standard)			31.21 euro (Light)			
ROUND TRIP: Min. Fare - Business	67.44 euro (Business Plus)			47.21 euro (Economy)			
ROUND TRIP: Min Fare - Flex				377.21(Flex)			

Note: Fares checked on October, the 27th (2015) for November the 25th on both Ryanair.com and for November the 23th on Alitalia.it with the purpose to look at the lowest possible price charged by both companies.

Table A3: Existing Rail services on the route Brindisi-Bari-Rome

		FA 9350			FA 9354			Intercity 704			FA 9358	
						Bari - Rome line						
Departure/Arrival		7.15 -11.20			13.17 - 17.20			16.05 - 22.20			18.17 - 22.20	
Travel Time		04:05			04:03			06:15			04:03	
Fares in euro - First Class (Base; Economy; SuperEconomy)	77.00 euro	69.00 euro	49.00 euro	77.00 euro	69.00 euro	49.00 euro		n.a.		77.00 euro	54.00 euro	39.00 euro
Fares in euro - Second Class (Base, Economy, SuperEconomy)	54.00 euro	39.00 euro	24.00 euro	54.00 euro	39.00 euro	24.00 euro	49.00 euro	19.00 euro	9.00 euro	54.00 euro	39.00 euro	24.00 euro
						Brindisi - Rome line						
Departure/Arrival		6.11 - 11.20			12.17 - 17.20			n.a.			17.14 - 22.20	
Travel Time		05:09			05:03			n.a.			05:06	
Fares in euro - First Class (Base; Economy; SuperEconomy)	96.00 euro	79.00 euro	59.00 euro	96.00 euro	79.00 euro	59.00 euro		n.a.		96.00 euro	66.00 euro	49.00 euro
Fares in euro - Second Class (Base, Economy, SuperEconomy)	66.00 euro	49.00 euro	39.00 euro	66.00 euro	49.00 euro	39.00 euro				66.00 euro	49.00 euro	39.00 euro
Average delay (uniquevisitor.it*)		8 mins			12 mins			n.a.			10 mins	
% Delay (uniquevisitor.it*)		57%			56%			n.a.			67%	
Punctuality Index (uniquevisitor*)		41%			39%			n.a.			29%	

Note: *Analysis on 300 rail services from 1st January 2014 to 30th November 2014.

** Fares checked on October the 27th for November the 25th. Only direct connections are reported.

Table A4: Alternatives, Attributes and Levels on the “Bari - Rome” line

Attribute	Levels	Flight	Bus	HSR	Existing Rail	Car	Car Pooling
In-vehicle Time	1	1 h 45 min	5 h 15 min	3 h	3 h 45 min	4 h 15 min	4 h 15 min
	2	2 h 15 min	5 h 45 min	3 h 15 min	4 h		4 h 45 min
	3	2 h 45 min	6 h 15 min	3 h 30 min	4 h 15 min		5 h 15 min
Access and Exit time from/to the airport	1	45 min					
	2	1 h 15 min					
	3	1 h 45 min					
Reliability	1	65	65	65	65	99	70
(Probability to respect the schedule time)	2	80	80	80	80		80
	3	95	95	95	95		90
Price (Standard / Business) - in euro	1	25 - 79	30	70 - 100	24 - 49		25
	2	58 - 118	34	95 - 125	39 - 69	75	30
	3	83 - 146	38	120 - 150	54 - 77		35
Frequency (Number of links per day)	1	7	5	4	4		7
	2	10	8	6	6		15
	3	15	12	10	9		30

Table A5: Alternatives, Attributes and Levels on the “Brindisi - Rome” line

Attribute	Levels	Flight	Bus	HSR	Existing Rail	Car	Car Pooling
In-vehicle time	1	2 h	6 h 30	3 h 30 min	4 h 45 min	5 h 20 min	5 h 20 min
	2	2 h 30 min	7 h	3 h 45 min	5 h		5 h 50 min
	3	3 h	7 h 30 min	4 h	5 h 15 min		6 h 20 min
Access and Exit time from/to the airport	1	45 min					
	2	1 h 15 min					
	3	1 h 45 min					
Reliability	1	65	65	65	65	99	70
	2	80	80	80	80		80
	3	95	95	95	95		90
Price (Standard / Business) - in euro	1	25 - 79	38	80 - 110	39 - 59		25
	2	58 - 118	42	115 - 145	49 - 79	90	30
	3	83 - 146	46	140 - 160	66 - 96		35
Frequency (Number of links per day)	1	6	4	3	3		7
	2	9	7	5	5		15
	3	14	11	9	7		30

Table A6: Mixed Multinomial Logit with triangolar and uniform distribution

	All, with HSR	
	T-MXL	U-MXL
Random Parameter means		
In-vehicle Time	-0.003**	-0.025***
	(0.001)	(0.001)
A/E Time	-0.008***	-0.045***
	(0.002)	(0.002)
Random Parameter s.d		
In-vehicle Time	0.111***	0.055***
	(0.003)	(0.001)
A/E Time	0.224***	0.090***
	(0.007)	(0.003)
Fixed Parameters		
Fare	-0.049***	-0.047***
	(0.001)	(0.001)
Reliability	0.014***	0.014***
	(0.002)	(0.002)
Frequency	-0.002	-0.001
	(0.005)	(0.005)
Controls (Ref: Flight)		
T: Brindisi	-1.227***	-0.815***
	(0.130)	(0.126)
B: Brindisi	-1.887***	-1.342***
	(0.227)	(0.219)
CP:Brindisi	-1.847***	-1.310***
	(0.186)	(0.184)
C:Brindisi	-1.497***	-1.113***
	(0.193)	(0.190)
HSR:Brindisi	-0.607***	-0.393***
	(0.113)	(0.111)
T: ASC	0.088	-0.007
	(0.220)	(0.218)
B: ASC	-2.570***	-2.938***
	(0.341)	(0.334)
CP: ASC	-0.299	-0.500*
	(0.268)	(0.266)
C: ASC	0.674**	0.479*
	(0.264)	(0.262)
HSR: ASC	1.004***	0.836***
	(0.203)	(0.200)
Other controls	Yes	Yes
N.	5,580	5,580
McFadden R2	0.254	0.280
Log-Likelihood	-6,546.872	-6,318.856
AIC	13167	12711

Note: *p<0.1; **p<0.05;***p<0.01
Mixed Logit based on 1000 Halton draws. Other controls include age, subjective evaluation of air transport mode, gender dummy.

Table A7: Mixed Multinomial Logit Model with correlated parameters

	All		**Only Bari**	
	With HSR	Without HSR	With HSR	Without HSR
Random Parameter means				
In-vehicle Time	-0.024***	-0.018***	-0.024***	-0.017***
	(0.001)	(0.001)	(0.002)	(0.002)
A/E Time	-0.029***	-0.011***	-0.031***	-0.017***
	(0.002)	(0.002)	(0.003)	(0.003)
Variance-Covariance Matrix				
ae_time.ae_time	0.035***	0.024***	0.039***	0.028***
	(0.001)	(0.001)	-0.001	-0.001
ae_time.inv_time	0.045***	0.001	0.045***	0.003
	(0.002)	(0.002)	-0.002	-0.002
inv_time.inv_time	0.041***	0.028***	0.043***	0.035***
	(0.002)	(0.001)	-0.002	-0.002
Fixed Parameters				
Fare	-0.048***	-0.041***	-0.042***	-0.032***
	(0.001)	(0.002)	(0.002)	(0.002)
Reliability	0.015***	0.016***	0.019***	0.019***
	(0.002)	(0.002)	(0.002)	(0.003)
Frequency	-0.001	-0.013**	0.001	-0.015**
	(0.006)	(0.006)	(0.007)	(0.007)
Controls (Ref: Flight)				
T: Brindisi	-0.546***	-0.630***		
	(0.126)	(0.124)		
B: Brindisi	-0.668***	-0.615***		
	(0.228)	(0.222)		
CP:Brindisi	-0.899***	-0.890***		
	(0.184)	(0.181)		
C:Brindisi	-0.777***	-0.848***		
	(0.190)	(0.170)		
HSR:Brindisi	-0.188			
	(0.120)			
T: ASC	0.148	0.274	0.018	0.072
	(0.219)	(0.224)	(0.270)	(0.275)
B: ASC	-3.022***	-2.661***	-3.259***	-3.029***
	(0.338)	(0.344)	(0.397)	(0.405)
CP: ASC	-0.333	-0.276	-0.460	-0.363
	(0.266)	(0.276)	(0.320)	(0.332)
C: ASC	0.674**	0.147	0.336	-0.462
	(0.263)	(0.262)	(0.317)	(0.318)
HSR: ASC	0.872***		0.611**	
	(0.201)		(0.248)	
Other controls	Yes	Yes	Yes	Yes
Ho: No Correlation	Rejected	Rejected	Rejected	Rejected
N.	5,580	5,580	3,609	3,609
McFadden R2	0.296	0.299	0.287	0.293
Log-Likelihood	-6,172.680	-5,044.450	-4,211.008	-3,519.619

Note: *p<0.1; **p<0.05;***p<0.01
Mixed Logit based on 1000 Halton draws. Successful convergence for all estimation. Optimization through BFGS maximization. Other controls include age, subjective evaluation of air transport mode, gender dummy.

Figure A1: Example of the Choice-set for the Bari-Rome route

Block 1 - Choice Set n. 4						
Attributes	Flight	Train	HSR	Bus	Car Pooling	Car
in-vehicle Travel Time*	2 h 15 min	3 h 45 min	3 h	5 h 45 min	4 h 15 min	4 h 15 min
Time to Get from and To the Airport	1 h 45 min					
Reliability (Probability to respect the schedule time)	95%	65%	80%	80%	90%	99%
Fares (Standard / Business)	83 - 146 €	39 - 69 €	70 - 100 €	30 €	30 €	75 €
Frequency (N. daily connections)	10	6	9	8	30	Infinite
Which alternative would you choose in absence of HSR? (For Flight and Train, you must choose whether Standard/II Class or Business/I Class)						
Travel Choice	☐ Standard ☐ Business	☐ Standard ☐ Business		☐	☐	☐
Which alternative would you choose in presence of HSR? (For Flight, Train and HRS, you must choose whether Standard/II Class or Business/I Class)						
Travel Choice	☐ Standard ☐ Business	☐ Standard ☐ Business	☐ Standard ☐ Business	☐	☐	☐
Select such factors (if any) which have not affected your final travel choice:						
☐ Travel time ☐ Access/Exit from/to Airport ☐ Reliability ☐ Fares ☐ Frequency						

* Please note that, for the air transport mode, this also includes waiting time, check-in, time at the gate.