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One price for all? The role of market captivity as a price discrimination device: evidence from the Italian city-pair markets.*

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Abstract

This paper aims at understanding whether market captivity is used by airlines as a price discrimination device. The purpose is twofold: to measure differences between the average fare on city-pairs with a different degree of inter-modal competition and to understand whether the competitive pressure exerted by the presence of rail competitors shapes the inter-temporal profile of fares. The Italian passenger market is particularly fit to test the research question posed, given the heterogeneity with respect to the inter-modal competition level. Results shows that competition by rail transport influences pricing behaviour in terms of both average fares and inter-temporal dynamics. Fares are higher when airlines faces very limited intermodal competition. Further, the level of inter-modal competition influences the shape of the inter-temporal profile, which seems to be non-monotonic. Fares reach their minimum more in proximity of departure when there is effective high-speed rail competition.

Key words: airfares, price discrimination, inter-modal competition

JEL: L11, L13, L93

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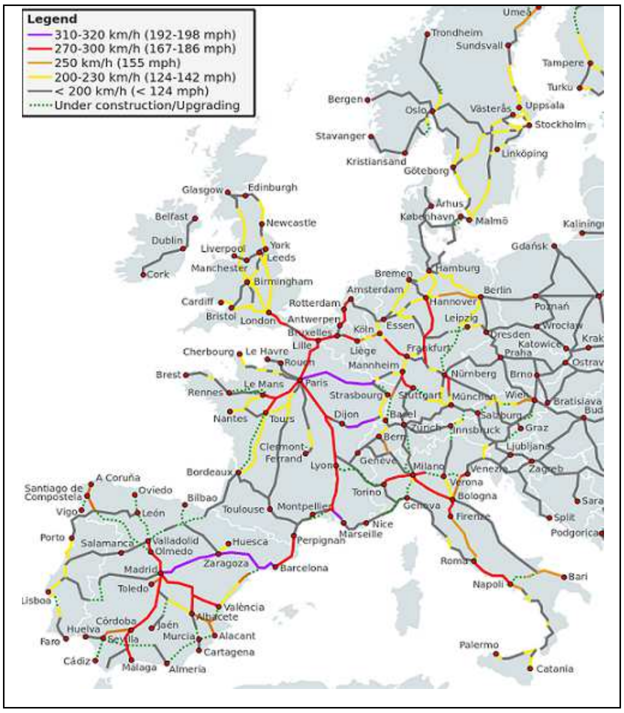
1. Introduction

In the market for short-haul flights there are three sources of competition jointly affecting airline pricing behaviour: the intra-modal competition, the inter-modal competition and the competition of airline companies with themselves. The first source of competition regards the competition with other airlines for the same city-pair markets. The second one refers to the competition with other modes of transport such as trains, and especially with high-speed trains. The third one considers that airlines compete with themselves by setting different fares in different time periods prior to departure. This pricing strategy is known as inter-temporal price discrimination.

There is a large number of empirical contributions exploring pricing behaviour and competition in the air transport sector, in various geographical contexts. However, this paper differs from existing works as it attempts to study airline pricing for short-haul flights taking into account *all* the competitive forces acting in the market. Indeed, we measure the effect of intra-modal competition on fares and we shed light on the inter-temporal profile of fares to verify if airlines compete also with themselves by engaging in inter-temporal price discrimination. The most relevant contribution of our work is to explore airline pricing when the extent of intermodal competition varies across routes. In other words, we want to understand if, and to what extent, airlines undertake different pricing strategies in captive markets, i.e. markets where there is often no alternative to air-transport. The aim is twofold: to measure differences between the average fare on city-pair with a different degree of inter-modal competition and to understand whether the competitive pressure exerted by the presence of rail competitors shapes the inter-temporal profile of fares.

The Italian passenger market is particularly fit to test the research question we posed, given the heterogeneity with respect to the inter-modal competition level. In this regard, Figure 1 is self-explanatory.

Figure 1. High speed rail network in Europe, 2012.



Source: Ministry of Infrastructure and Transport, Italy.

At first glance, one might notice that Italy shows a very relevant regional gap in rail transport. First, the rail network is less widespread throughout the country - in particular in southern regions - than the rest of western Europe. Further, high-speed rail (HSR) connections are effective in central and northern regions, while are scanty or even lacking in southern regions. Specifically, the red line depicts the fastest railway connections (HSR). As it can be seen, it lies for the largest extent, in northern Italy. Also other types of railway connections, depicted in orange and yellow, which are less fast than those in red, lie mostly in northern regions, while the southern regions are mainly connected by the traditional rails (in gray).

This gap among regional areas motivates our interest in developing an empirical analysis to understand whether airfares differs for markets with a more captive demand for airline services, that is whether airlines price discriminate according to the extent of inter-modal competition exerted by HRS.

The dataset we use to address the research question is unique. It covers a sample of Italian domestic routes operated from January 2011 to December 2012. Data on fares were collected starting sixty days before the departure from airline website to replicate consumer behaviour when making reservations. Following Bergantino and Capozza (2012), we simulate the purchase of round-trip fares instead of one-way fares. In this way, we effectively replicate the demand side since travellers use to purchase round-trip tickets rather than one-way tickets. In addition, we precisely recreate the supply side as we can clearly see if, for each round-trip flight, carriers and railway operators are feasible alternative for travellers and effective competitors.

Our results confirm our initial hypothesis that airlines apply different fares for connections characterised by a different degree of intermodal competition: fares are higher when airlines faces very limited intermodal competition. Further, we find out that the inter-temporal profile of fares is non-monotonic. The level of rail-competition influences the shape of the profile: fares reach their minimum more in proximity of departure -- thus the increasing part of the distribution is shorter -- when there is effective high-speed rail competition. Therefore, the competition by rail transport influences pricing behaviour in terms of both average fares and inter-temporal dynamics. Important implications can be drawn from the results for investment policy and evaluation strategies for transportation infrastructures. High speed networks require relevant investments. Being able to identifying the indirect benefits of these investments through downward pressures on competing airline fares adds an important element to its cost-benefit analysis.

The remainder of the paper unfolds as follows. In Section 2 we survey the relevant literature. In Section 3 we present the empirical strategy and in Section 4 we give a description of the data. In Section 5 we discuss the results and in Section 6 we draw conclusions.

2. Literature review

This work is based on a strand of literature dealing with airline pricing and the factors influencing it. Following the our main objectives, we initially review papers which analyse the effect of intra-modal competition on fares, then we focus on works studying the effect of inter-modal competition on fares. We conclude the survey with contributions exploring the inter-temporal price discrimination.

The first to study the impact of market structure on fares was Borenstein (1989) on the US airline industry. He develops a model using market share at both route and airport level. Results indicate that market share, whatever measure adopted, influences carrier's ability to raise fares since the dominant presence of an airline at an airport increases its market share on the routes included in that airport. However, Evans and Kessides (1993) point out that, when controlling for inter-route heterogeneity, market share on the route is no longer relevant in determining fares, which are, instead, determined by carriers' market share at the airports.

More recently, some contributions explored the European airline markets. Unlike the US market, Carlsson (2004) finds that market power, measured by the Herfindahl index, does not have a significant effect on fares whereas it influences flight frequencies. Consistently, Giaume and Guillou (2004) find a negative and, often, non significant impact of market concentration for connections from Nice Airport (France) to European destinations. Bachis and Piga (2007a) measure the effect of market concentration at the origin airport on fares applied by British carriers, considering either the route or the city-pair level. Their results reveal the existence of a large degree of substitutability between the routes within a city-pair. A greater market share at route level leads to higher fares while at city pair level it does not. Gaggero and Piga (2010) find that higher market share and Herfindhal Index at the city-pair level leads to higher fares on routes connecting the Republic of Ireland to the UK. Finally, Brueckner et al. (2013) provide a comprehensive analysis of competition and fares in domestic US markets, focussing on the roles of low cost carriers (LCCs) and full service carrier (FSCs). They find that FSC competition in an airport-pair market has a limited effect on fares, whilst competition in a city-pair market has no effect. In contrast, LCC competition has a strong impact on fares, whether it occurs in airport-pair markets or in city-pair markets.

While there is plenty of evidence on the impact of intra-modal competition on fares, relative few studies examined the impact of inter-modal competition on fares. Actually, some contributions mainly focused on the effect of inter-modal competition on the airline operation and market share. For instance, Behrens and Pels (2012) analyse inter-modal competition in the London-Paris market. Empirical results indicate that HSR is a competitor for both FSCs and LCCs insomuch as some FSC are pushed out of the market when they encounter strong competition from HSR. Jiménez and Betancor (2012) examine air carriers' reaction to the opening of the HSR service in Spain, finding that the presence of the new service has reduced, on average, the number of air transport operations by 17 per cent. The study conducted by Steer Davies Gleave (2006) shows that HSR is able to capture a relative large market share and, as a consequence, airline fares could drop even below that of HSR services. Additionally, Yang and Zhang (2012), exploring form both a theoretical and an empirical perspective the inter-modal competition, show that airfares are decreasing in rail speed when the marginal cost of HSR is not too large.

As far as concerns inter-temporal price discrimination, this pricing strategy entails that the same market is periodically covered.[1] Specifically, in the airline industry, inter-temporal price

[1] In a theoretical model with two time periods Logfren (1971) shows that a seller applies, for the same good, higher prices to consumers with higher purchasing power in the first period and lower prices to consumers with

discrimination consists of setting different fares for different travellers according to the days missing to departure when the ticket is bought. However, differently from markets for commodities, in the airline industry the inter-temporal profile of fares is increasing. Using inter-temporal price discrimination, airlines exploit travellers' varied willingness to pay and demand uncertainty about departure time. Price-inelastic consumers, usually business travellers, use to purchase tickets close to departure date, whilst price-elastic consumers, usually leisure travellers, tend to buy tickets in advance.[2]

Actually, Gale and Holmes (1992, 1993) prove that through advance-purchase discounts a monopoly airline can increase the output by smoothing demand of consumers with weak time preferences over flight times and extract the surplus of consumers with strong preferences. More recently, Möller and Watanabe (2010) show that advance-purchase discounts the is preferred to clearance sales for airline tickets because their value is uncertain to buyers at the time of purchase and reselling is costly or difficult to implement.

The inter-temporal profile of fares has been also empirically explored. McAfee and te Velde (2006) find out that one week before the departure there is a significant rise in fares, which is on the top of the rise of two weeks before the departure. Bachis and Piga (2007a) show that fares posted by British LCCs follow an increasing inter-temporal profile. Instead, Bachis and Piga (2007b), who examine UK connections to and from Europe, and Alderighi and Piga (2010), that focussed on Ryanair pricing in the UK market, find a U-shaped fare inter.temporal profile. Gaggero and Piga (2010) show that fares for Ireland-UK connections follows a J-curve. Gaggero (2010) argues that there are three categories of travellers: early-bookers and middle-bookers, usually leisure travellers, and late-bookers, mostly business travellers. Early-bookers have a slightly inelastic demand. Families planning holidays are, for instance, willing to pay moderately higher fares to travel during vacations. Middle-bookers exhibit the highest demand elasticity as they are more flexible and search for the cheapest fares. Late-bookers reveal an inelastic demand. A business traveller typically books the ticket a few days before departure, with fixed travel dates and destination. As a result, fare inter-

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lower purchasing power in the second period. Stokey (1979) implicitly extend Logfren's framework to a continuous of periods. She claims that IPD occurs when goods are "introduced on the market at a relatively high price, at which time they are bought only by individuals who both value them very highly and are very impatient. Over time, as the price declines, consumers to whom the product is less valuable or who are less impatient make their purchases". In her paper reference is made to commodity such books, movies, computers and related programmes.

[2] Travellers' heterogeneity appears to be a necessary condition to successfully implement price discrimination strategies. In a theoretical contribution Alves and Barbot (2009) illustrates that low-high pricing is a dominant strategy for LCCs only if travellers, on a given route, show varied willingness to pay.

temporal profile is J-shaped as it reflects a pattern opposite to that of travellers' demand elasticity.[3]

Bergantino and Capozza (2012) explore airlines pricing for short-haul flights in contexts with no credible threat of inter-modal competition. They find out a non-monotonic inter-temporal profile of fares with a minimum occurring between 43th-45th days before departure. Their claim is that, on the one hand, the non-monotonicity would be the evidence that airlines exploit consumer bounded rationality. On the other hand, a higher fare for very-early purchasers can be seen as a fee for risk-aversion.

This paper differs from previous contributions as it studies airline pricing for short-haul flights taking into account all the competitive forces acting in the market. Indeed, we measure the effect of intra-modal competition on fares and we shed light on the inter-temporal profile of fares to verify if airlines compete also with themselves by engaging in inter-temporal price discrimination. The most relevant contribution of our work is to explore airline pricing when the extent of intermodal competition varies across routes. In other words, we want to understand if, and to what extent, airlines undertake different pricing strategies in captive markets, i.e. markets where there is often no alternative to air-transport. The aim is twofold: to measure differences between the average fare on city-pair with a different degree of inter-modal competition and to understand whether the competitive pressure exerted by the presence of rail competitors shapes the inter-temporal profile of fares.

3. Empirical strategy

To explore airline pricing for short-haul flights taking into account all the competitive forces in the market, we begin by defining the following equation to be estimated:

$$ln\left(P_{\mathrm{ijkst}}\right) = \alpha + \beta HHI_{\mathrm{iks}} + \gamma f\left(Booking\ Day_{\mathrm{t}}\right) + \theta Peak_{ks} + \rho Control\ Dummies_{\mathrm{ijkst}} + u_{\mathrm{ijkst}} \qquad (1)$$

where *i* indexes the route, *j* the carrier, *k* the departure date and *s* the return date. We define a daily time dimension t that goes from 1 to 60.

[3] Abrate et al (2010) show that in the hotel industry, hoteliers undertake IPD with two opposite trends. If a room is booked for the working days, last minute prices are lower. Instead if a room is reserved for the weekend, last minute prices are higher.

The dependent variable is the log of the fares. The extent of intra-modal competition is measured by the Herfindahl-Hirschman Index (HHI): $\sum_{j=1}^{N} MS_{\mathrm{ijks}}^{2}$, where *MS* is the average share of the daily flights operated by an airline at the two endpoints of a city-pair.[4]

The variable *Booking Day* captures the effect of inter-temporal price discrimination and ranges from 1 to 60. As suggested by previous empirical findings, we cannot make any hypothesis on the functional form of Booking Day that, then, we empirically identify.

Further, the variable *Peak*, introduced to control for peak demand effects, is a dummy equal to 1 for flights occurring during summer holidays, winter holidays, bank holidays and public holidays, 0 otherwise. We also include a rich set of *Control dummies*:

- *Route-specific dummies* to capture route-specific effects, demand and cost (or price) differences;
- *Carrier-specific dummies* to absorb the impact of differing strategies among the players in the market;
- *Year dummies* to account for macroeconomic factors equally affecting all flights in each year;
- *Month dummies* to capture seasonal effects;
- *Stay dummies* to control for the length of stay (i.e. how many days elapse between departure and return).

Finally, u_{ijkst} is the composite error term, where $u_{\mathrm{ijkst}} = \alpha_{\mathrm{ijks}} + \varepsilon_{\mathrm{ijkst}}$. Specifically, α_{ijks} is the unobserved heterogeneity and $\varepsilon_{\mathrm{ijkst}}$ is the idiosyncratic error term. Standard errors are clustered at flight level since observations on flights are not likely to be independent over time.

To understand if market captivity is used by airlines as a price discrimination device - namely, if airline pricing differs when the extent of inter-modal competition varies across routes - the empirical analysis is structured as follows. First, the regressions are performed on the full sample of Italian domestic connections in order to measure the general effect of intra-modal competition on fares and to point out the dynamic of pricing over time. Then, regressions are performed on two subsamples of Italian domestic routes. The first subsample is composed by routes connecting northern cities to central cities, where the inter-modal competition from HSR services is effective. The second subsample is composed by routes connecting northern

[4] In the Italian domestic market only the city of Rome and Milan have multiple airports. On almost each routes included in the city-pairs from/to Rome and Milan carriers are monopolist. Therefore, we need the city-pair level to capture the real competition between carriers.

and central cities to southern cities, where the inter-modal competition from HSR services is scanty or totally missing. In this way, we are able to measure differences between the average fare on connections with a different degree of captivity and to see whether the competitive pressure, exerted to a different extent by rail competitors across connections, shapes the inter-temporal profile of fares.

The econometric issue arising in the estimation of equation (1) concerns the potential endogeneity of the HHI, since the other regressors are exogenous by construction. First, the possible endogeneity comes from the correlation with α_{ijks} (omitted variables problem). We might use the fixed effects (or within group) estimator to get rid of the α_{ijks}. However, fixed effects estimator does also eliminate all time-invariant variables. Instead, we want to obtain coefficients of time-invariant variables, thus the fixed effects estimator is not a solution. The choice should therefore fall on the random effects generalised least square estimator that to be consistent requires the strong assumption that the right-hand side variables are not correlated with the α_{ijks}. We run the Hausman test of random versus fixed effects to test such assumption. If the test reject the null hypothesis of no correlation between regressors and α_{ijks}, then we need to rely on instrumental variable estimation. Second, one might reasonably argue that market structure could be a function of the fares charged. In our model the HHI is potentially correlated with $\varepsilon_{\mathrm{ijkst}}$. To deal with both sources of endogeneity, we employ the generalised two stage least square (GLS-IV) estimator using the logarithm of the distance between the two route endpoint as instrument.[5]

4. Data collection

Data on fares were collected to replicate real travellers' behaviour when making reservations. First, we identified plausible round-trips, then we retrieve data directly from airlines' website by simulating reservations.[6] We observed fares daily starting, generally, sixty booking days before departure. However, for some round-trip flights we have less than sixty observed fares, thus the panel is unbalanced. We define a dataset comprising 10789 observations on 214 round-trip flights from January 2011 to December 2012. Our sample includes 37 routes (see

[5] The logarithm of the distance is a widely adopted instrument in the related literature. See, for instance, Borenstein (1989), Borenstein and Rose (1994) and Gerardi and Shapiro (2009).

[6] We avoid any potential distortion on pricing strategies caused by online travel agencies that could set discounted fares.

Table 1 in appendix) and 9 airline companies[7]. Both FSCs and LCCs are considered; thus we chose the basic services (no add-ons) to make carriers' supply effectively comparable.

We simulate the purchase of round-trip tickets, which gives us several advantages. Firstly, we effectively replicate the consumer behaviour since travellers use to purchase round-trip tickets rather than one-way tickets.[8] In addition to that, we precisely recreate the market structure as we can clearly see if, for each round-trip flight, a given carrier is a feasible alternative for travellers and an effective competitor. The use of round-trip fares allows also to account for peak-periods and to verify if airlines adjust the pricing behaviour during phases of greater travel demand. Further, one-way ticket pricing differs depending on carrier type. For FSCs a round-trip fare is lower than sum of the correspondent two one-way fares. This pricing policy is not adopted by LCCs. To avoid distortions, previous contributions using one-way fares limit the empirical analysis to LCCs or to a few carriers. Instead, we do not encounter this problem and we are able to carry out a market analysis and compare pricing behaviour of all carrier types. In Table 2 we provide descriptive statistics.

Table 2. Descriptive statistics.

Variables	Obs	Mean	St. Dev.	Min	Max
All connections					
Fares	10789	157.944	94.035	19.98	718.41
HHI	10789	0 .571	0.247	0.287	1
North to Centre					
Fares	2811	126.236	75.690	19.98	631.96
HHI	2811	0.635	0.178	0.451	1
North-Centre to South					
Fares	7978	169.116	97.269	21.99	718.41
HHI	7978	0.548	0.263	0.287	1

It is worthwhile noting that the HHI is not very different between the two subsamples, while fares for *North-Centre to South* connections are, on average, 43 Euros higher than fares for *North to Centre* connections. This would suggest that the inter-modal competition is actually exerting a downward pressure on airfares as we have assumed.

[7] Airitaly, Alitalia-Airone, BluExpress, EasyJet, Lufthansa, Meridiana, Ryanair, Volotea, Windjet.
[8] See, for instance, the analysis on airline travel demand carried out by Belobaba (1987).

5. Results

The results of the Robust Hausman test[9] lead to reject the null hypothesis that RE GLS estimator is consistent. As we stated in section 3, we want to estimate coefficients of time-invariant variables, therefore we use the GLS-IV estimator which allow us to deal with both sources of potential endogeneity (omitted variables problem and simultaneity or reverse causality). The F-statistic is considerably larger than the rule of thumb value of 10, so the logarithm of distance does not seem to be a weak instruments.[10]

Table 4 shows the main results. The *HHI* has a positive and highly significant impact on fares. Holding constant other variables, 10% increase in *HHI* leads to 15.3% higher fares. This finding is consistent with previous contributions providing evidence that when the intra-modal competition reduces and, then, the market power arises, carriers are induced to set higher fares.

However, the impact of intra-modal competition differs, varying the extent of inter-modal competition. Actually, 10% increase in *HHI* leads to 20% higher fares for *North to Centre* connections and to 16% higher fares for *North-Centre to South* connections. Although coefficient size is greater for *North to Centre* connections, the total effect on fares is higher for *North-Centre to South* connections. Indeed, the average fare posted for *North to Centre* connections is equal to 126 Euros, while the average fare posted for *North-Centre to South* connections is equal to 169 Euros. Then, 10% increase in *HHI* allows carrier to increase the average fare of, roughly, 25 Euros for *North to Centre* connections and 27 Euros for North-Centre to South connections.

9 Using the method of Wooldridge (2002), pp. 290-91.

10 A widely used rule of thumb suggested by Staiger and Stock (1997).

Table 3. Market captivity as a price discrimination device.

	All	*North to Centre*	*North-Centre to South*
HHI	0.0153***	0.0200***	0.0161***
	(0.0029)	(0.0049)	(0.0028)
Booking Day	-0.0361***	-0.0436***	-0.0336***
	(0.0016)	(0.0033)	(0.0017)
Booking Day²	0.0004***	0.0005***	0.0003***
	(0.0000)	(0.0000)	(0.0000)
Peak	0.5120***	0.5322***	0.5515***
	(0.1142)	(0.1087)	(0.1083)
Observations	10,789	2,811	7,978
F-stat	44.948	115.517	48.905

Standard errors (in parentheses) are clustered at flight level.

Control dummies are always included but not reported.

*** p<0.01, ** p<0.05, * p<0.1.

Results seem to support our initial hypothesis that airlines do use the different degree of market captivity as a price discrimination device since they apply higher fares in market where the inter-modal competition is very limited and there are no effective alternative to air-transport.

As far as concern the inter-temporal price discrimination, we find out that fare inter-temporal profile is non-monotonic and it can be roughly approximated by a J-curve. *Booking Day* has a negative and significant coefficient, suggesting that fares posted the day before are lower. However, the coefficient of *Booking Day*^{2} is positive and highly significant meaning that fares for very early purchasers are higher than those posted the day after. Basically, *Booking Day* has a negative effect of fares until the turning point is reached. Beyond that day, it has a positive impact on fares.

In the non-linear case, the marginal effect of Booking Day on fares is dependent on the level of *Booking Day*: $\frac{\partial(P_{\text{ijks}})}{\partial Booking\ Day_t} = -\gamma_1 + 2 * \gamma_2 Bookind\ Day_t$, where γ_1 indicates the coefficient of *Booking Day* and γ_2 indicates the coefficient of the variable *Booking Day*^{2}. In

Table 4 we report the marginal effect computed for given values of *Booking Day* which indicates how fares vary with respect to fares posted a day early. Overall, the minimum occurs in the interval 49th-46th days before departure.

Table 4. The marginal effect (ME) of Booking Day (BD) on fares.

All				*North to Centre*				*North-Centre to South*			
BD	ME	BD	ME	BD	ME	BD	ME	BD	ME	BD	ME
5	-0.0323***	45	-0.0018**	5	-0.0384***	45	0.0036**	5	-0.0303***	45	-0.0037***
	(0.0014)		(0.0008)		(0.0028)		(0.0014)		(0.0015)		(0.0009)
10	-0.0285***	46	-0.0010	10	-0.0331***	46	0.0047***	10	-0.0270***	46	-0.0031***
	(0.0012)		(0.0008)		(0.0024)		(0.0015)		(0.0012)		(0.0009)
15	-0.0247***	47	-0.0003	15	-0.0279***	47	0.0057***	15	-0.0237***	47	-0.0024**
	(0.0009)		(0.0009)		(0.0020)		(0.0016)		(0.0010)		(0.0010)
20	-0.0209***	48	0.0005	20	-0.0226***	48	0.0068***	20	-0.0203***	48	-0.0017*
	(0.0007)		(0.0009)		(0.0016)		(0.0017)		(0.0008)		(0.0010)
25	-0.0171***	49	0.0013	25	-0.0174***	49	0.0078***	25	-0.0170***	49	-0.0011
	(0.0006)		(0.0009)		(0.0012)		(0.0018)		(0.0007)		(0.0011)
30	-0.0132***	50	0.0020**	30	-0.0121***	50	0.0089***	30	-0.0137***	50	-0.0004
	(0.0005)		(0.0010)		(0.0010)		(0.0018)		(0.0006)		(0.0011)
35	-0.0094***	51	0.0028***	35	-0.0069***	51	0.0110***	35	-0.0104	51	0.0003
	(0.0005)		(0.0010)		(0.0009)		(0.0020)		(0.0006)		(0.0012)
40	-0.0056***	52	0.0036***	40	-0.0016	52	0.0120***	40	-0.0070	52	0.0009
	(0.0006)		(0.0011)		(0.0011)		(0.0021)		(0.0007)		(0.0012)
41	-0.0048***	53	0.0043***	41	-0.0006	53	0.0131***	41	-0.0064***	53	0.0016
	(0.0007)		(0.0011)		(0.0012)		(0.0021)		(0.0008)		(0.0012)
42	-0.0041***	54	0.0051***	42	0.0005	54	0.0141***	42	-0.0057***	54	0.0022*
	(0.0007)		(0.0012)		(0.0012)		(0.0023)		(0.0008)		(0.0013)
43	-0.0033***	55	0.0058***	43	0.0015	55	0.0194***	43	-0.0050***	55	0.0029**
	(0.0007)		(0.0012)		(0.0013)		(0.0027)		(0.0008)		(0.0013)
44	-0.0026***	60	0.0097***	44	0.0026*	60	0.0194***	44	-0.0044***	60	0.0063***
	(0.0008)		(0.0014)		(0.0014)		(0.0027)		(0.0009)		(0.0016)

The non-monotonic inter-temporal profile of fares has received various interpretations in the literature. Gaggero (2010) suggests that it reflects a pattern opposite to that of travellers' demand elasticity. Bilotkach et (2012) provide evidence that a fare drop is an indication that the actual demand is not as expected, therefore it responds to the need of raising the load factor. Bergantino and Capozza (2012) claim that, on the one hand, it would be the evidence that airlines exploit consumer bounded rationality. They argue that a common wisdom among travellers is "the later you buy, the more you pay the ticket", thus price sensitive consumers tend to buy in advance. Airlines, aware of this, can extract a greater surplus by posting moderately higher fares for very-early purchasers that will buy tickets believing to pay the cheapest fares. On the other hand, a higher fare for very-early purchasers can be considered as a fee for risk-aversion. We share these explanations and we believe that the non-monotonic inter-temporal profile of fares might be the results of these elements. Moreover, we add further evidence as we find differences among connections in the price dynamic over time. The minimum of the curve shifts on the right for *North to Centre* connections (43th-40th days before departure), while it shifts on the left for *North-Centre to South* connections (53th-49th days before departure). Basically, there is more than one week difference, meaning that the decreasing part of fare inter-temporal profile is shorter for connections with no alternative to air-transport. The marginal effects are also higher for *North to Centre connections*, then the J-curve appear to be more pronounced when the inter-modal competition is effective, while it is more flat for *North-Centre to South* connections. The inter-modal competition is able to influence also the distribution of prices over time.

Finally, the coefficient of *Peak* is positive and significant, as expected. During peak-periods airlines exploit the greater travel demand and set, roughly, 50% higher fares than off-peak periods. This finding is very similar across regressions in term of coefficients size. However, the average fare is higher for *North-Centre to South*, thus implying that the absolute effect is higher for market with a captive demand.

6. Conclusions

In this paper we study airline pricing for short-haul flights taking into account *all* the competitive forces acting in the market: the intra-modal competition, the inter-modal competition and the competition of airlines with themselves. The most relevant contribution of our work is to understand if, and to what extent, airlines use market captivity as a price discrimination device.

We explore on the Italian passenger market as it is particularly fit to test the research question we posed, given the heterogeneity with respect to the inter-modal competition level. First, we focus on the entire sample of Italian domestic connections in order to measure the general effect of intra-modal competition on fares and to point out the dynamic of pricing over time. Then, we restrict the focus to routes connecting northern cities to central cities, where the inter-modal competition from HSR services is effective and to routes connecting northern and central cities to southern cities, where the inter-modal competition from HSR services is scanty. In this way, we are able to measure differences between the average fare on connections with a different degree of captivity and to see whether the competitive pressure, exerted to a different extent by rail competitors across connections, shapes the inter-temporal profile of fares.

Our results on the effect of intra-modal competition on fares are consistent with previous contributions since we provide evidence that when the intra-modal competition on a city-pair increase, carriers loose market power and are induced to post lower fares. The effect is, however, heterogeneous across routes. Indeed, airlines are found to exploit the different degree of market captivity since fares for connections where the inter-modal competition is very limited are higher than fares for connection where the inter-modal competition is effective.

Moreover, we find out that the inter-temporal profile of fares approximates a J-curve which is, however, shaped by the level of inter-modal competition. Indeed the J-curve is more pronounced and its minimum shifts on the right for connections where there is an effective inter-modal competition, while it is more flat and its minimum shifts on the left for connections with no alternative to air-transport. These findings would suggest that the inter-modal competition forces airlines to keep prices decreasing for a longer period, thus exerting a downward pressure on fares in terms of both average fares and inter-temporal dynamics.

This results are definitely relevant in terms of implications for investment policy and evaluation strategies for transportation infrastructures. Our study points out the indirect benefits of these investments through downward pressures on competing airline fares, which should be embedded in the cost-benefit analysis of high speed networks' investments.

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Tables

Table 1. Lists of routes.

	Origin	*Destination*		*Origin*	*Destination*
1	Bari (BRI)	Milan Linate (LIN)	20	Milan Linate (LIN)	Naples (NAP)
2	Bari (BRI)	Milan Malpensa (MXP)	21	Milan Linate (LIN)	Reggio Calabria (REG)
3	Bari (BRI)	Milan Orio al Serio (BGY)	22	Milan Linate (LIN)	Roma Fiumicino (FCO)
4	Bari (BRI)	Roma Ciampino (CIA)	23	Milan Malpensa (MXP)	Bari (BRI)
5	Bari (BRI)	Roma Fiumicino (FCO)	24	Milan Malpensa (MXP)	Naples (NAP)
6	Bologna (BLQ)	Roma Fiumicino (FCO)	25	Milan Malpensa (MXP)	Naples (NAP)
7	Brindisi (BDS)	Bologna (BLQ)	26	Milan Malpensa (MXP)	Roma Fiumicino (FCO)
8	Brindisi (BDS)	Milan Linate (LIN)	27	Milan Malpensa (MXP)	Roma Fiumicino (FCO)
9	Brindisi (BDS)	Milan Malpensa (MXP)	28	Milan Orio al Serio (BGY)	Bari (BRI)
10	Brindisi (BDS)	Roma Ciampino (CIA)	29	Milan Orio al Serio (BGY)	Pescara (PSC)
11	Brindisi (BDS)	Roma Fiumicino (FCO)	30	Milan Orio al Serio (BGY)	Rome Ciampino (CIA)
12	Brindisi (BDS)	Turin (TRN)	31	Palermo (PMO)	Roma Fiumicino (FCO)
13	Lamezia Terme (SUF)	Bologna (BLQ)	32	Reggio Calabria (REG)	Milan Linate (LIN)
14	Lamezia Terme (SUF)	Milan Linate (LIN)	33	Reggio Calabria (REG)	Roma Fiumicino (FCO)
15	Lamezia Terme (SUF)	Milan Malpensa (MXP)	34	Reggio Calabria (REG)	Venice (VCE)
16	Lamezia Terme (SUF)	Milan Orio al Serio (BGY)	35	Turin (TRN)	Naples (NAP)
17	Lamezia Terme (SUF)	Roma Fiumicino (FCO)	36	Turin (TRN)	Roma Fiumicino (FCO)
18	Lamezia Terme (SUF)	Turin (TRN)	37	Verona (VRN)	Naples (NAP)
19	Milan Linate (LIN)	Bari (BRI)			