

Local railway service and housing value in small towns:

Empirical evidence from Italy

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Abstract

Local railway service is a key instrument to support the survival and the growth of small towns increasing the demand by individuals that are not interested to live in the main cities and that could accept the cost of commuting day-by-day for working. The existence of a local railway station connected with the main surrounding cities reduces the transportation cost for people leaving in small towns that cannot work in the town and reduces the risk of migration of citizens to the main cities.

The paper analyses a representative sample of Italian towns in the Lazio area for the time period 1996-2017 in order to measure the contribution of the local railway service on the land value for housing investment. Results show that the existence of local railway service matters for both the rental and ownership market but the effect may be different on the basis of the type of service provided by the railway company. The main features that affect the house value are the number of train lines servicing the station, the distance from the main cities and the number of towns served by each train line.

1. Introduction

Inland areas suffered from a population collapse during the last decades due to the concentration of production, commercial, and service activities in the main cities (Bonifazi and Heins, 2001). The reduction of the number of inhabitants has a significant impact on the budget of local authorities that, due to the lower tax income, have to reduce the quality and the amount of public services provided.

Local housing markets have suffered from a lack of demand for real estate assets outside the main cities and the time on the market for selling and/or renting houses in these towns or villages has increased significantly (Bank of Italy, 2017). Housing markets in these towns are characterized by a lack of liquidity and sellers are frequently obliged to accept above the average discount on the price or rent initially requested in order to complete the transaction in a reasonable time horizon.

The revitalization and regeneration of small towns is a key target for the municipality in order to avoid the risk of creating ghost towns where people are no longer interested to live. Solutions normally used aim to increase the average income of citizens, create and support the community identity, offer new public, promote the image and the reputation of the town, and the local railways service is only one of the instruments used in order to make the town attractive (Gatzlaff, and Smith, 1993). The main impact on the demand for housing related to local railway services is related to people that are working outside the town and may accept to commute daily if the quality standards in the town are acceptable for them (Berechman, and Paaswell, 1983).

The paper evaluates the rents and prices per square meter for houses located in small towns and the impact of the local railway services on both the renting and the ownership market. The empirical analysis on the towns in a region in the center of Italy (Lazio) shows that the existence of a train station has an effect on the real estate market and the effect is different on the basis of the number of different train lines that are servicing the town, the distance from the main surrounding cities and the number of towns served by each train line.

The paper contributes to the existing literature in many directions. It adds insight on the impact of the railway service on the ownership and rental market for a not previously analyzed geographical area and, additionally, it explores the impact of the railway service on the land value

for a not previously analyzed geographical area (Mohammad, Graham, Melo and Anderson, 2013); moreover, the empirical evidences are particularly important in light of the growing demand for low density locations emerging after the spreading of the Covid-19 pandemic, persisting also after the national level recovery of the housing market (Liu and Su, 2020).

The paper is structured as follows: section 2 presents a detailed literature review on the impact of local railway stations on the town features and the economic perspectives of the area, section 3 presents the results of an empirical analysis on a representative sample of the Italian market and section 4 discuss the implication of the results achieved for both private and public players in the real estate market.

2. Literature review

The existence of train station nearby an house has an impact on the real estate market because the value of the asset is not only driven by its building features (size, type, maintenance, etc...), and the urban features (average income, life quality, commercial activities, public services) but also by its accessibility for the owner / user (Hewitt, and Hewitt, 2011). The impact of the railway service depends on the type and quality of the service provided and there are significant differences between train stations that are servicing only the surrounding area and those that offer long term connections with national or international destinations (Mohammad, Graham, Melo, and Anderson, 2013). In the literature there is consensus that the impact on the housing value is higher when the station is able to provide multiple connections and normally the higher is the number of destinations served, the higher is the number of the users and so the impact on the value of houses nearby (Pagliara, and Papa, 2011).

The main positive outcome related to the development of local railway station is the increase of the overall demand for housing due the growth of demand by commuters wanting to live in the small town and work in the main cities nearby. Towns that are connected to the main cities through a local railway service are normally considered a different market with respect to other small towns and real estate agents adopt a different pricing policy for selling/renting real estate assets in these municipalities because they can ask to the buyer to pay something more for the opportunity to be easily connected with the main cities (Armstrong, 1994). The impact is maximized when the train service allows minimizing the time necessary for travelling from the town to the main cities where job opportunities are available and there is a clear economic convenience in using the train service with respect to private transportation (Debrezion, Pels, and Rietveld, 2007).

An additional positive impact that may be related to the local railway service is the development of commercial activities that will service the new residents that accept to commute daily for working in the main cities. The higher average wage of people working in the main cities support the sales in the small towns and create an incentive for offering above the average services and it may increase the number of job opportunities in the town (Boarnet, and Compin, 1999). Empirical evidence shows that the increasing quality of life in the town has a positive impact on all houses and all the citizens may benefits from the increasing value of their real estate wealth.

The negative externalities of the local railway station attain mainly to homeowners that are living nearer to the train station and they are mainly related to the noise pollution and the impact is higher when the station is in the downtown and there are a lot of trains that are using the railway line. The demand of housing nearby the train station is normally lower with respect to the rest of the town and so the value for both the renting and the ownership market will be lower (Seo, Golub, and Kuby, 2014).

Sprawl towns that have a local railway station may suffer of traffic congestions in the rush hours of the day especially if citizens reach the station using their private cars and the negative effects are maximized when the infrastructures (road and parking areas mainly) are not planned properly. The negative externalities on the housing market could be significantly reduced by the municipality through refurbishments and new investments that reduce the traffic congestion and the loss for the homeowners could be almost offset (Dube, Thériault, and Des Rosiers, 2013).

Train station buildings may become areas for homeless people that use this building when the railway is not working in order to have a safe place for staying and, when it is located in the suburbs and not surveilled, there it could be also a place where there will be a concentration of criminal and illegal activity (Ihlanfeldt, 2003). Municipalities have an incentive to invest in the security of areas independently with respect to where the station is located: stations in the suburbs have to be surveilled in order to avoid the risk of vandalism and reduce the probability that the surrounding areas will become an abandoned area while those that are located in the downtown need security services especially in the rush hours in order to avoid the risk of robberies (Bowes and Ihlanfeldt, 2001).

The net effect on the real estate prices in the area dependent on the market specific features but normally the housing sector has a net positive gain when the local railway facilities are developed while the net impact on the commercial real estate is less predictable (Billings, 2011).

Housing prices will react differently on the basis of the distance from the local railway station and empirical evidence suggests that the impact is higher when renters/owners live at a walking distance from station (Ryan, 1999). The housing demand is not independent from the type of building because commuters are more interested to sustain the cost of travelling day-by-day only if they can buy real estate assets that are not affordable or available in the cities where they work (Zhong e Li, 2016).

The impact on the value of commercial activities is limited to immediately adjacent areas (Debrezion, Pels, and Rietveld, 2011) and on average impact on industrial, retail and office buildings is neglectable (Landis et al., 1995). Renters and landlords that are looking for higher returns will always prefer the main cities instead the small towns and the only significant increase in the commercial real estate values could be related to the retail sector for the demand of building necessary for servicing people that will leave in the town. In fact, retail real estate owners benefit the most when the local railway station in a waking area in the town center while the benefits are significantly lower when it is placed in the suburbs (Cervero, 1984).

3. Empirical analysis

3.1 Sample

The sample considers all the towns in the Lazio region in the center of Italy and it collects all the data related to local railways services that are servicing the town and the citizens¹. On the basis of the data collected it was possible to identify more than 100 towns that are serviced at least by one local railway service in the time period 2006-2016 that are significantly different on the basis of the size and the number of inhabitants for square kilometer (Exhibit 1).

¹ Information about the local railway services are collected from the historical repository provided by the Fondazione FS Italiane (<http://www.fondazionefs.it/>) and attains to 12 different train lines that are servicing at least one town in the Lazio region.

Exhibit 1. Towns and municipalities served by local railway services in the Lazio region

Towns and municipalities served by local railway services in the Lazio region					
Size in km ²	n°	%	Population by Km ²	n°	%
Up to 10 km ²	2	2.00%	Up to 100 Inhabitants / km ²	21	21.00%
10 < km ² ≤ 50	54	54.00%	100 < Inhabitants / km ² ≤ 500	59	59.00%
50 < km ² ≤ 100	24	24.00%	500 < Inhabitants / km ² ≤ 1000	13	13.00%
100 < km ² ≤ 150	11	11.00%	1000 < Inhabitants / km ² ≤ 2000	5	5.00%
Over than 150 km ²	9	9.00%	Over than 2000 Inhabitants / km ²	2	2.00%
All towns and municipalities in the Lazio region					
Size in km ²	n°	%	Population by Km ²	n°	%
Up to 10 km ²	27	7.14%	Up to 100 Inhabitants / km ²	182	48.15%
10 < km ² ≤ 50	261	69.05%	100 < Inhabitants / km ² ≤ 500	165	43.65%
50 < km ² ≤ 100	56	14.81%	500 < Inhabitants / km ² ≤ 1000	20	5.29%
100 < km ² ≤ 150	20	5.29%	1000 < Inhabitants / km ² ≤ 2000	9	2.38%
Over than 150 km ²	14	3.70%	Over than 2000 Inhabitants / km ²	2	0.53%

Source: Census data processed by the authors

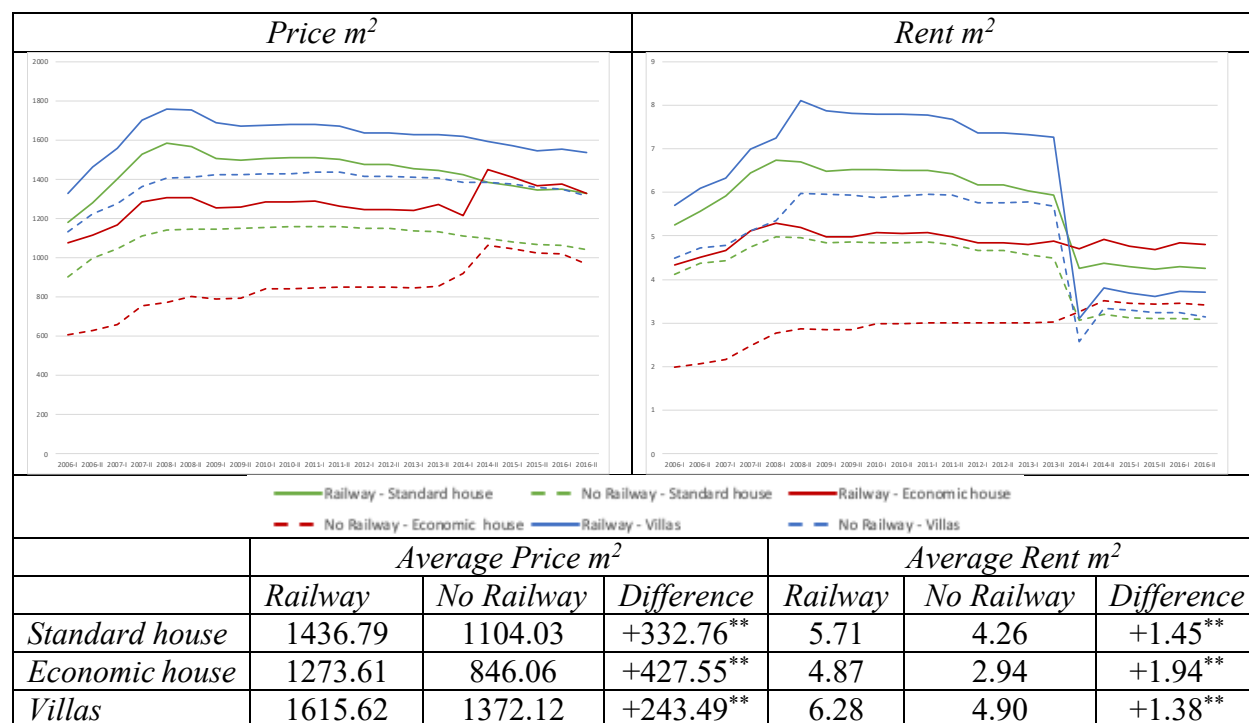
Areas served by local railway services have prevalently a size between 10 to 150 km² and the majority (9 over 14) of the bigger municipalities (over than 150 km²) are connected with a low of smaller towns. Less than the 10% (2 over 27) of the smaller towns (less than 10 km²) have an active local train station that connects with the main cities in the surrounding areas.

The population concentration in areas served by local railways is on average lower than 500 inhabitants for km² but all the main cities (more than 2000 inhabitants for each km²) are connected with some of the small towns in the surrounding area. Around the 50% of the medium density towns (from 500 to 2000 inhabitants for each km²) and less than 25% of the less populated towns (up to 500 inhabitants by km²) are served by local railways services.

The dynamics of the main municipalities in the area (Frosinone, Latina, Rieti, Roma, and Viterbo) is not comparable with all the other towns due to the higher incidence of people living and working in the cities and the higher attractiveness for touristic and studying purposes. For all other towns (373 of which 95 are served by local railway services) the database collects all the data by area of housing values for renting and for ownership over the time period 2006-2016². The analysis of the average price and rent per square meter for towns served by local railways and towns that are not served allows to point out some interesting differences (Exhibit 2)

² The full list of the towns considered in the analysis is available in the appendix (table A.1)

Exhibit 2. Price and rent by square meter in towns with and without a local railway service



Notes: ** t-test on the difference of means statistically significant at 99%

Source: Italian Fiscal Agency data processed by the authors

Independently with respect to the existence of a railway station, the average price for economic houses is growing from 2013 to 2015 while for other type of assets there is not the same trend. The renting market collapse in the time period 2013-2014 is related to a change in the taxation applied to homeownership to support low income individuals. The new rules make convenient for individuals economically affordable to buy they first own house and to current owners of multiple housing units to sell them at discount in order to avoid the higher taxation related to owning income real estate assets in the housing sector. The market for renting above the average quality houses (standard and villas) suffers of a significant reduction of the demand and, as a consequence, a reduction of the average renting value but in one year it reached a new equilibrium with a rent value variability almost comparable to the previous periods.

Independently with respect to the type of residential asset (standard house, economic house, or villas), there is a premium in the average price and rent per square meter in town where there is a local railway service. The premium is at the maximum for economic houses and at the minimum for villas showing that, on average, the demand is higher for less expensive real estate assets because commuters normally cannot afford high expenses for their accommodation.

3.2 Methodology

The empirical analysis considers the price and the rent per square meter for different areas in all the towns of the sample for the time horizon 2006-2016 by analyzing the data provided by the

Italian Fiscal Authority every semester for each town area³. In order to consider the difference in the housing supply in each town area the data are used in order to derive a land value for both the renting and the ownership market.

A standard hedonic price model is used in order to measure the effect of housing features on the price and rent per square meter (e.g. Rosen, 1974). In formulas:

$$Value_{it}^{m^2} = \alpha_t + \sum_{k=1}^n \beta_k BF_{it} + \sum_{j=1}^m \beta_j AF_{it} + \sum_{l=1}^o \beta_l SEF_{it} + \varepsilon_{it} \quad (1a)$$

where the model tests the impact of a set of explaining factors on the value of houses for both the renting and the ownership market (respectively measured by the price and the rent per square meter). On the basis of the information available for each town area, the building features considered (BF_{it}) are:

Downtown_{it} = Dummy variable that assumes value 1 if the house is in the downtown and zero otherwise;

Central Location_{it} = Dummy variable that assumes value 1 if the house is in a central location but outside the downtown and zero otherwise;

Suburbs_{it} = Dummy variable that assumes value 1 if the house is in the suburbs and zero otherwise;

Out of the town_{it} = Dummy variable that assumes value 1 if the house is in the out of the town and zero otherwise;

Average refurbishment_{it} = Dummy variable that assumes value 1 if the house has the same level of maintenance of similar buildings and zero otherwise;

New refurbishment_{it} = Dummy variable that assumes value 1 if the house has an higher level of maintenance with respect to similar buildings and zero otherwise;

Low construction standards_{it} = Dummy variable that assumes value 1 if the house has a lower quality standards with respect to other buildings and zero otherwise;

Medium construction standards_{it} = Dummy variable that assumes value 1 if the house has an average quality standards with respect to other buildings and zero otherwise;

High construction standards_{it} = Dummy variable that assumes value 1 if the house has an higher quality standards with respect to other buildings and zero otherwise;

Economic house_{it} = Dummy variable that assumes value 1 if the house is classified as economic house and zero otherwise;

Standard house_{it} = Dummy variable that assumes value 1 if the house is classified as standard house and zero otherwise;

Villas_{it} = Dummy variable that assumes value 1 if the house is classified as villa and zero otherwise;

The accessibility features (AF_{it}) for the housing sector are:

DistRailway_{it} = Distance (in km) from the nearest railway station;

DistHighway_{it} = Distance (in km) from the nearest highway exit;

DistJobCenter_{it} = Distance (in km) from the nearest town with at least 100.000 employees;

³ The areas are defined by the Italian Fiscal Agency on the basis of the size of the town and the population density in each area.

$DistSchool_{it}$ = Distance (in km) from the nearest public school;
 $Disthospital_{it}$ = Distance (in km) from the nearest hospital.

The socio economic factor (SEF_{it}) that may affect the housing value are:

$AverageIncome_{it}$ = Average income for the people living in the town;
 $RatioForeigners_{it}$ = The percentage of foreigners living in the town with respect to the overall population;
 $LandUse_{it}^k$ = The percentage of land classified by usage k

Coherently with the literature available (e.g. Davis, Olines, Pinto e Bokka, 2017), the land value is computed by deducting the expected price computed by using a standard hedonic model from the market value (price and rent). In formulas:

$$Land Value_{it}^P = Price m_{it}^2 - \sum_{k=1}^n \beta_k^P F_{it} \quad (2a)$$

$$Land Value_{it}^R = Rent m_{it}^2 - \sum_{k=1}^n \beta_k^C F_{it} \quad (2b)$$

where the land value is the difference between the real price and rent (respectively $Price m_{it}^2$ and $Rent m_{it}^2$) and the expected price and rent computed on the basis of the formulas (1a) and (2a). The land value is regressed with some features of the local railway service and some features of the local economy that may affect the demand of residential real estate. In formulas:

$$Land Value_{it}^P = \gamma_{it} + \delta_1 N^{\circ} Train Lines_{it} + \delta_2 N^{\circ} Train per Day_{it} + \delta_3 Distance City_{it} + \delta_4 N^{\circ} Towns_{it} + \varepsilon_{it} \quad (3a)$$

$$Land Value_{it}^R = \gamma_{it} + \delta_1 N^{\circ} Train Lines_{it} + \delta_2 N^{\circ} Train per Day_{it} + \delta_3 Distance City_{it} + \delta_4 N^{\circ} Towns_{it} + \varepsilon_{it} \quad (3b)$$

where the formulas evaluate the impact on land value for both the ownership and the rent market (respectively $Land Value_{it}^P$ and $Land Value_{it}^R$) of the number of train lines that are servicing the station ($N^{\circ} Train Lines_{it}$), the number of trains per day ($N^{\circ} Trains per Day_{it}$), the number of towns served by the train lines before reaching the main city in the area ($N Towns_{it}$) and the distance from the city in kilometers ($Distance City_{it}$).

3.3. Results

The analysis of the value of real estate assets located in towns serviced by local train lines points out a different weight of the location with respect to housing features (Table 3).

Table 3. Results of the hedonic model for prices and rents

	Prices	Rents
	(1a)	(1b)
Constant	1421.26**	5.03**
Downtown location	-166.32**	-0.31**
Central location	-236.39**	-0.77**
Out of the town	-193.23**	-0.41**
Suburbs	-	-
High construction standards	220.96**	0.86**
Average construction standards	-	-
Low construction standards	-220.96**	-0.86**
New refurbishment	279.32**	2.38**
Average refurbishment	-	-
Economic house	8.95**	0.31**
Standard house	-	-
Villas	240.85**	1.82**
R ²	21.14%	29.60%
Urban areas	2493	2950
Towns	95	95

Source: Italian Fiscal Agency data processed by the authors

In the property market, the minimum intercept of the model equals approximately 1421 euros, regardless of the location and the housing features. Compared to the suburban area where villas and detached houses and newly built properties are concentrated, the price per square meter in urban areas is lower with a greater penalty for semi-central areas.

Nel mercato delle proprietà il valore degli immobili prevede un'intercetta minima di circa 1421 euro per qualsiasi immobile indipendentemente da location e caratteristiche. Rispetto all'area suburbana in cui si concentrano ville e villini e immobili di nuova costruzione, the price per square meter in urban areas is lower with a greater penalty for semi-central areas il prezzo a metro quadro nelle aree urbane è minore con una maggiore penalizzazione per le aree semicentrali. Depending on the quality of the properties evaluated, it is possible to observe a difference of +/- 220 € on the price per square meter and if the maintenance status of the properties is above the average, it is possible to register an additional premium of 279 € per square meter. The least expensive properties are standard houses homes while the most expensive houses are villas and detached houses which are sold with a premium per square meter compared to civilian homes of around € 240.

The data on the value of the properties were used to construct a measure of the land value for the individual municipalities and a simple analysis of the demographic characteristics of the municipality (population density and size) allows to highlight their relationship with the value of the location (Table 4).

Table 4. The average land value for size and population density of the municipality

Size km ²		
	Ownership market	Rental market
Up to 10 km ²	1206.89	3.74
10 < km ² <50	1251.69	4.43
50 < km ² <100	1284.73	4.00
100 < km ² <150	1467.15	4.82
Beyond 150 km ²	1515.23	4.89
Population density		
	Ownership market	Rental market
Up to 100 Inhabitants / km ²	1278.44	4.37
100 < Inhabitants / km ² <500	1278.44	4.37
500 < Inhabitants / km ² <1000	1456.59	4.56
1000 < Inhabitants / km ² <2000	3104.78	10.61
Beyond 2000 Inhabitants / km ²	n.a.	n.a.

Source: Italian Fiscal Agency data processed by the authors

The land value both for the rental market and for the property market grows with the increase in size and housing density for all municipalities, demonstrating the greater the size of the reference market, the greater the internal demand from the citizens of the municipality. However, the value of the location does not grow linearly with respect to the internal demand measured by the size and density of housing and a part of this misalignment may be due to the demand from people working in other cities and those choosing to live in the municipality and commute daily.

In order to assess the impact of local transport on land value, some data were collected on the services offered by the railway stations of the municipality (n° lines, n° trains, distance from the provincial capital and number of towns served) and an analysis of the impact on the land value was performed (Table 5).

Table 5. The impact of the characteristics of the local railway service on the land value

	Ownership market	Rental market
	(3a)	(3b)
Costant	1363.50**	4.56**
N° lines	244.35**	0.97**
N° trains	2.87**	0.01**
Distance from provincial capital (km)	4.52**	0.01**
N° towns served	-25.86**	-0.08**
R ²	24.71%	15.12%
Urban areas	2493	2950
Towns	95	95

Source: Italian Fiscal Agency data processed by the authors

The value of the location is partly attributable to the local railway service and the most relevant variable is the number of railway lines that connect the municipality station and the greater the number of lines, the higher the land value (€ 118 for each additional line in the property market and € 0.65 per month for the rental market). The number of trains connecting the area is less relevant from an economic point of view even though there is a positive relationship between the value of the area and the number of trains per day for both the rental market and the property market. The value of the location is partly attributable to the local railway service and the most relevant variable is the number of railway lines that connect the municipality station and the greater the number of lines, the higher the land value (€ 118 for each additional line in the property market and € 0.65 per month for the rental market). The number of trains connecting the area is less relevant from an economic point of view, even though there is a positive relationship between the value of the area and the number of trains per day for both the rental market and the property market. Finally, the contribution of the local railway station to the land value is positively influenced by the distance of the municipality from the provincial capital and negatively by the number of municipalities served by the same railway line. This result is justifiable in relation to the times of use of the service with respect to alternative forms of transport: local rail transport acquires, in fact, a competitive advantage over alternative means of transport (wheeled vehicles) only when the distance to be covered is large and there are not too many intermediate stops before reaching the provincial capital.

4. Conclusion

The local passenger transport service in Italy does not cover a significant number of municipalities but there are many realities, even small ones (both in terms of extension of the municipality and in terms of population density) that currently benefit from the service. The presence of local railways serving the municipality can incentivize individuals who work outside the municipality to buy or rent properties in these realities to benefit from lower costs. The analysis of the impact of local transport on land value has shown that the presence of local railway lines influences the value of buildings and this impact is greater the greater the lines serving the station, the greater the distance from built-up areas, the more relevant (provincial capital) and the smaller the number of municipalities served by the same line.

The results obtained show that local railway policies have significant effects on the local real estate market as they can determine the growth of demand not only from owners or tenants employed in the local economy of the municipality but also the demand part of subjects who buy or rent properties and then lead a commuter life with other cities. The choices regarding local railway policies can also have effects on the enhancement of the real estate assets of small municipalities and the higher the quality of the service offered, the greater the demand and liquidity for local real estate markets outside the main urban centers. The results obtained are particularly relevant in light of the growing demand featuring low density housing markets after the spreading of the Covid-19 pandemic.

The proposed analysis took into consideration only one year and the results obtained can be influenced by the transport policy adopted by the transport company during the year since it has

the possibility to review the offer of services periodically according to the evolution of demand of transport services and the offer of any competitors (rail or road) serving the same areas.

An extended analysis over a multi-period time horizon would allow not only to generalize the results obtained but also to evaluate how changes in the local railway policy (activation or deactivation of a stop on a particular station) have implications for the value of the buildings of the town .

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Appendix

Table A.1 List of towns served by local railway services in the Lazio region

Albano Laziale	Colonna	Orte
Anguillara Sabazia	Corchiano	Paliano
Antrodoco	Fabrica di Roma	Piedimonte San Germano
Anzio	Falvaterra	Pofi
Aprilia	Fara in Sabina	Poggio Mirteto
Aquino	Ferentino	Poggio San Lorenzo
Arce	Fiumicino	Pomezia
Arpino	Fondi	Priverno
Arsoli	Fontana Liri	Ronciglione
Bomarzo	Formia	San Giovanni Incarico
Borgo Velino	Frascati	San Vittore del Lazio
Bracciano	Gaeta	Santa Marinella
Canale Monterano	Gallese	Santopadre
Capranica	Gavignano	Segni
Caprarola	Isola del Liri	Sezze
Cassino	Itri	Sgurgola
Castel Gandolfo	Labico	Sora
Castel Madama	Ladispoli	Sperlonga
Castel Sant'Angelo	Lanuvio	Stimigliano
Castro dei Volsci	Magliano Sabina	Supino
Ceccano	Mandela	Sutri
Ceprano	Manziana	Tarquinia
Cervaro	Marino	Terracina
Cerveteri	Mentana	Tivoli
Ciampino	Montalto di Castro	Vallecorsa
Cisterna di Latina	Monte San Biagio	Valmontone
Cittaducale	Montefiascone	Velletri
Civita Castellana	Montelibretti	Vetralla
Civitavecchia	Monterotondo	Vicovaro
Colfelice	Morolo	Villa Santa Lucia
Colleferro	Nettuno	Zagarolo
Collevecchio	Oriolo Romano	

Source: Italian Fiscal agency data processed by the authors