POLITECNICO DI TORINO

Collegio di Ingegneria Gestionale
Corso di Laurea Magistrale in Ingegneria Gestionale

Tesi di Laurea di II Livello

The impact of Airbnb on the long-term rental market and on house prices: the Case study of Firenze

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Anno Accademico 2019-2020

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Introduction

Since its increase in popularity over the last 10 years, Airbnb has been at the centre of many discussions of its possible negative externalities on cities regarding housing stress, mainly focusing on its effects on gentrification and relocation of residents. The main mechanism discussed is the conversion of long-term rental units into short-term ones, because of the higher profitability that home sharing platform can offer. This leads to a decrease in the number of available units in the long-term rental market, which ultimately leads to a general increase of rents. The struggle for residents to find homes at certain locations and the higher number of tourists crowding popular neighbourhoods has been the focus of many papers and researches over the last few years, with some of these also introducing the hypothesis that these effects could also be reflected on house prices in the real estate market.
This discussion has become very popular in Italy as well, where the higher density of Airbnb is mainly on the coasts and in the most touristic cities like Firenze, Rome, Milan and Venezia.
The regulation of home sharing has also been a struggle for many cities around the world; different approaches have been taken in consideration, in order not to completely ban the platform, but to soften its negative impacts, since it also comes with positive externalities like the increase in tourist demand or the increase in the number of economic activities in touristy neighbourhoods. If regulation is difficult for each city government, its reinforcement is an added struggle to the matter, as monitoring the short-term rental market comes with high costs.
The final aim of this thesis is to analyse if there is any correlation between rent and house prices increases and the density of Airbnb over the last few years, using the case study of Firenze, one of the most visited and most loved cities by tourists in Italy.
The first chapter will be focused on the main mechanisms that influence rents and house prices and how these two markets interact with each other; furthermore, it will be discussed how home sharing could interfere in these mechanisms, using related literature to support the hypotheses.
The second chapter will analyse the activity of Airbnb in Italy, as well as the rental and real estate markets trends in the Country over the years 2015-2018.
In the third chapter, the case study of Firenze will be introduced, where data coming from AirDNA for Firenze will be used to analyse the listings available on the platform in the time period from June 2015 to July 2018: this data includes information about hosts, types of listings, number of reviews and revenue, as well as the geographical coordinates. The trends for rental and real estate markets of the city will be presented as well, using data from Immobiliare.it.
In chapter four a data panel for the number of listings in a zone of Firenze, in a year-month is constructed, cross-referencing data from Immobiliare.it about rents and house prices in the same zone and year-month, using a Fixed Effect model. Other data from Comune di Firenze about number of residents for each zone over the years and the number of tourists staying in the city in the same time period will be used as control variables. Furthermore, an instrumental variable is built using an interaction between a measure of touristic attraction for a zone and the Google Trend measure in year-month as a proxy for Airbnb popularity. This instrument, which takes inspiration from the works of Barron et al. (2018) and Garcia-Lopez (2019), should be able to predict where and when listings are most likely to appear around the city.
Finally, in the last chapter the regulation of the short-term rental market and home sharing will be discussed, with its different approaches around the world and in Italy.

1. Airbnb and Sharing Economy

Airbnb was founded by Brian Chesky, Joe Gebbia and Nathan Blecharczyk in 2007, when an important conference was held in San Francisco and the three, then roommates, saw an opportunity to generate a bit of income that could help them paying rent: they accommodated three conference attendees who could not find any affordable hotel room in the city, offering them an airbed and breakfast. The idea of providing a listing service for individuals who had surplus space in their home, so that they could rent out to travellers and tourists, was officially born.

Airbnb is globally recognized as one of the pioneers of the so-called "Sharing Economy" (also called "collaborative consumption"), built around the concept of peer-to-peer exchange of goods or services through information technology, giving individuals the chance of renting access to their underused assets. Airbnb is essentially a two-sided Internet platform that works as a matchmaker between the hosts, the people who offer a room or an entire house for short rental, and the guests, travellers and tourists in search of a place to rent during their trip. The platform charges a service fee of 8% up to 18% for each booking, to both the host and the guest, and it also has the role of making sure that transactions are safe and reliable for both parties.

Airbnb has reduced traditional frictions that prevented homeowners from participating in the short-term rental market: first of all, it gives hosts the possibility of letting their accommodations known to possible guests; secondly, it has resolved the friction related to trust, acting as a guarantee between host and guests. This function is assured also through the review system on the platform: guests can leave a review within 14 days after check out and, to encourage impartial and honest comments, it is posted only after both parties have completed their own review.

This business model has been recognized as a disruptive force in the accommodation business (Guttentag, 2015), basically allowing small suppliers to compete with traditional providers such as hotels, most of all because of appealing prices (Lieber, 2011), but also because of various benefits that come from staying in a residential unit rather than a hotel room, including the chance for guests to live an experience 'like a local', as the platform itself states on their website.

However, many argue that Airbnb may not be a direct competitor in the traditional accommodation sector, because it has created a new group of consumers, a "niche" of the traditional market, encouraging tourists who may have not been able to afford certain destinations otherwise (Yglesias, 2012), and drawing them to neighbourhoods and areas of the cities not traditionally touristy. The business model is completely different from that of Marriott International, for example, which is valued at $45 billions by investors and owns more than one million rooms: Airbnb doesn't own any room, yet in 2019, it was valued at $31 billions by investors, and it has announced that it may go public in 2020. The company offers accommodation in more than 100.000 cities over 191 countries, and it has reached over 6 million of listings in 2019. A characteristic of this type of market is that it tends to concentrate in the hands of a small number of operators: the only significant competitors of Airbnb are HomeAway and Booking.com; the former has actually a small difference in its original business model, since it only offers entire homes and apartments (vacation rentals) not single or shared rooms; it has reached over two millions listings in more than 190 countries. As for Booking.com, it was conceived as a platform specifically for hotels, but has now expanded to all types of listings to keep up with the competition.

During its enormous growth in the past years, the listing options offered on Airbnb evolved in many ways, as people began to offer not only free space at their home, but also private

spare rooms, and eventually entire apartments and houses. This rapid shift has given an incentive to the conversion of residential units into tourist accommodations, taking units off of the long-term rental market to offer them on the short-term rental one, increasing rents, housing prices and reducing vacancy rents. This has raised the question of what type of impact these consequences could have on cities and their neighbourhoods, particularly in relation to their real estate and long-term rental market.

1.1 Real estate and rental market

To understand better what type of impact home sharing could have had over the years, it is necessary to understand how the real estate and rental market may influence each other.
Real estate market has many characteristics that distinguish it from other typical assets: low transaction frequency, high costs of research and transaction for both the seller and the buyer, primarily because of scarce information and particular expectations on both sides. Many externalities correlated to house purchasing exist outside the control of buyers and sellers, such as the location, public services and workplace accessibility, and these ultimately affect price.
The supply of land at a singular location is rigid, but the demand is quite elastic: while an owner can only either keep or sell his property, a potential buyer can consider many substitute sites. Furthermore, housing supply can't immediately adjust to growing prices, because of long production time. Supply is only partially determined by the flow of new constructed units, but mainly by the stock already available on the market.
Together with these considerations, the rental market also exists side-by-side, and it has a deep impact on the housing price formation mechanism.
Price in real estate market must be reflective of the locational advantages associated to each specific site: each single house or location is unique, and this means that demand considerations determine relative values of land or housing. This is called the theory of "Compensating Differentials", and was first stylized into a model by David Ricardo (1817).
Ricardo develops a simple model based on a linear monocentric city, in which the only differentiation parameter is the distance from the place of employment d, positioned at the city centre: Ricardian rent is therefore determined by subtracting from the income y the commuting costs to access to the workplace kd and the spending for consuming "other goods" x, which is what determines different levels of utility, keeping quality and density fixed. Rents must decrease with distance, because everyone is willing to bid higher for a lower expense in commuting. Considering all households identical in number of workers and income, which is spent only on rent, commuting costs and "other goods", Ricardian rent is defined as:

$$R(d) = y - kd - x \qquad (\mathbf{1}.1)$$

The market equilibrium condition is reached when consumption is uniform across locations, so rent differentials exactly offset commuting costs. Therefore, rent for housing varies by location to offset the value that households place on the advantage of these locations. If x^0 is the uniform consumption of other goods across all locations, Ricardian rent at the equilibrium can be expressed as:

$$R(d) = y - kd - x^0 \qquad (\mathbf{1}.2)$$

At the edge of the city (b), urban landlords can rent for agricultural or opportunity value $r^a q$; To switch from rural use to urban use, the structure rent is introduced, which is the annualized cost of constructing a unit (c), or the annual mortgage payment necessary to

cover the cost to build a unit. The sum of these two elements is the rent necessary to cover the creation of new housing at city's edge. Housing rent at any location equals replacement costs, plus the difference between commuting costs at the urban edge and commuting costs at the distance d considered:

$$P_t(d) = \underset{t\to\infty}{\text{PDV}}[R_t(d)] = \frac{r^a q}{i} + \frac{c}{i} + \frac{k(b_t - d)}{i} + \frac{k b_t g}{i(i-g)} \quad (\mathbf{1.4})$$

Where:

$$R(d) = (r^a q + c) + k(b - d) \quad (\mathbf{1.3})$$

Housing rent can then be divided into three different components:

- Rent necessary to convert farm land into urban land (*agricultural rent*)
- Rent for structure that sits on the lot (*structure rent*)
- Location (or Ricardian) rent resulting from saved commuting costs, where k is the slope of the gradient (*location rent*)

The Ricardian model points out that locations are rented to the use that makes them more valuable. It also gives a central role to the city's population: knowing the dynamics of the border of the city, and how it expands over time, the model is able to predict the dynamic of rent. Moreover, considering the monocentric city, as population increases the city expands horizontally to less desirable locations, making existing already developed sites more valuable and increasing housing rents in all locations.

1.1.1 Spatial separation

Distinguishing two categories of population, high and low commuting costs households, DiPasquale and Wheaton (1992) use the Ricardian model to examine whether these two groups tend to be spatially separated. Low commuting costs households form Group 1, who tend to spend less in commuting and to consume relatively more than high commuting costs households, who form Group 2, and are willing to live in less central positions. Therefore, the two categories will have different levels of x^0, with Group 1 separately located in a more central position, because landlords are able to extract a higher rent to said group, who enjoy lower utility. This points out that locations are rented to the bidder who is willing to offer the most and that a spatial separation exists within the city based on the utilities of each group of consumer.

1.1.2 Converting rents into prices

DiPasquale and Wheaton (1992) also analyse how Ricardian Rents convert into prices: the financial market conditions tend to discipline the price forming mechanism on the real estate market. In general, the housing price on the real estate market that rents for a perpetuity amount is determined on the financial market and cannot be lower than the evaluation of said perpetuity amount. The series of rent payments are considered as cash flows: house prices then reflect current rent, but also expected rent growth on the proper interest rates, the risk of future cash flows and fiscal treatment of real estate.
If g is the expansion rate of the city border, b_t the city border at time period t, i the discount rate at any time/any location already developed, price for existing housing at equilibrium will equal the present discounted value (PDV) of the rental income stream:

- $\frac{r^a q}{i}$ $is\ the\ agricultural\ value\ of\ land$
- $\frac{c}{i}$ $is\ \ the\ present\ discounted\ value\ of\ structure\ rent$
- $\frac{k(b_t - d)}{i}$ $represents\ the\ current\ location\ value$
- $\frac{k b_t g}{i(i-g)}$ $represents\ the\ future\ growth\ in\ location\ value$

A house located right at the border has no current location value; moreover, if the city is not expected to grow, the final term vanishes. The sum of the last two terms is considered the present discounted value of the location rent that will exist on the site.

1.2 Interactions between the markets and profitability rates

It is interesting to compare the supply sides of the two markets to understand what factors influence the decision to rent over selling, so why certain units are more likely to be sold than to be rented. As introduced before, locations are rented to the bidder who is willing to offer the highest value: this means that a unit would more likely enter the market that offers more advantages and profits. To understand this better, a profitability rate can be introduced, as the ratio of average annual rent over average annual price at a certain location. This index is useful investment-wise, because it gives perspective on the future of the profit from the unit. If this rate equals one, there is no difference in value in choosing a market over the other; if it is higher than one, the rental market makes the unit more valuable, giving more profit; vice versa, if the rate stands under one, the real estate market will be more valuable.
There may be many variables to take in consideration to understand why one market could be better than the other, for example location and units' characteristics. In a study published by Banca D'Italia (2019), in the biggest Italian cities an odds ratio is calculated, as the ratio of the probability that a unit would be rented, divided for the probability that a unit would be sold; its variation is examined as the units' characteristics and location. In general, in the biggest cities the number of rented units is higher in the central zones compared to the number of sold units. It is more likely for a unit to be rented if smaller and more centrally located. Also, apartments are evidently more likely to be rented, compared to independent units. Using the profitability rate as presented earlier, so as the ratio of average annual rent over average annual price, the study confirms that the rate decreases with distance from the city centre and strongly decreases as the units' dimensions increase. As discussed in the study, in Italy the profitability rates have been steadily increasing over the years, and this seems to be fitting with the fact that prices on the real estate market have been decreasing as a trend in the whole Country, while rents have been consistently increasing.
The result of a consistent increase in profitability rates should also bring an increase in demand on the Real Estate market, ultimately increasing housing prices in the long run, because people would find more profitable buying a unit instead of renting one (also considering the types of investments such as "buy-to-let").

1.3 Effects of Home Sharing

Analysing the possible effects of Home Sharing, the first one that comes to mind is the transformation of properties traditionally destined to long-term rental, to tourist accommodation on the short-time rental market: the change is easy for landlords, who don't usually require huge investments on their properties, except in some cases of renovation, even if they do require at least one person taking care of the place and of the guests'

reception and eventual needs. If units are rented to the use that makes them more profitable, the switch should happen most when short-term rental brings more value to the owner compared to the long-term rental.
If the switch from a market to the other happens for many landlords at a certain location, this has a direct effect on the long-term rental market, where supply lowers and the vacancy rates go up, subsequently rising rents. However, there may also be some externalities and indirect effects to consider: home sharing draws a large number of tourists to a neighbourhood, increasing the revenue for local businesses; this also increases the number of available services in the area, making it more appealing to live in, therefore increasing rents on both the short and long-term rental markets. However, if the number of tourists is too elevated, this can lead to uncomfortable situations for residents, making the neighbourhood less desirable to live in and therefore decreasing rents.
According to Poterba (1984), buying a house can be viewed as purchasing the present value of future rental payments. In this sense, house prices should be equal to the expected present value of rents for a similar unit, adjusted for any tax implications, borrowing costs, maintenance costs and physical depreciation. Barron, Kung and Proserpio (2018) use this statements in their study to state that any effect home sharing has on long-term rental rates, will be capitalized into house prices. Moreover, home sharing also allows the owner to sell unused capacity on the short-term market, providing an additional potential income source: this can be viewed as an additional increase of prices. Other effects could be on the supply of homes for sale, because the option to rent short-term may affect owners' propensity to decide to list their homes for sales. The externalities could also be negative, as some homeowners may be more sensitive to noisy neighbours than renters.
The effects of both rents and house prices could then have an impact on the profitability rates, increasing them as rents increase. Also, if a new profitability rate is introduced, as the ratio of average annual short-term rent (instead of long-term) over average annual price at a certain location, this also could have higher values compared to the same index calculated with the long-term rents, if short-term rents really are more profitable.
As discussed, the rental market has a key role on the housing price formation mechanism: taking in consideration the equation *(1.4)* developed by DiPasquale and Wheaton, it appears that if there is a high enough demand for vacation rentals at a particular location, the current location value may increase, as landlords are able to extract higher rents from tourists on the short-term rental market, compared to the long-term one. As previously mentioned, in fact, locations are rented out to the use that makes them more valuable.
It also can be argued that the future growth in location value may go up: as mentioned above, there are some indirect effects caused by the large number of tourists in a neighbourhood, such as the increasing of businesses and therefore services available, which can potentially make the site more appealing to live in. Moreover, there are some evidences to support the theory that a neighbourhood, once considered as dangerous and rough, by becoming a point of touristic interest, can be completely requalified; for example, Mead (2019) illustrates the case of the Raval, in Barcelona: this neighbourhood, which had always been associated with drugs, prostitution and crime, was completely requalified by the development of many cultural points of interest, which led to the increasing of number of tourists, but also residents wanting to live in the now very appealing location. This phenomenon has increased rents and relocated poorer residents, causing gentrification. In recent years, a notably similar case may be the one of "Quartieri Spagnoli", in Naples: this neighbourhood, always seen as one of the most dangerous in the city centre, has now seen one of the biggest increases in demand of vacation rental in the city.

Therefore, future growth in location value may go up in such neighbourhoods, if they become appealing enough for residents, making housing prices go up as well.
On an opposite note, there are also many negative externalities related to the fact that some neighbourhoods draw too many tourists. Beside gentrification and housing stress, in fact, another point of interest in the analysis of the consequences of home sharing in cities around the world is the so-called "Disneyfication": This term was first used by Zukin (1993), referring to the decontextualization of urban reality and its repackaging in a family-friendly and simplified format, which is ideal for mass-consumerism. According to Zukin, tourism has produced hyper-real non-places, focused around events and iconic architectures, with limited connections to the rest of urban life. These effects are surely part of globalization: as Sorkin (1992) had already suggested, global consumerism replaces local particularities with theme park versions of themselves, extracting the symbolic essence of a place.
In many cities, the massive tourist flows favoured by short-term rentals seem to be transforming the historical centres, from places of local cultural and political life, into "consumption citadels". This tends to mark the distance between the centre and the periphery way more than in the past (Mammone, 2017), and to bring the risk of social desertification of historic city centres.
According to Törnberg (2019), the advent of Airbnb and similar home sharing platforms has played a role in what is called "new tourism", which aims for authenticity within the urban experience. Following the motto of Airbnb itself, "live like a local", travellers started to search for alternative, community-based, ethical and responsible forms of tourism, reacting against the alienation of consumism and preferring places that promote authenticity, to feel part of the urban context they were in. This has led to a new type of Disneyfication, which Törnberg refers to as "Dark Disneyfication", which now gears towards the staging of authenticity, based on symbolism and stereotypes. In this process, local life is marketed, sold as an added value to the rental of the accommodation, putting at risk the identity of some neighbourhoods, which have to face the escaping of residents.
Another effect that could be interesting to take in consideration is the fact that the relocating residents drawn away from the central or more touristic areas, could have to choose relocation in other neighbourhoods, which would then see an increase in demand as a result, and therefore an increase in rents and house prices. It is, however, difficult to predict where these residents may choose to relocate, whether they would prefer staying in the areas still close to the central ones (perhaps Semi-Central) or if they would prefer relocating to the Peripheral or Extra-Urban ones.

1.4 - Related literature

Many papers of research have been published which study in deep the effect of home sharing on the landscape of cities and neighbourhoods, housing costs and rental vacancy.
Roy Saman (LAANE, 2015) has analysed the effect of Airbnb on the Los Angeles housing market. Saman argues that the company created a platform that allows landlords to "pit tourist dollars against renter dollars". Landlords can potentially earn significantly more by converting traditional rental stock into short-term rentals. Interestingly enough, through a comprehensive set of data regarding Airbnb listings in Los Angeles, Saman found out that almost 90% of the total revenues in the city was generated by lessors offering a whole unit and by leasing companies that rent out two or more whole units, units that are most likely being removed from rental markets. Furthermore, neighbourhoods in Los Angeles with higher density of Airbnb listings are the ones to present rents well above citywide average and lower rental vacancy. Analysing the nine neighbourhoods (out of 95) that are

responsible of generating 73% of revenue for Airbnb, Saman found out that these have all had a double-digit increase in rent over the span of just three years (2011-2015), some of them reaching an increase of more than 40%. The average rental vacancy for these top Airbnb neighbourhoods stands at 3.5%. This analysis has led to the conclusion that there must be a correlation between the preeminent presence of the platform and the housing market in the city, stating that entire-house units which are only used as Airbnbs, are basically units taken off the rental market, increasing the average price for rent.

Wachsmuth and Weisler (2018) have presented a framework to analyse the relationship between short-term rentals and gentrification, also offering a case study based on the city of New York. Their study is based on the theory of the rent gap (Smith, 1979). This theory describes a situation in some neighbourhoods where the actual economic returns to properties tend to decrease or stagnate, while the potential economic returns tend to increase. This phenomenon opens a 'gap', which is the difference between the two economic returns, and that results in an incentive for real estate investors, driving up housing prices and displacing poorer residents, subsequently causing gentrification.

According to Wachsmuth and Weisler, Airbnb has been raising potential ground rents in housing markets by giving the opportunity of higher income on the short-term rental market. It may therefore be opening new rent gaps in certain neighbourhoods in cities around the world. These gaps are 'short – term', because their turnaround time is much shorter than the original gaps Smith (1979) introduced. Airbnb is considered the factor that creates the possibility of potential returns, but also the mean through which achieve these returns, decreasing the time necessary to close out the rent gap. Moreover, the only necessary step for converting a long-term rental to a short-term rental is removing the existing resident: the result is the displacement of an existent, lower-income population and the arrival of higher-income newcomers, which is usually the scenario of gentrification, but with the exception that the newcomers are tourists, temporary visitors. These short-term rent gaps are expected to be unequally distributed across the city, as the demand of tourist accommodations differs from neighbourhood to neighbourhood for different factors, such as distance from touristic attractions, transportation and commodities.

Wachsmuth and Weisler focused New York City's market, which is Airbnb's third largest market worldwide: entire-home listings in the City make up just over half of all active listings, but they earn approximately 75% of all platform revenue. Hosts with multiple entire-home listings or listings with more than three private rooms, make up for almost 30% of platform revenue, proving that most of the listings are not primary residencies and therefore most of the hosts are not real 'home sharers'.

Wachsmuth and Weisler applied the rent gap theory by focusing on two indicators. The first is the percentage of total residential rental revenue in each neighbourhood which flows through Airbnb: this showed that the platform had major impacts in the areas considered as 'post-gentrified', intensifying dynamics that had already been acute for several years. The impact had increased, but not as intensely, in other areas, which have been more popular on the platform in recent years. The second indicator is the percentage of median rent that an average full-time Airbnb property earns relative to prevailing rents in the neighbourhoods, basically comparing how much money landlords can make on Airbnb in proportion to what they could be making with traditional long-term rentals. Their results showed that there were areas in New York, that had their housing supply heavily impacted by Airbnb, but that were close to an equilibrium (a closed rent gap). Other areas still did not show any impact, but could show it anytime in the near future, because landlords were making much more money by using Airbnb (open rent gap). Lastly, there were areas where impacts were showing, but still not at their fullest (not-yet closed rent gap).

Barron, Kung and Proserpio (2018) conducted an econometric study to estimate the impact of Airbnb's growth on housing costs across different cities in the United States. They concluded that a 10% increase in exogenously determined Airbnb listings leads to a 0.42% increase in rents. Nationwide, they estimated a 1% increase in residential rents caused by the platform from 2012 and 2016, with effects concentrated in cities where Airbnb's activity is highest, such as New York, Los Angeles and Miami.

They also argue that home sharing may be influencing house pricing for potential buyers: in fact, their results show that a 10% increase in exogenously determined Airbnb listings leads to a 0.76% increase in house prices and that nationwide, the platform is responsible for a 2% increase in housing prices from 2012 to 2016.

Lopez et al. (2019) conducted a similar econometric study, focusing on the case study of Barcelona: their findings indicate that Airbnb has increased both rents and house prices, with the former effect being more significant than the latter. For rents, they state that the 54 most active listings in a small neighbourhood (which is the average level in 2016) increase rents by 1.9%. Transaction and posted prices increase by 5.3% and 3.67% respectively. Their results also show that the average number of listings in the top decile of Airbnb activity distribution in 2016 increases rents by 7% and transaction and posted prices by 19% and 14% respectively. Furthermore, their model also predicts that Airbnb listings reduce the number of resident households.

2. Airbnb in Italy

According to Confcommercio and Federalberghi (2019), with more than 400.000 listings in 2018, Italy stands at the third place in the list of biggest markets for Airbnb, after the United States and France. This, compared to data coming from 2016, represents a 78% growth for the platform in the country. Of these 400.000 listings, 76,88% refers to entire apartments and approximately the 62% refers to hosts who manage more than one listing on the platform: hosts managing one or two listings are the 87%, while the 9% manages three or four listings and the 4% more than four listings. Furthermore, two listings out of three are available on the platform for more than six months in a year. This is important to consider analysing the effect of the platform on the long-term rental market, because entire apartments units that spend more time available on the platform could be units switched to the short-term market use. Also, the fact that a host manages more than one listing could mean either that there are lots of secondary homes available on the platform, or that there might be professional real estate agents or agencies that take care of a certain number of listings on the short-term rental market. In the last few years, for example, there has been a growing number of platforms that take care of Airbnb listings for those hosts who aren't available to: taking a percentage out of the income of each booking, these platforms take care of account management, check-in and check-out of guests, cleaning and any type of emergency that may happen during the stay. Beside these platforms, other agencies exist in each city or region, which offer management of vacation rentals.

A report by Banca D'Italia (2019) analyses the presence of Airbnb in Italy, which isn't homogeneous, but logically tends to increase in the most touristic areas, along the coast, near the northern lakes and in the regions with the most artistic and famous cities. The regions with the highest number of listings are Tuscany, Sicily, Lazio and Lombardia, while the most popular cities on the platform are Roma, Milano and Firenze, with this last one representing almost a quarter of the entire listings in Tuscany: furthermore, considering data from 2016, it stands out that the weight of the Tuscan region on the platform market was way more significant than the equivalent on the traditional facilities market.
According to the same report, the entry of Airbnb in the hospitality sector was part of a reconstruction on the supply side of the market, which began over 15 years ago: while the number of hotel facilities has been nearly constant, the average capacity of the facilities grew over the years; in the mean time, there has been a sort of requalification which led to the exit of the market's most low-range facilities (mainly one or two stars hotels), favouring medium or high-range hotels (most of all three stars hotels) and luxury structures. On the other hand, the number of extra-hotel facilities has almost doubled in the same period of time. This seems to suggest that the rapid expansion of Airbnb and other online platforms (often referred to as OTAs, as in Online Travel Agencies) may have influenced the volume of business, decreasing it, inducing the exit from the market of some more traditional facilities, in particular those operating in the low-cost segment.

In a report published in 2019 by Airbnb itself, the direct economic impact of the platform in Italy was estimated at over 5 billions euros. Italy stands at the fourth place in the list of countries with most economic advantages guaranteed by the platform, thanks to new touristic flows that the platform was able to create over the years. It is important to point out that the report was guided by the platform itself: either way, the results came from an enquiry that analysed both internal data as well as data coming from 228.000 hosts and guests registered and active on the platform. This study also tried to analyse the indirect

impact of the platform on local businesses and services: it came out that even those businesses usually out of touristic interest were registering an increase of activity. More than 50% of the guests analysed stated that they spent most of their money in the neighbourhood in which they were staying. Also, data coming from Federalberghi and Confcommercio shows that bar and restaurants have seen a growth of 15,1% in Italy from 2008 to 2018. In the biggest cities, this growth represents the 18%.
The value of the economic impact in Italy seems to be divided mainly between Lazio (1 billion of estimated economic advantages), Toscana (961 millions) and Lombardia (760 millions). Considering the single cities, Roma stands at the first place, followed by Firenze, Milano, Venezia and Napoli.

Before introducing the case study of Firenze, the general trends for the long-term rental and real estate markets in Italy over the last years will be analysed in the next sections, in order to have a bigger picture of the analyses.

2.2 – Analysing The Long-term Rental Market in Italy

In a report drawn up by *Banca D'Italia* (July 2019), which analyses the long-term rental market in Italy, it is specified that the supply of units available for rent in the Country has had a 10% decrease in the three-year period from 2016 to 2018. The number of units that exited the market has decreased the most between 2016 and 2017, re-increasing a little in 2018. The data used in the report comes from the popular Italian online platform for rental and real estate purposes *Immobiliare.it*. As a proxy for the demand side, the report uses the number of views of listings on the platform, finding out an increase in the same three-year period. An index for market liquidity is also calculated, as the percentage ratio between the number of units potentially rented and the number of units on offer on the site: this index stands near 25% in 2016, and it increased to 29% in 2018. Overall rents have risen of 1,6% in 2017 and 2,2% in 2018. This wasn't uniform in the whole country, as the most affected cities were Milan, Bologna and Firenze. To further explore the analysis, Banca D'Italia also examines different characteristics of the units offered on the platform, such as the state of preservation, size, number of rooms, etc. They come to the conclusion that in the biggest cities of the Country there has been a recomposition of the supply side in favour of smaller units in a better state of preservation; therefore, higher rents are associated to units with these characteristics.

The Real Estate Report drawn up by the Italian Inland Revenue Agency (*Agenzia Delle Entrate*, 2019) referring to the year 2018, shows that the number of registered long-term rental contracts in the Country has grown a little over 0,7% since the year before. For the analysis of this market in the report, four types of possible contracts for residential use are specified:

- *Ordinary Temporary:* duration of at last one year, but less than three years;
- *Ordinary Long-Term:* duration of at last three years;
- *Subsidized for students:* duration of at least one year, but less than three years;
- *Subsidized agreed upon:* duration of at last three years;

For each type of contract the number of rented units, their size and the negotiated rent are available in the report, together with the share of residential stock effectively rented: this is called intensity of the rental market (IML) and it is calculated as the ratio between the

number of rented units (number of new contracts) and the number of potentially rentable units (units that are not used as primary houses).
The Ordinary Long-Term is the prevailing type of contract representing the 54,7% of rented units and almost the 54% of total rents in 2018. The data regarding the eight biggest Italian cities for this type of contract are shown in Table 2.2.
Firenze stands at second place for the highest average rent, behind Milano. It is also very active in terms of intensity of the market, with an IML well above 5%. Firenze is also the most active City out of all eight in both the Subsidized for students and the Ordinary-Temporary, also presenting one of the highest average rents for those types of contract.

Table 2.2 – The table shows the Number of rented units, IML and Average Rent for the eight biggest cities in Italy as of 2018. The data used comes from Agenzia delle Entrate.

City	Number of rented units	IML	Average rent (€/m2)
Roma	21.323	3,80%	124
Milano	34.081	8,90%	152,5
Napoli	9.707	4,40%	73,8
Torino	13.969	6,20%	86,7
Palermo	5.713	3,70%	55,5
Genova	2.197	1,80%	69,8
Bologna	6.395	6,20%	117,6
Firenze	4.421	5,20%	126,6

To have a better understanding of the situation in 2018, it is useful to compare it with the one presented in the Real Estate Report referring to 2015 (Agenzia Delle Entrate, 2016). The variations are shown in Table 2.3 and they refer to the Ordinary Long-Term contract, which was the most popular contract used for renting units in 2015 as well: Firenze has seen an increase of rented units of 11% in the span of time between 2015 and 2018, an increase in the intensity of the rental market (IML) of 6% and an increase of 21% in average rent; this last one is the highest increase out of all eight cities, while for number of rented units and IML it stands at second place behind Torino.

Table 2.3 – This table shows the variations between 2015 and 2018 for each variable shown in the previous table.

City	Variation in number of rented units (2015-2018)	Variation in IML (2015-2018)	Variation in average rent (2015-2018)
Roma	-16%	-19%	5%
Milano	7%	5%	16%
Napoli	-11%	-17%	4%
Torino	49%	41%	10%
Palermo	-20%	-24%	4%
Genova	-18%	-22%	7%
Bologna	8%	7%	17%
Firenze	11%	6%	21%

2.3 – The Real Estate Market in Italy

The real estate market usually follows cyclical patterns, mostly because of its variations on the demand side; these variations are influenced not only by price, but also by savings, financing costs, current and expected income. As suggested in the Real Estate Report by the Italian Inland Revenue Agency (*Agenzia Delle Entrate*, 2019), the supply side is only partially determined by the flow of new constructions, but much more by the existent stock available on the market. In the report the NTN index is used to analyse the last decades of the real estate market in Italy: the NTN is the number of normalized transactions, and it is basically a measure of the market dynamism; it equals the ratio between the number of normalized transactions and the number of sold units in a certain period of time. This index has shown a trend of recovery in the years from 2013 to 2018, compared to the situation in the previous six years, which were characterized by

the huge crisis of that period. The trend of prices is different, as they have begun to decline in late 2012, and were still decreasing in 2018, even if at a slower pace. Focusing on the eight biggest cities, these as well seem to be following the recovery trend. Using the IMI (Intensity of the Real Estate Market), calculated as the ratio between the number of sold units and the stock of real estate units available on the market, the most active cities are Milano, Torino, Firenze and Bologna. In these eight cities, more than a quarter of value of national revenue is concentrated. After Milano, Firenze is the city with the highest average value of a singular unit.

3. The case study of Firenze

Data from ISTAT shows us that (as of 2018) Firenze stands at the fourth place in the list of most visited cities. In general, according to the Firenze City Council data, as showed in the table 3.1, the city continued to welcome more and more tourists in the last five years, reaching 3.945.451 visitors in accommodation facilities in 2018.

The Council also released a report which proved that the number of nights spent by visitors has increased over the last five years: the length of stay was approximately 9,3% higher for Italian tourists and 2,3% higher for foreigners. The study confirmed that all the extra-hotels structures seemed to have an average of 3 nights stay, while the hotels showed an average of 2,7 nights. This could be explained by two factors: the first being that extra-hotel structures usually have a lower price compared to hotels, so visitors could be able to enjoy more time in the location they are visiting having to spend less; secondly, in terms of comfort it may be better for some people to stay in actual homes and residencies instead of an hotel room, so they would tend to book more nights compared to hotels bookings. Also, in Airbnbs guests usually have a kitchen available most of the time, so that they can eat at home, saving money that they could use for an additional night in town.

Table 3.1 – Number of tourists checking-in at hotel and extra-hotel structures in Firenze over the years. Data from Comune di Firenze.

Year	Hotel structures	Extra-Hotel structures	Total
2014	2.827.078	673.521	3.500.599
2015	2.825.071	761.951	3.587.022
2016	2.802.271	819.111	3.621.382
2017	2.962.294	920.281	3.882.575
2018	2.973.349	972.102	3.945.451

Analysing the data from the Council, the number of arrivals in the city is divided between hotel and extra-hotel structures; the number of visitors in hotels is way higher compared to the extra-hotel structures one and this may have different explanations: in part, it is difficult for the Council to establish the exact number of extra-hotels structures, because of various problems that all of Italy has had regarding regulating and controlling the regular registration of guests by hosts; on the other hand, as introduced before, there has been a shift in the accommodating sector which has led hotels to increase their capacity, which means that the average size and number of rooms has risen, with structures being able to accommodate a large number of visitors. On the contrary, extra-hotel structures are usually smaller in capacity and size. Either way, what is clear from the data is that since 2014, the number of hotel structures visitors has not seen an intense growth, while the extra-hotel structures have registered a notable one: in the time period between 2014 and 2018, the increase has been a little over 5% for hotel structures, while it has reached over 44% for extra-structures.

As a proxy for Airbnb popularity, to see in which year it started getting well known, many studies use Google Trends, a website by Google that gives information about the most used queries on the search engine. As displayed in Figure 3.1, which summarises the Trend for the query “Airbnb Firenze” worldwide, by semester over the years, it is evident that the platform started gaining notice in the city back in 2012, and has grown in popularity year after year, reaching the maximum peak in 2017. This data seem to fit well with the growth of Extra-Hotel structures visitors.

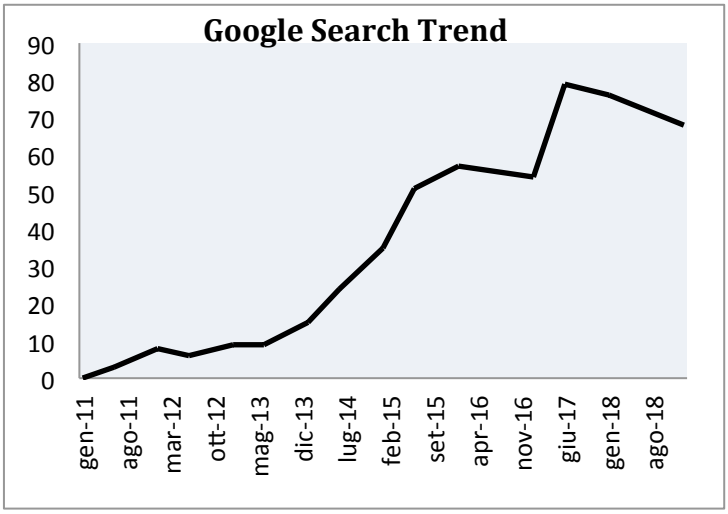

Figure 3.1 – Google Search Trend for "Airbnb Firenze" worldwide, over the years

3.2 Airbnb Listings Analysis in Firenze

Using the dataset from AirDNA for Firenze, it is possible to analyse the listings available on the platform in the period between June 2015 and July 2018. The data include information about the host, the type of listing, number of reviews and revenue per month, as well as the geographical coordinates.

3.2.1 Listing types and hosts

As introduced in Chapter one, Airbnb initially intended to focus its business on renting out free space at hosts' homes, so that they could generate an additional income welcoming guests. This means that the original idea was to actually have a host present in his property during the entire stay of his guests. However, nowadays the platform lists three different types of units:

- *Entire homes/apartments*: the host gives his entire house to rent out on the platform, so he won't be present during the guests' stay.
- *Private rooms*: a room within the host's apartment, which gives the guests privacy. Usually implies that the host will be present during the stay, which would make the guest essentially a short-term 'flatmate'. In some cases, however, the listing of a private room refers more to a Bed & Breakfast room situation, where the host is the owner of the facility.
- *Shared rooms*: usually implies that guests and hosts occupy the same space, with reduced privacy. This was the original experience offered on the platform when it was first created. However, now the meaning of shared room may have shifted, as it is possible to find this type of unit shared with other guests instead of the host himself, which essentially means that the whole unit is available on the platform.

It is important to distinguish between these types of listings, because if all listings were to be shared rooms which guaranteed the original Airbnb experience, there would probably be a lower impact on the long-term rental market and housing stress. However, if most types of listings are entire homes and also private rooms which could be destined to the long-term

rental market (private rooms, for example, could be destined to students rentals), but are instead switched to short-term rental use, this could add up to the effects of home sharing. In the case of Firenze, entire homes and apartments represents the 72% of all listings available, and together with private rooms they make up for 99% of all listings on the platform, leaving shared rooms at 1% in total.
To understand even better the supply side of the platform, it can be useful to analyse the types of hosts present; therefore, three categories of hosts can be mainly identified:

- *Hosts that rent a single entire home or apartment:* this can include either hosts that rent their home when they are away or hosts with a secondary home.
- *Hosts with more than one listing on the platform*: while this includes also individuals owning more than a unit in the city, it should also include all the agencies and companies that take care of the marketing, booking and guests' accommodation on behalf of the owner of the unit, basically vacation rental management companies.
- *On-site hosts:* this category includes all the hosts listing one single private or shared room. Having only one single room available on the platform should mean that these are hosts present in their unit during the rental.

Using this categorization on the 9355 hosts in Firenze as of July 2018, what comes out is that most of them, precisely the 51%, falls into the first category (Figure 3.2), while the On-site hosts represent approximately the 17%. The remaining 32% falls into the second category. This could lead to thinking that most of the units available on the platform are secondary homes, but also that lots of businesses are growing and spreading rapidly thanks to home sharing, like the agencies managing vacation rentals on behalf of owners.

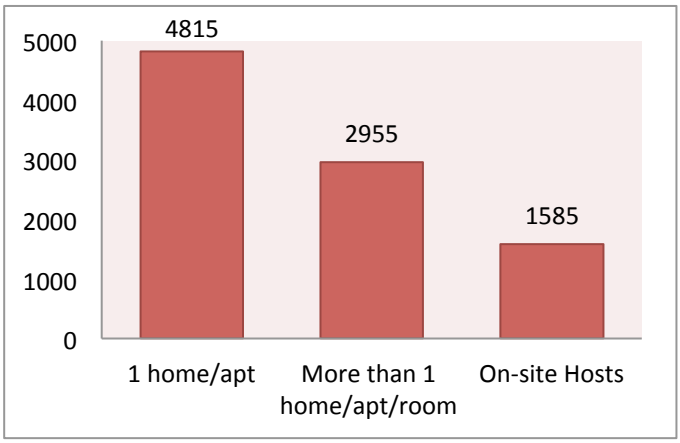

Figure 3.2 – Number of hosts for each category analysed in Firenze as of July 2018.

3.2.2 Listings and touristic attractions per neighbourhood

The Italian Inland Revenue Agency (Agenzia delle Entrate) takes care of analysing and elaborating technical-economical information about real estate values and long-term rental market. To do so, it identifies "homogenous" zones (OMI zones) grouped in a way that mirrors the urban landscape of the cities, categorising each zone in either Central (B), Semi-Central (C), Peripheral (D) or Extra-Urban (E).
This categorisation is available as well for the City of Florence, as shown in Figure 3.3. The town is composed of five Central zones, fourteen Semi-Central, fifteen Peripheral and one Extra-Urban. This will be useful to understand better where Airbnb listings tend to locate in

the City of Florence, and how neighbourhoods have been affected both in the long-term rental and real estate market.

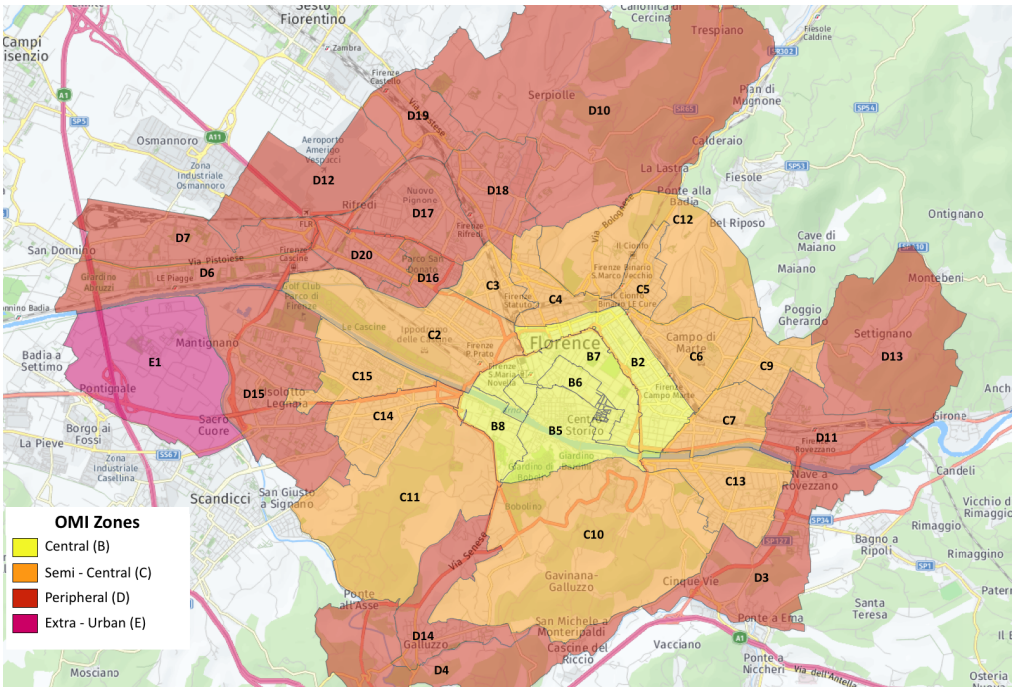

Figure 3.3 –Homogenous (OMI) Zones identified by the Italian Inland Revenue Agency for the City of Firenze.

According to Mammone (2017), in Italy the massive tourists flows tend to concentrate in the historic city centres, where most of the major points of interest of the cities are situated. To see if this suits the case of Firenze, it can be useful to develop an index for proximity to touristic attractions, to apply on the neighbourhoods and analyse the differences in terms of desirability for tourists' accommodation. Taking inspiration from Lopez et al. (2019), the famous platform TripAdvisor can be used for the list of most famous touristic attractions in Firenze and, as a weight of their importance and popularity, the number of their Google Reviews can be easily collected as well (the number of reviews on Google is higher than the one on TripAdvisor); the attractions are then geolocated in each OMI Zone, and the index TA for the zone is developed as follows:

$$TA_n = \sum_k \frac{1}{d_{n,k}} R_k \qquad (3.1)$$

Where k is the touristic attraction, $d_{n,k}$ indicates its distance from the zone centroid n and R_k its number of reviews. In Figure 3.4 the index is mapped for each neighbourhood, using a Natural Breaks Map, which uses a nonlinear algorithm that maximizes within-group homogeneity (following the works of Fisher, 1958 and Jenks, 1977): it determines break points to group observations that yield the largest internal similarity. This kind of map should be better at grouping extreme observation. As shown in Figure 2.4, in fact, the OMI Zone B5, which includes the heart of the historical centre of Firenze, presents a way higher index than all the other ones and is therefore grouped separately. In general, all the Central and Semi-Central Zones appear to be presenting the highest index, while the undefined zones, which present zero touristic attractions, are composed of most of the Peripheral zones plus the Extra-Urban zone E1.

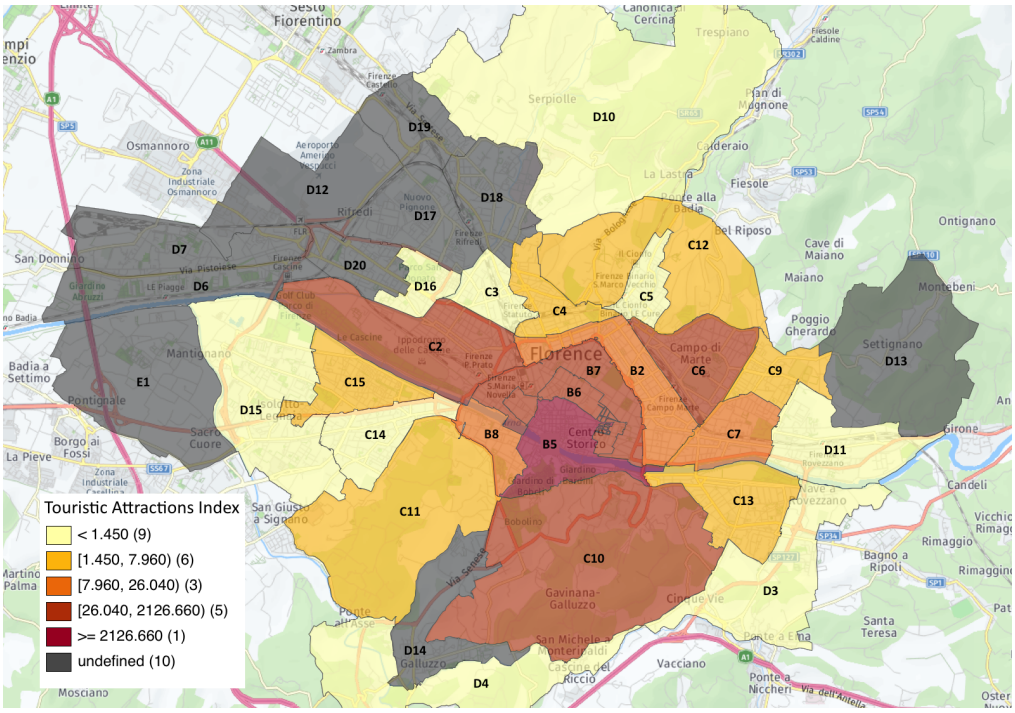

Figure 3.4 – The index TA, which indicates the density of touristic attraction for each homogenous zone, is mapped for the entire city using a Natural Breaks Map.

As a consequence, it can be expected that most tourists would prefer staying in the Central Zones, or the ones closer to them. This means that demand for Airbnbs is expected to be higher in these neighbourhoods, which should also predict a higher density in the number of listings available there.

Using again the data from AirDNA, the number of listings available in each neighbourhood can be mapped to see the density of Airbnb listings in each neighbourhood as shown in Figure 3.5, using a quantile map of eight quantiles for the count of listings per zone. Considering the categorization in OMI zones, the Central ones (B) present the highest number of listings, representing the 70% of the total number. The Semi-Central (C) zones are

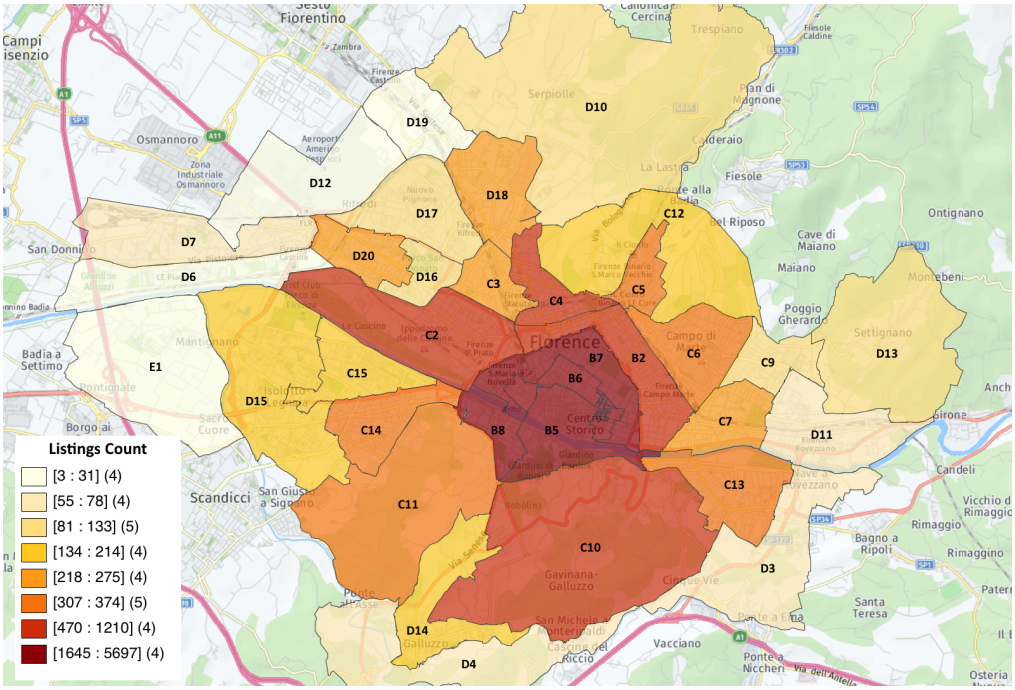

Figure 3.5 – Quantile map (8 quantiles) for the density of Airbnb listings in each Homogenous Zone in Firenze.

at second place with 23%, while the Peripheral zones (D) stand at 7%, followed by the Extra-Urban Zone (E1) that stands under 1%. These results seem to confirm that most of the listings are located in the City Centre, which should mean that the flows of tourists brought by Airbnb tend to crowd mostly this part of the town, or the ones close by, where most of the touristic attractions are located. B5 is, in fact, both the area with the highest number of listings and the one with the highest TA index.

3.3 The Long-term Rental Market in Firenze

Using data coming from Immobiliare.it, which publishes its average prices per month for each neighbourhood in Firenze for the years from the end of 2014 to the end of 2018, and mapping them so that they fit the OMI division in zones, as shown in Figure 3.6, it is evident how the prices have risen in the whole city, of about 13%; this shows a discrepancy with the data coming from the report regarding the variation in average rent analysed in chapter 2; this is because of many factors: firstly, the prices shown on Immobiliare.it are the ones offered initially, but not the actual final prices that end up in the contract after the negotiation.

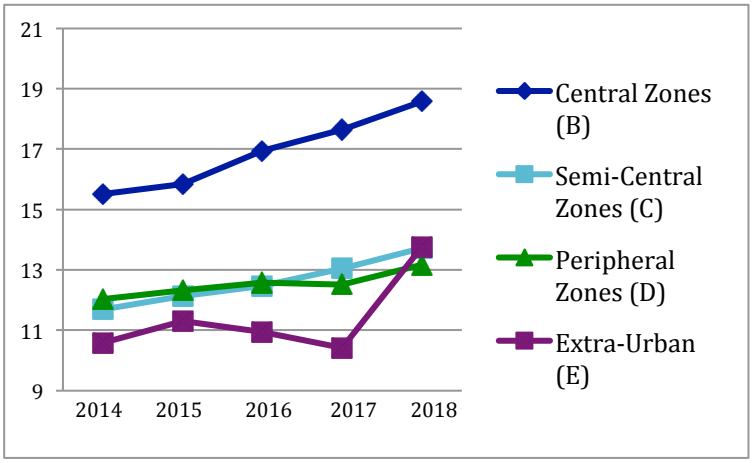

Figure 3.6 – Trends for each type of zone in Firenze for the long-term rental market prices between 2014 and 2018.

Moreover, the data shown in the report refers to the Ordinary Long-Term type of contract, which is the prevailing type, but not the only one.

The central zones all present an average well above the other zones, and overall they have seen an increase of over 20% in the span of 4 years. The Extra-Urban zone E1 has seen the highest increase in average rent, especially between 2017 and 2018, with a staggering 30% increase. Using once again a quantile map of seven quantiles to group the data from the

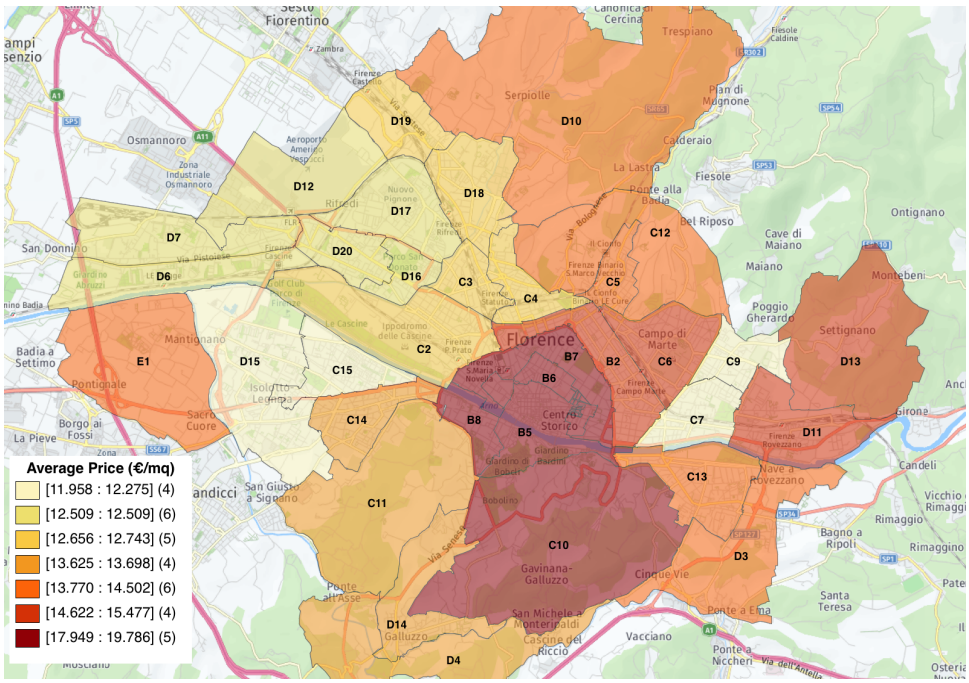

Figure 3.7 – Average rents (€/mq) as of 2018 for each homogenous zone (OMI) in Firenze, mapped in seven quantiles.

average rents of 2018, the results are shown in Figure 3.7: four out of the five Central Zones fall into the last quantile, presenting the highest average rents. In Figure 3.8 the variation in rents are also mapped in seven quantiles, comparing the average in 2018 with the average in 2014. All the "red" zones in the first figure (except for C10, which presents unavailable data for 2014) present an increment between 19% and 23% in rent, together with the Zone B2 (which actually falls into the sixth quantile). In general, almost all the zones closest to the centre of the city have seen the highest increases, and therefore tend to fall into the last quantiles.

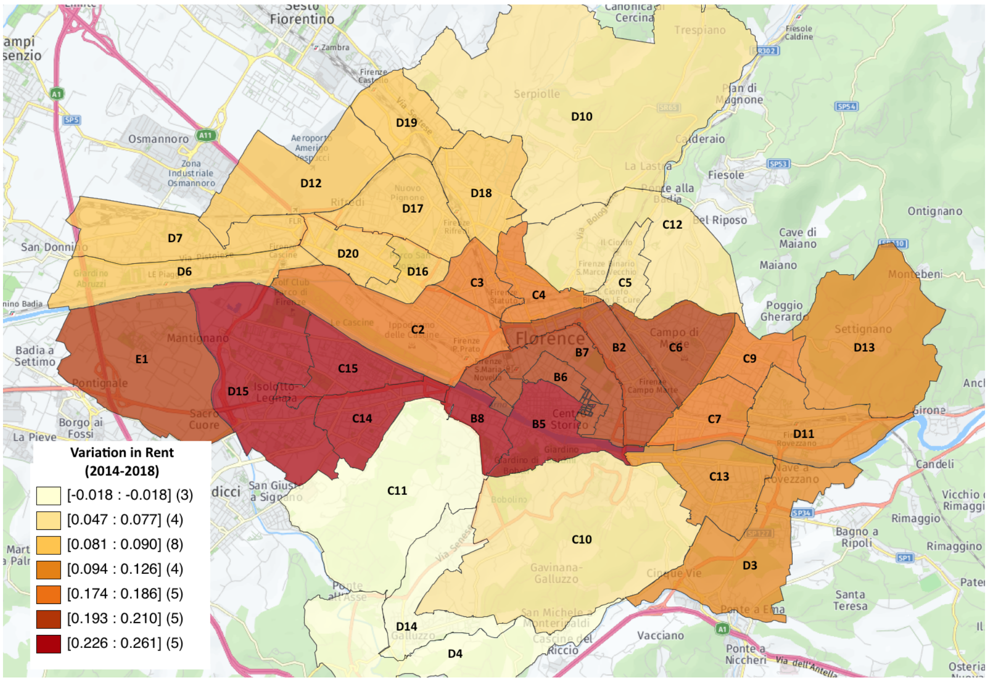

Figure 3.8 – The variations in rents between 2014 and 2018 mapped in seven quantiles.

As introduced in Chapter One, one of the effects of home sharing is the shift from long-term units to short-term ones, which leads to a decrease on the supply side of the long-term market, increasing rents. Therefore, it is useful to analyse the increase in certain zones of the city, especially the most touristic ones, such as the Central ones, even if it is still to analyse how much of these increase can be explained by the density of Airbnb listings available in the area. The decrease on the supply side could also lead to the reallocation of residents from central zones to other parts of the city; it is difficult to predict where these flows of relocating residents may be heading, but surely the neighbourhoods in which they choose to move would present an increase in rent, as it would imply higher demand. Therefore, analysing the increase in rents in other less-central zones could be useful to understand what other neighbourhoods are most appealing. Once again, three the most central zones fall into the last quantile, together with other Semi-Central and Peripheral zones.

3.4 The Real Estate Market in Firenze

Analysing once again data coming from Immobiliare.it, which publishes the average price per square metre per neighbourhood, once again fitting them to the OMI zones, there is a general rising of prices from 2014 to 2018, even if less evident compared to the long-term rental market: the Central Zones show an increase in price of 5%, the Semi-Central Zones of 6% and the Peripheral zones of 3%. The Suburban Zone E1 is the only zone to present a decrease in price, with a negative 8%.

The seven quantiles map for average price in 2018 is shown in Figure 3.8: again almost all the central zones fit into the last quantile, together with the Semi-Central Zone C10. This coincides with the last quantile in the long-term rental prices for 2018 shown in Figure 3.6.

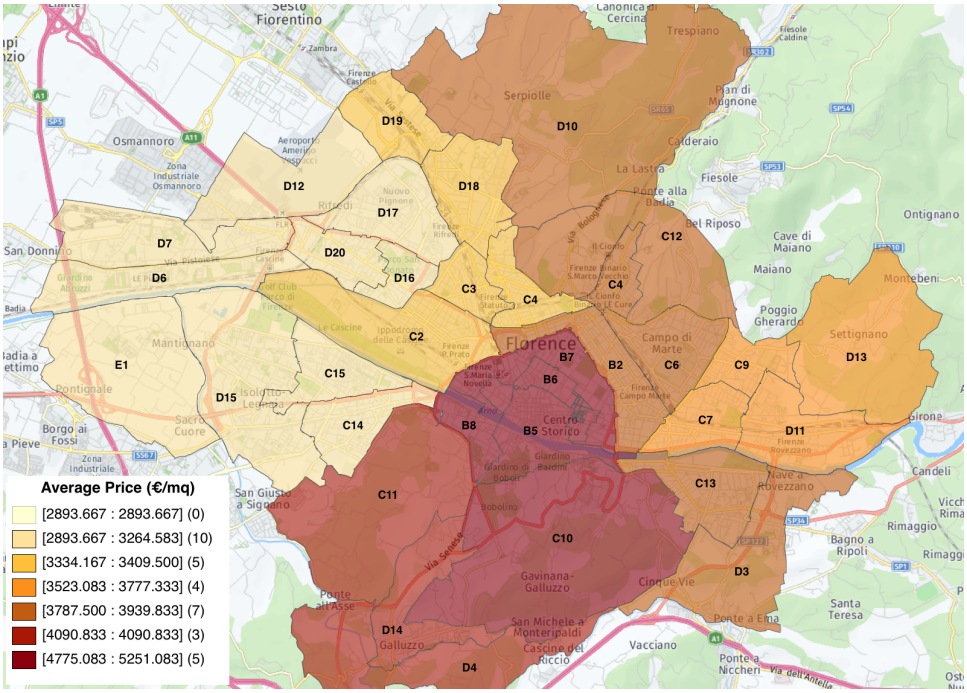

Figure 3.8 – Eight – quantile map for the average price (€/mq) of housing for the homogeneous zones in Firenze, as of 2018.

In Figure 3.9 an eight quantiles map for the variations in price between 2014 and 2018, for each Zone OMI, is shown. Singularly, the zones that show the highest increase are B5 and B8, with a 9% growth in price; In general, the central and semi-central zones are the ones showing higher variations in price, even if many Peripheral Zones also show notable increases.

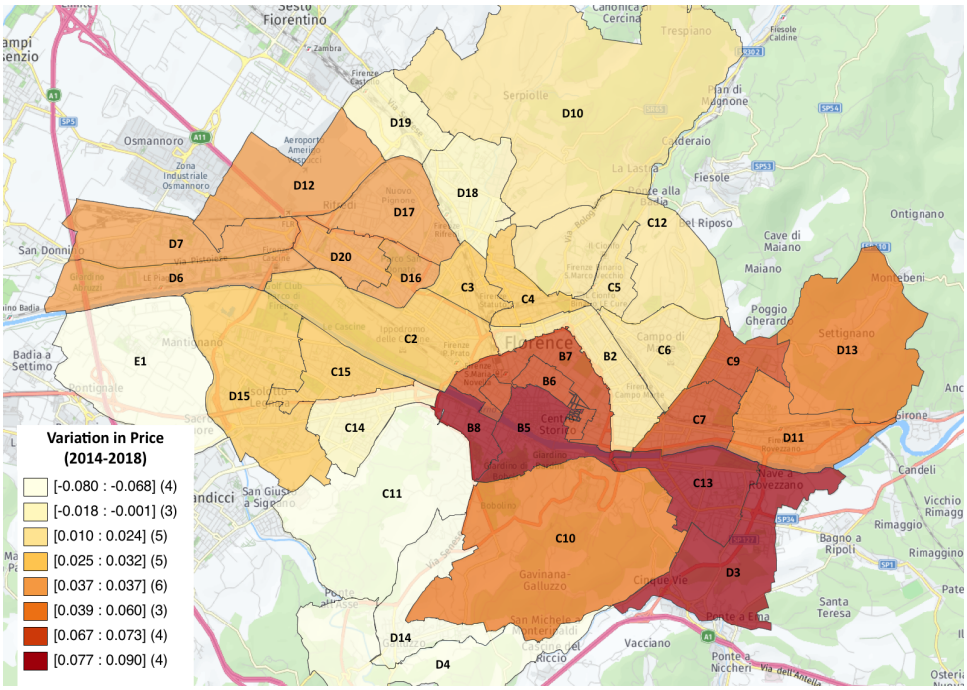

Figure 3.9 – The variations in housing price between 2014 and 2018 mapped in eight quantiles for the homogenous zones in Firenze.

3.5 Profitability rates

As introduced in Chapter One, the profitability rate of a unit can be calculated as the ratio of average annual rent over average annual price at a certain location. In general, Italy has seen a growth in profitability due to the decreasing in prices on the real estate market, together with the increase in rents.

Table 3.4 – The variations in profitability rates between 2014 and 2018 for each type of zone in Firenze.

OMI Zones	Variation 2014-2018
Central Zones (B)	14%
Semi-Central (C)	12%
Peripheral (D)	6%
Extra-Urban (E)	42%

It would be interesting to analyse the situation in Firenze: here, as discussed above, rents have been steadily increasing with an average of 13% in the whole city between 2014 and 2018; on the other hand, house prices have been increasing but at a slower pace. In table 2.4, the variations in profitability rates are calculated using once again data from *Immobiliare.it,* both from rental and housing markets over the years from 2014 and 2018. The Extra-Urban zone E1 is the only one showing a staggering variation between the years considered, due to the high rent increase in the zone over the same time period. In second place the Central Zones present a positive 14%, close to the 12% of the central zones.

The increase in the index is very useful for investors looking in the real estate market, because it shows a good possible profit from the units, especially those more centrally located; moreover, if these rates continue to steadily grow over the years, it would bring an increase of housing prices in the city, due to higher demands from investors.

This could be considered an indirect effect of home sharing, because being able to rent on the short-term market is an additional income available for the unit, which leads to increase in both rental and real estate markets; there is still to understand how much of this increase can be explained through the increase in Airbnb listings in the city.

4. Empirical Analysis

Proceeding in an empirical analysis to understand how much Airbnb presence in Firenze has impacted both rents and housing prices, data from AirDNA will be used alongside data from Immobiliare.it for both house rents and prices to create a model, which takes inspiration from the works of both Garcia-Lopez (2019) and Barron (2018). The final aim is to understand how much of the high density of Airbnb listings in certain OMI zones explains the general rising of housing prices and rents.

4.1 Model Specification

Let $Y_{n,t}$ be the measure of either housing prices or rents for OMI Zone *n* in year-month *t*, over the time period 2015-2018; let $Airbnb_{n,t}$ be the number of active listings in each OMI Zone *n* in year-month *t* in the same time period. The following fixed-effects specification can be introduced:

$$Y_{n,t} = \beta AirbnbListings_{n,t} + \gamma X_{n,t} + \epsilon_{n,t} \quad (\mathbf{4.1})$$

Where $X_{n,t}$ are the control variables chosen for the analysis which will be specified below. $\epsilon_{n,t}$ might contain additional factors that could influence Y, for example factors associated to the desirability of living in a certain OMI zone, like the quality of the neighbourhood services or the local labour conditions. Some of these factors might be correlated to the independent variable $Airbnb_{n,t}$ at both zone and time levels; for this reason, $\epsilon_{n,t}$ has to be broken down into time-fixed effects t_t and OMI zone fixed-effects μ_n that represent time-invariant zone characteristics. This way, equation 4.1 becomes:

$$Y_{n,t} = \alpha + \beta AirbnbListings_{n,t} + \gamma X_{n,t} + t_t + \mu_n + \varepsilon_{n,t} \quad (\mathbf{4.2})$$

As control variables, data regarding the yearly number of residents in each neighbourhood from 2015 to 2018 was collected from the Open Data portal of the Council of the City of Florence; this should give a time-varying control at zone level over possible effects of gentrification within the city.
The other control variable used in the analysis was already introduced in Chapter 3 and it consists in the number of tourists arriving in the city that chose to stay in extra-hotel structures; this data was collected from the Council as well, and it can be useful to control the level of "touristiness" experienced by the city in the time period analysed from 2015 to 2018.

4.1.1 Instrumental variable

In equation 4.2, the error term $\varepsilon_{n,t}$ may actually still contain some unobserved zone OMI – specific, time-varying factors that influence $AirbnbListings_{n,t}$, leading to an inconsistent estimator of the coefficient β. A useful technique to solve this problem is building an instrumental variable; so, after an Ordinary Least Square Regression with the Fixed Effects Model introduced in 4.2, a IV approach will also be used.
In order to build a valid instrument Z, this has to satisfy two conditions:

1. Relevance condition: *Z* must be correlated to $AirbnbListings_{n,t}$;
2. Exogeneity condition: *Z* must not be correlated to the error term $\varepsilon_{n,t}$;

In this case, the instrumental variable would have to be uncorrelated to shocks in the housing market, but likely to affect the number of Airbnb listings.
Taking once again inspiration from the works of Garcia-Lopez (2019) and Barron (2018), an instrumental variable can be built using the interaction between an exogenous time series and an endogenous cross-sectional variable: the time series element is the Google Trend gt_t for the query "Airbnb Firenze" worldwide, as already introduced in Chapter 3; the data is collected per year-month t from 2015-2018. This index is likely to reflect the overall growth in the supply of short-term housing driven specifically by Airbnb in the city.
To complete the instrument, gt_t is interacted with a measure of 'touristic attraction' for each zone of the city; this index was already introduced in Chapter 3 as TA_n and it is built as follows:

$$TA_n = \sum_k \frac{1}{d_{n,k}} R_k \qquad (\mathbf{3.1})$$

Where k is the touristic attraction, $d_{n,k}$ indicates its distance from the zone centroid n and R_k its number of reviews. The TA index is likely to reflect where most of Airbnb would tend to locate in the city, as it shows where most of the attractions are the most interesting for tourist demand.
As suggested by Garcia-Lopez (2019), this instrument should predict both where and when listings are most likely to locate. Since the model specified in equation 4.2 includes year-month and zone fixed effects, the variation of the instrumental variable results in comparing Airbnb listings between higher and lower Airbnb popularity in the year-months analysed, and between more and less touristy zones.
As introduced before, in order for the condition of Exogeneity to be valid, the instrument should not be correlated to the error term $\varepsilon_{n,t}$; in the case of this model, it is reasonable to assume that the error term in equation 4.2 is mostly correlated to shocks on the long term rental market and on the real estate market, and these types of shocks are most likely not correlated to the touristic attractiveness of the city of Firenze.
In order to check the instrument validity and power, hosts with a unit in a more touristic zone must be more likely to rent their property in the short-term rental market as the popularity of the platform grows; to verify this assumption, it can be useful to analyse the differences in the number of Airbnb listings between more touristy and less touristy OMI-zones and if these are somewhat correlated to the Google trends index. To divide the OMI-zones in the two categories, the index Touristic Attractions TA (introduced in Chapter 3) can be used: the less touristy OMI-zones are the ones with an undefined index (therefore they don't present any touristic attraction) plus the ones with an index under 1, while the most touristic ones are the one with an index above 1. For each OMI-zone, both touristy and less touristy, the average number of listings for each year is calculated; in Figure 4.1, the average of listings in each zone, both touristy and less touristy, is plotted as a function of Airbnb popularity, using once again Google Trends, which summarises the Trend for the query "Airbnb Firenze" worldwide for each year. There is a positive trend for both the categories between average number of listings and popularity of the platform over the years analysed; for the touristy OMI-zones the trend is more significant, with the average of number of listings almost doubling in the span of four years.
This confirms that the number of Airbnb listings in both categories rises with the rising of Airbnb popularity.

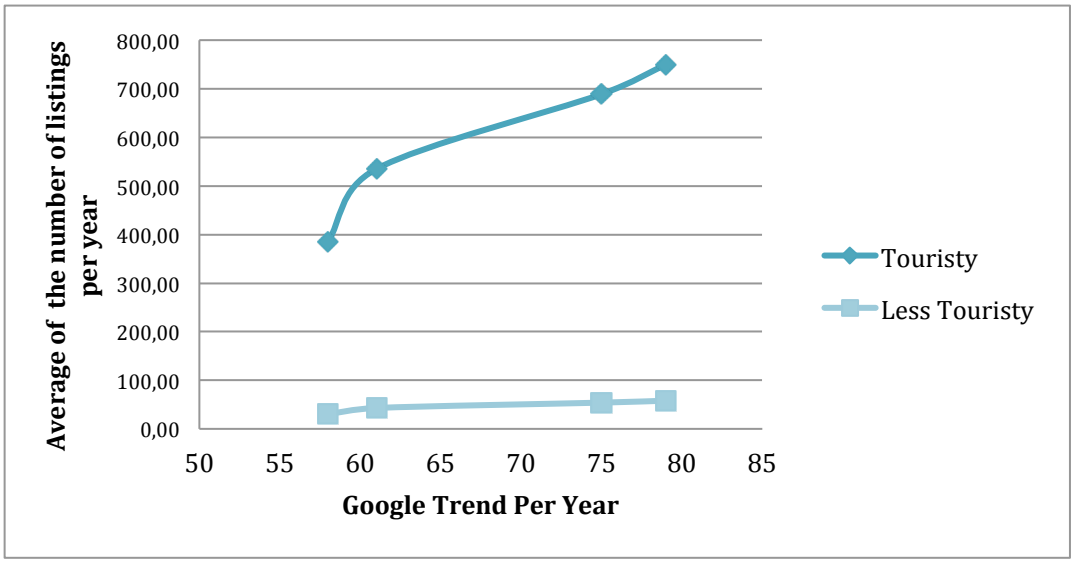

Figure 4.1 – The Average of number of listings per year for Touristy and Less Touristy OMI-zones in function of Google Trends.

Furthermore, it is useful to plot both rents and house prices for both touristy and less-touristy OMI-zones, comparing them, as a function of the number of listings in said zones over the years, in order to see if there is any correlation with the "touristiness" of a zone; the plots for rents are shown in Figure 4.2 and 4.3: in the touristy zones, there seems to be a positive significant trend between the two, with a positive 15% increase, while in the less-touristy ones there is also a positive trend, but less significant, as the rising of rents stays under 3%.

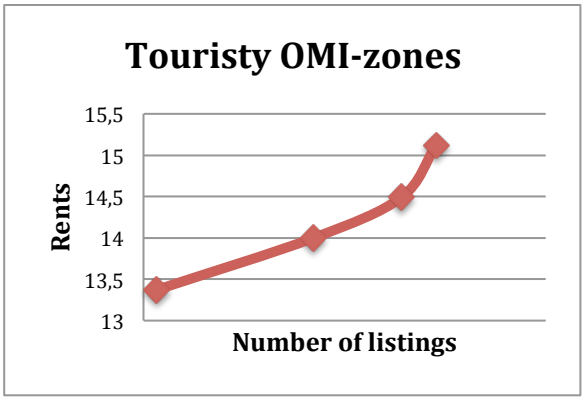

Figure 4.2 – The trend for rents over the years in function of the number of listings in the touristy OMI-zones

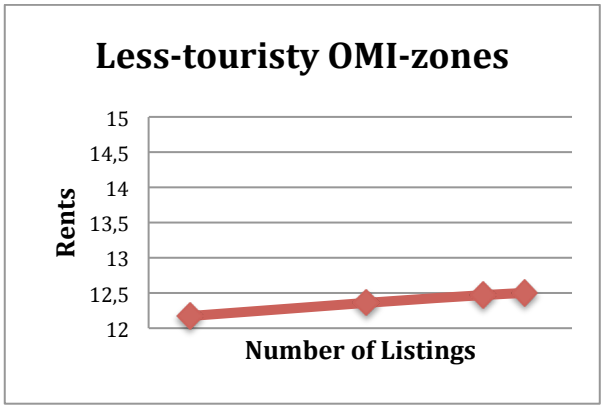

Figure 4.3 – The trend for rents over the years in function of the number of listings in the less touristy OMI-zones

Meanwhile, analysing house prices in Figure 4.4 and 4.5, there is a clear difference between touristy and less touristy OMI-zones: while the former shows a clear positive trend, the latter shows no particular trend. This should forecast a higher efficiency of the instrument for the regression of House Prices.

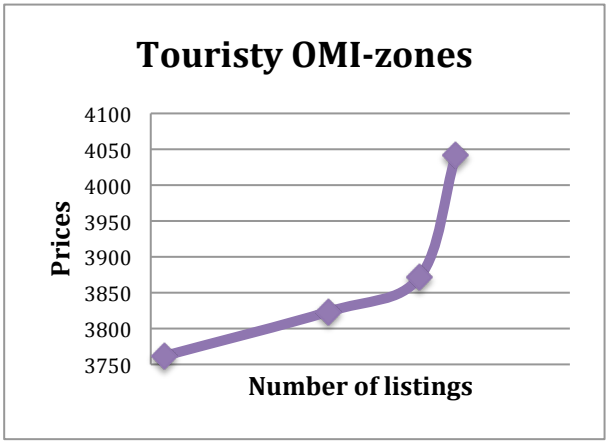

Figure 4.4 – The trend for house prices over the years in function of the number of listings in the touristy OMI-zones.

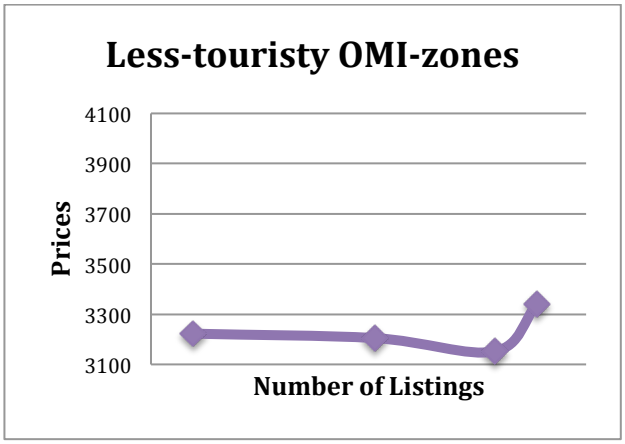

Figure 4.5 – The trend for house prices over the years in function of the number of listings in the less touristy OMI-zones.

4.2 First Results: Ordinary Least Square Regression

First, the results using Ordinary Least Square Regression are shown in Table 4.1 and Table 4.2, for the impact of Airbnb respectively on Rents (Panel A) and on House Prices (Panel B); as specified in equation 4.2, the regression implies a fixed-effect model which controls for both OMI-zone and year-month fixed effects.

In column 1 the results for the dependent variable *AirbnbListings* for both Rents in Panel A and House Prices in Panel B show positive and significant coefficients: this implies that an increase in the number of listings translates in an increase in rents and prices. The effects on prices are slightly larger than on rents.

In column 2 the Residents controls are added, which lead to an increase in both the coefficients of rents and prices, even if not a statistical significant one.

In column 3 and 4 the controls for Extra-hotel tourists (alone in column 3 and together with the residents control in column 4) are added as well, which show no effect on coefficients neither on rents nor prices.

Therefore, these results seem to confirm that a higher number of Airbnb listings leads to increases in both rents and house prices, with this latter effect being a little larger than the former.

Focusing on the results in column 2, the economic size of these results imply that an increase of 100 Airbnb listings leads to a 0,7% increase in rents and a 0,8% increase in house prices.

Table 4.1 – Panel A: The effects of Airbnb presence on rents using OLS.

PANEL A: RENTS

	Dependent variable:			
	log(RENTS)			
	(1)	(2)	(3)	(4)
AIRBNBLISTINGSx100	0.005^{***}	0.007^{***}	0.005^{***}	0.007^{***}
	(0.001)	(0.001)	(0.001)	(0.001)
log(Residents)		1.376^{***}		1.376^{***}

		(0.380)		(0.380)
log(ExtraHotelTourists)			0.304***	0.369***
			(0.049)	(0.052)
Observations	1,085	1,085	1,085	1,085
R^2	0.240	0.250	0.240	0.250
Adjusted R^2	0.192	0.201	0.192	0.201
F Statistic	9.201*** (df = 35; 1019)	9.417*** (df = 36; 1018)	9.201*** (df = 35; 1019)	9.417*** (df = 36; 1018)
Note:				*p**p***p<0.01

Table 4.2 – Panel B: The effects of Airbnb presence on house prices using OLS.

PANEL B: HOUSE PRICES

	Dependent variable:			
	log(PRICES)			
	(1)	(2)	(3)	(4)
AIRBNBLISTINGSx100	0.006***	0.008***	0.006***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)
log(Residents)		1.170***		1.170***
		(0.159)		(0.159)
log(ExtraHotelTourists)			0.089***	0.145***
			(0.021)	(0.022)
Observations	1,085	1,085	1,085	1,085
R^2	0.256	0.293	0.256	0.293
Adjusted R^2	0.208	0.247	0.208	0.247
F Statistic	9.993*** (df = 35; 1019)	11.723*** (df = 36; 1018)	9.993*** (df = 35; 1019)	11.723*** (df = 36; 1018)
Note:				*p**p***p<0.01

4.3 Mechanism

As discussed throughout the analysis, the main mechanism that leads to an increase in rents and housing prices is most likely the fact that the short-term rental market is more profitable than the long-term one, which means that units that once were part of the long –term rental offer are shifting towards the short-term thanks to home sharing platforms like Airbnb; ideally, this would mean that to prove this concept it would be necessary to look at the number of units rented to residents; however, this data is not available, so what could be analysed is the number of residents in each OMI zone per year-month in the time frame available. The impact of Airbnb listings on the number of residents is presented in Table 4.3: the coefficient is negative and significant, which means that an increase of 100 Airbnb listings causes a decrease of 0,2% in the number of residents. This data seem to confirm the mechanism explained of switching from long-term to short-term rentals.

Furthermore, this negative coefficient also suggests that Airbnb is to some extent influencing the phenomenon of relocation and gentrification in the city of Florence.

Table 4.3 – The impact of Airbnb presence on the number of residents.

	Dependent variable:
	log(Residents)
AIRBNBLISTINGSx100	-0.002***
	(0.0001)
Observations	1,085
R^2	0.702
Adjusted R^2	0.683
F Statistic	68.660*** (df = 35; 1019)
Note:	*p**p***p<0.01

4.4 IV approach: the instrumental variable results

As introduced above, an instrumental variable approach can also be used, where the independent variable *AirbnbListings* is instrumented with the interaction between a cross-sectional tourist attractiveness index and a time series element, which consists in the Google Trend searches for "Airbnb Firenze" worldwide.
The results are shown in Table 4.4 for rents and in Table 4.5 for prices; in column 1 the regression considers both OMI-zones and year month fixed effects; in column 2 and 3 the same controls specified in section 4.1 are introduced.

Table 4.4 – Panel A: Results for the presence of Airbnb on rents, where AirbnbListings is instrumented with the interaction between the Touristic Attractions Index and Google Trends.

PANEL A: RENTS (INSTRUMENTAL VARIABLE)

	Dependent variable:		
	log(RENTS)		
	(1)	(2)	(3)
AIRBNBLISTINGSx100	0.004	0.006*	0.006*
	(0.003)	(0.003)	(0.003)
log(Residents)		1.259**	1.259**
		(0.509)	(0.509)
log(ExtraHotelTourists)			0.370***
			(0.052)
Observations	1,085	1,085	1,085
R^2	0.240	0.249	0.249
Adjusted R^2	0.192	0.201	0.201
F Statistic	309.638***	316.612***	316.612***
Note:		*p**p***p<0.01	

Overall, the results are very different for the two panels. In Panel A, the use of the instrument keeps the coefficients positive, but they become not significant. As discussed in section 4.1.1, through Figure 4.2 and 4.3, both touristy and non-touristy OMI-zones present a positive trend of rents in function of Airbnb listings; meanwhile, through Figure 4.4 and 4.5 it is clear that touristy zones present a positive trend for house prices which is not mirrored in less-touristy zones; subsequently, Panel B shows that the instrument keeps the coefficients both positive and significant, even if slightly decreased in the specification in column 2 compared to the one in section 4.2, but not in a statistically significant way.

Table 4.5 – Panel B: Results for the presence of Airbnb on house prices, where AirbnbListings is instrumented with the interaction between the Touristic Attractions Index and Google Trends.

PANEL B: HOUSE PRICES (INSTRUMENTAL VARIABLE)

	Dependent variable:		
	log(PRICES)		
	(1)	(2)	(3)
AIRBNBLISTINGSx100	0.006***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)
log(Residents)		1.024***	1.024***
		(0.214)	(0.214)
log(ExtraHotelTourists)			0.146***
			(0.022)
Observations	1,085	1,085	1,085
R^2	0.255	0.291	0.291
Adjusted R^2	0.207	0.245	0.245
F Statistic	219.099***	233.365***	233.365***
Note:			*p **p ***p<0.01

The validity of the instrumental variable can be tested through the standard rule of thumb (Angrist and Pischke, 2008), which consists in checking the F-test of the first-stage results of the instrumental variable: in this first-stage, the independent variable is regressed directly on the instrumental variable; the results are shown in Table 4.6. The F-statistic is above 10, which confirms that the instrument is not weak and predicts well when and where Airbnb listings will appear.

Table 4.6 – First stage results for the instrumental variable.

	Dependent variable:
	AIRBNBLISTINGSx100
GoogleTrend:AttractionsIndex	0.0001^{***}
	(0.00001)
Observations	1,085
R^2	0.387
Adjusted R^2	0.348
F Statistic	18.417^{***} (df = 35; 1019)
Note:	$^{*}p^{**}p^{***}p<0.01$

5. Regulation of the short-term rental market

Because of fear of gentrification, relocation and housing stress, home sharing and in particular Airbnb, have been at the centre of many discussions in different cities around the world, facing the importance of regulating the short-term rental market: the regulation implies registration of hosts, so that cities can monitor and keep track of the listings, but also the collection of taxes.

In many countries the measures aiming at regulation also involve limiting the number of days that a residential home can be listed as a vacation rental. In this way, fewer units should be taken out of the long-term rental market to be offered on the short-term one.

The first problems that Airbnb had to face were in San Francisco, hometown of the platform. Here, the city banned residential rentals of less than 30 days in multi-unit buildings, making most of Airbnb listings illegal, until 2015, when an ordinance was enacted to legalize short-term rentals, under some restrictions: only permanent residents of San Francisco could become short-term hosts, and they were allowed to offer only their primary residences on the platform, not vacation or secondary homes. Furthermore, San Francisco short-rental law now limits rentals where the host is not present in the unit to a maximum of 90 days.

The situation was a bit more difficult in the city of New York, where the company found itself in many legal battles with the State government. In 2016, the Multiple Dwelling Law was passed. This law defines a “dwelling” as any building or structure, occupied in whole or in part as the home of one or more human beings. A “multiple dwelling” is a dwelling either rented, leased or occupied as the residence of three or more families living independently. A “class A” multiple dwelling is a multiple dwelling occupied for permanent residence purposes. The Multiple Dwelling Law restricts renting out and even simply advertising a “Class A multiple dwelling” for periods of fewer than 30 days, if the host is not present. Furthermore, the New York City Office of Special Enforcement set out a Zoning Code to regulate the number of listings in particular zones of the City. The company itself decided voluntarily to implement a “One Host, One Home” program for entire home listings in New York: hosts citywide are only allowed to list entire home listings at one, discrete address, deactivating or suspending all accounts found in violation of this policy.

Similar measures have been taken around Europe: for example, the City of Amsterdam recently limited the listings of entire homes as vacation rentals for a maximum of 30 nights per year, unless a specific permit has been allowed by the City itself. Also, according to the Amsterdam Housing Regulations, the city requires a notification every time an entire home is listed on the platform.

In Berlin, a specific act signed in 2018 prohibits the use of living spaces for unauthorized purposes and regulates the use of residential property. According to this act, hosts are required to have a permit to rent out an entire residence on a short-term basis, even in the case of secondary residences. The act doesn’t specify a limit for how many days someone can rent their primary residence to guests, meanwhile for secondary residences there is a clear limit of 90 days a year.

In London, in most cases, it’s considered a “change of use” using residential premises as temporary sleeping accommodation. However, the Deregulation Act of 2015 states that all the properties used as a short-term rental for 90 or fewer nights per year are to be considered exceptions to the “change of use”.

5.1 Regulatory approaches

The regulation of short-term rental markets can be mainly identified in four types of approaches (Nieuwland and van Melik, 2018):

- Quantitative restrictions, which include limiting the number of listings, of guests, of days rented or times an Airbnb can be rented out in a year;
- Locational restrictions, which basically tend to confine the listings to specific locations;
- Density restrictions, which limit the number of listings in certain zones or neighbourhoods;
- Qualitative restrictions, which limit the type of listing that can be rented short-term (for example a single room can be rented out, but not an entire apartment/house), or other types of impediments, for example having to get a permit or license to rent out.

The different types of approach in regulating home sharing change depending on the issue each location chooses to focus on. Some cities may find Airbnb useful in attracting more tourism and stimulating the local economy, but still they would like to regulate the taxation and security issues that come along (Oskam and Boswijk, 2016).
Nieuwland and van Melik (2018) examine short-term rentals regulation in 11 American and European cities and conclude that most cities share the same interest in protecting residents from housing stress perceived by the higher density of Airbnb listings. In general, their results find that no city has an interest in banning short-term rentals altogether, but they would like to stimulate Airbnb positive effects for the tourism industry, while mitigating the negative ones, focusing mainly on preserving affordable housing for residents. They conclude that the rationale behind the approach in regulation must differ according to the city characteristics. They also found that European cities tend to be more lenient towards short-term rentals compared to the American ones, where restrictions are more
Furukawa and Onuki (2019) analysed both Airbnb and socio-economics data from 17 American cities, and found out that the rigour of short-term rentals regulation is positively correlated to some social-economic indicators: for example, in cities where the lodging industry constitutes more than 1% of the local economic, or where the increase in rents and house prices are more prominent and tend to be more of a popular discussion, the regulation tends to be stricter. Also according to their analyses, the enforcement of regulation remains the most difficult problem, because the nature of peer-to-peer transactions makes the monitoring of hosts and guests behaviours highly expansive.

5.2 Regulation in Italy

In Italy hosts are required to collect their guests' identifying information during check-in, including a copy of their passport or identification document. This information is then submitted to the state police web portal where each host must be registered through the local police headquarter. If the duration of the rental is under 30 days the host has to prepare a written short-term rental contract, which the guests need to sign at check-in; the contract is not subject to tax office registration unless guests are staying for more than 30 days.
The conversation about regulating the short-term rental market has been different in each Region of the country: for example, in Tuscany an identification code has been required for each unit that enters the platform (not only for Airbnb, but for all vacation rentals platforms

and OTAs) so that they can be able to map and track the phenomenon. At the end of 2018, the region of Tuscany has also introduced a form that all hosts have to fill within 30 days from the first booking, to communicate the number of beds available in the unit they intend to rent on any home-sharing platform. This type of form has been introduced in different regions as well, and in some of them it is clarified that hosts that will not give this information could be sanctioned with fines up to 2000 euros.

In 2019, a decree-law introduced the idea to create a national database available to the Italian Revenue Agency (Agenzia delle Entrate) to identify each host all over the Country, using the data collected both from the communications to the Police Headquarters and the different forms each region has decided to introduced to track the listings. This data will be useful for each city council in order to collect taxes, but also to monitor the effects of short-term rental market, especially in the most touristic zones of the country.

While these seem to be good solutions for tracking short-term rental intensity, no city seems to have yet come up with restrictions of any type for home sharing. Analysing the case of Firenze, which, as was previously shown, tends to have its most touristic zones at the centre, a density restriction for the number of Airbnb in the most central zones could be useful to soften the effects on rents and prices.

Conclusions

The effects of home sharing on both long-term rental and real estate markets continue to be interesting topics for each city, especially in the context of its possible regulation. The mechanism analysed throughout this thesis, is the conversion of long-term rentals in short-term units, which causes a reduction in the offer side of the long-term rental market, leading to an increase of prices. Furthermore, the opportunity of offering a unit in the short-term rental market becomes an additional income for a potential buyer of a unit, therefore eventually increasing prices in the real estate market as well.
The mechanism of conversion is incentivised by the possibility to rent out on Airbnb (as well as other OTAs) entire homes and apartments on the platform; in this way, the traditional "home sharing" idea introduced by the founders, which involved the presence of an on-site host renting out additional space he had to visitors, became less popular, therefore leading many to choose the short-term over the long-term rental market for their unit.
Analysing the case study of Firenze, what comes up is that approximately 72% of all listings available consist of entire homes and apartments. Moreover, 51% of hosts present on the platform offer one entire home or apartment, while on-site hosts represent less than the 17%. The remaining 32% offers more than one home/apartment or private room.
In the city of Firenze the neighbourhoods presenting a higher index for touristic attractions (the most central ones), which also present higher density of Airbnb listings, are the ones that present rising rents and house prices in the period of time analysed. Rents have been rising at a faster pace than house prices, which leads to an increase in profitability rates as well. This means that in the future house prices may continue to increase, because more people will be willing to buy based on the rising profitability rates which are interesting indexes to take in consideration for possible investments.
Using a Fixed Effect Model for Regression applied on the Case Study of Firenze, the findings shown in Chapter Four indicate that an increase of 100 listings in a zone of Firenze causes an increase of 0,7% for rents and of 0,8% for house prices. Adding an instrumental variable to the model, the effect for rents becomes not significant, while the one for house prices stays significant and slightly decreases, even if not in a significant way.
Since these topics have been at centre of discussion for many cities, especially the most touristic ones, some degree of regulation has begun to appear around the world to absorb the negative effects of short-term rentals: different types of restrictions (on the number of listings in a particular zone of the city, on the number of days a host can rent for in a year, on the type of listings offered by hosts, etc.) have been taken in consideration depending on the prevalent type of local issue the city has been suffering from.
In Italy, however, even if many regulations have been taken for keeping track of the number of listings with regular registration of hosts, no clear restriction is present in any city or region around the Country. In the Italian most touristic cities like Firenze or Venezia, certain types of restrictions for the most central zones could be useful to prevent the effects of housing stress on residents.

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Many thanks to the Future Urban Legacy Lab, in collaboration with Politecnico, for making the data regarding Airbnb listings available.

Ringraziamenti

Dopo anni e anni, finalmente la mia avventura al Poli finisce qui. Questo percorso insidioso mi ha insegnato tanto, mi ha fatta crescere (come si dice a Sassari, “a mala gàna”), ma soprattutto mi ha permesso di conoscere tante persone meravigliose e diciamolo… Mi ha cambiato la vita.

In primo luogo vorrei ringraziare il mio Relatore, il Professor Luigi Buzzacchi per la disponibilità, la gentilezza e la professionalità con cui mi ha seguita in questo lavoro.

Un ringraziamento speciale alla mia famiglia, senza la quale non sarei potuta essere qui: mio Padre (per il sostegno economico oltre che quello morale), i miei fratelli Simone, Paolo, Giorgio e mia sorella Roberta.

Un grandissimo grazie a Zia Anna che in questi ultimi anni è stata un punto di riferimento importantissimo qui a Torino, e negli ultimi mesi di stesura tesi (con annessa quarantena) mi ha ospitata, supportata (e sopportata).

A Paola, senza la quale la mia vita a Torino sarebbe completamente diversa, a Elena, Zio Lelio e soprattutto Nonna Anna.

A tutto lo Zander (lista di nomi troppo lunga!), al quale dedico questa tesi, per tutti gli anni di avventure e per tutti gli anni che verranno.

A tutti i miei amici della Sardegna, Rina, Carla, Erica, Ale, Vero e Marco, lontani ma sempre presenti.

A Francesco, per aver assistito a ogni crisi esistenziale causata dal Poli. Sai che non mi piace essere smielata (e oltretutto a te non piace leggere), quindi mi fermerò qui. Un grazie anche alla famiglia speciale di Francesco che mi ha accolta come una figlia.

Insomma, a ogni persona che mi abbia anche solo un pochino incoraggiata in questi lunghissimi anni, che in fondo però sono volati. Grazie.

Dedico come sempre un pensiero alla mia Mamma. È difficile superare un altro traguardo senza lei al mio fianco, ma i suoi insegnamenti e il suo amore incondizionato vivono ancora dentro di me.

Francesca