(Con)temporary Housing: The AirBnb Phenomenon and Its Impact on the Naples Historic Center's Rental Market

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Abstract. Some significative historical events have contributed to radical changes in people life (industrial revolution, great depression of the 1920s, world wars, digital revolution, American subprime crisis of the 2000s, COVID-19 pandemic, war in Ukraine). All this at the same time as the unprecedented acceleration of digital technological development. This has led to the birth of new forms of economy, which have made it possible in many cases to fill the income gaps caused by the post-crisis aftermath. The study aims to provide a general overview of "home sharing", and subsequently focusing on the real estate market of Naples by comparing, through geoadditive statistical models, the spatial distributions related to the real estate incomes of two forms of distinct rent: short-term, traditional long-term. The analysis is conducted with reference to the latest data available for 2020, before the COVID19 pandemic, as for about two subsequent years the tourism sector was overwhelmed by uncontrollable and non-ordinary dynamics. Preliminarily, the paper deals aspects linket to urban changes, gentrification, touristification, rent gap, home sharing and Airbnb phenomenon and the influence it has had on the most relevant turistic realities.

Keywords: Gentrification · Touristification · Rent Gap theory · Short and long-term rental · AirBnB · Geoadditive models

1 Introduction

Man, by his nature, is the living being with the greatest ability to adapt to new situations, to unknown and often not easily modifiable problems, to environmental conditions of all kinds. Certainly not only for his potential and biological and physical characteristics, but rather for the great variety of behavioral responses that he can implement and for the high dynamism by nature intrinsic in the behavior of the human being.

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In 1927 Scheler considers man as a being different from all other animals due to his ability to escape from environmental enclosure [1]. According to Scheler, man differs from animals not in intelligence, which animals also possess to a greater or lesser extent, but in being a creature open to the world without a predefined essence; while the animal lives entirely within its environment, like a snail in its shell, man possesses a world and not an environment. In this world, man has adapted in order to satisfy his needs, which in turn have evolved over time due to historical, anthropological and economic changes.

We can identify multiple historical events that have contributed to radical changes in society and therefore in the individual; the industrial revolution, the great depression of the 1920s, the world wars, the digital revolution, the American subprime crisis in the end of the first decade of the 2000s, the COVID-19 pandemic, the war in Ukraine with the consequence of crises both energy (supply of natural gas) and economic (inflation linked to the increase in the cost of raw materials and fossil resources). Events that, in one way or another, have radically influenced the world economy and, in detail, the way of life of the individual [2].

All this at the same time as the unprecedented acceleration of digital technological development.

This has led to the birth of new forms of economy, which have made it possible in many cases to fill the income gaps caused by the post-crisis aftermath. This is the case of the sharing economy, more specifically of "home sharing", and this study focuses also on this.

The study aims to provide a general overview of this phenomenon, certainly by the best known but rarely explored, and subsequently focus on the real estate market of Naples by comparing, through a geo-additive statistical model, the spatial distribution related to the incomes of two forms of distinct leases: short-term rental (STR) and the traditional lease, or long-term rental (LTR). The analysis is conducted with reference to the latest data available for 2020, before the COVID19 pandemic, as for about two subsequent years the tourism sector was overwhelmed by uncontrollable and non-ordinary dynamics.

As a preliminary point, however, it is necessary to analyze the phenomenon in its generality, focusing on the effects of the new market on urban, anthropological and economic spatial systems, maintaining a reference system on a metropolitan scale. We want to refer on the phenomenon of gentrification, of how urban and socio-cultural changes influence city centres, alienating the traditional inhabitants in favor of a more affluent social class with a consequent loss of tradition in the neighborhoods in question. We want to put a magnifying glass on tourism, therefore on the influence of unbridled low-cost tourism on the historic city centers and how it has inevitably conditioned the real estate market. Subsequently, the investigation scale of home sharing narrows down to the Airbnb phenomenon, the giant of the short-term rental market, and the influence it has had on the most relevant italian and global urban realities.

2 Urban Changes

2.1 What Social and Sharing Phenomena?

The city can be defined in many ways, and every definition can be correct.

The multiplicity of definitions derives from the possibility of highlighting only some of the many features characterizing the city. By highlighting, for example, the dimension and physical density, a settlement can be defined considering as buildings set placed close to each other, or the place where men have transformed spaces more and more densely to improve their living conditions. Therefore, the city has become an exchange place for relationships, as well as for commercial, cultural, productive, and social links [3].

It is an open, dynamic and highly complex system, made up of a set of related components. To say that it is a dynamic and complex system means to affirm that the city can be traced back to a set of components in relation to each other, that the processes of the system are not manageable and controllable with deterministic tools and, lastly, that the future evolution of the system city is not predictable linearly on the basis of knowledge of the initial conditions.

The city changes: from the "polis" of ancient world, passing from the static organizational structure of medieval walled city and from the ideal city theory in the 18th century, understood as possible alternatives to pre-existing cities. Furthermore, from the end of eighteenth century the changes become dynamic due to the revolutions that affect all aspects of city life: economic, political, scientific, industrial, and demographic (it is in this period that the European population passes from 180 million in 1800 to 400 million of 1900). And it is precisely from the industrial revolution onwards that the city begins to take on the appearance of modern city, the one we live today. And the changes that invest it become more and more sudden, becoming uncontrollable and unpredictable. Globalization and digitalization are the phenomena that have upset the city in recent decades and that have contributed most to accelerating the dynamics of change of all the components of which the city system is composed, also giving rise to the phenomena of "gentrification" and "touristification".

2.2 Gentrification

In sociology, the term gentrification indicates the set of urban and socio-cultural changes in an urban area traditionally popular or inhabited by the working class, resulting from the purchase of properties by more rich people [4].

The term gentrification was introduced by the English sociologist Ruth Glass in 1964 to describe the physical and social changes in a London neighborhood following the settlement of a new middle-class social group [5]. Ruth Glass identified gentrification as a complex process involving the physical improvement of housing stock, the change of housing management from rental to ownership, rising prices, and the removal or replacement of the existing working-class population by the middle-classes. These changes do not occur only in the urban suburbs, but above all in historic centers and central districts, in areas with a visible deterioration from a building point of view and with low housing costs. As these areas undergo redevelopment and urban improvement, they tend to bring in new high-income residents and expel old low-income residents,

who can no longer afford to reside there. It is a process of progressive socio-spatial transformation, which can take several years to produce a new image of the place on which it insists. Furthermore, its effects on the urban fabric and on the resident population can vary greatly according to the contexts and the type of "gentrifiers" involved (university students, artists, highly skilled workers, etc.).

Rents and house prices soar, large chain stores and sophisticated restaurants begin to crowd the area, gradually replacing the popular neighborhood shops. The result is a generalized increase in the cost of living which makes it very difficult for the old inhabitants of the neighborhood to continue to reside there.

When we refer to gentrification, we must also consider another fundamental aspect: that of displacement of the less well-off residents of the neighborhood, usually towards the suburbs.

A series of effects are therefore created, which can be traced back to the phenomenon in question, which depend on the characteristics of the new inhabitants, the connotations of the neighborhood and the relationships that are established between these two elements. Certainly, a common effect of gentrification is the aesthetic and functional improvement of the area concerned [4]. The neighborhood is redeveloped through the action of private individuals, through specific public projects or through public-private partnerships. The fight against degradation, architectural improvement, the orientation towards greater urban decorum are topics that develop in many political contexts, and which generate a series of institutional responses.

It is a process that develops on a neighborhood scale and which involves its physical (through the rehabilitation of the built environment), social (through the replacement of the population) and economic (following the change in prices in the real estate market) transformation. Hence the interest in the phenomenon on the part of various scholars, such as urban planners, sociologists, economists and geographers.

In 1987, Smith defined it as a process of urban transformation that involves changes in the structural characteristics of buildings, variations in the real estate market and the replacement of the original residents with new residents belonging to another social class [6]. With reference to the aesthetic improvement of neighborhoods in order to satisfy the taste of the new middle-class that settles there, gentrification has also been defined as "trendification" [7] or "yuppification" [8].

2.3 Touristification

By touristification we mean the phenomenon that is taking hold in many cities of the world, closely related to gentrification, through which cities, or more specifically the historic centers of cities, are literally invaded by the tourist flow causing a series of problems connected to the inability of the neighborhoods themselves to cope with this situation. It is a process by which a place becomes an object of tourist consumption, thus bringing about profound changes to the morphology and economy of that place [9].

In the last decades, many cities have opted for growing tourism as a way to cope with the growing economic decline and to intensify competitiveness in a context of economic globalization. Growing masses of visitors arrive in the cities, especially in the high season and, consequently, the negative perception that residents produce towards tourism is growing. Among the positive effects of this phenomenon there is certainly

the strong contribution to the economy of the cities concerned through the creation of employment in terms of work, in fact, tourism is very often the major or even the only source of local economic development in many cities and is the driving force behind significant urban renewal. But, despite the positive contributions, in recent years the debate has grown regarding the negative consequences of mass tourism in certain places, surrounded by demonstrations of intolerance by the locals towards unbridled tourism.

Many of the criticisms of urban tourism are related to the fact that the concentration of this phenomenon is often enclosed in very small areas of the city, overloading the services present in these areas and creating inconvenience for the population, especially during the high season. During which the infrastructures become saturated, and the traffic becomes congested, causing severe problems for the livability in the areas concerned. In addition, very many visitors also have a significant impact on the environmental sustainability of the place.

From a social point of view, tourism can cause strong economic imbalances between the city center and its hinterland, and this can lead to the initiation of a migratory phenomenon from rural areas and an important loss of the specific traditions of that place.

These imbalances are related to the new forms of dependency between centers and peripheries.

Mass tourism contributes to an increase in the demand for accommodation, which can be addressed both by the presence of large hotel chains and by the conversion of apartments into short-term rental adverts and all of which we know is the cause of gentrification. Tourist interest in city centers and especially in the architectural heritage contained therein is also related to the growing tendency, in a situation of global capitalism, of exploitation of cultures. This "mass cultural consumption" is connected to urban tourism since cities are places where "cultural products" are developed.

Some cities have tried to mitigate the negative effect of "overtourism" through urban planning which, together with a correct management of "intended uses", is the most useful tool for being able in some way to counter the incessant advance of the phenomenon concerned in urban centres.

Most tourists look for accommodation that is not far from the major historical points of interest and this does nothing but favor the accommodation facilities located within the city center to the detriment of those located in the peripheral suburbs.

When urban planning does not take into account this type of analysis and is focused solely and exclusively on short-term profit, rapid changes in the central areas of the city can lead to a degenerative vicious circle and potentially, due to overcrowding, negative change the feelings of the resident population towards tourism.

The dramatic increase in the number of tourist apartments is a particularly controversial topic also due to the problems that can exist between residents and short-term visitors, such as noise, anti-social behaviour, use of common facilities, etc. Studies on this topic show that the major dissatisfactions from the point of view of residents are excessive property prices and rents, shop prices, lack of hygiene, urban decay, lack of human respect, insecurity, noise, without neglecting the loss of the historical identity of the place [9].

2.4 Rent Gap

The concept of rent gap is closely related to that of urban gentrification. In contrast to other hypotheses on this question, which explain the phenomenon in terms of demand and preferences of users who opt to return to the city after a disappointing life in the peri-urban countryside, in 1979 Neil Smith assumes a logic of offer according to which it is the capital invested in the degraded areas that triggers the process on the basis of the growing gap between the current rent, depreciated by the degradation, and the potential rent that could be realized after the intervention [10]. Classical theory, especially the contributions of Ricardo and Von Thunen, has always considered land rent as essentially generated only by the demand for accessibility [11]. Proximity to the urban center therefore, maximizing the "position value" indicated by Marshall [12] and minimizing transport costs [13], would represent a certain advantage capable of guaranteeing the stability or growth of real estate values over time. The classical theory, however, is unable to explain the presence of deteriorated neighborhoods in central areas of the city, nor the fluctuations of rent values in comparative terms between the various parts of the city having the same distance from the centre [14]. In various Italian cities, in central areas, highly degraded neighborhoods are found both from a social and an economic/environmental point of view. Obsolescent buildings welcome increasingly poor and marginalized inhabitants, commercial services close or move; degradation advances in public places and increases the level of crime and vandalism and, as result of all this, real estate values collapse [15–17].

However, it may happen that signs of improvement begin to appear with a gradual positive transformation of both public spaces, which begin to be exploited for innovative activities, and private spaces through increasingly frequent renovations. This turnover begins to attract a younger and more socially inclusive population, able to cope with the price increase in the neighborhood under analysis.

The phenomenon does not manifest itself in flashes and in reference to a single building or block but concerns entire neighborhoods. The whole process appears as the result of the interaction of many individual decisions that influence each other within a given spatial limit. For years, the question has been whether the gentrification process is a demand-driven or a supply-driven process. The debate has always taken one side or the other, with the supporters of the question essentially represented by exponents of sociological studies, such as Ley [18] or Lipton [19], who claim that the cause is the desire to return to live in the city center of the middle class, which moves again from suburban villas to urban centres (demand). The supporters of the offer mechanism, of which Smith is the spokesman [6], state that it is capital which, under certain conditions, can find it convenient to invest in degraded districts of the city and subsequently promote a redevelopment of these areas to favor a turnover population of the highest social class and therefore make a profit on the investments made.

2.5 Home Sharing

The digital economy is closely linked to the diffusion of information and digital technologies. These new technologies are the means by which the so-called digital revolution

began, which has radically and rapidly changed not only our daily life, but also some of the founding concepts of cultural tradition.

E-commerce, social networks, crowdfunding and sharing economy are now terms permanently present in our vocabulary, but if they are analyzed ex-ante it is immediate to understand how these have had such a sudden development, adapting perfectly to the socio-economic changes of the third millennium, going to fill the needs of the individual, fitting perfectly with the progressive liberal wave of today, albeit contradicting the anti-capitalist principles of which the latter is characterized.

Home sharing is the short-term practice of renting one's home to tourists and travellers, an economic model spread through various digital platforms that act as intermediaries in the market between private individuals in exchange for an economic consideration paid in the form of a commission. It represents a way for owners to supplement their income and for travelers to save on accommodation (compared to an authorized structure).

However, to better understand the phenomenon and the meaning of home sharing, it is appropriate to deepen the concept of sharing economy. In particular, the sharing economy can be defined as an economic system based on the sharing, free of charge or with fee, of underutilized services or properties directly by private individuals [20].

It is a term applicable to various economic sectors and can be explained in many words: gig economy, on demand services, peer to peer economy, sharing mobility and, obviously, home sharing. It is a concept that has been gaining ground in recent years, declined in various ways and applied to various economic and social sectors. Thus, a series of contiguous, analogous, or parallel definitions have developed, differing from each other only in the type of service or product offered. The sharing economy can be defined as a new economic approach that promotes more conscious forms of consumption based on reuse instead of purchase and access rather than ownership, therefore it indicates an emerging economy based on the sharing of private resources, both material (such as the apartment, car, bike, desk), and intangible (provision of services, jobs, etc.). The form of innovation of these activities lies in the scale on which it operates, which is not limited to a more or less wide geographical context, but extends to cover the entire globe, putting completely strangers who live in distant places that do not know each other, thanks to the development and diffusion of new digital technologies, via computers, smartphones and tablets. This model aims to make itself an alternative to classic consumption by reducing the impact it produces on the environment around us.

The term was originally coined by Felson and Spaeth in a 1978 [21], even if their definition underwent changes as little related, due to the lack of perspective of new technologies, to what is currently provided. The advent of new technologies was the factor that had the most weight in the birth of this new type of economy. The birth of social networks has made it possible to facilitate communication, but also transactions and exchanges, in revolutionary way. These platforms, from places in which to communicate and share one's opinions, have transformed into real commercial places, where users become consumers, but also offerers of goods or services, which can be exchanged at a "click" in simplified and immediate way. Environmental aspects have also contributed to the development of the sharing economy model. Climate change, the unstoppable depletion of resources, the increase in population, highlight the need to set limits on the

unbridled consumption of newly manufactured goods or services and therefore to adopt more sustainable behaviours [22–24].

2.6 The AirBnb Phenomenon

Multinational born in San Francisco in 2008, Airbnb is the first digital platform aimed at connecting people looking for a shared accommodation or a room for short periods. In the short-term rental sector, Airbnb is certainly the pioneer and the most successful case. In 2011, Airbnb had already reached 50,000 listings and registered bookings for one million nights, mainly through listings in New York and San Francisco. In 2018, the site boasted nearly 5 million listings worldwide, rising to 6 million in 2019, in nearly 100,000 cities and 191 countries [25].

If San Francisco is the birthplace of Airbnb, New York is its first market. New York was one of the first cities to adopt gentrification as an economic strategy, as a true urban policy, at least starting from 1929, when the approval of the Regional Plan initiated the conversion of the industrial fabric into commercial and residential areas in all areas along the East River, i.e. Manhattan and Brooklyn.

Research by the Boston University Department of Economics has highlighted a causal relationship between the proliferation of Airbnb and house prices: every 12 listings on Airbnb by area corresponds to a loss of houses on the ordinary market of 5.9%, an increase rents by 0.4% and an increase in real estate values by 0.76%. Nationwide, researchers estimated that Airbnb contributed in U.S.A. to a 1% increase in rents and a 2% increase in house prices between 2012 and 2016. A further study based on the same metrics concluded that in New York Airbnb's growth between 2014 and 2017 resulted in an average rent increase of $ 380 per year [26].

According to Wachsmuth and Weisler [27], a house on Airbnb affects the cost of ordinary rent by creating a rent gap, as a tool for increasing real estate income, and then fills it with the increase in values throughout the area. Wachsmuth and Weisler concluded their study, which focused on New York City, by establishing that Airbnb facilitates gentrification and the expulsion of residents through the creation and then "closing" of rent differentials. Furthermore, unlike the traditional rent gap, AirBnB triggers gentrification dynamics even in the absence of an initial disinvestment situation, such as in already gentrified and touristized urban centers. In fact, to increase the real estate income with Airbnb, there is no need for large initial investments, but a change of use of the house and the possible eviction of the previous tenant is enough [25].

Italy is the third market in the world after the USA and France for short-term rentals [28, 29].

The historical connotation and the urban morphology of the cities has led to a greater density of advertisements in the italian historical centres. The scale of the concentration of advertisements in Italian historical centers has no equal in the world. In the urban area of the historic center of Rome, 8% of the apartments are rented on Airbnb. In Florence, 18% of the entire homes in the historic center are on the platform, but it is in Matera that the highest percentage of homes located in the STR is reached, even reaching 25% in the Sassi area. Matera is probably the most fitting example of what is happening to Italian historic centers which are literally emptying themselves of the original inhabitants

to make way for the tourist swarm, attracted by the characteristic European capital of culture 2019.

In recent years, the city of Naples has recorded the greatest increase in tourist presences in Italy (91.3%) after Matera. From 2017 to 2019, the listings more than doubled, reaching 7,169 in the latest Inside Airbnb registration, with the greatest concentration in the Montecalvario, San Ferdinando and San Lorenzo districts. Of the 7169 total listings in Naples, 58.9% are entire houses or apartments (4223), 40.4% private rooms (2897) and 0.7% shared rooms (49). Since there are no legislative limits in the municipal regulation, each host can decide to extend the availability of their home up to 365 days a year, so there is 92.2% of homes with high availability (>60 days/year), the 7.1% advertisements with low availability and a territorial average of 259.8 nights a year, i.e. 71.2%. The estimated number of nights per year booked on average per listing is 82, with an estimated occupancy rate of 22.6% and an estimated monthly turnover of 376 euros.

It is important to note that some Airbnb hosts may have more than one listing. A host can list more than one room in several listings, or more than one fully available house or apartment. It is likely that hosts with multiple listings are run as a real business and that the hosts do not live on the property itself, thus violating the terms of short-term rental regulations designed to protect affordability in the residential market. 58.7% of multiple announcements were detected in Naples. The growing success of the platform in the Neapolitan area is evidenced by the tourist boom in the years from 2017 to 2018, with a 46% increase in announcements, for an average length of stay per person of 3.2 nights.

3 Materials and Method

The most relevant areas of the city of Naples, in terms of number of real estate sales offers published, are the Vomero, Chiaia, Arenella, Posillipo, Fuorigrotta, Pendino, San Giuseppe, Bagnoli, and Pianura districts.

By far, the area most present in real estate sales offers is Vomero with over 2,678 total real estate sales offers among rent and sale. In total, as of 2020, there are 31,843 real estate sales offers in the city, of which 22,338 are for sale and 9,505 for rent, with an overall index of 33 sales offers per thousand inhabitants [30].

According to O.M.I. data [31], the price of apartments in the different areas of Naples is between 850 €/m^2 and 5,550 €/m^2 for the sale, and between 2.3 €/m^2 month and 13.4 €/m^2 month for long-term rent. The average price of the apartments for sale (2,800 €/m^2) is approximately 55% higher than the regional average quotation, equal to 1,800 €/m^2 and is also approximately 28% higher than the provincial average quotation (2,150 €/m^2). The asking price for individual apartments in Naples is extremely uneven throughout the city and in 40% of cases it is lower than €1,450/m^2 or higher than €4,000/m^2. As far as a long-term framework is concerned, the O.M.I. from 2006 to 2019 shows a strong decrease in both market values and rental values, for each building typology and for each area analyzed in this work.

All data relating to the Airbnb platform in this work was retrieved from the Inside AirBnb site [28]. The information that can be inferred from this portal is processed by data

scraping, an IT technique for extracting data from a website by means of special software programs. With Inside AirBnb you can easily access a series of detailed information such as: exact number of listings present in a city, with the relative typological distributions in percentage and in detail; an estimated average of the annual occupancy of individual advertisements, of the selected neighborhood or of the entire urban context; the average price per night; the employment rate estimated as a percentage; the estimated turnover per month; the annual availability of the posted ads; the percentage and detail of multiple ads. This information is assisted by an interactive map of the area containing each single advert which can be filtered by type, booking frequency, availability, multiple or single adverts and, of course, by neighbourhood.

The information sources used to collect information on the trend of long-term rent values in the Naples area are instead constituted by the Observatory of the Real Estate Market of the Revenue Agency (public law body controlled by the Italian Ministry of Finance), as well as by one of the main digital real estate portals on the national internet (www.immobiliare.it) [30, 31].

In our case, 54 rental announcements of residential properties located in Naples in the areas of San Ferdinando, Montecalvario and Chiaia were taken into consideration. Each advertisement contains: indication of the neighbourhood, exact address, monthly rental price, surface area in sqm, floor level, number of rooms, presence of lift, latitude and longitude.

It should be emphasized that the study carried out here refers, as far as AirBnb announcements are concerned, only to the data of entire homes, recovered as we know from the Inside AirBnb site, ignoring the rooms in apartments and clearly the shared rooms.

The intention is to highlight the differences between STR and LTR in terms of yield, and what influence the former have on the latter on the selected districts of the municipality of Naples.

Only announcements of entire apartments with an annual availability of no less than 300 days have been considered.

The occupancy rate used is the average recorded for each neighbourhood.

Therefore, by multiplying the occupancy rate with the number of days in which an ad is available, we obtain the estimate of the days in which the apartment is actually booked. By multiplying the latter with the price per night we obtain the annual gross income, which divided by 12, gives us the monthly gross income per advertisement (estimated). On this basis, for the most important listings, an estimate of what the gross revenue can be for each listing is obtained.

The relationship between geographical location and rental values of the STRs and LTRs are analyzed using a semi-parametric approach, based on a geo-additive model. These models consist of the sum of a semiparametric component in the form of an additive model, which serves to express the non-linear link between the response and the explanatory variables, and a linear mixed-effects model, with which the spatial correlation of the observed values [32, 33].

If s_i e y_i ($i = 1, \ldots, n$) are, respectively, the observed values of an antecedent variable and of the response variable corresponding to the spatial location x_i, ($x \in \Re^2$), a geo-additive model can be defined through the following general formulation:

$$y_i = \beta_0 + f(S_i) + \beta_1^T x_i + S(x_i) + \varepsilon_i \quad (1)$$

where *f(.)* is a smooth function, *S(x)* is a stationary Gaussian stochastic process of the second order with zero expected value and constant variance equal to ${\sigma_x}^2$. In relation (1) the additive component, the mixed effects one and the erratic one ε, are mutually independent.

In order to obtain a version of (1) that can be estimated using the procedures related to mixed effects models implemented in standard statistical software, a low rank version of both the additive and mixed effects components has been considered.

For the first component a penalized spline function of the form was used:

$$f(s_i) = \beta_s s_i + \sum uk(s_i - k_k) + \quad (2)$$

Considering the coefficients u_k of the nodes κ_k as random effects.

The fundamental advantage of this formulation consists in the possibility of obtaining the estimates of the model parameters through R.E.M.L., using the spm function of the *SemiPar* library of *R* software [34]. Furthermore, the low rank representation means that the number of basis functions used does not increase with the sample size.

The amount of smoothing of the model with reference to the additive and spatially correlated components is quantified on the basis of the ratios ${\sigma^2}_\varepsilon/{\sigma^2}_s$, e ${\sigma^2}_\varepsilon/{\sigma^2}_x$, computable using REML estimated variances.

These smoothing parameters are involved in the determination of freedom degrees for non-linear component and make possible to control the trade-off between the adaptation of the model to the observed values (values close to zero of the smoothing parameters) and its smoothness (high values of the aforementioned parameters) [32, 33].

4 Results and Discussions

This section presents the results of the model previously described in relation to the data sample collected for traditional LTR and that for STR.

The sample relating to the LTR it is made up of 54 residential units located in Naples in the areas of Montecalvario, San Ferdinando and Chiaia. The variables taken into consideration for this sample are floor level (*lev*), presence of lift (*lift*), geographical coordinates (longitude and latitude, or *Xcoord* and *Ycoord*).

The reference function for this sample, about the unitary sale price for LTR, is the following:

$$Uprice_{LTR} = lev + lift + f(Xcoord, Ycoord)$$

For STR the main variables available are the geographic coordinates only (*Xcoord* and *Ycoord*), considering a number of real estate rental offers equal to 219:

$$Uprice_{STR} = f(Xcoord, Ycoord)$$

Subsequently, from the availability of rooms number for each real estate sale offer, the indicative sqm of each unit was obtained considering the following indications: up to 35 sqm no rooms, 35–50 sqm equal to 1 room, 50–65 sqm equal to 2 rooms, 65–80 sqm equal to 3 rooms, 80–95 sqm equal to 4 rooms, 95–120 sqm equal to 5 rooms, over 120 sqm equal to 5 rooms.

Furthermore, from the price per night of the apartment, the annual availability of the announcement on the Airbnb portal and the average occupancy rate of the reference neighborhood, the estimated annual turnover was obtained which, divided by 12, returned the estimated monthly turnover.

The graphical results of models are presented in Figs. 1 and 2, while the distribution of LTR and STR data in the districts considered is shown in Fig. 3.

The effect estimates in the nonlinear model were significant, as shown by the values of the degrees of freedom and the smoothing parameters. The values of the predictions obtained are consistent with the observed data, furthermore the analysis of the residuals did not show any anomaly in its structure.

In the area examined, the spatial distribution of unitary property rents clearly shows how the geographic component affects the rents of the sampled properties. The main result of the interpolation, for each of the two cases, is a thematic map which depicts the unitary values of the real estate rents in the considered urban context, in which the blue and red colors represent the unitary rents respectively, the lowest and the highest.

Basically, the values resulting from the analysis of LTR collected coincide with the data of the O.M.I. Observatory relating to the areas analyzed (Montecalvario, Chiaia, San Ferdinando).

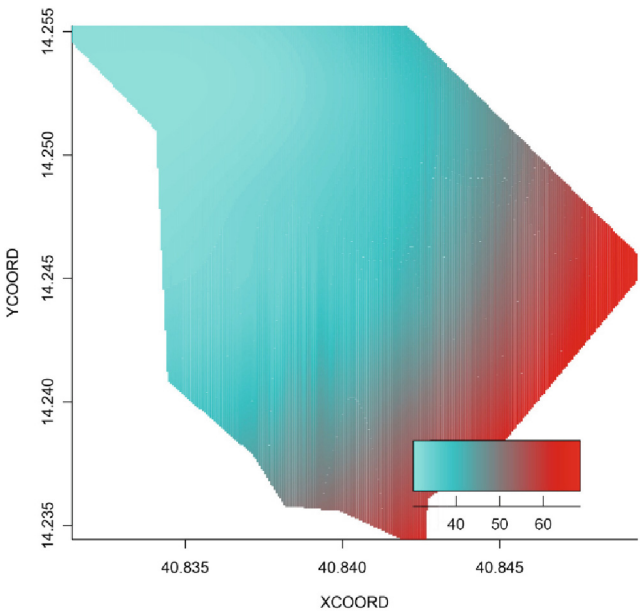

Fig. 1. Isovalue map of the geoadditive model for LTR

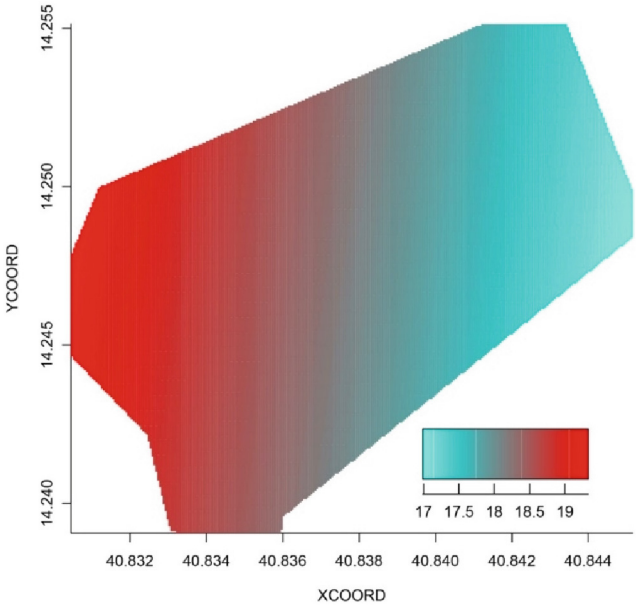

Fig. 2. Isovalue map of the geoadditive model for STR

In the Naples area, with the same qualitative characteristics and accessibility, the income that can be drawn from short-term leased real estate units is approximately double that of traditional leases. The range of price variation for STR varies from 30 €/sqm to 70 €/sqm, while for traditional LTR the variation is contained in a range that goes from 17 €/sqm to 20 €/sqm.

The geoadditive analysis shows that, as regards the STR (Fig. 2), the highest values are concentrated on the coastal strip, i.e. in reference to those solutions that have characteristics of proximity to the sea, panoramic or semi-panoramic. The lowest values are found in the vicinity of the Quartieri Spagnoli, where multiple rental solutions adapted to the classic Neapolitan "bassi" (cellars) have been identified, traditional social housing located on the ground floor or in the basement. The practice of renting these basses is connected to the desire to attract tourists in a typically Neapolitan traditional context, but also to the need to make the most of otherwise unused or underestimated living spaces for the purpose of a long-term lease and maximize their income. This practice is conceptually similar to that adopted in the historic center of Matera, with the short-term rental of houses in the "sassi".

As regards the analysis of the geoadditive model referring to traditional or LTR locations (Fig. 1), the highest values are recorded for the area that goes from via Toledo towards Mergellina, while they decrease in the direction of Corso Umberto I.

The values agree for the area of via Partenope and via Caracciolo, where in both cases they are very high. Based on these considerations, we can state that, for the same type of property, the dynamics between STR and LTR are completely different from each other, both in terms of profitability and in terms of space.



Fig. 3. Data distribution for LTR (blue dots) and STR (orange dots)

The results obtained are valid for the territory of Naples, a city that structurally has a relatively limited historic center in terms of space and an urban distribution with multiple outlets to the sea, which are probably not found in other provincial capitals [35–39].

5 Conclusions

The fact that the short-term rent sector in Italy is not definitively regulated makes this practice in some cases convenient for property owners from an income point of view, but also less binding in contractual terms.

Nowadays, renting your property on a long-term basis to a private individual can in practice lead to a series of problems relating to the management area and the constraints that follow from signing the contract, as well as being in most cases less profitable than a short-term rental. It must be emphasized that the management of a fully operational STR requires a considerable amount of time, necessary to carry out all those activities aimed at welcoming tourists, a fundamental qualitative characteristic for a successful accommodation business. And precisely for this reason, many hosts entrust the management of their property to third parties, generally agencies aimed at this purpose, placing themselves in competition with the authorized accommodation businesses and in some cases contributing to increasing the phenomenon of tax evasion.

Finally, we do not want to overlook the issue relating to the phenomenon of gentrification in historic centres. Unlike some districts of Rome, Venice, Florence and Matera, in

Naples this phenomenon does not seem to have affected the housing dynamics of the historic centers yet, influencing real estate values and distancing the traditional inhabitants from their place of birth.

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