LISBON
SCHOOL OF
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UNIVERSIDADE DE LISBOA

# MASTER

FINANCE

# MASTER´S FINAL WORK

DISSERTATION

# THE IMPACT OF SHORT-TERM RENTALS IN HOUSING AND RENT PRICES

ALICE PEREIRA GONÇALO

OCTOBER - 2021

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**SUPERVISION:**
PROFESSOR JOÃO CARVALHO DAS NEVES

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# GLOSSARY

AL – Alojamento Local (Local Lodging)

CC – Collaborative Consumption

CML – Câmara Municipal de Lisboa (Lisbon's City Council)

LTR – Long-term rentals

INE – Instituto Nacional de Estatística (National Institute of Statistics)

JEL – Journal of Economic Literature

NRAU – Novo regime do arrendamento urbano (New Urban Rental Regime)

OLS – Ordinary Least Squares

P2P – Peer-to-peer

RNAL – Registo nacional de alojamento local (National Tourist Registry)

STR – Short-term Rentals

VRBO – Vacation Rentals by Owner

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## ABSTRACT, KEYWORDS AND JEL CODES

Lisbon's housing market is currently experiencing a scaling price increase of properties and by consequence rents. It is well-established that this phenomenon is leading to a house unaffordability and displacement of residents from urban central areas. On the other hand, new house-building activities are giving a fresh face to old and vacant buildings and busting neighbourhoods economies. An upraise trend in tourism, and deductively high touristic accommodation demand, induced several homeowners and constructors to react to the demand, and convert residential houses into touristic lodging. Discussions about the accountability of the short-term rentals and home-sharing platforms in the housing market change, driven governmental intervention in traditional neighbourhoods. Due to these debates, the empirical question of this study is whether the short-term rentals activity increases the housing and rent prices. The effects of home-sharing rentals on housing market are detected by estimating house and rent prices as a function of number of listings in the city. An increase in housing prices of approximately 96 €/$m^2$ and 0.16€/$m^2$ in rents is estimated to be due to short-term rentals. Understanding this impact is fundamental to evaluate the necessity of regulation in this market, in order to create a balance between economic growth and quality of life of residents.

KEYWORDS: Sharing economy; Short-term rentals; Housing market; Lisbon

JEL CODES: C01; R21; R31; R38; Z32

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# THE IMPACT OF SHORT-TERM RENTALS IN THE HOUSING AND RENT PRICES

By Alice Gonçalo

Lisbon's housing market is currently experiencing a scaling price increase of properties and rents. An upraise trend in tourism and a high touristic accommodation demand, induced homeowners, and constructors to convert residential houses into touristic lodging. The goal of this research is to find proof the responsibility of the touristic lodging in the increase of the housing and rent prices in Lisbon. The effect of short-term rentals on housing market is identified by estimating house and rent prices as a function of number of listings in the city. An increase in housing prices of approximately 96 €/$m^2$ and 0.16€/$m^2$ in rents is estimated to be due to short-term rentals.

## 1. INTRODUCTION

The Sharing-economy represents a peer-to-peer online market where a set of goods or services are transacted between demanders and suppliers. This activity goes from peer-to-peer accommodation, transportation, collaborative finance to on-demand household or professional services. Home-sharing, in specific, is significantly responsible for the growth of this market. In a short period of time the sharing economy business models entered the accommodation and tourism sector with peer-to-peer lodging services in cities all over the world.

Lisbon was considered in 2017 the fifth most popular Airbnb destination in Europe based on guest arrivals, receiving around 1,030 thousand guests that year (Statista Website, 2020a). In 2018 occupied the fifteenth place in the leading European city tourism destinations ranking, with 10.76 million bed nights (measure of occupancy of one person for one night) (Statista Website, 2020b). This rapid growth of the industry, obligated governments and policymakers to take measures to regulate these new business models. This government intervention has taken different forms in many urban centres across the world, since restricting the number of days a lodge can be rented or property owners' obligation to acquire a permit and even making the activity illegal. In Portugal the home-sharing was regulated in 2014, but it was in 2018 mainly in the city of Lisbon, that controlling measures emerged, where the city-council decided to suspend new short-term rentals in areas with most touristic pressure.

The strong tourist demand also instigated the growth of the gentrification phenomenon. The uneven development in the city was heightened by the tourism boom Lisbon is facing. As tourists are captivated by the most historical and traditional areas of

the city, the gentrifiers started to invest in these neighbourhoods displacing the poorest and creating all kinds of tourist activities in these areas, from restaurants to nightlife spots and other tourism-oriented sectors.

Following the excessive tourism, astronomic increase of home-sharing lodging and gentrification, also the housing market suffered changes in the latest years with a nonstop up-rise trend in prices and demand, leading to serious access difficulties for population with average income. Considering this exponential increase in the Lisbon's housing prices, it is important to understand if the growth of the short-term rental activity in the city had impact on residential housing market.

Opinions differ regarding the responsibility of home-sharing platforms in the rise of housing prices. (Stulberg, 2016) for instance, argued the impact of Airbnb is too small since the number of properties rented full time is too small to be able to drive rents up. However, (Lee, 2016) claims that this activity increases home prices by restricting the supply of long-term rentals exacerbating affordability issues.

Due to these debates, the empirical question of this study is whether the short-term rentals activity increases the housing and rent prices. To identify the effects of short-term rentals on housing market, we estimate house and rent prices as a function of number of short-term rental listings in the city.

Most of the until now published findings address the impact of Airbnb on tourism, its implications for the hotel industry or regulation of the sharing-economy. The impact on the housing market has not been approached many times. Most of the research is focused on the American market, studies on many European cities are starting to emerge but are still scarce, however what previous research have in common is the solid evidence of short-term rental platforms influence on the quantity and price of houses and long-term rentals.

Using data provided by AirDNA on short-term rentals, housing and rent prices from all parishes of the city of Lisbon since 2013 until 2019, and other auxiliary control variables, we estimate an overall increase in housing prices of approximately 96 €/$m^2$ and 0.16€/$m^2$ in rents is due to short-term rentals. We also find that these effects are intensified in the historical parishes of the city, where the concentration of home-sharing lodgings is higher.

# 2. LITERATURE REVIEW

The underneath chapter aims to provide a literature review of the topic of research and a brief insight of the sharing economy. Addressing the evolution of the market and its main features, the accommodation segment will be discussed in more detail. In the interest of considering the effects of the home-sharing in Lisbon and the related housing phenomena it is also explained the gentrification concept, emergence and its manifestation in the communities. This will help to clarify the investigation goals and place the reader in the industry.

## *2.1 The Sharing-Economy and the accommodation sector*

Sharing is part of the human behaviour since the beginning of times, this interaction contributed to human progress and was essential specially when the periods were of scarcity. In the recent years, the concept gained other shape, the technological advances and the economic needs ascended from the economic 2008 crisis imposed the necessity of saving money. An accelerated growth of this market was driven by the consumer disbelief in the market, the high unemployment rate and the low purchasing power. In that sense, new ways of sharing emerged when people started to acknowledge the benefits of peer-to-peer business models. (Dervojeda et al., 2013)

The perception of a new market creation came up when (Weitzman, 1986) approached sharing as an alternative to purchasing. After this, several studies attempted to classify the market and give it clear definitions. In 2010, Botsman and Rogers provided to the academic world significant knowledge by defining and studying the idea of sharing. The terms collaborative consumption, sharing economy or peer-to-peer economy became part of our vocabulary and this growing system gained massive interest (Botsman & Rogers, 2010). Proof of this impact was the introduction of the concept in the Oxford English Dictionary in 2015, where sharing economy is categorized as “an economic system in which assets or services are shared between private individuals, either free or for a fee, typically by means of the internet” (Oxford University Press, 2015). Many well-known companies by the public and famous worldwide follow this business-model, some of them are Airbnb, YouTube, Facebook, Twitter and Wikipedia (Belk, 2014b).

According to an article of Sarote Tabcum Jr. in Forbes, this business model where access substitutes proprietorship was game changer specially for the millennials, people

highly educated struggling to enter the labour market, see ownership as a burden and not as a source of pride (Sarote Tabcum Jr., 2019). This generation is responsible for a significant part of this economy growth, because they are driven by efficiency and reduction of waste, they prioritize experiences and repel the idea of spending money in material goods (Williams, 2018).

The environmental concerns implied in the mindset of the millennials are consistent with the business model of the market, and bust a significant growth of the market, since the reduction of carbon dioxide emissions with the use of car sharing services to the food sharing apps. The common-good claims of this economy attract consumers and providers to consider this market as an alternative to the global market runed by capitalism (B. Schor & Cansoy, 2019). According to a PwC study, 76% of U.S adults believe the sharing economy is better for the environment (PwC USA, 2015).

With the rapid growth of the industry, the transaction of durable goods is no longer the main activity of the intervening individuals, labour works, and social connection activities joined the marketplace, offering household tasks or creating food waste apps. Currently as reported by PwC, we can divide sharing economy sectors into five segments that goes from peer-to-peer accommodation, transportation, collaborative finance to on-demand household and professional services. The same study also reports that the platforms on these five segments of the market in 2015 produced 4 billion euros of revenues in Europe and enabled nearby 28 billion euros in transactions. In that year, the transportation sector was the most profitable and the accommodation sector was responsible for more transactions (Vaughan & Daveiro, 2016).

According to Eurostat statistics, 21% of the residents in the European Union used any website to arrange accommodation from another individual in 2019, and 17% used dedicated websites for the same propose. This increasing trend is evident in the majority of the UE countries, both in the accommodation and transportation sectors. Portugal follow the pulse, with an increase from 6% in 2017 to 14% in 2019 of the percentage of individuals that use any website to book an accommodation, and 4% to 6% use dedicated websites with the same intention (Eurostat - Data Explorer, 2019). Despite the trend, the transportation sector still has a higher percentage of users comparing to the accommodation sector, but all evidences point to its growth in the long run.

Considering the previous statistics, it is important to state that Europe has a weaker participation in the collaborative consumption comparing to other regions of the world, the U.S continue to be the region where this market has more influence (Vaughan & Daveiro, 2016).

The lack of regulation or how should companies be regulated is a discussion where the opinions differ, governments are however not ready to handle the regulatory conflicts between the upstart sharing firms becoming large companies and the incumbent firms in the industry. The necessity of clear and specific regulation for this new form of business model is certain for most academics and policymakers, but for others this market can easily be self-regulated and bring fairness, options and better access to information to the consumers (Koopman et al., 2014). Nevertheless, (Rauch & Schleicher, 2015) have a different perspective regarding this subject, they believe the excessive regulation will be avoided if the governments take advantage of the business models and technology of sharing firms, to be able to deliver more efficient public services and expand services.

It is clear these companies are bringing alternatives, easy access and efficiency to consumers, are appealing to the eco-friendly zero waste mentality, and drive the economy, but this business format is object of a lot of controversy. (Morozov, 2013) stated: "the sharing economy amplifies the worst excesses of the dominant economic model: it is neoliberalism on steroids" as he inquires himself about the equality and basic working conditions practiced within this companies, while they pursue gain through the ideology of a different and altruistic market sold to consumers and workers. The designation given to sharing economy is viewed by many critics as dishonest and nothing related to the actual business, which is driven purely by monetary reasons instead of the true solidarity. (Belk, 2014a) has a similar perspective respecting the terminology associated to the market, he prefers to call it "Pseudo-sharing: a business relationship masquerading as communal sharing", the author states platforms such as Airbnb follow this pseudo-sharing philosophy because they charge fees for the services. Defenders of the consumer and labour rights are also critics of the market, they enhance the doubtful safety and the discrimination present in the market, situations hard to fight because of the lack of regulation and the posture of the platforms by nothing taking measures (B. Schor & Cansoy, 2019), if the situation is rectified and all intervenient agents align the sector can positively evolve and respect the common good claims with which it began.

The mechanics of home-sharing platforms transactions are based on reciprocity between the owner of the rented home which receives a monetary compensation and the consumer who expects a more affordable place to stay. This business-model fits properly in the collaborative consumption market in the sense that its characteristics and methods are based in the principles of the sharing-economy. According to (Belk, 2014b): "Collaborative consumption is people coordinating the acquisition and distribution of a resource for a fee or other compensation.", which corroborates the association between the market and the business model of these platforms and the definition of sharing economy previously chosen in this chapter.

The peer-to-peer accommodation companies follow an internet commission-based business model, where the platform has an intermediary function between the provider and the customer charging a fee for each transaction, which is case of Airbnb, the most famous online platform functioning in the short-term rental activity worldwide. Competing with the hotel industry, Airbnb has more rooms than any chain of hotels and the number of users is continuously growing. A study performed by (Zervas et al., 2017) of the Texas state confirmed this impact in the hotel industry, concluding that increases of Airbnb listings were the cause of a decrease in hotel revenues, with a causal impact of 8% to 10% in hotel revenues registered where Airbnb supply is highest.

Among the many reasons for such growth of this type of activity, the lower prices with flexible accommodation options for every budget, desire to have an authentic community experience and social interaction are the ones that stand out when a consumer prefers renting instead of going to an hotel. (Hamari et al., 2016) supports this view with a collaborative consumption participants survey: "The results show that participation in CC is motivated by many factors such as its sustainability, enjoyment of the activity as well as economic gains.".

Although, the sharing-economy expansion in the travel and tourism marketplace is visible, there are still people who are hesitant regarding the use of peer-to-peer accommodation rental services. Therefore, it may be presumed sharing in the lodging sector is nowadays a mainstream practice and has been disrupting long-stablished businesses, there are still consumers who prefer the traditional hotels.

The shift of behaviour and attitude of consumers and the takeover of short-term rental online platforms has generated a great concern in the community, between critics, scholars, activists, even governments and authorities the discussion is perceptible. One of the biggest debates of the moment is the dimension of the impact of the short-term rentals, especially in the cities. Critics exposed this problematic several times in the past years, the majority believe the rise of short-term rentals is influencing the prices and accessibility to long-term rentals leading to higher rental and selling prices. Other parts mention the effect of this process in the communities, in the urban life and spatial distribution of neighbourhoods, issues that will be discussed in more detail further in this chapter.

The shortage of regulation can easily lead to tax avoidance and hinders the control or prevention of collateral effects created by the extreme supply and demand of short-term rentals, such as housing affordability issues or gentrification. The lack of labour laws is another issue so far not mentioned in this chapter, since deprivation of specific regulation that protects the workers can easily appear situations of workforce precariousness and discrimination where companies until now had a hands-off approach (B. Schor & Cansoy, 2019).

The regulation heretofore applied has taken the form of restricting the number of days a lodge can be rented, the property owners' obligation to acquire a permit or making the activity illegal. To match hotels commitments, the online platforms also started to charge a tourist fee to their customers, fee that is delivered to local governments. The home sharing regulation stipulated in Lisbon is shaped as Local Lodging (Alojamento Local), where the homeowner must have a license to be able to rent his property (its regulation and features will be addressed in more detail further in this research).

These types of directives were also applied to Barcelona, but other forms of regulation can be observed in a lot of cities around the world, in Berlin for example, the host is only able to rent his property at a 50% occupancy rate. In Amsterdam the host can only rent for 30 days during the year and in Paris it is mandatory a registration number and the apartments can only be rented for 120 days a year. Several cities in the United States adopted more restricted regulation, city-councils in some cities implemented directives turning short-term rentals illegal if the hosts were not present, if is not a primary and

permanent resident and the amount of available days for rent are also limited (iPropertyManagement, 2020; Paes, 2020).

The above examples were only the tip of the iceberg of the numerous forms of regulation applied in cities where the short-term rentals have monopolized neighbourhoods. It is until now a question if the supply-side restrictions will be effective, however if the goal is achieved, many of the collateral effects will be controlled for the sake of the platform's users, and local economies can exploit the benefits of the market in a regulated and undamaging environment.

### *2.2 Gentrification*

Opportunities, innovation, facilitated access to nearly everything are all appealing elements and advantages of living in big cities. It is clear the attraction of people to the main centres in an attempt to get higher income and human development. As the cosmopolitan dream spreads globally, statistics indicate half of the world population live in cities and by 2050 that number is expected to rise to two-thirds (National Geographic, 2019). With the rapid growth of the urban areas and the massive migration of people to cities, the infrastructures and neighbourhoods are becoming to be insufficient to accommodate all of those who want to live in the urban centres. This shortage and the high population density are a cause for numerous problems, such as the rise of the housing prices, the failure of many public services and environmental degradation. Gentrification is another outcome of this strong urban development. The term was firstly used by Ruth Glass in 1964, on her book London: Aspects of Change, to describe the new urban changes of the city of London, while working class people's houses were being occupied by the middle class (Lees et al., 2008). After that, several studies in different cities of the world emerged, evidences of this effect were spread all over the world and opinions differ regarding its benefits and impact on the welfare of all citizens.

When authors discuss the emergence of gentrification, evidences of similar processes to gentrification were part of history before coined by Glass and before capitalism. This process can be simply defined as the recovery and development of a part of a city with the intention to get people of a higher social class interested in living there. Nevertheless, the concept goes beyond that, and it has suffered several mutations throughout time. Most critics agree this practice consists in the rehabilitation and renovation of a neighbourhood

or a specific area where exists an appropriation of a wealthier class, displacing and effecting the lower-income residents.

With gentrification, the diversity is substituted by cultural uniformity. Even with few social governmental measures to avoid the displacement of poorer people, the pressure of the change by the majority lead to the vanishment of the previous characteristics of the neighbourhood and residents (Davidson & Lees, 2010). A phenomenon seen by (Berry, 1980) as short-lived, resultant of a temporary or cyclical housing stress, and a state of degentrification by (Bourne, 1993) in the early 1990's, ended up not happening, and is expanding at the same level as globalization, even in location terms, since there are indications of gentrification events outside big cities and not just in an inner-city format.

As the term mutates, we can observe several forms of gentrification happening over the years, since 'rural gentrification' to the expansion to newly built condominiums and townhouses, contradicting the original definition of rehabilitating old houses. This version of gentrification was not approved by some critics. (Boddy, 2007) for example emphasizes the distinction between gentrification and redevelopment, made by Neil Smith in 1982 to define the concept: "I make the theoretical distinction between gentrification and redevelopment. Redevelopment involves not rehabilitation of old structures but the construction of new buildings on previously developed land.". The most recent derivative of the term was super-gentrification that is based on the gentrification of an area that was previously gentrified, enabled by a higher financial investment.

Unquestionably, we are seeing different forms of gentrification as the world and people evolve, for this reason there is a tendency for gentrification growth and not extinction. It is instead following the pace of globalization, but unfortunately also is erasing the marks of the past. As (Glass, 1989) said: "Urban, suburban and rural areas have thus become encouraged to merge into one another; and they have lost some of their differentiating features". Approaching the case of the city of Lisbon, it is interesting to mention another variation of the concept that is being observed in the last years and is impacting the house and people's allocation. The alteration of a neighbourhood into a wealthier and prosperous area where there is a clear increase of recreation and tourism areas, it is designated by (Gotham, 2005) as 'tourism gentrification'. This process is

performed by the emergence of hotel chains, rental companies, localised consumption, cultural presence and many more activities designed to attract tourists.

Over the past years, the presence of gentrification or regeneration processes in Lisbon were visible and it had major impact on the city's structure, as well as in the people who live in it. As reported by Statista website, Lisbon was ranked in thirteenth place with a 2.96 millions of inhabitants, as one of the largest urban agglomerations in Europe in 2020 (Statista Website, 2020c). This urban transformation process took place essentially when the country was still facing a serious recession, where the purchasing power of the residents was low and fragile due to it reduced income. The upper-middle and upper classes were able to appropriate the historical centre but was the private investment and local government initiatives that boosted this change, putting the ageing urban poor and immigrants in a vulnerable situation.

In areas with strong tourist demand, another tool of gentrifiers that in some sense instigate the growth of gentrification are the short-term rental online platforms. These companies offer people an easy way to make profit and provide a new income stream, everyone with a spare room or a vacant home saw an opportunity to rise their income due to the high demand of tourists. On the account of the lack of supply, investors started to buy old buildings and renovate them, others started to buy once rented homes or removing the existing tenant to convert houses from long-term to short-term rentals. Consequently, the housing and rental prices increased and the ones that were not able to afford this rise were displaced, making almost impossible for residents to live in the city centre, and this opened doors to the foreigners with more purchasing power. According to a (Wachsmuth et al., 2018) study of the city of New York on the impact of the Airbnb platform, 7.000 to 13.500 long-term rental houses were transformed into short-term rentals on account of Airbnb.

Among many discussions, gentrification processes bring up multiple concerns since the uneven spatial development, class transformations or how it led to unequal city experiences or vanishment of the community identity. Nonetheless, it also provides positive effects into societies, it is visible the rehabilitation of declining neighbourhoods and combat of social separation and differentiation over the mix of sections of society in a neighbourhood, gentrified areas end up being rebranded.

If the present trends persist, urgent measures to control the negative effects of gentrification are necessary to guarantee the welfare of the many citizens involved in the transition process. (Shaw, 2005), highlights the fundamental role of governments to manage and regulate the collateral damages of the gentrification, the author believes local governments can ensure affordable housing and encourage private investment for the creation of housing in favour of the low-income residents.

The shocking changes and impact that gentrification has caused, transformed the landscape and distribution of society all over the world, the rapid growth of urbanization is interlinked with the dominance of capitalist interests, the question is if the world is willing to accept more viable and democratic alternatives to gentrification. Wondering about the future of gentrification, the majority of the critics predict a world of cities, as (Lefebvre, 2003) designates the changes as the final frontier, where the society becomes a total urbanization, (Freeman, 2006), adds to the discussion: "If (...) gentrification is becoming a widespread trend that represents the future of many cities, we should be thinking about how to manage the process to help us achieve a more equitable and just society."

### *2.4 The Housing Market and the Short-term Rental (STR) Phenomenon*

Taking into consideration the intention of this research is exactly to obtain empirical evidence for the European context, by studying the home-sharing impact on housing costs for residents in the city of Lisbon, all the possible explaining variables for this phenomenon need to be mentioned and identified. The excessive tourism and gentrification are clearly factors that can be seen as cause and consequence of the rise of short-term rentals in urban areas, at the same time a large number of papers explain part of the house prices variability by the amount of local amenities, areas with high amenity proportions have higher housing values. According to a Strutt&Parker research publication the local amenities that add most value to a property are supermarkets, restaurants, transport hubs, green spaces, sports centres and churches (Robinson, 2016). In the housing supply side, restrictiveness regulation on housing quantity (Ihlanfeldt, 2005), housing rehabilitation programs and geographic constrains (Saiz, 2010) are mentioned as relevant variables.

Although the factors that can lead to a rise of the housing prices and rents are not straightforward and can easily be questioned, elements from both supply and demand sides can influence the housing market. On the contrary of the home-sharing market, an extensive literature in real estate examining the determinants of housing prices can be found and the same occurs with rent prices. This available research claims holding and rent markets are related, however the house prices adapt slowly to the fluctuations of the market, while rent price data provide a better assessment of the housing flow trends (see Kashiwagi, 2014; Riddel, 2004; Ambrose, Coulson and Yoshida, 2015). In this research the goal is to explore the strong possibility of the rise of rents and house sales being boosted by the expansion of the short-term rental platforms.

When approaching the rise of the housing prices, opinions differ regarding the responsibility of the short-term rental online platforms, an analysis of Airbnb, conducted by Ariel Stulberg, concluded, against every expectations, the impact of Airbnb is small in most cities and the number of commercial listings (units rented full time) is too small to be able to drive rents up (Stulberg, 2016). Contradicting this idea, several studies argue the number of listings is not uniformly distributed and confirm that where exists a vast concentration of listings the impact is significant.

Considering firstly the literature focused on the US market, there are several examples of the topic. (Lee, 2016) explores how Airbnb effect the price and aggregate supply of affordable housing in Los Angeles, nevertheless, also refers the importance of regulation and the role of municipal policymakers. (Horn & Merante, 2017) analyse the impact of Airbnb in Boston and determine, using a fixed effect model, that one standard deviation increase in Airbnb listings relative to the total number of houses increase rents by an average of 0.4%, suggesting this effect is determined by a decrease in the supply. On the other hand, (Barron et al., 2020) find for the entire United States and for the same period of time, that one standard deviation in listings within the CBSA (Core Based Statistic Area, geographic unit defined by the U.S Office of Management and Budget) zip code implies a 0.54% increase in rents. They also find that one percent increase in Airbnb listings, on average increase rents by 0.18% and 0.26% house prices, explaining the results by stating that most people offering short-term rentals are owner-occupiers rather than commercial operators, the authors also believe that any increase in listings is caused by the increased demand from tourists for STR. (Sheppard & Udell, 2016) and

(Wachsmuth et al., 2018) both study the impact of Airbnb listings on the house prices of the city of New York, the first conclude the housing prices increased by about 31% due to Airbnb, the second find a 1.4% increase in NYC rents, which equals to a $384 annual increase of the rent prices. (Koster et al., 2019) for Los Angeles County and (Valentin, 2020) for New Orleans, use policy changes as natural experiments for identification. Koster et. al (2019) demonstrate that the regulation reduced the number of listings by 50% and property prices by 3%, Valentin (2020) results suggests that short-term rentals regulation in New Orleans decreased house prices by 30%.

In Europe, (Garcia-López et al., 2020) analysed the housing market in Barcelona discovering that rents and house prices suffered an increase when Airbnb listings became more widespread. (Duso et al., 2020) document that policy changes reduced by 8 to 10 listings per square kilometre the number of entire homes listed on Airbnb in the city of Berlin. (Franco et al., 2019) take advantage of the regulatory reform implemented in Portugal and throughout that methodology the authors estimate a 34% increase in property values and 10.9% in rents for the entire Portuguese market.

## 3. OVERVIEW AND INSTITUTIONAL SETTING ON STR AND HOUSING MARKET

Home-sharing platforms visibility and growth in the last decades, boosted the short-term rentals market. The first online platform was VRBO (Vacation Rentals by Owner) launched in 1995, but it was Airbnb, a start-up founded in 2008, that drove exponentially the industry growth (Medium Online Platform, 2019). With more than 150 million users and 650,000 hosts worldwide, 7 million listings spread over 220 countries and regions, where Portugal is one of the most popular destinations, with an direct economic impact from Airbnb of 2.3 billion dollars in 2018 (iPropertyManagement, 2020).

Due to the increasing demand and supply of this activity, the short-term rentals became heavily regulated in many cities across the world, as was described in the previous chapter. In Portugal, the home-sharing was regulated as AL (Alojamento Local), where the concept is defined as a temporary accommodation service for tourists, for a period of less than 30 days, in exchange of a fee only if it does not meet the legally requirements to consider it as a tourist resort (Ferreira et al., 2019). This figure was firstly introduced in the Portuguese legal system in 2008, only to provide legal coverage for the phenomenon. Since this turned out to be a consistent and global activity, the policy

makers were forced to create a specific legal regime in 2014. The law, Decreto-Lei nº 128/2014, fits the STR exploitation fiscally, presents the general requirements of exploration for each property including security and hygiene measures and implements the need for a registry where each property is assigned a license number (Ministério da Economia, 2014), this supply of short-term rentals is officially registered in the National Tourist Registry – Registo Nacional de Alojamento Local (RNAL). With this simplification of registration introduced by the policy change more hosts appeared renting their own homes or vacant rooms to tourists.

In addition to the AL regulation, more policies contributed to the short-term rentals growth. Lisbon suffered from a progressive loss of population in the last decades, it was visible a strong tendency of reallocation of the residents from the most central and historical parishes to the suburbs, which led to an increase of the number of vacant houses. On the other hand, the freeze rent policies in the housing market regulation before 2012 drove to a shortage in the rental houses supply and to the degradation of many buildings in the historical centre of Lisbon.

Also, the preferences of residents changed across the ages, in the beginning of the 80's, residents that used to be tenants in a rented home, started to exploit ownership options and a structural change in property occurred, drastically reducing the number of rented houses to property owned in the entire city. Statistics of an urbanistic study of Lisbon show that besides the trend, the historical centre is still the area with most rented houses, areas where in last decade the number of run-down buildings was high and the tenants had fewer purchasing power, being the majority old people. Younger residents had the opposite flow, while searching for more conditions were forced to leave to the suburbs, all of these phenomena was worsened by the 2008's financial crisis, having a huge impact in the housing market.

In 2012 the market changed direction, the implementation of the New Urban Rental Regime - Novo regime do arrendamento urbano (NRAU), came with the goal to update the rental contracts made before 1990, contracts that would not reflect the market values (Lei n.o 31, 2012). This new law drove old tenants to leave their contracts, because they could not afford the rental update, or landlords to cease the contracts with the tenants. This rental update process made possible the option for owners to transform their lodgings

into AL, which was a very successful measure and gave tenants an opportunity to make more profit. Another important alteration was the introduction of penalty fees for vacant or run-down buildings, what stimulated the renovation of neighbourhoods and consequently the establishment of local accommodation units in order to recover from the investments. Adding on to this housing market boosts, the tourism boom increased substantially the number of overnight stays in the city increasing the demand and consequently the need for supply.

Because of the exponential growth of short-term rentals, the law suffered some alterations throughout time but was in 2018 that the institutional setting changed more drastically. The government was forced to create more restrictive measures to control the market activity and the collateral effects produced by the appropriation of STR intervening agents. The law, Lei 62/2018, emerged to suppress these concerns and within the measures it provided autonomy to municipalities to define containment areas, where these can limit the number of STR and the number of lodges each owner can rent, the register is still mandatory but with this law the municipalities can deny the license.

After this law came into force, in November of 2019 the city council of Lisbon, deliberated and approved the suspension of new AL registrations in areas with most touristic pressure and started to monitor concerning areas with the creation of municipal regulation of local accommodation (Município de Lisboa, 2019), to fight the burden over housing that reduced the available stock of permanent housing in the city. In order to evaluate the areas that experience the most impact of STR, the municipality relied on the database of registration required to provide the license to hosts, which led the city-council to suspend the new licenses for two different areas, both located in the historical centre, neighbourhoods present in the parishes: Estrela, Misericórdia and Santa Maria Maior. However, the RNAL platform is not completely reliable since, besides the obligation of registration, there are still evidences of active listings that are not present in the database.

In Figure 1, can be observed the evolution of the number of listings and the parcel of them that have a license according to the AirDNA platform dataset combined with the number of licenses given to hosts by the municipality present in the national register of local accommodation.

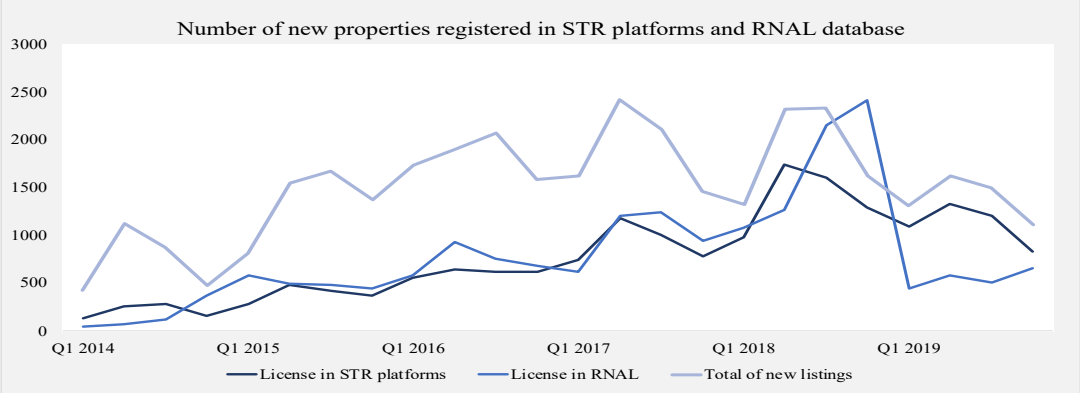


FIGURE 1 - Number of new listings in STR platforms and in the RNAL database

Observing the graph, apparently exists a severe discrepancy between the values of the two databases, when comparing the number of licenses with the number of new listings. With this evidence can be stated that most of the hosts did not respect the AL regulation until the registration was strictly mandatory. When observing the trend of the number of licenses, the values are similar in most of the years, the small differences in values might be due to the lack of control from the home-sharing platforms, when verifying the validity of the licenses or listings advertised on platforms not covered by the database of the research.

## 4. DATA DESCRIPTION AND ANALYSIS

In this section will be exposed all the sources and description of the data used for the research, and different descriptive analyses will be provided to understand better the data. Starting with some results on short-term rental data regarding the most interesting approaches to evaluate the sector, followed by the procedures and assumptions made to achieve the expected outcome. Afterwards, the same type of analysis is applied to the rental and sale housing prices.

For the analysis it was combined data from multiple sources. The information collected on the STR online platforms was obtained from a proprietary dataset obtained from the consulting firm AirDNA. This database includes the number of listings and its characteristics (listing title, number of bedrooms, cancellation policies, etc.) from 2008 to 2020, for all parishes in the city of Lisbon. The STR dataset contains 48783 listings advertised in the most relevant online short-term rental platforms during a period of 12 years. To measure the price of rents and houses was used data provided from Confidencial

Imobiliário, a data bank that delivers statistical data related to the housing market. The data set features all the average quarterly asked sale prices and asked housing rental prices from the first quarter of 2013 to the fourth quarter 2019 of the city of Lisbon also segmented by civil parish level.

The data was supplemented with an additional source, where was possible to gather a set of control variables related to local socio-economic and geographic aspects, removed from the Portuguese Statistic Institute (INE) obtained from the 2011 Census. Most of this data is presented in the old civil parish distribution, since the reorganization of the administrative boundaries was applied in 2013, all the data presented before that period was converted to the new civil parish level regime.

Finally, because the geography in study is the city of Lisbon, was decided for the research to present the results segmented by civil parish to account for different outcomes in terms of tourism and attractiveness of each parish and neighbourhood. Lisbon has at this moment 24 parishes, consequence of the law where the civil parishes were reorganized, Lei nº 56/2012, and the resident population adds up to a total of 509,515 people in 2019, a number that was decreasing since 2011 but has been slowly increasing since 2016. The period of the study chosen will be from 2013 to 2019, in a view of the fact that the STR activity increased after the regulation of 2014, and suffered a downfall after the regulation of 2018, in this regard, when accounting for these two implemented laws in the sector will be most certainly achieved more reliable results.

### *4.1 Home-Sharing Platforms Data*

Since the creation of most relevant home-sharing platform in 2008, the short-term rental activity captured the attention of the Lisbon's city residents and along with the foreign investment instigated a substantial increase of the sector. Its growth until 2014 was slow but constant, although after the implementation of the AL regulation in the middle of the same year, it was clear an increasing and continuous trend of the number of new rentals in that year besides the seasonal flotations.

In Figure 2, this behaviour is visible as well as the impacting decrease of the number of new listings after the restrictive policy changes enforced after the middle of 2018. Figure 2 represents the number of listings available in Lisbon decomposed by the type of rental.

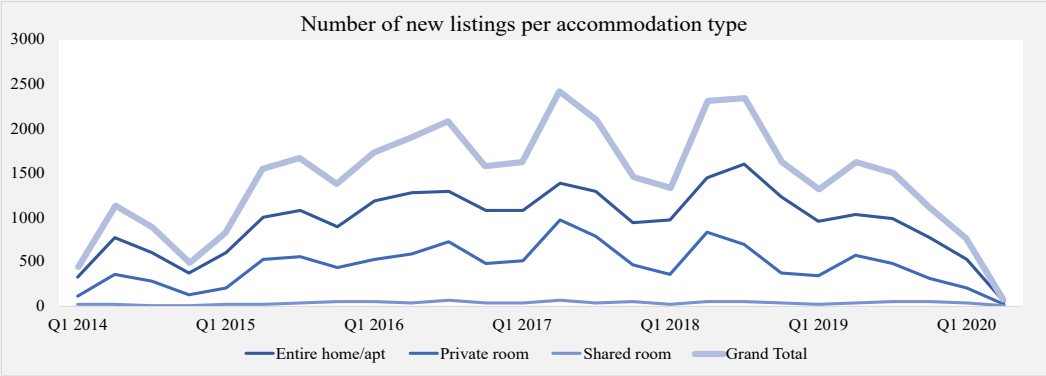


FIGURE 2 - Evolution of the number of STR listings in Lisbon

It can be presumed many of the entire apartments rented are for commercial purposes and the remaining portion is when hosts are away for a period and decide to make some profit of their temporarily vacant home. Nevertheless, this believe can have some flaws since a commercial owner can also choose to rent their properties room by room, and occasional hosts described above can also have a spare room that decide to rent regularly. The greater part of the shared rooms listed most certainly matches the hostels advertisements. Within the years of 2018 and 2019, according to the AirDNA database, the average daily rate of entire home rentals was on average 84€, private room 36€ and shared room 17€ in the city of Lisbon, where this measure represents the total revenue of each listing divided by the number of booked nights.

### *4.1.1 Descriptive analysis*

The following part of the chapter is intended to provide an analysis and portrait of the home-sharing activity in Lisbon with focus on the spatial distribution of the short-term rentals. After the analysis of the evolution of the number of listings in the city of Lisbon exhibited in Figure 2, it is also important to analyse its distribution of listings among the civil parishes of the city. Lisbon has experienced a large affluence in short-term rentals, but this phenomenon is not homogeneous in all parishes of the city. Due to this, were elaborated two maps of the STR distribution in Lisbon, in two different time segments in order to compare the number of listings created in each parish. The analysis made is expected to reflect a period where the rentals had scarce significance in the market and a second period where the rentals were in high expansion. Figure 3 represents the number of listings created between 2010 and 2013, period where the home-sharing activity was still in development. The figure shows that the parish with the highest number of new

listings was Santa Maria Maior with 702 listings created. This parish is located in the historical centre of the city, as well as the other parishes that have the highest numbers, by contrast with the peripheral areas that are the ones with the lowest number of new listings.

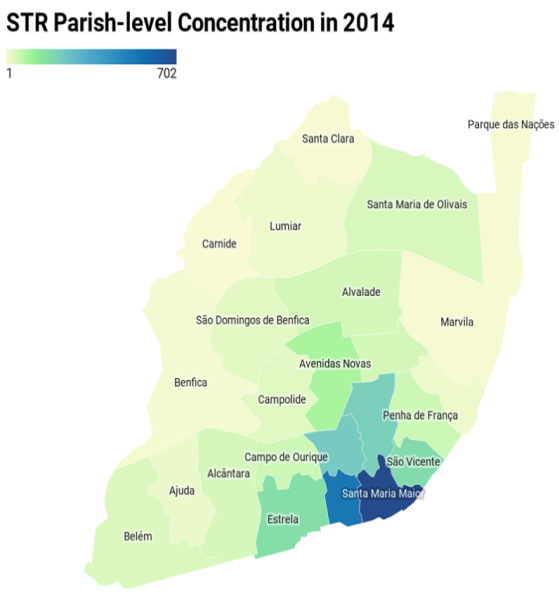


FIGURE 3 - Distribution of the number of new STR listings until 2014

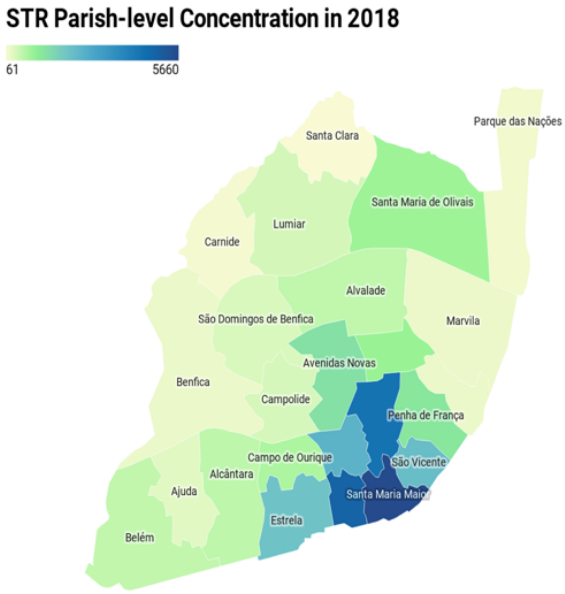


FIGURE 4 - Distribution of the number of new STR listings (2014-2018)

Comparing the two-time segments, the changes are unequivocal because of the enormous increase of the number of new STR after the beginning of 2014. Observing Figure 4, that concerns the creation of listings over the period of 2014 to 2018, the number of new listings creation increase in every parish of the city, but the pattern among the highest and lowest numbers maintains the same geographically. The only dissimilarity visible is spread of listings from the most central parishes to the ones near them, which can be resultant from the scarcity of lodgings with high demand, obligating investors to turn to nearby parishes with potential and vacant buildings to continue to expand the activity. The civil parishes with the highest level of new listings, within the period, were Santa Maria Maior with 5660 new listings, Misericordia with 494 and Arroios with 4462 new listings. The parish with the lowest number of listings was Santa Clara, with only 61 listings created in this four-year period.

After the distribution and evolution of listings assessment to measure the supply, it is also relevant to analyse the demand for home-sharing. In order to make this evaluation

was used the average of days each listing was reserved by guests. In Figure 5 can be observed as an example the demand for STR listings in each parish, during 2019 but this trend of demand is constant in approximately the last five years of research.

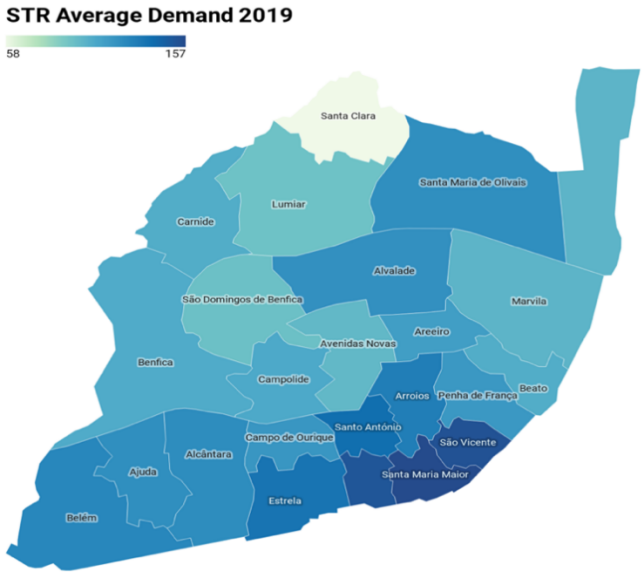


FIGURE 5 - Average demand of STR listings in 2019

The guest choices when choosing the location of the rental tends to be related to the proximity to cultural and historical points and recreation places. The properties with more reservations are located in the historical centre, where the supply is also the highest (Santa Maria Maior; São Vicente; Misericórdia). These rentals are reserved more than half of the year, on opposite listings with lower demand are booked less than 100 days a year (Santa Clara; Lumiar; São Domingos de Benfica).

Presuming the areas that are more attractive to guests, are the ones with most points of interest in the city, it is also interesting to consider which parishes have more profit. Doing so, it will enable us to conclude if this analysis and the one made above are in accordance. To explore this concept, it is used the average daily rate, this measure implies the total revenue of each listing is divided by the number of booked nights, that will reflect the revenue a host obtains for his property per booked day.

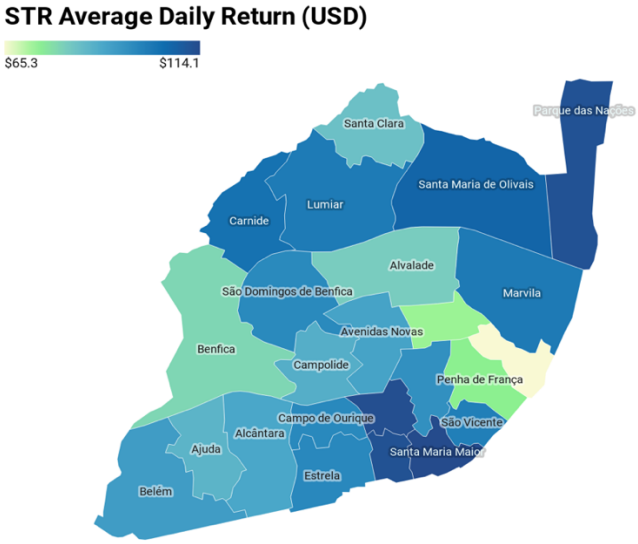


FIGURE 6 - Average return of listings per number of bookings

Observing Figure 6, the average revenue varies between 65.3 to 114.1 dollars. Among the civil parishes with lowest revenue, Beato followed by Areeiro and Penha de França, are the ones with the lowest income, neighbourhoods mainly described as residential areas. The properties with greatest revenue are the ones located in the most central parishes (Santa Maria Maior; Santo António; Misericórdia). On the other hand, there are exceptions of peripherical parishes with also a substantial volume of revenue. It is the case of Parque das Nações, which might be explained by the strong presence of several touristic places, museums and business centres in this parish. The high housing prices in some areas of Lisbon, buildings renovated recently, or neighbourhoods known for being expensive, can also affect the revenue and price of the listings, and this can possibly be the reason for superior revenue of some listings in the peripherical parishes represented in Figure 6.

This belief can be tested by the analysis of Figure 7, that displays the localization of listings by the published nightly rate, which expresses the price the host lists his vacation rental. In Figure 7 we can conclude that parishes with the most expensive listings are located in the less central area contradicting the trends observed until now, in this area the nightly price of listings is on average $135. The rest of the parishes with the highest prices have on average a nightly price of $105.

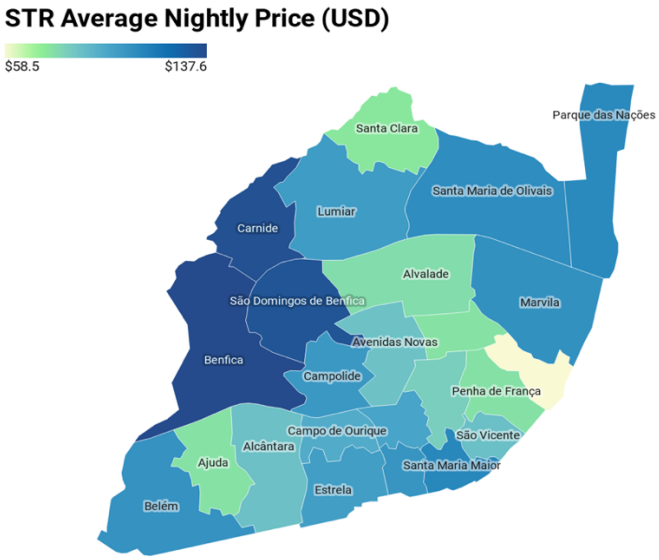


FIGURE 7 - Average price of listings by civil-parish

The historical centre and the parishes with touristic points attractive for guests are included in the second group mentioned. The stipulated prices on the parishes with the most expensive listings is possible to result from the housing market prices or the better conditions and space of the listings, since these are more residential areas. When analysing the return of listings and its price, it is evident that the listings with more revenue are not the ones with the highest prices and the guests have a higher demand for vacation rentals in the most central areas. This can suggest the purchasing power of the majority of guests in Lisbon is relatively high, but they do not choose the most expensive accommodations, putting first the location.

### *4.1.2 Calculating the number of active listings*

One of the main difficulties of the research is to calculate accurately the exact number of listings considered active during the time interval in study. The STR activity database includes all the listings that were created since 2008 but there are situations that cannot be underestimated and can lead to results far from reality. Such situations are for example when the host removes his property from the market, or when the property is still listed but the host does not accept reservation requests. Taking this into account, it is necessary to compute an approximated measure of the period each listing is active on the home-sharing platforms that do not overestimate the supply of STR. To overcome the exposed limitations, was initially decided to use the creation date of the listing and filter this variable by the number of listings scrapped in 2020. Scrapped listings in 2020, means that

was verified in 2020 by the platform if the listing was still in the market, and doing so it can probably eliminate from the research the listings that already left the market. Following this, the second adjustment made was to only include in the results from the first alteration, the listings that had at least one booking during 2019, which reduces the probability of including listings that are active but not accepting reservations. This approach was only possible owing to the extended database obtained from AirDNA. Considering the access to the database is limited, several authors use the number of reviews of each listing or the first time the host sign up in the home-sharing platform, which can be less reliable, since making a review after a booking is optional for users and creating an account in the platform is not synonym of renting a property.

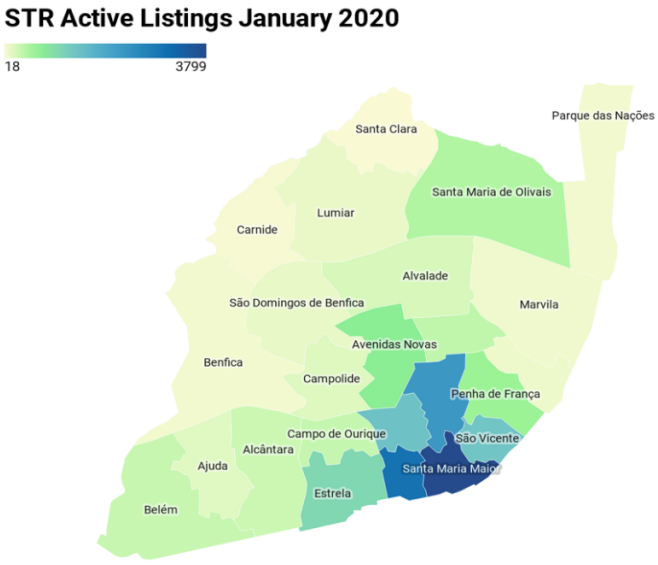


FIGURE 8 - Number of active listings in 2020

The computation of the proxy, led to a total of 17,084 active listings by the end of 2019 in Lisbon, which reflets closely the actual number of active listings according to the AirDNA platform, since the numbers have a variation of approximately 300 listings. This can imply the assumptions presented produce a reasonable variable to represent the number of active listings in a certain period of time in the model. Figure 8 exhibits the number of active properties for renting by location in Lisbon according to the computed proxy. Observing the map, it is perceptible the active listings location is in conformity with creation of new listings in last 6 years and the guest demand. Exist a higher number of active properties in Santa Maria Maior, Misericórdia and the parishes around them. The parish with the lowest number of vacation rentals is Santa Clara, the parish located

furthest from the centre. There is also a big discrepancy in the numbers, the first five parishes with more supply have on average 2400 listings, the parishes with less supply have on average 70 listings each, in the rest of the city's parishes prevails an average of 400 listings.

### *4.2 Housing and Rent Prices Data*

The Portuguese housing market in the last decade was marked by the sovereign debt crisis, crisis that affected all European markets strongly, striking Portugal in the beginning of 2008. The housing prices in that year dropped drastically, the construction and real estate sector entered a serious crisis, the banks stopped financing real estate purchases resulting in lack of investment and purchasing power of the internal demand. The housing market in Lisbon experienced a less severe impact, there was a drop in the prices between 2008 and 2012 but not as significant as in the rest of the country, this maybe because it is a touristic area of Portugal. After the period of Troika's intervention, the market recovered with an increase in the housing prices, leading to serious difficulties in the access of a house for population with average income. Houses started to be seen as a financial asset instead of a home, tourism amplified the rental for a short period instead of permanent home and the foreign investment had an enormous influence in the real estate market. These factors, led to an exponential increase in the Portuguese housing prices, decreasing extremely the housing market supply.

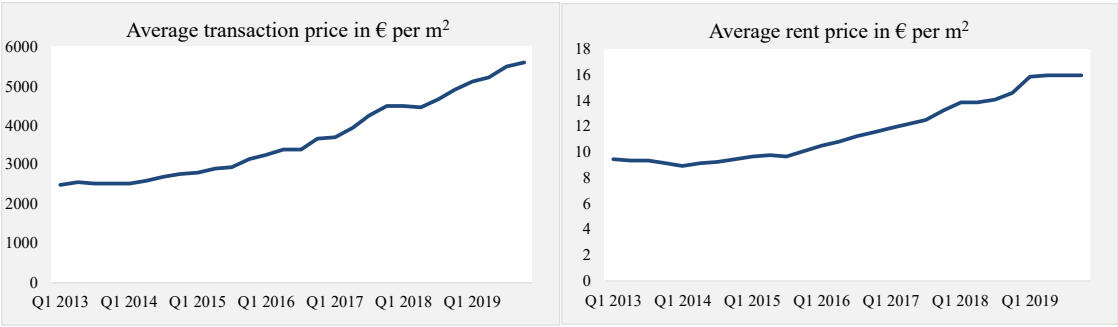


FIGURE 9 - Evolution of the average sale and prices in € per m2 (2014-2019)

Observing Figure 9 is it clear the constant increase of the housing sale and rent prices in Lisbon. The data demonstrates an increase of approximately 50% in the average sale price per square meter since the first quarter of 2013 until the end of 2019 with an increase of the average price in Lisbon from 2378€ to 5030€. The long-term rental market suffered some fluctuations in the same period, but an increasing trend is also visible. Besides the

reluctance of investors and owners about this segment of the real estate market, the average price of long-term rents in 2013 was 9.3€ per square meter contrasting with 15.7€ in 2019.

### *4.2.1 Housing market descriptive analysis*

Finally, in order to conclude this first examination, it is also necessary to evaluate the housing market in Lisbon spatially. To do so, trends of the housing prices and rents distribution are exhibited geographically per parishes. Two-time segments were chosen to elaborate a comparison between the changes of prices in the different parishes of the city, 2014 and 2019, a period where the housing boom was not significant and the most recent year with available data. Firstly, the comparison is among the transaction sale prices of lodging in the different neighbourhoods of Lisbon.

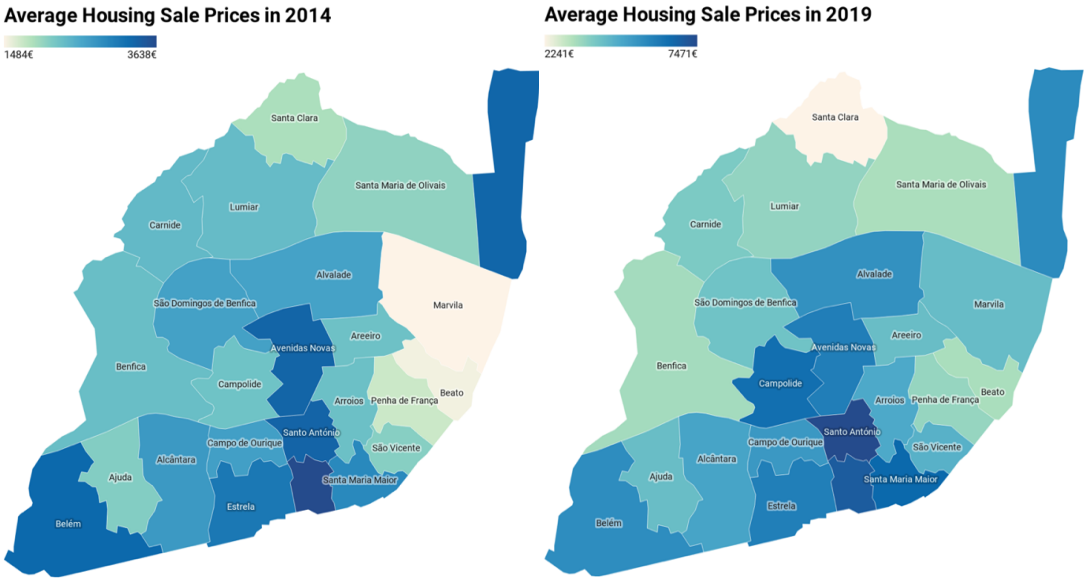


FIGURE 10 - Average housing prices by civil parishes in 2014 and 2019

Figure 10 displayed above, demonstrates that the parishes with highest housing sale prices are Misericórdia and Santo António both located in the historical centre, Avenidas Novas, Parque das Nações and Belém are also parishes with high sale prices, areas characterized by attracting people with a high purchasing power searching for more luxurious dwellings. Comparing these results, with the ones concerning 2019, exists the same trend regarding the highest and lowest sale prices, but there is a significant increase in the housing prices in the space of this five years, with a substantial rise of the number of parishes with high sale prices, almost the entire city has an expensive housing supply.

Analysing the supply of number of houses for sale within the period of research, in 2013 there was around 380 houses for sale, between that year and 2017 the offer decayed, but after that there was a rise in the supply, being in 2019 approximately 400 houses for sale. These oscillations in offer might be due to the number of new constructions and building rehabilitations. According to INE statistics, the number of new constructions in Lisbon had the same trend, in 2013, 161 new dwellings were constructed, but that number decreased drastically until 2017, in that year a small recovery was noticed, but it was in 2018 and 2019 that those number went up strongly with 141 new constructions in 2018 and 199 in 2019. The number of reconstructions had a bigger weight in the number of constructions in the year of 2015 and 2016, but had still a high importance in the following years (Statistics Portugal - Web Portal, 2020a, 2020b).

Examining now the average rent prices path in Lisbon, the most expensive requested rents among parishes suffered some alterations in distribution term from 2014 and 2019. In 2014, the parishes more high-priced follow a similar path when comparing with the housing sale prices, with the exception of Belém. According to Figure 11, parishes such as Parque das Nações, Misericórdia, Santa Maria Maior or Santo António have an average rental price of around 11€ per square meter, the rest of the city have a similar average price between a range of 8€ to 9€, exempting the regions in green and Santa Clara that reported a slightly smaller average price.

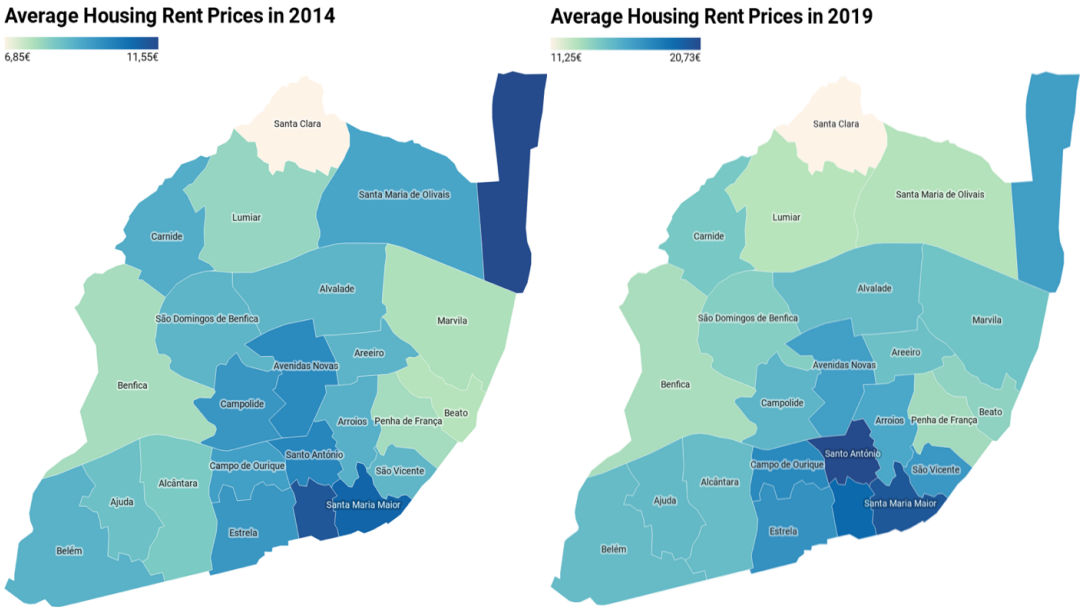


FIGURE 11 - Average long-term rental prices by civil parishes in 2014 and 2019

The long-term rental market reality in 2019, was characterized by a requested average rent prices with an identical pattern between parishes when comparing to the prices of 2014, the most significant difference was a strong increase in all the average prices, where the highest and lowest prices almost doubled between both years. At that point in time, only the historical centre parishes had the strongest rent prices, but the requested rent in the rest of the city was consistent, with rental values of approximately 15€ per square meter. The exceptions can be considered the less attractive parishes, or the ones located on the peripherical part of the city. In general term, renting houses in the city of Lisbon became only affordable for residents with high income or foreigners, because even with selling housing prices extremely high there are signs in the last years, that people find more profitable to get a loan from a bank in order to buy a house instead of paying excessively high rent.

After the analysis of STR and housing variables, it can be stated that in the parishes where the percentage of STR listings is higher, the average rent and sale prices are also the highest. Having both the same trend throughout the years, the geographical demand for short-term rentals and permanent houses is similar, prevailing constantly the attraction for the historical centre. What is clear from both analysis, is the increase of the number of STR and the sale and long-term rental prices tendency to spread from the centre to the peripherical parishes, which can indicate that the exhaustion of the most attractive areas led to a search for more proprieties in other less attractive areas, creating a significant real estate bubble in the entire city. Concerning the policy changes in the home-sharing regime, in some respects it is possible to presume the differences in the evolution of some variables analysed reflect the institutional changes, especially the observable decrease of short- and long-term rentals in 2018, when the restrictions were implemented. The housing market managed to avoid price fluctuations, maintaining its inflated prices.

Comparing the prices of short-term rentals and long-term rentals, it is clear the market of STR is more profitable, with prices stablished per night the host can make a considerable amount of money without renting its property for an entire month. The parishes with the highest long-term rental prices are in accordance with the parishes that present the highest number of STR listings, located in the historical centre and the parishes that offer the residents more quality of life, such as transports or friendly and green areas.

# 5. QUANTIFYING THE SHORT-TERM RENTALS (STR) IMPACT

## *5.1 Empirical Methodology*

The attempt to measure the influence of the short-term rental online platform's activity in the housing prices and rents can be challenging mainly due to possible endogeneity issues, since the geographic distribution of STR is likely to be associated to some factors that can also influence the housing and rent prices. For instance, houses/rents and touristic demand are both influenced by local amenities and specific characteristics of a parish. Considering these limitations, a simple regression analysis of housing and rent average values on the exposure of STR was firstly implemented, including control variables that can reduce the probability of omitted variables bias.

The baseline model has the following specification:

(1) $Y_{1,it} = \alpha_0 + \alpha_1 STRDensity_{it} + \alpha_2 Covariates_i + \alpha_3 \chi_{it} + \tau_t + \varepsilon_{it}$,

(2) $Y_{2,it} = \alpha_0 + \alpha_1 STRDensity_{it} + \alpha_2 Covariates_i + \alpha_3 \chi_{it} + \tau_t + \varepsilon_{it}$,

where the variables $Y_{1,it}$ and $Y_{2,it}$ represent the average annual house prices and rental prices, in parish $i$ in period $t$ (where a period is a given year). $STRDensity_{it}$ is the share of listed properties to the total number of houses in parish $i$ in period $t$, $Covariates_i$ the vector of time-invariant characteristics in parish $i$, $\chi_{it}$ the time-variant vector of the characteristics in parish $i$ , at time $t$, and finally $\tau_t$ denotes the time-fixed effects. Finally, $\varepsilon_{it}$ is the error term that contains additional unobserved variables that can influence $Y_{it}$.

Because $\varepsilon_{it}$ and $STRDensity_{it}$ can be correlated through unobserved parish level factors, was included a parish level fixed effect $\varepsilon_i$, to absorb the effects particular to each parish. Considering the covariates of the specification are all time-invariant, they will not be relevant for the model estimation since their effects in the regression cannot be determined. Because of this, only the parish level time-varying characteristics remained in the model.

With the previous transformations the Equation (1) becomes:

(3) $Y_{1,it} = \alpha_0 + \alpha_1 STRDensity_{it} + \alpha_3 \chi_{it} + \tau_t + \varepsilon_i + \varepsilon_{it}$

(4) $Y_{2,it} = \alpha_0 + \alpha_1 STRDensity_{it} + \alpha_3 \chi_{it} + \tau_t + \varepsilon_i + \varepsilon_{it}$

Because the regular OLS regression does not consider heterogeneity across the sample or time, its results are likely unrealistic since this model acknowledges the behaviour of the variables is homogeneous for all the individuals and throughout time. OLS estimations stack up all the database observations, ignoring the panel data structure, and subsequently assume that the parishes are independent and identically distributed variables. To overcome the OLS limitations for panel data, specific econometric approaches that have been developed to recognize and exploit all the information included in panel datasets were considered, namely the fixed and random effects models.

This selection of models, expose the residual variable as the unobserved heterogeneity and the idiosyncratic error that varies randomly for all individuals and periods. Doing so, these models fix the problem of unobserved heterogeneity. In theory, we can predict that the fixed effects estimation is more suitable for the study, as it assumes that exists some type of association between the non-observed parish level characteristics and the observed control variables included in the model. On contrary, the random effects model implies that there is no association between the regressors and the unobserved effects, which we have reasons to believe is not true in this study, since parish level characteristics not included in the estimation can easily affect the number of STR in a determined parish.

After these transformations, we also decided to control for fixed effects in each period, including binary variables, which capture anomalous events, if there were any and doing so, controlling for the light evidence of seasonality. To avoid multicollinearity issues, it was considered 2013 as the year of reference.

Contemplating the previous strategy, we obtain the following specification:

(4) $$Y_{1,it} = \alpha_0 + \alpha_1 STRDensity_{it} + \alpha_3 \chi_{it} + \sum_{t=2014}^{2019} year_t + \tau_t + \varepsilon_i + \varepsilon_{it},$$

(5) $$Y_{2,it} = \alpha_0 + \alpha_1 STRDensity_{it} + \alpha_3 \chi_{it} + \sum_{t=2014}^{2019} year_t + \tau_t + \varepsilon_i + \varepsilon_{it},$$

where $\sum_{t=2014}^{2019} year_t$ are the year fixed effects dummy variables.

### *5.3 Results*

In the specification were considered two dependent variables: housing average prices and rent average prices per square meter. Also, STR density was described as the proportion of listings according to the number of houses in each parish, all reported during the time frame of significant growth of STR.

From Table II and III, we can see the results of the models performed for the two dependent variables. The regression results show that the share of STR listings have a significant influence on housing and rent prices in all approaches (p-value < 0.001). From a simple OLS regression without any controls, can be observed an increase of, on average, 181.75€ in the housing prices and 0.38€ in rent prices per square meter, when STRDensity increases 1% (Column 1).

To recall the STR density concept and understand the real impact of 1% increase in the share of STR listings, we will analyse two different parishes. When observing the parish with the highest number of houses (Lumiar) we can conclude that if the STR density proportion increases 1% in this parish, it reflects an increase of 185 houses being used as a short-term rental. Do not forget, that this area is not considered one of the most attractive to tourists, as it is a residential area located away from the city centre. Nevertheless, since 2013 to 2019 it suffered a STR increase of more than 7000% and therefore 0.6% of houses where STR in 2019. When observing the parish with the smallest number of residential houses (Santo António), the STR listings represented 14% of the existing houses in 2019 in this parish, and when this proportion increase 1% it suggests that approximately 55 houses were transformed into STR accommodations.

Once we incorporate year and parish controls, followed by the time-variant parish controls (deaths, births, number of new houses and buildings renovations), the estimate declines to an 85.73€ increase on housing prices (Column 3). Nevertheless, the controls have the predictable signs, and some are statistically significant, also the residual standard error of the model decreases to a third. Finally, when analysing the panel data models, the fixed effects estimator translates an increase on average of 202.16€ in housing prices and 0.48€ in rent prices is explained by 1% increase in STR density, while in the random effects estimator the coefficients decrease to 188,50€ and 0.39€ (Column 5/6). From the Adjusted r-square values, there is a strong preference, both in rent and housing prices, for the pooled OLS model with parish and year controls since the specification explains approximately 0.93 of the variance of the prices of houses and rents.

Bearing in mind the Pooled OLS estimation is inappropriate for the database, since does not consider heterogeneity across groups or time (see Figure 12/13), and random effects estimator assumes no correlation between the residuals and the independent

variables, several tests were implemented to decide which model fits better the data. Firstly, were realized the tests regarding the Pooled OLS estimation. To do so, the F-test for individual effects is suitable to choose between Fixed Effects estimator and the Pooled OLS regression. This test null hypothesis undertakes that individual intercepts are equal to zero, being a characteristic of the pooled OLS model.

(6) $H_0: \varepsilon_i = 0, i = 1, \dots, N.$ vs. $H_1: \varepsilon_i \neq 0, i = 1, \dots, N.$

As executing the test, the result indicates a p-value of 4.453e-14 for housing prices and 7.105e-06 for rent prices. Because p-values are lower than 0.05, the alternative hypothesis (fixed effects) has significant effects. Afterwards, the Breusch-Pagan- LM test was computed to choose between Random Effects estimator and the Pooled OLS regression, as it compares the estimations verifying if the null hypothesis of variances across individuals are zero, that is no panel data effect (Breusch & Pagan, 1980).

(7) $H_0: \sigma_\varepsilon^2 = 0$ vs. $H_1: \sigma_\varepsilon^2 \neq 0$

The result rejects the null hypothesis with p-values of 2.2e-16 and 0.001245 (p-value<0.05), so the Random effects is the preferred model demonstrating significant differences across parishes.

Finally, is required to choose between Random and Fixed effects models. To do so, the Hausman Test was computed. This test null hypothesis represents the characteristics of random effects, which is that individuals' error term is not correlated with the explanatory variables (Hausman, 1978).

(8) $H_0$: $\varepsilon_i$ not correlated with the explanatory variables. vs. $H_1$: $\varepsilon_i$ correlated with the explanatory variables

Because the p-value is higher than 0.05, we accept the null hypothesis and admit the random effects model as favourite, not corroborating our first analysis.

The Fixed Effects model was, in a primary analysis, the preferred model between all the models tested, so before jumping into rushed conclusions, it was settled to keep both models until we finish the next steps. In this sense, it was decided to control for year fixed effects. This decision was based on the results of the F-test for individual effects and Breusch-Pagan - LM time effects test. When executing both tests, the p-value<0.05, so

the use of year-fixed effects is recommended. The results of our preferred estimation versus the estimation chosen by the Hausman test can be observed in table I.

According to the results, 1% increase in STR density leads to an 85,73€ increase on house prices and 0.16€ in rents, using fixed effects model. Using random effects model the interpretation is slightly different, when STR density increase by 1% across time and parishes it has an average effect in house prices of 96,22€ and 0.16€ in rents. Both estimations explain adequately the house and rent prices displaying very good measurements.

TABLE I: THE EFFECT OF SHORT-TERM RENTALS IN HOUSING AND RENT PRICES

| Dependent Variable | (1) sales | (2) rents |
|---|---|---|
| STR_DensityCC | 8,572.971*** | 15.945*** |
| | (1,285.973) | (2.771) |
| Deaths | -1.832 | 0.001 |
| | (1.581) | (0.003) |
| Births | 0.271 | 0.001 |
| | (1.538) | (0.003) |
| Building's Renovations | 0.803 | 0.024* |
| | (6.506) | (0.014) |
| New houses | 0.459 | -0.006** |
| | (1.279) | (0.003) |
| Year FE | yes | yes |
| Observations | 168 | 168 |
| $R^2$ | 0.898 | 0.929 |
| Adjusted $R^2$ | 0.871 | 0.911 |

*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

| Dependent Variable | (1) sales | (2) rents |
|---|---|---|
| STR_DensityCC | 9,622.437*** | 15.885*** |
| | (1,096.608) | (2.218) |
| Deaths | -1.587* | -0.002 |
| | (0.912) | (0.002) |
| Births | -0.050 | -0.001 |
| | (1.092) | (0.002) |
| Building's Renovations | 8.828* | 0.029*** |
| | (5.042) | (0.010) |
| New houses | 0.556 | -0.005* |
| | (1.286) | (0.003) |
| Constant | 2,705.924*** | 9.490*** |
| | (316.688) | (0.590) |
| Year FE | yes | yes |
| Observations | 168 | 168 |
| $R^2$ | 0.881 | 0.920 |
| Adjusted $R^2$ | 0.873 | 0.914 |

*Significance levels: *p<0.1; **p<0.05; ***p<0.01*

The use of dummy variables is not problematic because there is a significant number of observations in the model and in that sense the loss of liberty is not reflected in the estimation. This allowed us to analyse the evolution of housing and rent prices throughout the selected time frame. From table IV we can see that housing and rent prices have increased significantly throughout the entire period of research. In 2019 the housing prices have increased on average, 20.10€ per m2 and rent prices 0.06€ per m2 when compared to the prices in 2013. When analysing the year fixed effects in the random estimator, the increase in housing prices is slightly lower (19.69€), but rents prices maintain the same increase (0.06€).

After this analysis, is still mandatory to verify if the Random Effects model is the best fit for the data as the Hausman test suggests. We can find this conclusion by analysing the other difference of both models, the intercept. The Fixed Effects models treat intercepts as fixed parameters and, on the other hand, Random Effects model assumes the intercepts as random variables (reflects the individuals as random sample of a bigger population). To achieve this result, was computed the F-test for coefficient stability to verify if the intercepts are different between individuals.

(9) $H_0$: the intercepts $\alpha_{0i}$ are different vs. $H_1: \alpha_{01} = \alpha_{02} = \alpha_{0k}$

Given that p-value<0.05, we reject the null hypothesis that intercepts are the same for all individuals, and subsequently, we should use the Random Effects model.

### *5.4 Robustness Checks*

To assess the reliability of the preceding results and approve the strength of the estimation, several tests were performed to check the structural validity of the model.

Performing the Pesaran CD test for cross-sectional dependence, the null hypothesis is that the residuals across individuals are not correlated (Pesaran, 2015). Both house and rent dependent variables accept the null hypothesis of no cross-sectional dependence, i.e., p-value>0.05. This result validates the indication of differences among parishes.

Shapiro-Wilk normality test was computed to check if the dataset was modelled by a normal distribution. The null hypothesis is to have normality in the residuals and if the p-value is higher than 0.05 we accept the null. The result rejected the null hypothesis, assuming non normality in the residuals.

When testing for serial correlation, we resorted to Breusch-Godfrey/Wooldridge test for serial correlation in panel models. This approach tests the autocorrelation in the error terms, where the null hypothesis is of no serial correlation (Breusch, 1978). The p-value result was lower than 0.05, so we rejected the null hypothesis of no serial correlation, concluding that there is autocorrelation among the residuals i.e., the residuals are not independent.

Using Dickey-Fuller test, to assess for the presence of unit roots/stationarity, the null hypothesis of non-stationary or presence of unit roots was rejected, since p-value<0.05.

Analysing the heteroscedasticity of the model, we resort one more time to the Breusch-Pagan LM test, where the null hypothesis of this test in no homoscedasticity (Breusch & Pagan, 1979). After computing the test, the p-value was lower than 0.05, so, we accept the null hypothesis, assuming the presence of heteroscedasticity in the residuals i.e., variance of the errors is not the same for all individuals Then we should control for the heteroscedasticity, using robust standard errors. Once adjusting the standard errors using the covariance-variance matrix, the model results maintain the same, only some control variables decrease its significance levels.

The results presented in this section provide evidence that our model delivers an acceptable estimation of house and rent prices, although it does not meet every statistical requirements.

## 6. CONCLUSION

The rapid growth of short-term rental platforms, instigated by excessive tourism demand, has led to substantial changes in Lisbon. Historical neighbourhoods' mischaracterization, displacement of residents from the centre due to unaffordability and the frenetic expansion of the housing market with prices astronomically increasing in all areas, many critics guarantee these platforms are the ones to blame.

Despite the current discussion and controversy of the topic, the research literature and studies about the subject are scarce. For that reason, this study aimed to quantify if the rise in house and rent prices are related to the increase of the number of home-sharing listings and consequently if the short-term rentals effectively are the main responsible for the up-rise trend in the housing market.

Lisbon was the focus of the analysis, as it is the city that suffered more touristic pressure and exhibited the highest levels of concentration of home-sharing in the latest years, leading to restrictive government policies. It was observed that this levels of concentration are particularly higher in the historical centres, but the exhaustion of the market in central areas led a spreading trend to other more peripherical parishes. In Santa Maria Maior, one of the most attractive parishes for tourists, 30% of the residential houses were home-sharing listings in 2019 with roughly 1765 listings, coincidence or not, was also the third most expensive parish to live in with sale prices of approximately 6600€ per $m^2$ in that same year. On the contrary, Marvila was the less desired location, with only

57 listings and a home-sharing pressure of 0,40% on residential homes, but even with low statistics, since 2013 to 2019 the number of listings increased around 7500% and sale housing prices increased around 278%, following the same trend as Santa Maria Maior, with a 235% increase housing prices and 2053% increase in the number of listings, which corroborates the expansion of the trend to peripherical parishes.

Limitations to the research, had an enormous impact on what were the initial intentions of the study, which led to several method changes and results not as accurate as what were the expectations. The main limitation, which impacted the whole study, was the lack of available data, not only on short-term rentals, which required the use of several assumptions, but also on control variables to make the study and model as accurate as possible. Since most statistic websites focus only on municipality and country levels, parish control variables were scarce and not available for the chosen time frame. Also, it was not possible to account for the effect of gentrification in the sense that demographic controls that could exclude its effect from the estimation were not available for the spatial sample chosen.

Under these limitations, the effects of short-term rentals on housing market were identified by estimating house and rent prices as a function of number of listings in the city. Was estimated an increase in housing prices of approximately 96 €/$m^2$ and 0.16€/$m^2$ in rents due to short-term rentals. Furthermore, we could also identify an average increase of approximately 20€/$m^2$ in house prices in 2019 when compared to 2013. We were also able to state that in the parishes where the percentage of STR listings is higher, the average rent and sale prices are also the highest.

Finally, we conclude that the empirical approach has some flaws since the quantification results can be biased due to methodical limitations and the impossibility of accounting for the numerous factors can similarly influence the housing market. However, this research indicates similar behaviours and trends between the housing and home-sharing market, and even not perfect, the estimations are acceptable to conclude that the concentration of short-term rentals affect housing and rent prices. Therefore, this research delivers further details and information when debating the power of short-term rentals and provides a suitable setting of Lisbon's housing market fluctuations and its consequences for locals.

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## APPENDICES

TABLE II: DESCRIPTIVE STATISTICS. OBSERVATIONS AT PARISH-YEAR LEVEL.

| Statistic | N | Mean | St. Dev. | Min | Max |
|---|---|---|---|---|---|
| Housing Prices (€/m$^2$) | 168 | 3,328.359 | 1,274.849 | 1,319 | 7,470 |
| Rent Prices (€/m$^2$) | 168 | 11.431 | 2.842 | 6.750 | 20.725 |
| STR new listings | 168 | 56.786 | 78.456 | 0.000 | 354.000 |
| STR listings | 168 | 189.774 | 318.133 | 0.000 | 1,765.750 |
| Number of Houses | 168 | 9,977.125 | 3,818.815 | 5,498 | 18,457 |
| STR Density (STRlistings / nºhouses) | 168 | 0.462 | 0.392 | 0.0005 | 1.592 |
| Area (km$^2$) | 168 | 4.173 | 2.360 | 1.490 | 10.430 |
| Deaths | 168 | 279.304 | 127.954 | 56 | 551 |
| Births | 168 | 240.863 | 100.535 | 105 | 547 |
| New Buildings | 168 | 1.161 | 1.278 | 0 | 7 |
| Renovations Buildings | 168 | 14.077 | 14.243 | 0 | 75 |
| New Houses | 168 | 12.042 | 26.394 | 0 | 162 |
| t1 new houses | 168 | 3.214 | 8.109 | 0 | 55 |
| t2 new houses | 168 | 4.060 | 10.609 | 0 | 72 |
| t3 new houses | 168 | 3.161 | 8.810 | 0 | 55 |
| t4_new_houses | 168 | 1.607 | 4.043 | 0 | 21 |

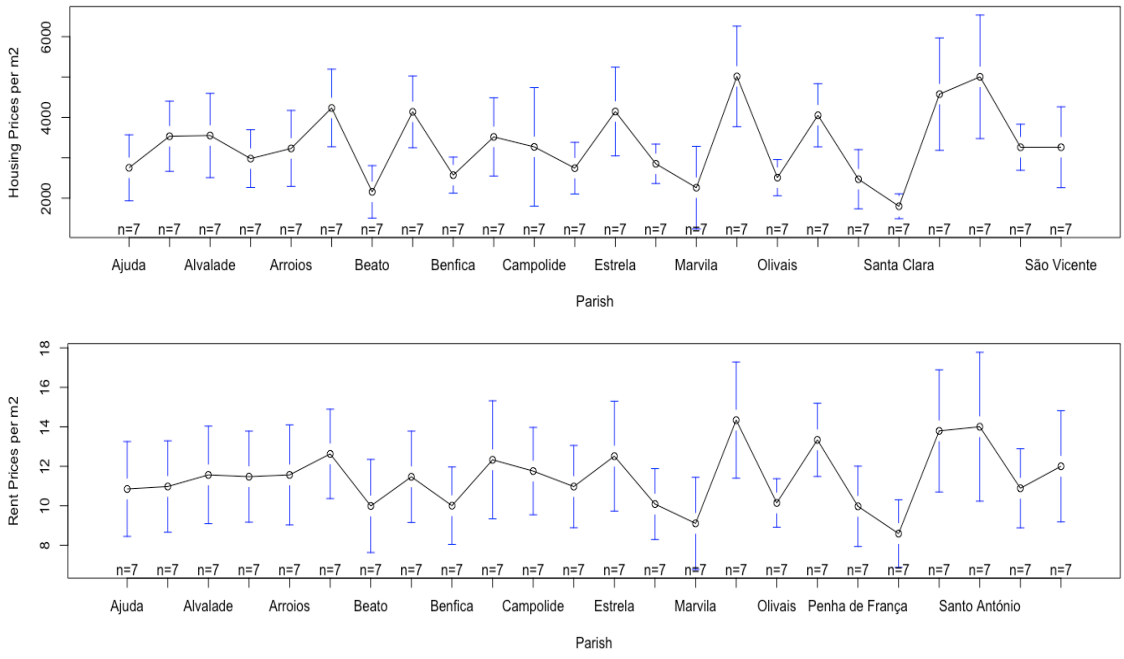


FIGURE 12 – Heterogeneity of Housing and Rent Prices across parishes (unobserved variables that do not change over time)

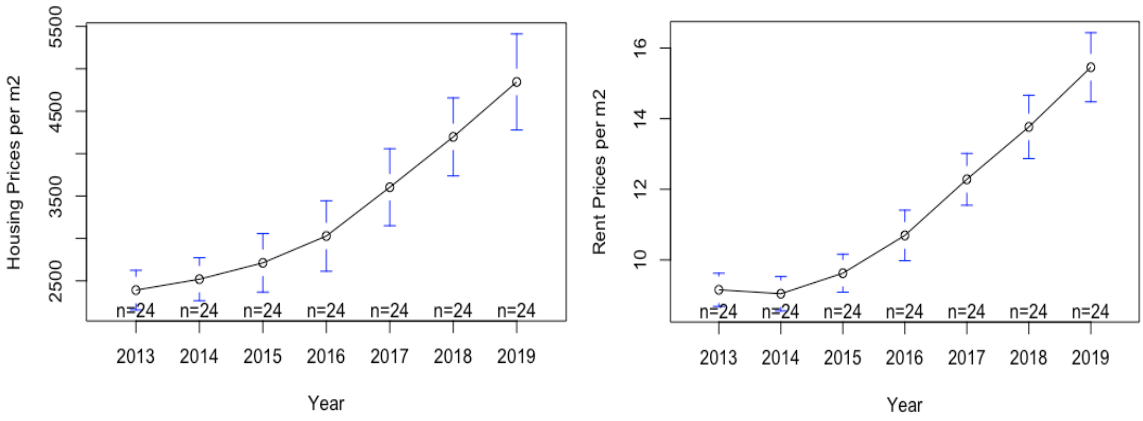


FIGURE 13 – Heterogeneity of Housing and Rent Prices across years (unobserved variables that do not change over time)

TABLE III: THE EFFECT OF SHORT-TERM RENTALS ON HOUSING PRICES

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| STR_DensityCC | 18,175.330*** | 8,640.721*** | 8,572.971*** | 15,709.210*** | 20,215.710*** | 18,850.450*** |
| | (1,503.439) | (1,027.830) | (1,285.973) | (1,651.588) | (1,999.489) | (1,566.992) |
| Deaths | | | -1.832 | -1.427** | -0.884 | -2.043* |
| | | | (1.581) | (0.708) | (2.919) | (1.136) |
| Births | | | 0.271 | 0.139 | 8.389*** | 2.088 |
| | | | (1.538) | (0.946) | (2.581) | (1.438) |
| Renovations_buildings | | | 0.803 | 6.170 | 7.796 | 3.614 |
| | | | (6.506) | (5.627) | (10.259) | (6.746) |
| New_houses | | | 0.459 | 13.237*** | 10.840*** | 11.720*** |
| | | | (1.279) | (2.623) | (2.105) | (2.146) |
| Constant | 2,835.144*** | 1,958.262*** | 2,371.347*** | 3,061.345*** | | 2,741.079*** |
| | (144.336) | (141.446) | (466.039) | (229.927) | | (376.873) |
| Year FE | no | yes | yes | no | no | no |
| Parish FE | no | yes | yes | no | yes | yes |
| Method | OLS | OLS | OLS | OLS | FE | RE |
| Observations | 168 | 168 | 168 | 168 | 168 | 168 |
| $R^2$ | 0.468 | 0.944 | 0.945 | 0.550 | 0.612 | 0.575 |
| Adjusted $R^2$ | 0.465 | 0.932 | 0.931 | 0.536 | 0.534 | 0.562 |

*Significance levels: *p<0.1; **p<0.05; ***p<0.01*
*Notes: Standard errors in parentheses clustered at parish level. STR_DensityCC is calculated as the share of STR listings to the number of houses.*

TABLE IV: THE EFFECT OF SHORT-TERM RENTALS ON RENT PRICES

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| STR_DensityCC | 37.563*** | 13.405*** | 15.945*** | 36.132*** | 48.353*** | 39.720*** |
| | (3.553) | (2.261) | (2.771) | (3.949) | (5.645) | (4.010) |
| Deaths | | | 0.001 | -0.003 | 0.003 | -0.003 |
| | | | (0.003) | (0.002) | (0.008) | (0.002) |
| Births | | | 0.001 | -0.001 | 0.026*** | 0.001 |
| | | | (0.003) | (0.002) | (0.007) | (0.003) |
| Renovations_buildings | | | 0.024* | -0.016 | 0.021 | -0.016 |
| | | | (0.014) | (0.013) | (0.029) | (0.015) |
| New_houses | | | -0.006** | 0.028*** | 0.026*** | 0.029*** |
| | | | (0.003) | (0.006) | (0.006) | (0.006) |
| Constant | 10.509*** | 8.796*** | 8.150*** | 11.339*** | | 10.906*** |
| | (0.191) | (0.311) | (1.004) | (0.550) | | (0.737) |
| Year FE | no | yes | yes | no | no | no |
| Parish FE | no | yes | yes | no | yes | yes |
| Method | OLS | OLS | OLS | OLS | FE | RE |
| Observations | 168 | 168 | 168 | 168 | 168 | 168 |
| $R^2$ | 0.402 | 0.946 | 0.949 | 0.482 | 0.540 | 0.484 |
| Adjusted $R^2$ | 0.399 | 0.934 | 0.935 | 0.466 | 0.447 | 0.468 |

*Significance levels: *p<0.1; **p<0.05; ***p<0.01*
*Notes: Standard errors in parentheses clustered at parish level. STR_DensityCC is calculated as the share of STR listings to the number of houses.*

TABLE V: IMPACT OF YEAR CONTROL VARIABLES

| Dependent Variable | (1) sales | (2) rents |
|---|---|---|
| (Year) 2014 | 95.570 | -0.374 |
| | (112.677) | (0.243) |
| (Year) 2015 | 225.536** | 0.215 |
| | (103.414) | (0.223) |
| (Year) 2016 | 455.112*** | 1.201*** |
| | (109.201) | (0.235) |
| (Year) 2017 | 934.452*** | 2.774*** |
| | (110.817) | (0.239) |
| (Year) 2018 | 1,458.737*** | 3.968*** |
| | (120.300) | (0.259) |
| (Year) 2019 | 2,010.036*** | 5.751*** |
| | (130.787) | (0.282) |
| Year FE | yes | yes |
| Observations | 168 | 168 |
| $R^2$ | 0.898 | 0.929 |
| Adjusted $R^2$ | 0.871 | 0.911 |

*Significance levels: *p<0.1; **p<0.05; ***p<0.01*