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Graduate School
Master's Thesis in Economics:

“On the Sharing Economy.
How Airbnb alters Barcelona Housing Market”

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Abstract: Housing prices are on the rise in Spain at an alarming speed during the last years. Neighborhoods and organizations in Barcelona are on the move against this situation. It is said that the sharing economy, by the use of housing peer-to-peer platforms are affecting the housing market. Different city councils in Spain are taking legal actions against these platforms, even to the point of banning them from existing. This thesis paper describes the particular case of Barcelona and the largest peer-to-peer platform in the city; Airbnb. The paper includes a review of the current situation and relevant theory, and an econometric study, enabling us to analyze the relation between Airbnb activity and housing prices.

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1. Introduction

During the past years, the sharing economy has become a relevant subject of several research papers. Sundarajan (2017) dates 2010 the year when this economic method highly increased its popularity. Even with the agreement on a common description and enclosure, its notion brings about confusion among academics. The sharing economy's main purpose is to help share the use of different idle products through the internet; a car ride, a room for rent, renting a bike, renting tools, among many other opportunities. Hamari et al. (2016) describe the sharing economy as an umbrella that combines different communication technology developments; "*sharing consumption of goods and services through online platform*". The boost for globalization, ease access to a global communication and technological world had positively rebounded on these peer-to-peer-online-based firms. The internet has enabled the inclusion of new practices and business models since its inception (Puschmann, 2016). As a result to this favorable environment, the sharing economy has seen a rapid growth within the recent years. In figures, Forbes (Geron, 2013) estimates a \$3.5 billion dollar income for families using these new technologies, and a growth of 25% revenue flow. PwC's study to the European Commission (2016) describes how the sharing economy generated revenues of €4 billion, and €28 billion of transactions within Europe 2015, with a growing forecast for the following years.

There are handful perceptions among authors to describe how the increasing use of the sharing economy and the growth of companies such as Uber and Airbnb affects positive and negatively to the world's economy. It is widely perceived as a tool to empower people, increase efficiency and reduce carbon footprints. On the other hand, critics describe it may be used as an exploitative tool with a self-interest goal rather than a sharing purpose (Schor, 2014). Some authors claim that the eruption of such activities generate controversies in the market, due to the non-delimitation and taxation implications on these activities.

This paper targets a particular aspect of the sharing economy, the peer-to-peer accommodation sector. More precisely, I analyze Airbnb activity in Barcelona and its hypothetical effect on housing prices.

Airbnb is one of the biggest firms on the sharing economy. It is an online platform for people to rent out their idle accommodation (Guttentag, 2013). It makes use of the collaborative consumption and new technologies worldwide. Based on more than 191 countries and over 3 million listings (Airbnb, 2017), the firm is a clear example of a business model success on the sharing economy, as since its foundation in 2008 in San Francisco, California, the start-up grew at an incredible speed. It is indisputable that Airbnb brings about positive impact on the economy: it helps to efficiently make use of available and unutilized resources. The platform helps generate extra income, and it brings tourists to different areas wherein they may spend money in local stores and restaurants. Nonetheless, is it all positive benefits from the increasing activities of Airbnb?

Different research papers have analysed issues concerning these peer-to-peer based activities. Platforms such as Airbnb, brings out a wider opportunity to the users to rent out temporarily room or apartments. However, it also brings a collision between the housing market and tourism. The situation is said to increase prices on both dwelling trade and rental markets. It is said to be caused by the contraction on the offer side of the rentals in favour of an increasing offer of temporary touristic rooms. Moreover, it may attract investors, increasing the demand on dwelling trade. In addition, this issue brings city structural problems, and it has an impact on gentrification, central and touristic areas, and cities where tourism is relevant for the economy.

Ibiza is an example of this extreme problematic situation, with an increase of 25.1 percent on housing prices since 2014. Accordingly, there has been an attractive incentive for investors to benefit from tourist accommodation (El Mundo, 2017). Besides difficulties from tourism to find inexpensive accommodation, inhabitants find impossible the task to find affordable housing, which ultimately turns into breakout of public workforce of the region due to the cost of the apartments. Other examples are New York City and Los Angeles, where local governments had to implement restrictions to these peer-to-peer activities. Currently Mallorca is planning to restrict all these platforms' activities. All things considered, I believe this subject is gaining relevance and it generates a challenging debate in the population. However, there little literature on the specific matter.

Barcelona has been the centre of the debate over the past years in Spain related to this concern. The local government has issued this type of peer-to-peer platforms due to illegalities (Rodriguez, 2016). Around 78 percent of rooms and apartments of the platforms lack of legal registration from the tourist office, thus they avoid paying the respective taxes (Insideairbnb, 2016). Furthermore, the problem brings about another issue; there have been recent waves among inhabitants raising voice against massive tourism. These groups claim negative effects of tourism are putting the city at risk. Initially, these voices based their point of view on the fact that rental prices are increasing in Barcelona at a high rate. This is due to the fact that investors take their rooms/apartments previously part of the rental market, and they include them in these peer-to-peer platforms. Dwelling trade prices are to be affected as well due to the increasing interest from investors, and the lack of housing offer. Secondly, these groups claim it harms areas where tourism was not abundant before the inclusion of the platforms. Last but not least, the described novel situation of the vast majority of the room/apartments of the platform sets a situation where there is a case of tax evasion.

This paper examines the issue concerning the rise of housing prices in Barcelona – dwelling trade and rentals – with a specific target on Airbnb; understanding if there is a relation between Airbnb increasing activities and the increment on prices over the housing market. Hereafter, I depict housing market in two: dwelling trade market, and rental market. The purpose is to describe the situation in Barcelona, together with relevant theory from the housing market, and to develop an econometric study to further conclude whether there is a relation between Airbnb activity and the housing market prices. The contribution of the paper is to address and analyze these recent population concerns with regard to the housing peer-to-peer activities and its possible effect on the increasing housing prices.

The thesis paper is divided into eight chapters. The current chapter introduces the topic in question. The second chapter depicts the background, relevant happenings and facts. It is divided in three subchapters describing Airbnb, housing market and tourism, and an overview of the situation in Barcelona. Chapter three describes available literature utilized throughout the study, including the sharing economy general aspects, and more specific theory about these peer-to-peer platforms. Chapter four contains a theory review of previous sections. Chapter five introduces empirical implementation, which includes the hypothesis and the econometric approach of the paper. Chapter six

describes the data employed in the study, main sources and descriptive statistics. Results and analysis of the econometrics are presented in chapter seven. Last but not least, a brief conclusion ends the study in chapter eight.

2. Background

The following chapter introduces relevant facts to describe Airbnb in Barcelona. First I describe Airbnb facts, together with relevant figures of Airbnb in Barcelona. Second I include a description of Barcelona's housing market and tourism. Third, an overview is depicted.

2.1 Airbnb

Airbnb is one of the most successful peer-to-peer firms in the field of accommodation. The platform describes itself as a trusted community marketplace, where people can book and list accommodation around the world (Airbnb, 2017). The platform states their task is to connect people and provide them with unique travel experiences with all kind of ranged prices (Airbnb, 2017). Airbnb enables "hosts", to post their idle room, entire apartment, or shared accommodation, to "guests" such as tourists that rent it for a temporary period of time.

Airbnb has seen a rapid growth since its inception in 2008. It is located in more than 65,000 cities and 191 countries (Airbnb, 2017). According to Punschmann (2016), globalization and ease access to a global communication system enabled peer-to-peer online firms to grow.

Taking a closer look at Airbnb Barcelona, the platform was firstly established in the city in 2010. Estimations from the platform describe that guests generate €321 million in restaurants over a year on local communities (La Vanguardia, 2017). Figure 1 illustrates a map of Barcelona and how Airbnb is spread across the city, currently occupied by 17,369 listings. Listings are described as each one of the apartment/room for rent or shared in the platform. Among the listings, 50.40 percent are entire homes, and 48 percent are private rooms in the platform. The remaining percentage corresponds to shared rooms (Insideairbnb, 2016). Centric neighborhoods have a higher demand than those in the outskirts; there is a concentration of Airbnb activity in central

neighborhoods. Figure 2 summarizes relevant facts of Airbnb in Barcelona, retrieved from Insideairbnb (2016). According to the data, 57.50 percent of hosts own more than one listing in Barcelona. Cox (Insideairbnb, 2017), describe these multiple listings hosts are more likely to be running a business. Moreover, the average availability is 225 days per year, with a 71.70 percent of listings with high availability.

2.2 Housing Market and Tourism

Housing market cycles have a significant effect over the general economy in Spain (Rodriguez, 2016). Spain has registered a handful cycles of peak performance on the housing market since the 60s:

- Important real estate development during the 60s
- Development between 1971-74
- Development between 1985-1990
- A strong expansion between 1997-2007

According to Rodriguez (2016), in 2007 National Accounting registered construction reached 12.4 percent of GDP, while 2005 reached the top level of housing sales (987,500). During the same phase, prices grew above 195 percent. This growth is explained by the positive evolution of the basic variables such as GDP, employment, and low cost of credit (Rodriguez, 2016). After this phase of growth begins a phase of decline in 2007 up until 2013, due to the boom of the housing bubble, which highly affected Spain, with the most uncertain moment during the bankruptcy of Lehman Brothers in 2008. This phase is marked by a pronounced fall of prices in real estate and credit restriction (Rodriguez, 2016). Since 2014, the cycle has changed and in general terms, there has been a significant increase of prices (Rodriguez, 2016). In 2011 the percentage of rentals on the total number of houses in Spain is 13.5 percent; which is very low in comparison with a 36 percent average inside the Eurozone (Rodriguez, 2016). However, there is an increasing trend to rent accommodation, which is mainly caused by the difficulties to find new accommodations (Rodriguez, 2016). According to Huguet (2014), rental market describes a similar trend to real estate within the past years in Spain. Madrid and Barcelona are the cities where prices have increased the most. Accordingly, Barcelona has one of the highest rental prices of the country; 11 euro per square meter and month as average in 2016 (Rodriguez, 2016).

According to Global Destination Cities Index Report (2016), Barcelona is ranked the 12th most visited city in the world. Accordingly, a total of 8.6 million people visited the city and stayed overnight in 2016. Over this total, 90.3 percent travels to the city for leisure purposes. The months with the most number of visits are July and August (Global Destination Cities Index Report, 2016). Figure 3 shows the trend in both Catalunya and Spain. The number of visitors is increasing over time in the city.

2.3 Situational Description

There are three main actors at play we must account for: Airbnb and similar platforms such as HomeAway and Rentalia, the local government, and neighborhoods and other organizations against these activities.

Airbnb's great expansion is raising some legal concerns over different cities. Taking a look at Airbnb Barcelona, the firm has had several encounters with the local government. The City Council decided in 2014 to legally issue Airbnb and similar platforms (Hipertextual, 2016). Despite the differences, the City Council and Airbnb agreed on the regulation of the platform, requiring all the hosts of the website to be legally registered and display their registration number (Airbnb, 2017), in order to provide the service of hosting. Meanwhile, several groups and waves against these platforms are arising. Neighborhood associations together with other organizations in the city claim that this type of platform together with the active tourism flow is creating unprecedented problems to locals. It is claimed that housing prices have been recently increasing due to gentrification issues and a drop on the offer side of the housing market (Hipertextual, 2017). The latter incidents have forged a trend of hate against tourism among locals (Hipertextual, 2017).

The situation has become an arduous task to the local government, as there are no regulatory precedents that help understanding how to intervene in such situation. Airbnb and similar platforms are being regulated in Barcelona since 2017. Currently, the hosts must register their apartment/room in the Catalan Tourist Office prior the room/apartment is posted. Airbnb's purpose is to connect unused resource with tourists that wish to visit the city and experience it as a local, either renting the whole apartment, or a single room; this is part of the sharing experience. However, this platform may be used for commercial purposes; some of the apartments/rooms are rented out to continuously obtain benefit from it. Most of the hosts have more than one listing; this

may indicate the owners wish to maximize their profit, and they are likely to be running a business. It is yet true that this is not the only cause of the rise on prices both dwelling trade and rentals. A growth in population may cause the rise of the prices as well, due to an increase on the demand side. Moreover, one must have in mind we are before a positive economic cycle; therefore increase in housing prices may be considered as a regular part of the trend.

3. Literature

The following chapter describes the literature employed during the study. It is divided in two subchapters; theory on the sharing economy, and theory on the peer-to-peer platforms.

3.1 The Sharing Economy

Some authors date the origins of the sharing economy in 1995 (Schor, 2014; Sundararajan, 2016), the moment when online precursors such as eBay, Craigslist, and Kozmo were established. Yet it has not been until 2010 when it gained worldwide recognition (Sundararajan, 2016). Different authors describe it as the economy of the XXI century. A commonly accepted definition of the sharing economy describes it as a peer-to-peer-based activity which eases access to goods and services through online services (Hamari et al., 2016).

Schor (2014) describes that the sharing economy activities bring a great deal of benefits such as increase in income levels, capital increase overall, job opportunities, among others. However, these activities bring some legitimate concerns. Schor (2014) states these activities bring about two main issues: job concerns and taxation concerns. The sharing economy firms generate jobs and opportunities for people to make use of their idle resources. Yet these jobs may affect other labor conditions. According to Schor (2014), some critics describe jobs are becoming short-term gigs and job insecurities are arising. To this respect, several authors agree on a need to adapt legislation and policies to the current needs (Lee, 2016; Sheppard & Udell, 2016; Sundararajan, 2016). Sundararajan (2016) states that regulations are meant to correct market failure and incentive economic growth. As the author suggests, we are facing an economic

transformation and the rise of crowd-based capitalism in the new century. It is thus important to rely on the implementation of new regulations that help to conduct this economic growth. The intended regulations are to solve failure caused by the characteristics of the services provided by these new peer-to-peer platforms (Sundararajan, 2016). Political institutions and peer-to-peer platforms have not been working hand in hand in the past years; examples of regulatory pushbacks such as Spain banning Uber in 2014, New York restricting Airbnb activities (Sundararajan, 2016). Other examples such as Belgium and California set to legalize Uber by implementing new laws, describe a negative situation to all the parties in question.

3.2 Housing Peer-to-Peer Platforms

Despite all the importance the sharing economy has brought to light, there is little study on how these platforms similar to Airbnb affect the society and the economy eventually, lesser is the amount of papers addressed to housing prices and peer-to-peer platforms. Most of the papers lay the focus of the study on how to unlock the legal implications these activities bring about. Nonetheless, there are a few research papers studying the particular case of these peer-to-peer platforms and house prices.

A major practical case in this area is undergone by Sheppard and Udell (2016). The authors describe whether Airbnb properties affect housing prices in New York City. The authors describe several mechanisms that may impact the value of residential properties. Figure 4 summarizes Sheppard and Udell (2016) impact mechanisms. An increase in population driven by an increase in tourism, the inflow of new income due to such activities, and the positive economic impact of guests in the neighborhood are the main positive impacts from the establishment of Airbnb properties. On the other hand, negative externalities such as safety and noise bring about negative impact on the area. Moreover, the authors suggest a concentration of Airbnb properties may also affect house prices. Sheppard and Udell (2016) collect data on house prices, Airbnb activity, and neighborhood characteristics in New York City such as level of criminology, demographics, and property characteristics, and run a fixed effect model to determine the direction of the relation between Airbnb and housing prices. As described by Sheppard and Udell (2016), *“the results generally support, but do not ensure that this impact would be for house prices to increase in response to Airbnb listings”*.

Lee (2016) takes a look at the housing crisis in Los Angeles and how Airbnb rentals affect housing prices, more specifically the rental market. The author describes a distortion in the housing market in two steps. First any room for rent that becomes listed on the peer-to-peer platform is thus removed from the rental market and added to the city's supply of hotel rooms. This leads to a shrink in the supply side of rentals, most likely affecting centric areas – gentrifying these neighborhoods. Second, as long as the host rents out the room/apartment at a cheaper price than the average hotel room, it has a great advantage, that enables a higher profit than reintroduce the room/apartment to the housing market (Lee, 2016). This leads again to a shrink in the housing market supply. Nonetheless, the author states “*Airbnb is a response to, not a cause of, gentrification and Los Angeles's affordable housing crisis*”. Therefore, the author suggests that Airbnb activities are not the main reason housing prices are increasing, and it is an answer to the housing crisis. Finally, the author suggests a regulation on Airbnb activities to achieve equitable housing.

Housing market and tourism have never described an overlap; tourists and renters have different needs (Lee, 2016). However, by the inclusion of Airbnb and firms with similar activities, it brings tourists into a direct competition with renters, causing this market distortion (Lee, 2016). The resident owners may obtain more benefits from renting out their apartment/room through these platforms instead of renting it to the locals; there is an overpowering incentive to enter the hotel market, where investors feel attracted to increase their activities even further (Lee, 2016). This is translated into a reduction of the aggregate dwelling stock. Lee (2016) suggests a shortage in the aggregate housing stock cannot be quickly addressed.

Sundararajan (2016) takes a look at the intention of these Airbnb activities. The author describes there are two possible scenarios within the peer-to-peer platforms: there is a commercial, and a sharing opportunity. Initially these platforms are meant to make use of idle resources; a sharing opportunity. However, the moment an individual finds an opportunity to increase utility from renting out its resources the latter may become a commercial purpose. This is the moment a distortion between both markets emerges –as Lee (2016) states, the overlap between housing market and tourism.

On the other hand, other studies claim these pessimistic theories not to be entirely accurate. Accordingly, most of the increment on prices has been registered in less

attractive neighborhoods in Barcelona (Idealista, 2017). Moreover, the rooms and apartments posted on these websites have a limited availability; these are only seasonal, while the rest of the year the tenant resides in the apartment/room (Idealista, 2017). These trends explain the increasing rental prices due to an improvement in the economy – lower unemployment rate – and a deficit in the construction of new buildings in Barcelona (Idealista, 2017).

4. Theory Review

Throughout this chapter I employ the literature section together with the described background in Barcelona. The goal is to establish a framework that enables a valid hypothesis specification.

The situation regarding Airbnb activities in Barcelona has become an arduous task for the local government. Not only due to the possible repercussion on housing prices, but other issues arise. As many authors describe (Lee, 2016; Sheppard & Udell, 2016; Sundararajan, 2016), it is necessary to address a correct tax regulation, and a framework that enables good practices and job safety. There is no previous experience on this market overlap between housing market and tourism discussed above. Thus, there are no previous examples on regulations that may help to address the situation and adjust for inequalities. The main purpose of this study is not to address issues in terms of tax and regulations. Nonetheless, it is important to point out these market failures due to the repercussions it brings. For instance, hate against tourism may turn into a decreasing number of tourists and deficiencies in cleanliness and safety in different neighborhoods of a city.

Airbnb and similar peer-to-peer platforms bring a great deal of economic benefits to the city. According to Sheppard and Udell (2016), some of these benefits are new taxable benefits, new income from tourists, and positive economic impact on areas where tourism was not visible before, with the creation of new shops and marketplaces. The authors describe as well how Airbnb activity impact on the housing market. We have seen dwelling trade market and rental market have similar characteristics in Spain (Rodriguez, 2017). The rental market may be affected at a higher rate than the dwelling trade market is by the inclusion of Airbnb activities in the city. Shortage in dwelling

stock cannot be easily addressed. The rental market is more volatile and short term perspective, whereas the dwelling trade market requires larger investment; it is easier for an individual to take their room from the rental market and introduce it in the peer-to-peer platform. In addition, we have seen that most of these Airbnb “hosts” have more than one listing on these platforms. This scenario describes there are commercial intentions rather than sharing intentions when the individuals introduce their apartment on the platform.

4.1 Impact Mechanisms

Airbnb activity may be affecting housing prices as described earlier in this paper; a shortage in the offer side of the market due to an increase of listings in the peer-to-peer platform occurs, which turns into an increase in dwelling and rental prices. In addition, the following mechanisms nuance the manner these activities impact on prices.

The first impact mechanism is through an increase in population. In general terms, an increase in local population in the city may result in an increase in the aggregate demand of the housing market, which leads to an insufficient housing stock, and ultimately turns into an increase of prices. Lee (2016) describes this as a distortion between housing market and tourism. As described in section 3, this two-step distortion reduces housing stock by increasing the offer of temporary housing for tourists. Hence, the previous increase in population is being augmented by the inclusion of the tourism population. Moreover, price rises in centric neighborhoods lead to gentrification, and population seeking housing in the outskirts, which eventually raises the demand and in turn, increase prices of these areas.

Sheppard and Udell (2016) describe income as an impact mechanism on housing prices. An increase in available income turns into an increase on housing prices. Accordingly, neighborhoods with higher income levels describe an increase on prices. To further evaluate this impact mechanism in the study, I have introduced income as a control variable to explain the relationship between Airbnb activity and housing prices.

On the other hand, safety and noise impacts negatively on housing prices. The increasing number of tourists may now be located in unusual areas for tourism – previous to such platforms, hotels and hostels concentrated most of the tourism

occupation. These platforms enable the chance for tourists to rent a room practically in any part of the city.

I have described positive and negative impact mechanism on housing prices. However, is there a possible reversed causality? Is it possible that Airbnb practices are increasing due to an increase of housing prices? Lee (2016) describes a distortion in the market, and the existence of gentrification in the city as a result. In my opinion, the reasoning behind is that due to the increasing prices in centric areas, people tend to move to the outskirts to find affordable housing, leaving idle apartments/rooms that may be instead introduced in such peer-to-peer platforms. I suggest it is more likely that Airbnb activity affects prices than otherwise.

5. Empirical Implementation

The following section includes the hypothesis I wish to test, and a description of the econometric section of the paper.

5.1 Hypothesis

I have reviewed relevant background about Airbnb and Barcelona, available theory, and previous research papers; a wide picture of Barcelona housing market, Airbnb activity, and other related issues that influence the current situation. The following pages set up a model that helps to understand whether there is a relation between these peer-to-peer practices and the increasing housing prices in Barcelona. I have chosen Airbnb as an example of these peer-to-peer platforms due to its importance and extension in the city. However, data on any other platform can be included in future research.

I wish to investigate to what extent there is a relationship between Airbnb activities and the rise in housing prices in Barcelona within the past years, both in dwelling trade and rental markets. Further I try to understand whether there is a causal relation between the variables. I suggest there is an overall positive relation between Airbnb activities and housing prices.

I assume Airbnb activity impacts on rental prices at a higher rate than it does on dwelling trade prices. I base this assumption on the fact that rental market is more

dynamic. A rental contract may be easily terminated by the owner, who might see the peer-to-peer platforms as a great opportunity to increase their benefit. Nonetheless, there may be also an impact on dwelling trade prices, due to the interest arising from investors that may see Airbnb as a long term opportunity to benefit from.

I assume the reason behind the positive relation is due to a shrink on the aggregate offer of available housing. There is incentive to obtain more benefit through the platform. As long as this incentive is not overcome, the aggregate offer of housing will still shrink. This assumption cannot be described by the use of econometrics, but is thoroughly debated in the analysis with the use of the information gathered in previous sections.

5.2 Econometric Method

The baseline specification describes our variable of interest, housing prices – given I differentiate dwelling trade prices and rental prices – and the independent variable Airbnb activity. I include control variables such as income per capita, population, and a time dummy variable. All the data gathered is divided into the different neighborhoods and districts of the city, throughout quarterly year periods. The study includes two well separated sections; dwelling trade prices and rental prices. In both sections I introduce step by step the different control variables. The reason behind the inclusion of both neighborhood and district levels analysis is the existence of more data available over the time at a district level for the rental market. Neighborhoods give more specific information and common characteristics – since neighborhoods are narrower, and can be part of districts –, but it may be relevant to see the results from a prolonged time period. All the data is described in section 6. The following paragraphs focus on the econometric model motivation. Both analyses follow the same baseline approach:

$$\text{Ln (housing price)}_{it} = \alpha + \beta_1 \text{Ln (Airbnb activity)}_{it} + \delta_1 \text{time dummy}_t + \delta_2 \text{income}_{it} + \delta_3 \text{demographics}_{it} + v_{it}$$

- Logarithm of housing prices is our dependent variable.
- Logarithm of Airbnb activity is our independent variable.
- A time dummy variable is introduced to capture the effect over the time. As Airbnb activity is expected to increase over time and so it does housing price overall during the selected period, our estimator β_1 might be highly affected. To overcome this issue, I have included a dummy variable in our specification, which also helps to

reduce seasonality. The dummy is divided in quarters of year. I do not believe it is relevant to include a yearly dummy, as the current time period is very short.

- Income on a year basis of the different neighborhoods and districts, throughout the different periods in time.
- Demographics in Barcelona is a control variable for the evolution of the number of inhabitants in the different areas of the city.

Each observation includes information on the district and neighborhood, as well as the period of time it has been retrieved, where “ i ” represents location, and “ t ” describes the time period.

The interpretation of β_1 coefficient would be then as follows: for a given neighborhood/district, as Airbnb activity varies across time by one percent, the result is an increase or decrease on housing prices by β percent.

I work with a panel data analysis, and I implement a fixed effects model. This type of analysis gives us a great advantage in order to solve some of the issues encountered along the research.

One of the most common issues of econometric studies is to encounter omitted variable bias. One of the weaknesses of this study is the lack of explanatory variables that may cause housing prices to vary. For instance, there may be other external causes, such as neighborhood improvements, closeness to metro stations, and levels of criminology, which may be affecting our variable of interest. All these may leave unobserved variables and in turn misspecification of the real effect on housing prices. It is important to control for time variant and time invariant characteristics as much as possible, in order to avoid endogeneity issues. It is important that the independent variable is endogenous in fixed effect studies. To this purpose, I control for income, population, and introduce a time dummy variable to avoid seasonality.

Time-invariant characteristics are done away by the implementation of a fixed effects model. It is done at the two available levels named neighborhoods and districts in Barcelona. These characteristics may be causing a variance on the price at the neighborhood level in Barcelona. Fixed effects provide us with the advantage of obtaining the mean effect derived from each section; in this case, the time-invariant characteristics on each neighborhood are unique to each section, hence may not be

correlated with any other entity; the effect Airbnb activity has on housing prices on each neighborhood or district differ due to its unique characteristics. There are central areas in the city with most Airbnb activity, whereas some external areas describe minor activities. The model helps as well to solve for the economic attractiveness of central areas; central areas will have a major Airbnb activity.

On the other hand, time variant characteristics bring bias to our study. To this concern, I introduce some of the impact mechanisms described in previous sections, such as income and population levels. Moreover, I include a dummy variable to avoid seasonal effect of Airbnb activity. Yet it has not been possible to add some other control variables, such as safety, noise, or cleanliness; some of the data could not be retrieved. These facts may affect negatively on housing prices and bias the outcome of the study. Nonetheless, there are other peer-to-peer platforms in Barcelona which describe similar activity to Airbnb and are not included in the study. Therefore I suggest if the paper would include these activities, the effect of these peer-to-peer platforms over housing prices would increase.

I implement fixed effects instead of random effects due to the characteristics of this study. It is evident that the characteristics on the different neighborhoods are not randomly implemented, since each observation has common characteristics within the different sections; the entity's error term and the constant term shall not be correlated with others.

Concerns over autocorrelation do not affect our study. This issue appears in larger data sets with more time periods, whereas our study is only applicable for a reduced time period. As described in previous sections, I believe reversed causality not to be a problem for the study.

Heteroskedasticity concerns lead to adopt robust standard errors in all the specifications described.

6. Data

The following chapter describes how the data has been gathered. It is divided in four subchapters. The first three describe Airbnb activity, housing prices, and control variables. The last subchapter introduces descriptive statistics.

6.1 Airbnb Activity

The following variable estimates Airbnb activity in Barcelona. There are different manners to estimate Airbnb activity. I have chosen to analyze their activity by collecting data on the number of available room/apartments at the Airbnb website in Barcelona on a quarterly year basis. Therefore, this paper measures Airbnb activity by the number of rooms and apartments available in the platform for each time period, in each neighborhood and district in Barcelona.

Since Airbnb does not provide any information from their database, I could not retrieve data straight from the main source. Nonetheless, I gather the data from Insideairbnb, external project directed by Murray Cox. Insideairbnb works independently from Airbnb and regularly collects data from the website on different cities around the world. The author has compiled different sets of data throughout seven scraps to the Airbnb website. The sets provide relevant data on each room posted on the website such as room ID, host ID, neighborhood, room type, price, availability, number of reviews, first review, last review, and license, among others. I have gathered all seven different datasets from Insideairbnb and merged them, keeping only listings with different identification number. Once all the listings have been gathered, we encounter a total of 69,065 room/apartments. Eliminating the duplicated values with the same ID, a total of 36,729 values remain –dating from the fourth quarter of 2009 until recent second quarter 2017. Lastly, I dropped those without first review date, having a total of 27,369 listings in Barcelona. The observations include specification of the different district and neighborhoods as well, with a total of 10 districts and 74 neighborhoods, from 2011 until the second quarter of 2017.

As Sheppard and Udell (2016) carried out in their study, I use the room/apartment's first date review as a proxy to estimate the date the room/apartment had its first activity on the platform. Such estimation may bring bias to the study; it is possible that the room has only been used at that point in time, and it would not be of use to describe it as a

continuous Airbnb activity. However, Sheppard and Udell (2016) and Cox (Insideairbnb, 2017), agree that the use of the date of the first review can be proxy for the first activity of the apartment/room. Looking at the average of reviews per month, we can see how the different observations are active throughout the years; this data describes Airbnb activity in Barcelona as a very active and continuous platform. Figure 2 collects all the relevant information. There is high average availability in the platform in Barcelona – 225 days per year – and the total average occupancy is around 100 days per year. The data shows high availability, which shows the hosts are active along the year in Barcelona.

6.2 Housing Prices

Housing prices are gathered from Generalitat de Catalunya official website – main institution of the Catalan region. I collect both sets of data; dwelling trade prices and rental prices in Barcelona:

- Statistics on Registered Trade on Dwelling (“*Estadística de compraventas de viviendas registradas*”). The data is gathered and updated every quarter of year by Generalitat de Catalunya. It includes data of new and secondhand dwelling trade, sold between 2013 and 2017. Every movement and property change must be included in this registry, therefore, all the dwelling that has been traded in the city must be included in this data set. It is divided on a quarter of year basis, over the different districts and neighborhoods. The data is measured in Euros per square meter. This enables us to compare different locations and apartments and eliminate bias on the different dimensions the apartments may have over the different areas of the city.
- Rentals in Barcelona by Districts and Neighborhoods (“*Contratos y precios registrados de las viviendas en alquiler*”). The data set is based on the statistical exploitation of rentals, deposited at INCASOL – Catalan Institute of the Built Ground. In the rental section, I have collected two different sets of data; the first set of data is collected at a neighborhood level, and contains data from the first quarter of 2014 until the first quarter of 2017. On a district level data is retrieved from 2000 until 2017 on a quarterly year base. As described previously, neighborhood level allows us to piece together smaller areas that may have more characteristics in common. Nonetheless, I have included the district level as I could find a larger data

set, which may bring relevant analysis to the study. All the values are described in Euro per square meter, which enables to compare different apartments independently from its size.

6.3 Income and Population

The variable income is retrieved from the Barcelona City Council official website. It contains data of average real income per capita and of each neighborhood from 2011 to 2016. The data consist on an index based on real income per capita in a yearly average over the different neighborhoods in the city. With the inclusion of such variable, we introduce more characteristics to our specification, which may help us control for our variable of interest.

The variable population is collected from the Barcelona City Council official website. It contains data on the evolution of the number of inhabitants within the different neighborhoods in Barcelona on a yearly basis, from 2010 until 2016. The variable helps us to control for the levels of population growth.

6.4 Data Timeline

To summarize, the study retrieves data on Airbnb activity from the fourth quarter of 2009 until second quarter of 2017, and three different sets of data with regard to housing prices; dwelling trade prices are observed between 2013 and 2017 both at neighborhood and district level, whereas rental prices includes two data sets. At a neighborhood level, data is observed from the first quarter of 2014 until the first quarter of 2017, and at a district level the data is observed from 2000 until 2017. It may be of great interest to include more data over the following years in order to have a better understanding of the relation between the variables. Figure 5 shows the time period of the data retrieved.

6.5 Descriptive Statistics

Table 1 shows descriptive statistics on Airbnb activity, dwelling trade prices, and rental prices. There are 1,095 observations on Airbnb activity, 929 values on dwelling trade prices, 1022 values on rental prices by districts, and 690 values on rental prices by neighborhoods, all the above throughout 73 neighborhoods and 10 districts. The data is analyzed quarterly over the years, from 2013 to the second quarter of 2017. As

previously mentioned, there is the exception of rental prices over the district level, which includes data from 2000 to 2017. Data on Airbnb activity is collected from 2011.

Overall the descriptive statistic tables 1 and 2 prove the data to have high standard deviation. There is a great difference between minimum and maximum value in both prices and Airbnb activity. This is due to the existing difference between neighborhoods, which will be corrected thanks to the use of fixed effects method. Giving a detailed descriptive statistics on each neighborhood would take a great deal of effort to the reader; therefore I have chosen not to show it in the appendix of the paper. Nonetheless, table 1 and 2 describes relevant characteristics in general terms for the reader.

Figure 6 shows this Airbnb activity positive trend in all the different districts. It is obvious that most of Airbnb expansion is located within touristic and centric areas. Neighborhoods with the most activity in the second quarter of 2017 are el Raval (2,768), el Barri Gòtic (2,248), la Dreta de l'Eixample (2,156), and Sant Pere (2,113). On the other hand, figure 6 also shows there certain districts with barely any Airbnb activity. With the data at hand one may see neighborhoods such as la Clota, Can Peguera and Baró de Viver, located in the outskirts, with little Airbnb activity.

Figure 7 shows dwelling trade prices trend on the different districts over the period. We see a smooth increase until 2015. From this year onwards, the price increment is highly pronounced. Figure 8 shows the trend on rental prices. Overall there is an increase during the period, similar to the increase described on dwelling trade prices.

7. Analysis and Results

The relation between dwelling trade prices and Airbnb activity is shown in figure 9. Figure 10 shows the relationship between the platform's activities and rental prices. The relation on both figures is described at a neighborhood level. Overall, the figures describe a positive correlation between the variables Airbnb activity and housing prices, both on dwelling trade and rental markets. The following subchapters describe how the analysis has been driven and the results gathered.

7.1 Dwelling Trade Market

The results are shown in table 2. Initially, I run a fixed effects model that only includes dwelling trade prices and Airbnb activity (1) (3). The results show a positive coefficient β_1 . The results are statistically significant, and a positive relationship between the variables on both neighborhood and district level.

However, the previous specification does not account for seasonality, and no control variables have been added. I introduce a time dummy variable in order to account for these months of the year with high seasonality on Airbnb activity. Once I control for time (2) (4), the results turn to be statistically insignificant, both at neighborhood and district level. The results describe a positive relation at a district level (2), and negative at a neighborhood level (4).

The results indicate a rather small log Airbnb activity coefficient. For instance, (3) indicates that one percent increase on Airbnb activity results in a 0,09607 percent increase in prices. Such small effect is expected. Airbnb activity increases much quicker than dwelling trade prices. It is not realistic that an increase in Airbnb activity may result in a large impact on dwelling trade – no causal effect exists between both variables. Standard errors are rather small among the specifications. All the results include robust standard errors. The R squared shown in the tables describe the coefficient within the level of distribution – either neighborhood or district level. Overall the results show a small R squared, which is higher at the district level.

At the last step, I introduce control variables income and population (5). The coefficient on Airbnb activity increases slightly, but the results turn to be again statistically insignificant.

7.2 Rental Market

Figure 10 shows the relationship between the variables rental prices and Airbnb activity, at a neighborhood level. The figure describes a positive trend between the variables. The results on rental prices are shown in table 3. I first run a basic specification with no control variables (1) (3). The results indicate a positive coefficient at both neighborhood and district level. At a district level the results show statistical insignificance, but significant at the neighborhood level.

In contrast with the previous subsection, once I include the time dummy variables both at a neighborhood and district level (2) (4), the results describe a positive relation between Airbnb activity and rental prices. Moreover, the results are statistically significant at a neighborhood level. The coefficient (4) indicates that if Airbnb activity increases by one percent, we expect rent prices to rise by 0.0084 percent. It is again a rather small coefficient, but one must keep in mind that Airbnb activity is increasing at a high rate during these years. Therefore, a small impact may be sufficient to explain the change on prices. Overall standard errors are rather small, and our R squared within the level of distribution is higher in comparison with the previous analysis on dwelling trade prices.

The results do not vary significantly once introduced income and population control variables (5) (6). There is statistical significance at a neighborhood level. It is arguable that Airbnb activities have a higher impact over rental prices than it has on dwelling trade prices.

7.3 Discussion

Along the current section, I have analyzed if there is a positive relation between Airbnb activity and housing market in Barcelona with the help of econometric tools. The results describe an overall positive relation on dwelling trade prices, but a negative relation at a district level. The relation is statistically insignificant once we control for income, population, and seasonality. Secondly, results indicate a positive relation between Airbnb activity and rental prices. The relation is better described in the sector of rentals, with statistical significance at the neighborhood level.

Therefore, one may summarize the results indicate a positive relation between Airbnb activity and rental prices, but no such a clear relation between Airbnb activity and dwelling trade prices is depicted. As described in the theory section of the paper, rental prices may be easier affected by Airbnb activities than it is dwelling trade prices. This is due to the volatility of the market. It is easier for a property owner to switch from the rental market to introduce their apartment/room in the peer-to-peer platform. This describes an overlap between markets, as stated by Lee (2016). Moreover, I have introduced a few impact mechanisms on house prices described by Sheppard and Uddel (2016). Population and income are used as control variables during the analysis.

However it has not seen a major effect over our model. Neighborhoods with the most Airbnb concentration have seen a major increase in prices.

To summarise, the results indicate a positive relation between Airbnb activity and rental prices. However, it is not possible to indicate a causal relationship. The results may be improved if introduced more control variables that explain the model. Characteristics such as closeness to the metro station, levels of criminology, among others, may be relevant to explain our model and may be taken in consideration in further research.

8. Conclusion

This paper employs theory econometric tools to describe the relation between the increasing Airbnb activities and the rise of prices in the housing market in Barcelona.

As some authors describe in previous research paper (Lee, 2016), I suggest there is an overlap between two markets, dwelling and tourism. Most of Airbnb hosts have more than one property on the platform in Barcelona, which describes a situation where investors play a major role. Investors gain more utility from renting out the apartments through the platform than renting out to inhabitants; there is higher income in the prior option. Housing offer becomes insufficient to sustain both markets, and the lack of housing turns into higher prices. A short term constraint due to lack of apartments, caused by the limited offer of real estate. In the short run, the offer cannot be easily increased –time of construction. In the long run this may be overcome. In addition, this situation will hold until we reach a point at which investors no longer benefit from the platform; point at which there are enough apartment/rooms in the platform so that there is no sufficient benefit for all the hosts.

The econometric results show a positive relation between Airbnb activity and rental prices in Barcelona. It does not show such positive relation when it comes to dwelling trade, as the results are statistically insignificant when controlling for seasonality. Therefore I conclude there is a relation between Airbnb increasing activities and the rental prices in Barcelona. Investors see the platform as a way to benefit, and it turns into a decrease in the number of rentals in the city. The results indicate however, this effect to be rather small.

Nonetheless, one must be careful with the results. Further research may include other platforms similar to Airbnb, as well as more control variables previously described such as safety and noise levels in the different neighborhoods. In addition, this increasing trend in prices may be as well caused by a regular positive economic cycle. More data over the consequent years shall be useful to improve the results.

The sharing economy platforms have brought a great deal of benefits, and particularly relevant assist on how to make use of idle goods. Sharing economy platforms bring beneficial effects to the economy. These peer-to-peer platforms are changing consumer behaviour. Thus there is a need to adapt to these new market changes and overlaps in order to overcome possible market failures; there is a need of flexibility and inclusion of new policies and laws, which local governments may have to deal. We are facing a new era: the era of the shared consumption.

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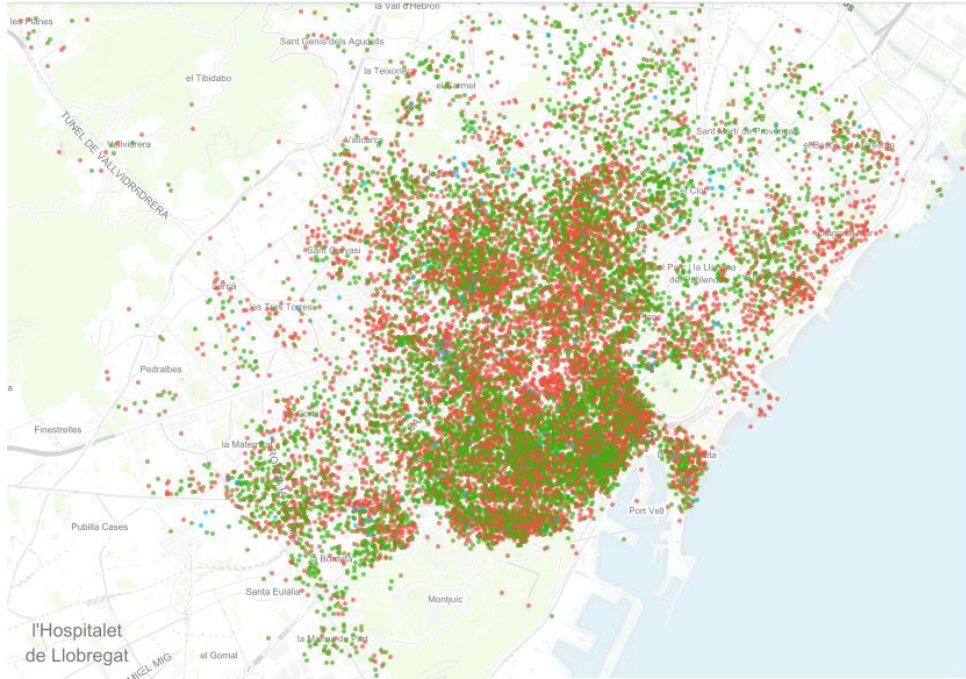
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10. Appendix

FIGURES

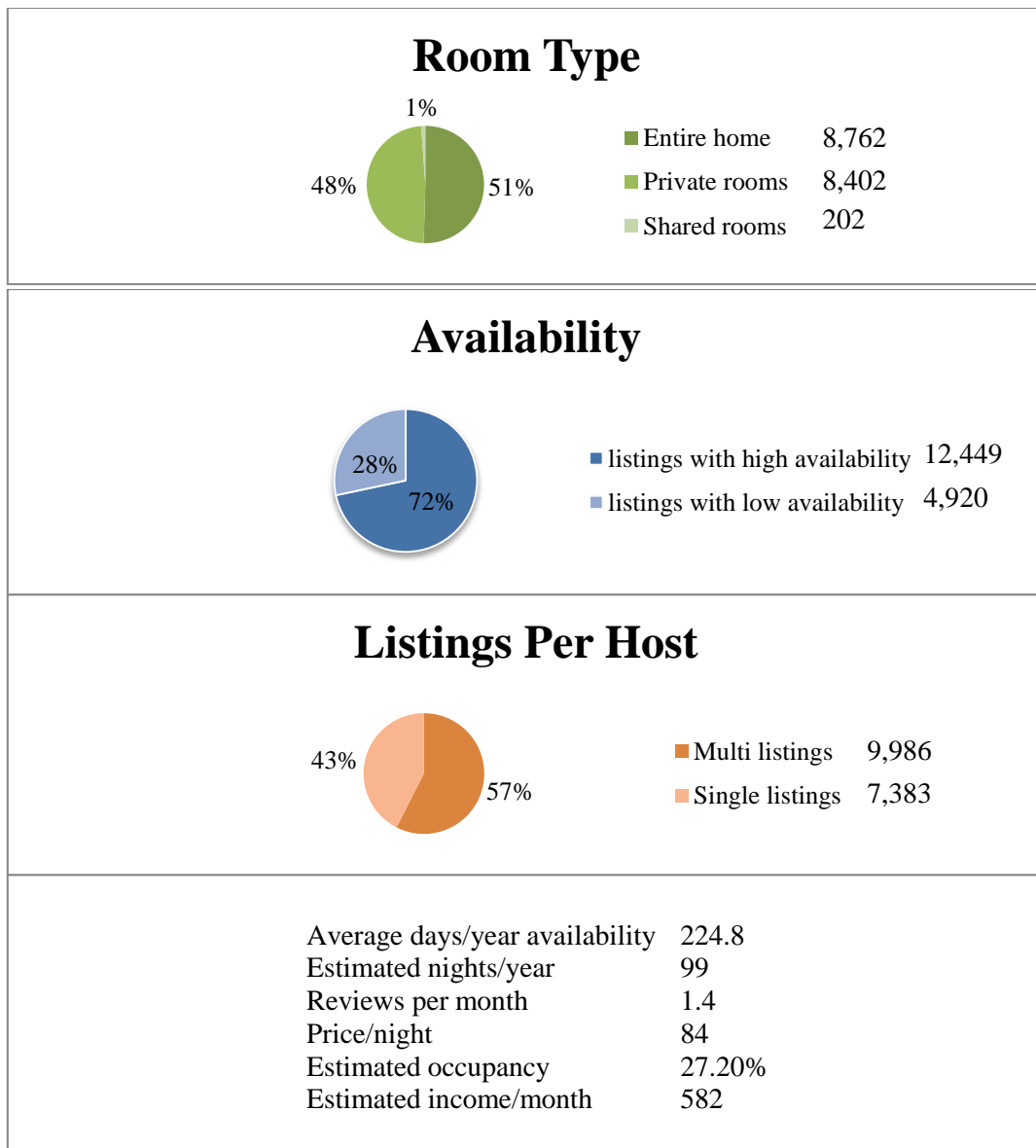
Figure 1. Airbnb listings map of Barcelona 2016, divided by the type of apartment.



Red: Entire apartments; Green: Private rooms; Blue: Shared rooms.

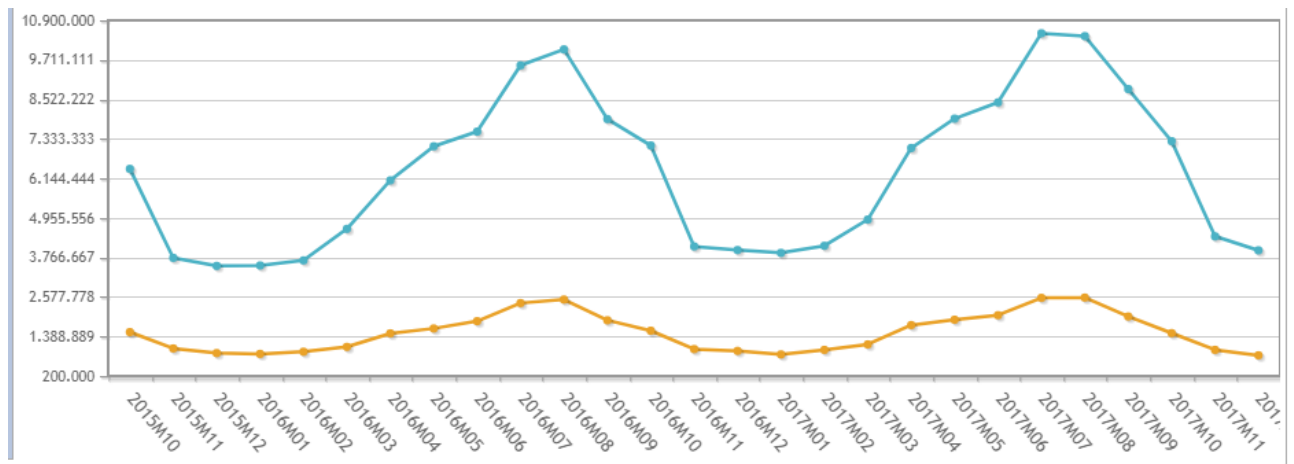
Source: Insideairbnb (2016).

Figure 2. Facts on Airbnb Barcelona.



Source: own elaboration. Data retrieved from Insideairbnb.

Figure 3. Tourism in Barcelona.



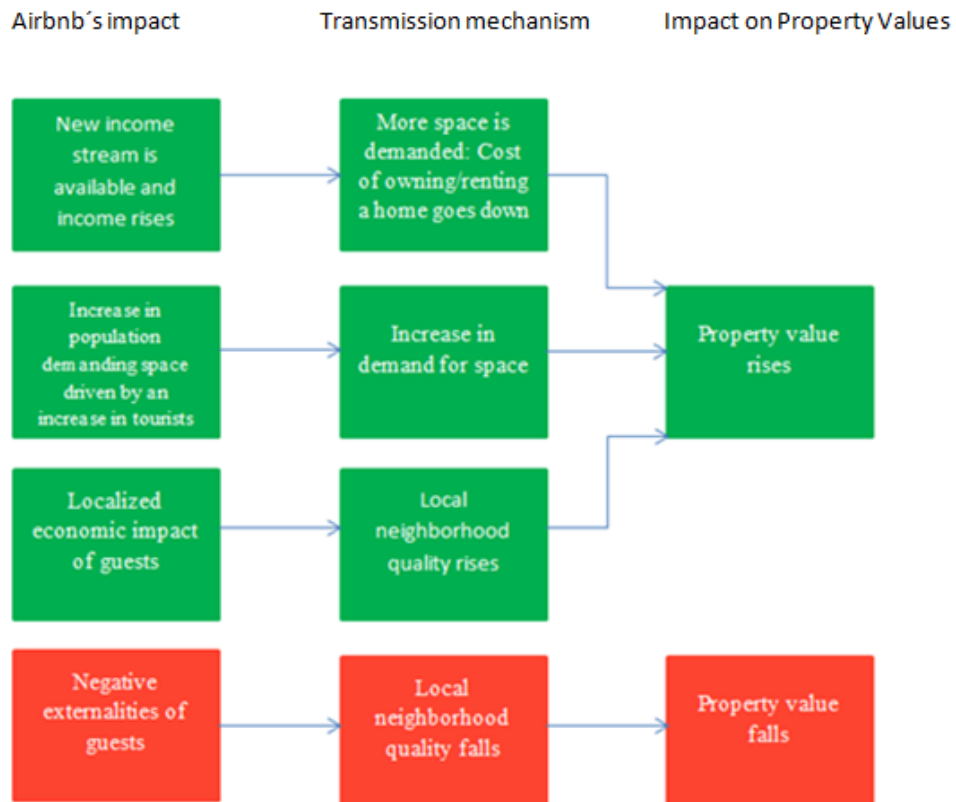
Vertical axis: Number of tourists.

Horizontal axis: Time period.

Blue: Spanish trend; Orange: Barcelona trend.

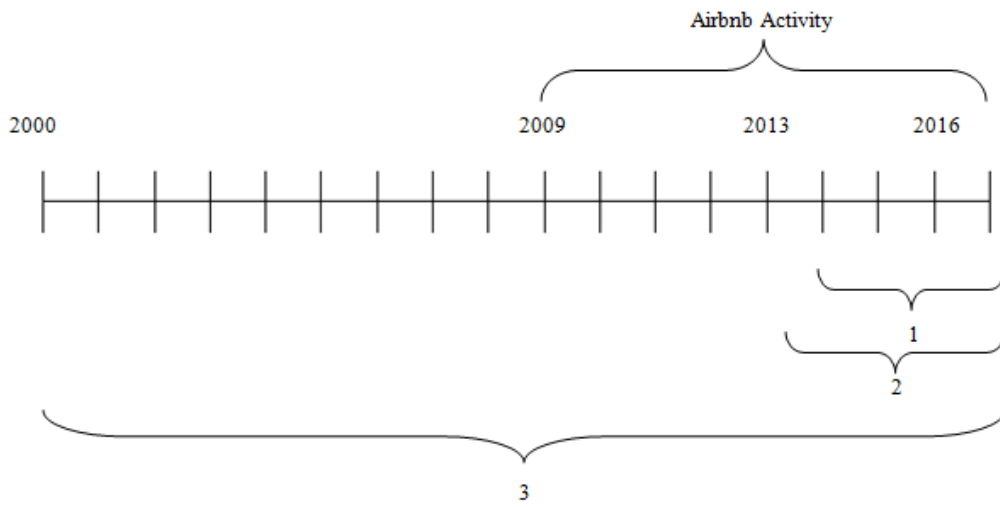
Source: Instituto Nacional de Estadística – Spanish Statistical Office.

Figure 4. Sheppard and Udell transmission mechanisms for the impact of Airbnb activity on housing prices.



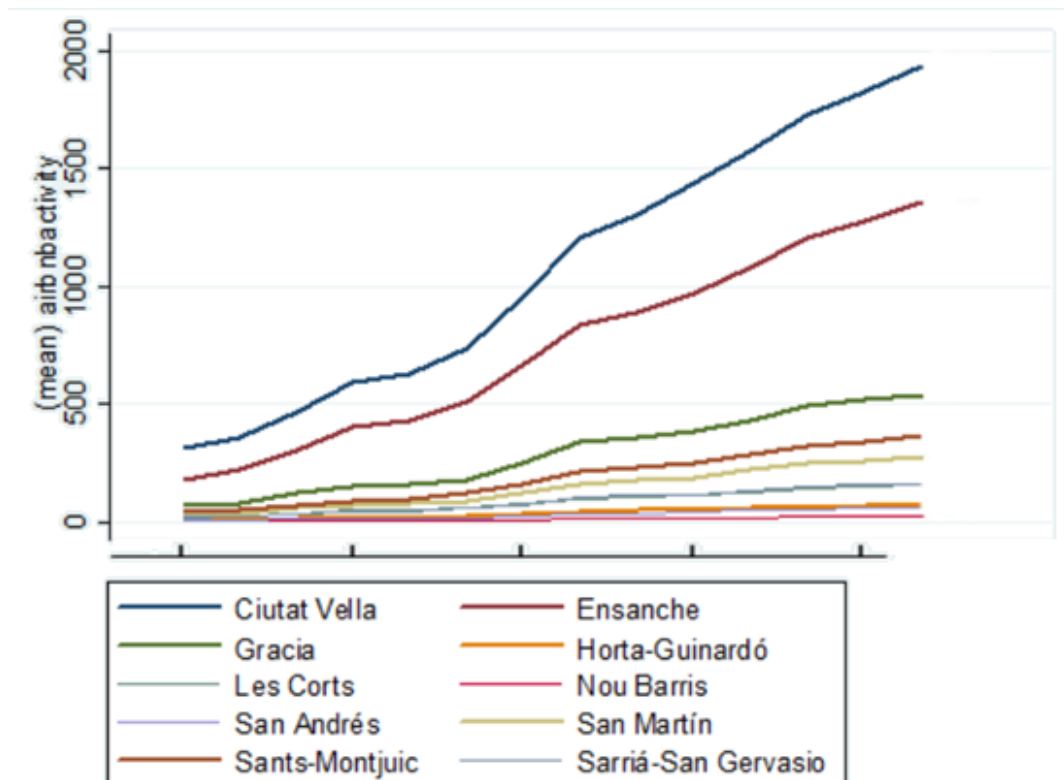
Source: Sheppard and Udell (2016) impact mechanisms.

Figure 5. Timeline of the data retrieved.



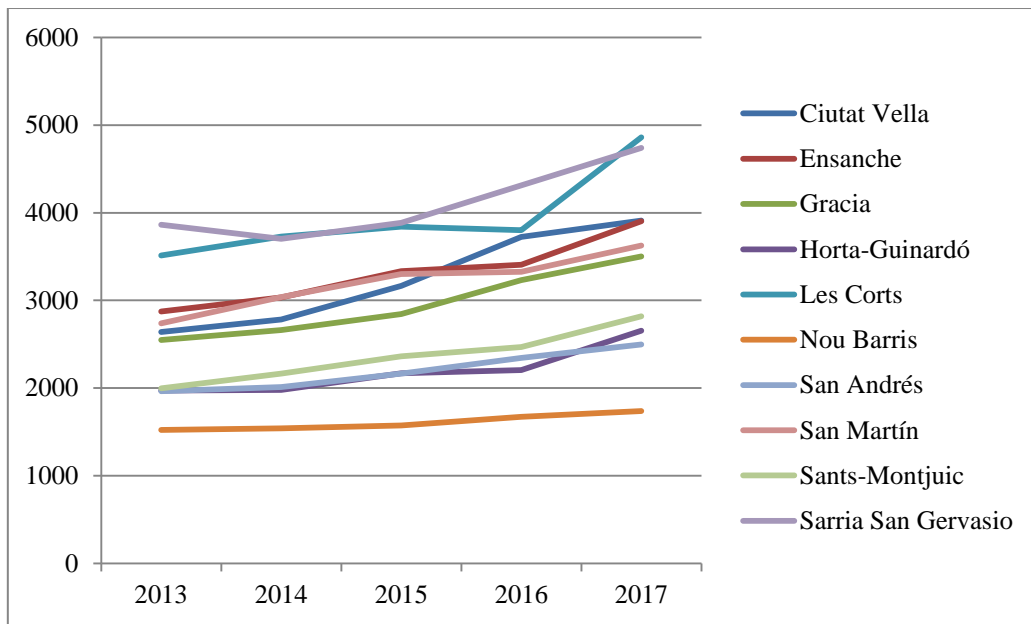
- 1 Rental prices, at a neighborhood level.
- 2 Dwelling trade prices, at neighborhood and district level.
- 3 Rental prices, at a district level.

Figure 6. Airbnb activity trend by districts 2013 to 2017.



Vertical axis: Airbnb activity; number of listings.
 Horizontal axis: Time period – 2013q3-2017q2.
 Source: own elaboration. Data retrieved from Insideairbnb.

Figure 7. Dwelling trade prices trend by districts 2013-2017.

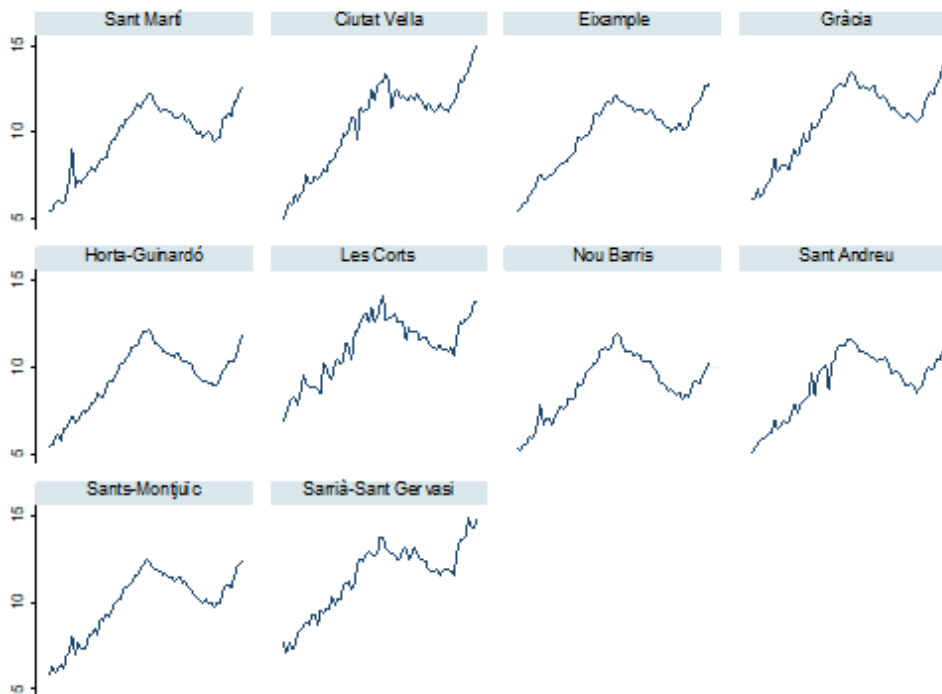


Vertical axis: Prices in Euro per square meter.

Horizontal axis: Time period.

Source: own elaboration. Data retrieved at Generalitat de Catalunya.

Figure 8. Rental prices trend by districts 2013-2017.

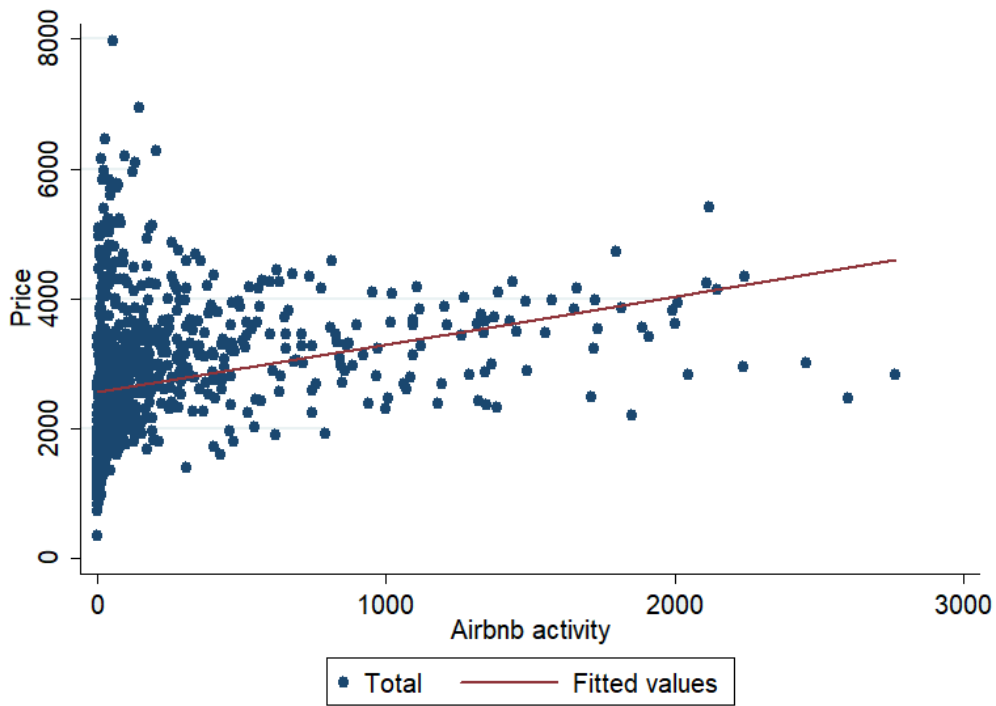


Vertical axis: Prices in Euro per square meter.

Horizontal axis: Time period – 2013 to 2017.

Source: own elaboration. Data retrieved from Generalitat de Catalunya.

Figure 9. Relation between dwelling trade price and Airbnb activity. Neighborhood level.

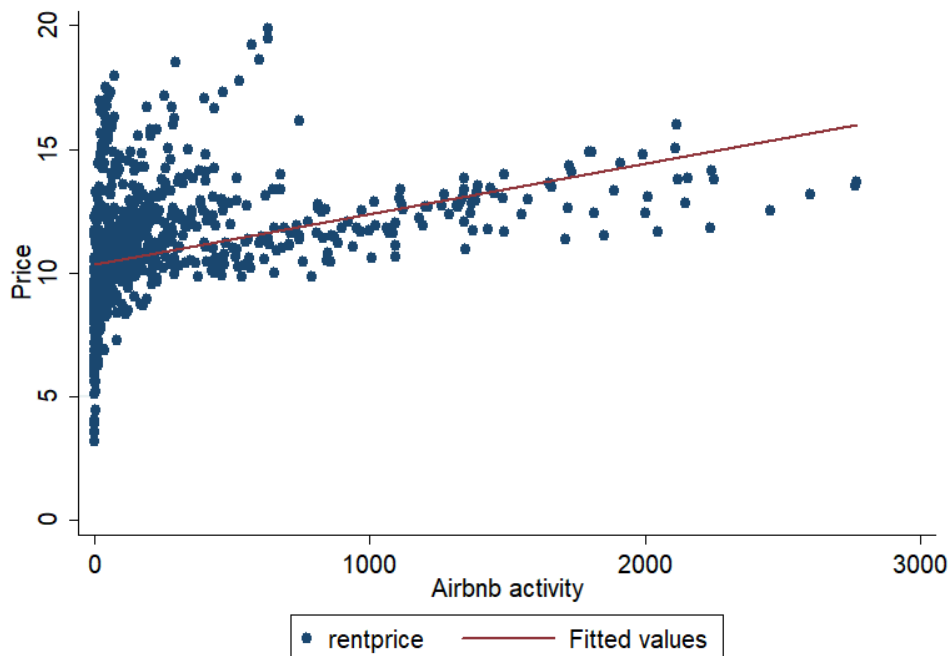


Vertical axis: dwelling trade prices €/m².

Horizontal axis: Airbnb activity

Source: own elaboration.

Figure 10. Relation between rental prices and Airbnb activity. Neighborhood level.



Vertical axis: rental prices €/m².

Horizontal axis: Airbnb activity.

Source: own elaboration.

TABLES

Table 1. Descriptive statistics on housing trade prices at neighborhood level.

Variable	Mean	Std. Dev.	Min	Max	Observations
Dwelling price	2,712.3190	1,055.21	342.61	7,960.18	929
Rental price	10.82	2.33	3.18	19.87	962
Airbnb activity	212.54	415.44	1	2768	1095
Income	120.58	85.44	1	267	1095
Population	127,133.30	9,2705.37	1,000	292,000	1095

Table 2. Results from dwelling trade analysis.

	1	2	3	4	5
Ln Airbnb	0.10796	-0.09428	0.09607	0.03126	0.03855
SD	(0.01185)	(0.08028)	(0.00927)	(0.04522)	(0.04569)
P	0	0.27	0	0.492	0.402
Level	district	district	neighbourhood	neighbourhood	neighbourhood
Time dummies	no	yes	no	yes	yes
Income	no	no	no	no	yes
Population	no	no	no	no	yes
Constant	7.45165	8.04524	7.44801	7.62863	7.71755
N. observations	140	140	929	929	929
N. of groups	10	10	73	73	73
R squared within	0.5843	0.6977	0.1880	0.2235	0.2301

Table 3. Results from rental market analysis.

	1	2	3	4	5
Ln Airbnb	0.00143	0.01434	0.08728	0.00845	0.00884
SD	(0.00267)	(0.02396)	(0.00587)	(0.00407)	(0.00400)
P	0.604	0.564	0	0.041	0.030
Level	district	district	neighborhood	neighborhood	neighborhood
Time dummy	no	yes	no	yes	yes
Income	no	no	no	no	yes
Population	no	no	no	no	yes
Constant	2.39025	2.00384	2.00384	2.23759	2.25376
N. observations	270	270	944	944	944
N. of groups	10	10	73	73	73
R squared within	0.0019	0.8669	0.4124	0.6424	0.6441