

## **Competition law approaches related to the operation of Airbnb in Budapest**

Áron Drabancz – Nedim Márton El-Meouch

*In our study, we examine the operation of Airbnb among the sharing-based companies. We review the operation of Airbnb, the European and American regulatory systems, and examine the economic results of each regulation (e.g. a limit on the number of short-term housing days). Our initial hypothesis is that a regulatory framework can be developed in Budapest, in which the operation of the company is possible without the lives of the residents becoming impossible. In our study, we try to map the economic implications of short-term housing renting with a simple microeconomic calculation and a spatial simulation. Based on the results of our research, the 120-day restriction on annual short-term rent could eliminate investment-type short-term renting and contribute to the reduction of “party districts” in Budapest. An agreement with Airbnb could increase state tax revenues and create a more level playing field between hotels and short-term housing platforms. Our regulatory framework would largely eliminate the negative externalities associated with Airbnb, but at the same time, the positive returns would be greatly reduced.*

*Keywords: Sharing economy, real estate market, regulation*

### **1. Introduction**

The spread of companies and market participants in the sharing economy can significantly transform the economic structure of countries, which can be linked to the development of new competition law regulations. In a sharing economy, the consumer transfers his or her own product and related service to another member of society, so that the economic transaction takes place between consumer and consumer. During the 20th century, business-to-business (B2B) transactions and, at the end of the production chain, business-to-consumer (B2C) transactions were dominant. Through economies of scale, concentrated production and sales, and specialization, companies could become dominant actors on the supply side for the first time since the unfolding of the Industrial Revolution. At the dawn of the 21st century, however, energy-saving considerations, attitudinal and lifestyle changes, and Internet applications have made it possible to connect consumers to consumers (C2C), i.e. lead to a high degree of sharing of unused assets in the possession of the individual. Companies using C2C solutions are gaining significant ground in the world economy (e.g. Uber, Airbnb, Couchsurfing) and in Hungary (Oszkár Telekocsi, Rukkola) as well. Companies connect consumer demand and supply through online applications, where the unused capacity of consumers is the product or service typically offered. Companies using a sharing economy solution can have a significant impact on a country's economy: sharing unused resources – e.g. hedge trimmers, cars, real estate – can increase the volume of economic events not measured by GDP, as well as improve the efficient use of natural resources. Sharing can create a significant consumer surplus, as online platforms significantly reduce the transaction

costs of handing over devices, so the sharing of products and devices with each other can divide the price of a product between its users. However, the regulation of sharing-based businesses is still rudimentary in most countries, mainly due to the immaturity of companies and solutions, their sometimes too rapid spread, and the fact that consumers are facing each other in a novel way on the demand and supply side.

In our study, we examine the operation of Airbnb among the companies based on sharing. We chose the company because more than 13,000 apartments were rented out via Airbnb in Budapest before the coronavirus (Airdna 2021), which may have significantly contributed to the real estate market price increase in Budapest in recent years. Furthermore, the noise associated with the spread of short-term housing rentals also affected the well-being of those living there, with residential communities trying to limit the operation of Airbnb through regulations and bans. Comprehensive legislation on short-term housing rental was introduced in the summer of 2020, in which the government gave municipalities the option to regulate their directly managed areas individually (Parliament 2020). The timing of the adoption of the legislation is not coincidental, as the precautionary measures introduced in response to the coronavirus have decimated the number of tourists arriving from abroad, with the result that the number of apartments available for short-term stays has roughly halved in 1 year (Airdna 2021, Gabay 2020). The period of reduced tourism caused by the pandemic provides an opportunity to think through and implement the regulatory actions that were previously delayed, in order to keep economic aspects and the quality of life of local people compatible even with increasing tourism. In the analysis, we basically formulate regulatory proposals from the viewpoint of local residents, based on their interests. The main reason for this is that regulations are motivated by the goals of local residents, and their choice determines the political picture, and thus indirectly the regulatory steps. Our initial hypothesis is that a regulatory framework can be developed in Hungary where the operation of the company is possible without the lives of the residents of Budapest becoming impossible. Our main goal is to examine the economic outcomes of the annual limit used in many countries for short-term housing rental days. Our hypothesis is that if an apartment can only be used for Airbnb for a certain period of time in a year, it has a significant effect on market processes. Furthermore, we examine the possible clustering of Airbnb flats, and by running a simulation we show that flats rented out for the short term are starting to cluster around each other in the long run. In order to prove the hypotheses, in the first section we present the operation of Airbnb, in the second section we present the international and Hungarian regulatory framework in relation to the company before the coronavirus. In the first subsection of the third section, we build a microeconomic model where we show how the spread of Airbnb may have affected property prices, the well-being of residents, and the prices at which the market for short- and long-term housing will be balanced. In the following subsection, we run a simulation regarding the location of short-term housing rentals. In the fourth section, we summarize the results and make recommendations for some elements of the Hungarian Airbnb regulatory framework.

## 2. Operation of Airbnb

Airbnb is a private company founded in 2008, its main activity being the pairing of accommodation hosts and accommodation seekers through an online platform. The company's main revenue comes from the costs charged from matching supply and demand: accommodation bookers have to pay a 3% transaction fee after their booking, and accommodation hosts pay a 10% commission to the company. The company's shares have been traded on the stock exchange since 2020, the company's market capitalisation exceeds the combined value of the four largest hotel chains (Carville et al. 2020). The perception of how Airbnb works is extremely divided, which is basically due to its sharing-based model. The potential advantages and disadvantages of Airbnb are described in Table 1.

*Table 1* Identified advantages and disadvantages of Airbnb

Advantages	Disadvantages	Advantage and disadvantage as well
Growing income of homeowners	Host and user risks	Intensified competition due to the accommodation of tourists
Increase in the number of tourists	Increase in noise levels and littering in apartments and districts	Rising house prices
Sharing of the resources	Residents being pushed out of their homes	Increase in sublease prices
	Possible tax evasion	

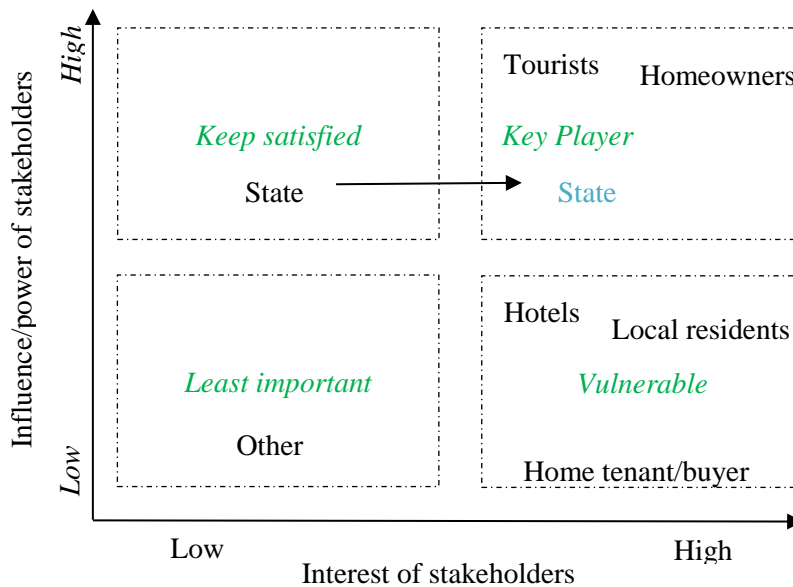
*Source:* Own construction

Residents renting out their homes for the short term can earn money, and tourists can spend the night in a cheaper, more authentic and more people-friendly environment. Lodgings much smaller than hotels can provide accommodation further away from the main tourist destinations, thus boosting regional tourism in some regions. And the sharing of resources and flats can increase the total resource usage. However, connecting consumers to consumers also involves risks, the company does not always compensate for damage caused by guests, and despite previous evaluations, the guest may find a living environment that he did not expect. Furthermore, regulation of Airbnb accommodation, which is less stringent than for hotels or even not yet in place, results in unequal competition in the tourism market, allowing landlords to start renting the apartment on a system-wide basis for more than 360 days a year or to choose to rent more apartments simultaneously (Comprehensive Survey 2016). This forces hotels to compete on price, leading to consumer surplus. By then, however, the housing and resource-sharing motive will disappear, meaning that homeowners rent out their homes for short-term rather than long-term due to profit-oriented purposes and even buy new homes for investment. Thus, Airbnb apartment blocks could arise, which could displace local residents due to high noise and dirt and make downtown living conditions impossible to bear. In parallel with the increase in the supply of short-term housing

rental, the supply of long-term housing rental is narrowing, so the local population is facing higher real estate prices, and residents are lagging behind tourists in price competition. The essence of the sharing economy is that it creates added value through the release of unused capacity without producing a new product, so we tend to view housing rental different to this motive more negatively.

To synthetize the thoughts written above, we perform a stakeholder analysis concerning the influence the different agents have on the spread of Airbnb and the impact it has on them (see: Olander, 2007, 280). We divided the stakeholders into 4 sub-groups depending on the degree of influence and impact (Figure 1). In this analysis, the most important key players are the price-sensitive tourists and the home-owners, who could decide between renting out their home on the short- or long-term housing rental market. They basically constitute the demand and supply side of the short-term housing market, for which Airbnb provides a platform. The least important sub-group in this matter consists of all those not directly affected by the spread of Airbnb (i.e.: non-local residents, rich tourists or those who usually do not go on vacation, those who do not seek to buy or rent an apartment for long-term etc.).

Figure 1 The influence and interests of the stakeholders in connection with Airbnb



Source: Own construction

In the vulnerable sub-group, the agents do not have high influence on the spread of Airbnb, though it has a high impact on them. The group consists of the local residents, hotels and residents, who want to rent or buy a home in the neighbourhood. Another stakeholder is the state, who has a high potential to regulate and control the spread of Airbnb, and its interest could be significant concerning the issue, like a tax revenue and even as a social problem if the spread of Airbnb greatly exacerbates the relationship between locals and regulating power. It means that when there is no social outrage in

connection with Airbnb, the state is acting like a high influence-low impact stakeholder, since it has the potential regulatory power, while as social pressure increases, impact also becomes an increasingly important factor for it (see Figure 1). As the vulnerable group has increasing concerns in connection with Airbnb, the state is required to step in as a legislator in favour of them, but it is important that the key players' situation and the functioning of the market is not made impossible. That's why we think new regulation is needed in the case of potential negative externalities affecting the vulnerable group. Aside from that, we believe that a well-regulated community house sharing market can intensify competition for tourist accommodation and thus have a positive return. The aim of our study is to determine whether the reduction of exclusively profit-oriented short-term housing rental can be achieved by introducing an annual daily limit on the homeowners for housing rent, without making it impossible for actual house sharing to function.

### **3. Regulatory environment**

In the next section, we present the main foreign regulations affecting major developed countries before the coronavirus, and briefly describe the situation in Hungary.

#### *3.1. International regulatory environment*

##### *United States of America*

In 2016, two of the 5 cities with the most Airbnb ads (New York and Los Angeles) were in the United States (McCarthy 2016). In the US, cities and states individually have a great deal of autonomy to regulate Airbnb, so we can come across a wide range of solutions in the country. However, most of the time, one common point of the regulations is that their purpose is to register short-term housing rentals and thus to include the tax liability of homeowners renting out their house subject to regulation. Furthermore, a typical regulatory step is to impose tax conditions similar to the hotel sector, which, by definition, seek to create a level playing field between hotels and advertisers on the online platform in the short-term housing rental market. Nothing proves the social acceptance and legitimacy of registration and the tax regulation better than the agreements where Airbnb undertook to collect tax liabilities and then deliver them to cities (e.g., New Orleans, Portland, Los Angeles) (Airbnb 2017). Another common point in the various regulations is that for properties that are not used personally by their owner (they do not live in them), the relevant rules are either much stricter or the activity is completely prohibited. Portland's regulation concretizes the issue: for homes where owners do not stay for a total of at least 9 months in a year, short-term rentals are not allowed, these homes are not considered homes of primary residence (Njus 2014). Typical restrictive measures include a one-year limit, i.e., the maximum number of days a home can be rented out in a year. This is not inducted for all cities/states, but where it is, it typically means a 30-, 60-, 90-, 180-day limit and tries to help reduce short-term housing supply. The rule of maximum number of guests that can be accommodated at the same time is trying to eliminate neighbourhood complaints, i.e., the formation of "party apartments", such as the Austin ordinance's limit of 10

adults or 6 unrelated adults (White 2016). A similarly motivated measure introduced in the Sacramento area is the notification obligation that requires a landlord to notify those living within 60 feet of the home about the rental of the apartment (Garrison 2016), or the Louisville regulation requiring a person to be named, who is not more than 40 km away from the site at the time the apartment is rented out, so he or she can take action in the event of a complaint (Bailey 2015).

In many cities, resistance to Airbnb has led to regulations that may have had the goal of making it impossible to rent out homes in the short term. The Chicago ordinance, for example, also regulates the number of homes that can be rented out within a residential building and allowed districts themselves to vote on a ban on short-term housing rentals (Lentino 2016). This is one of the most stringent laws in the U.S., and civilians have since twice challenged the ordinance in court for unconstitutionality (Marotti 2016a, Boehm 2016a), which led the court to later suspend the ordinance (Marotti 2016b). The same fate befell on the Nashville ordinance, where unconstitutionality was also found (Barchenger and Garrison 2016) because regulation was overly vague and complicated. In the case of New York, San Francisco, Santa Monica and Anaheim, the regulations were challenged by Airbnb on the grounds of unconstitutionality. These regulations also regulated the short-term housing rental market very strictly. In New York, it was illegal to rent out an apartment for less than 30 days, with the ordinance intended to penalize Airbnb for all homeowners advertising illegally on the site (Benner 2016a). The end of the legal dispute was an agreement that only advertisers could be penalized by the City of New York instead of the online platform (Benner 2016b).

There are far fewer examples in the US of regulations that are not strict but are online platform-friendly and specifically targeted at Airbnb and similar short-term housing issues. Regulations favourable to platforms such as Airbnb are adopted typically at state level. This is also the reason why Airbnb seeks to negotiate at state level in several states where no agreement has been reached at city level, thus circumventing the agreement with strict urban decision-makers: an initiative with this purpose can be seen in Tennessee (Garrison 2017) and Texas (Alfaro 2017). This negotiation strategy can be effective for Airbnb, as Member State regulations could override city regulations. Further examples of state regulations in favour of Airbnb are the cases of the states of Virginia and Indiana, where regulations stipulate that cities in those states may not prohibit short-term housing rentals provided by Airbnb and similar online platforms (Boehm 2016b, Sikich 2017). Of the states, it is clearly the state of Arizona that is specifically trying to support Airbnb's operations, encouraging further growth. The state has also banned cities from banning similar online platforms and has not imposed any restrictions on them, either an annual limit or a limit on the number of flats that can be rented out per person (Kerr 2017).

Overall, it can be said that the regulations of US cities/states are extremely diverse, and that there are many ways to approach the regulation of the short-term housing rental market. In addition, it can be noted that the regulations on short-term housing rentals are typically stricter in cities with large populations and visitor numbers (in some cases they are practically prohibiting it from operating). This may be because interest groups with negative externalities are better able to express their views to urban decision-makers, while in state negotiations, stakeholder groups lobbying is likely to have less influence on legislation, regulations are market-oriented, thus favouring Airbnb.

### *European Union*

The major cities in the European Union are the biggest destinations for Airbnb tourists, with 6 of the 10 cities with the most advertisers being cities of EU member states in 2016 (McCarthy 2016). In terms of taxation and registration, EU cities follow similar guidelines to US cities, with the goal of creating market competition in the short-term housing rental market. For three cities/countries, Airbnb also collects the tax from its users and then forwards it to the city: Paris (and the whole of France), Amsterdam and Lisbon (Airbnb 2017). The joint agreements have also led to closer cooperation. On the one hand, in March 2016, Airbnb agreed with Paris to warn illegal advertisers (an unoccupied home being offered for rent, or the 120-day limit has already been exceeded) in a letter (Coldwell 2016). On the other hand, at the end of 2016, Airbnb undertook in a contract to monitor the achievement of the annual renting limit for apartments advertised in London and Amsterdam (London - 90 days, Amsterdam - 60 days). If this limit is reached by homeowners, Airbnb staff removes their ad from the site (Woolf 2016). As far as typical regulations are concerned, in EU cities/countries where there is a limit, it is between 60 and 120 days. Like in the US, regulation can also be found where the number of guests is maximized, which means 4 guests at a time for Amsterdam (DutchNews 2017). In addition to the usual standards, we found some surprisingly specific requirements for apartments: in Madrid internet access is mandatory (Stucklin 2015), while in Athens, according to the provision, services other than accommodation, such as dining, should not be provided to guests in the apartment in order to not put the local service sector in a disadvantageous position, whose revenues are largely determined by tourist consumption (Kousounis 2016).

In the case of European Union cities in general, strict regulations are much more typical. Barcelona is at the forefront of this, as it was the first city to penalize Airbnb. The company was first hit in 2014 with €30,000 (Kassam 2014), in 2015 with €60,000 (O'Sullivan 2015), and in 2016 with €300,000 (Badcock 2016) in penalties. Interesting in this resistance is that the regulation did not change the Barcelona authorities' legal assessment of the activities of the online platform, which was considered illegal by them, as the first penalty was imposed before the regulation, while the second and third penalties were imposed after the regulation. The Berlin regulation practically banned short-term housing rentals with a decree that came into force in 2016 (after a two-year trial period) that only homes in certain parts of the city can be rented out and only with a permit (Vasagar 2014). The issuance of permits, on the other hand, is minimal, as evidenced by a statement from decision-makers in one of the districts that 95 percent of submitted permits will not be accepted (Oltermann 2016), making short-term housing rentals in the city virtually impossible. There is also a strict rule in Brussels as well as in Luxembourg, in Brussels an apartment can only be rented out if it is approved by the residential community (Boyle 2015), while in Luxembourg the profit from housing rental is accounted for as business profit and is therefore subject to a much higher tax burden (Luxemburger Wort 2016).

With regard to Airbnb and short-term housing rental, in addition to the example of Amsterdam (and London) (where the two sides negotiated throughout the regulation), Portugal is also worth highlighting. In Portugal, owners can rent out their apartment without any annual limit, and the number of rooms is not limited by the regulation, they

can rent out any number of rooms to tourists (Minder - Scott 2014). In addition, the Lisbon city administration has sought to simplify processes (together with Airbnb, as they collect the tax), thereby also encouraging homeowners to register as well as to pay taxes (Airbnb 2016). Presumably, the importance of tourism to the country and the positive impact on employment opportunities for those living from tourism may be the cause of the behaviour of Portuguese decision-makers towards Airbnb.

Regarding the relationship between Airbnb and the cities/countries of the European Union, big cities on the old continent as a whole are particularly strict about the online platform. This may be the reason why, based on the US example, Airbnb is trying to negotiate and conclude agreements at the country level (cf. TheLocal 2017). In addition, it is typical for EU countries to regulate short-term housing rentals in the rest of the country based on the agreement of the big city (usually the capital): this is the case in Belgium (Johansson 2016) and also in the Netherlands (DutchNews 2016).

### *3.2. The Hungarian regulatory environment*

Comprehensive regulation of Airbnb has become necessary in Hungary, as the number of apartments advertised through Airbnb almost tripled between 2010 and 2019, and Airbnb apartments already make up a substantial part of the community accommodation market today (Airdna 2021). The spread of Airbnb is basically limited to the capital, in most counties the number of advertised apartments is typically less than 100, while in Budapest this number exceeds 5,800.<sup>7</sup> In addition, the shared nature of housing rental does not dominate among housing rentals, as in Budapest homeowners rent out the entire apartment for a shorter period of time in 88.7%, rent out a room only in 10.5% and share a room with others in 0.8% (Airdna 2021). This means that, in essence, it was the spread of Airbnb that has allowed homeowners to rent out their homes, which have so far been rented for the long term, for short-term stays due to economic reasons. The new option could have provided a higher income for owners renting out apartments in Budapest, but it could have increased the prices of apartments and the general noise level of condominiums. The residential communities in Budapest are seeking to eliminate and reduce the above-mentioned negative externalities in different ways.

Due to the spreading Airbnb fever, housing communities have tried to achieve a reduction in the rate of short-term housing rentals in their housing community by convening residential assemblies and amending the organizational operational rules accordingly. The Curia of Hungary's BH Resolution No. 117 of 2016 took a position in this matter, according to which the co-owners may validly restrict the non-residential activities in the apartment of the co-owner. Comprehensive regulation on short-term housing rentals was made in the summer of 2020, delegating the creation of conditions to local governments (Parliament 2020). Most rural settlements and Budapest municipalities have not yet established their own regulations, but initial steps have already been taken. According to the plans, in Terézváros, in addition to the permit of the condominium and the registration of the accommodation, the provision of 24-hour availability of the operator to the residents of the condominium and the posting of the condominium policy in English were included in the regulations (Portfolio 2021).

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<sup>7</sup> As of May 4, 2021.



## 4. Modeling

In the following section, we wish to better understand two Airbnb-induced processes using models. In one of them, we analyse price processes in the short- and long-term housing rental market using a simple microeconomic model. Equality of supply and demand and the condition of transaction-free passage between the two markets allow us to model the development of prices between the two markets. The second, spatial simulation model, simulates the clustering of Airbnb flats with the spatial location variable and by capturing the transaction cost of the movement between the two housing rental markets. The first microeconomic model thus analyses the price dynamics of short- and long-term housing rental market and seeks to answer how to reduce the number of people renting their apartment short-term who are purely profit-oriented. The second, spatial model examines the location of Airbnb apartments and the chances of party districts developing. Our first model is simple, has few variables, so its parameters can be better estimated, and the logic of market price development can be better illustrated with it. Our second model is more complex, but therefore the parameters of many variables cannot be estimated, and they are based only on priori assumptions. It follows that the results of this model may seem significant, going beyond the presentation of the Airbnb apartment clustering, but due to the many parameters which cannot be estimated, no serious conclusions can be drawn from the model. Rather it is appropriate only to identify long-term trends.

### 4.1. Equilibrium prices for short- and long-term housing rentals

We would like to illustrate one of the main disadvantages of Airbnb, the increase in prices in the market of apartments used for living, with a microeconomic model. It is important that we examine two well-separable markets and their relationship to each other during modelling. We distinguish between the short-term housing rental market and the long-term housing rental market. This is due to the fact that the short-term housing rental market (hereinafter: STH) has to comply with different regulations, other competitors (hotels, apartments) are present and the consumers of the market can be well separated (mostly tourists) compared to the long-term housing rental market (LTH).

The basic equations of the model:

*Baseline scenario, Airbnb is not yet in the STH market, no passage between markets*

Short-Term Housing rental market:

$$\left. \begin{array}{l} \text{Supply: } Q_{S,STH} = a + b * P_{1,STH} \rightarrow P_{1,STH} = \frac{Q_{S,STH} - a}{b} \\ \text{Demand: } Q_{D,STH} = c - d * P_{1,STH} \rightarrow P_{1,STH} = \frac{c - Q_{D,STH}}{d} \end{array} \right\} P_{1,STH} = P_{1,STH}$$

$$\frac{Q_{S,STH} - a}{b} = \frac{c - Q_{D,STH}}{d} \quad / \text{Demand and supply are equal in equilibrium,}$$

$$Q_{S,STH} = Q_{D,STH} = Q.$$

$$Q_{1,STH} = \frac{a * d + b * c}{b + d} \rightarrow \boxed{P_{1,STH} = \frac{c - a}{b + d}} \quad / \text{An equilibrium price is formed.}$$

Long-Term Housing rental market:

$$\left. \begin{array}{l} \text{Supply: } Q_{S,LTH} = e + f * P_{1,LTH} \rightarrow P_{1,LTH} = \frac{Q_{S,LTH} - e}{f} \\ \text{Demand: } Q_{D,LTH} = g - h * P_{1,LTH} \rightarrow P_{1,LTH} = \frac{g - Q_{D,LTH}}{h} \end{array} \right\} P_{1,LTH} = P_{1,LTH}$$

$$\frac{Q_{S,LTH} - e}{f} = \frac{g - Q_{D,LTH}}{h} \quad / \text{Demand and supply are equal in equilibrium,}$$

$$Q_{S,LTH} = Q_{D,LTH} = Q.$$

$$Q_{1,LTH} = \frac{e * h + f * g}{f + h} \rightarrow \boxed{P_{1,LTH} = \frac{g - e}{f + h}} \quad / \text{An equilibrium price is formed.}$$

The parameters may vary from country to country, but they are the same in that STH prices are always higher than LTH prices. This is also the case in Hungary, based on research carried out on ingatlan.com and booking.com, which will be presented in detail later. In order to obtain comparable prices, the overhead cost must be deducted from the STH price, as it is paid by the tenant in the long term and by the homeowner in the short term. Thus, the average monthly LTH rent is 276 517 HUF/month, i.e.  $P_{LTH} = 9\,217$  HUF/night, while the average price of STH calculated is (33 000 HUF - rent)/night, i.e. approximately  $P_{LTH} = 30\,000$  HUF/night. So the main conclusion of the basic model is that the STH price exceeds the LTH price:  $\boxed{P_{STH} > P_{LTH}}$ .

*Airbnb enters the STH market, there is passage between markets ( $\theta$ )*

Short-Term Housing rental market:

$$\left. \begin{array}{l} \text{Supply: } Q_S = a + b * P_{2,STH} \rightarrow P_{2,STH} = \frac{Q_S - a}{b} \\ \text{Demand: } Q_D = c - d * P_{2,STH} \rightarrow P_{2,STH} = \frac{c - Q_D}{d} \end{array} \right\} P_{2,STH} = P_{2,STH}$$

$$\frac{Q_S - a}{b} = \frac{c - Q_D}{d} \quad / \text{As there is passage, supply changes.}$$

$$\frac{Q_{STH} + \theta * Q_{LTH} - a}{b} = \frac{c - Q_{D,STH}}{d}$$

$Q_{2,STH} > Q_{1,STH} \rightarrow \boxed{P_{2,STH} < P_{1,STH}}$  /No equilibrium price is formed. The degree by which the STH price decreases in the second case depends on the passage rate, i.e. the rate of increase of the parameter  $\theta$ .

Long-Term Housing rental market:

$$\left. \begin{array}{l} \text{Supply: } Q_S = a + b * P_{2,LTH} \rightarrow P_{2,LTH} = \frac{Q_S - a}{b} \\ \text{Demand: } Q_D = c - d * P_{2,LTH} \rightarrow P_{2,LTH} = \frac{c - Q_D}{d} \end{array} \right\} P_{2,LTH} = P_{2,LTH}$$

$$\frac{Q_S - a}{b} = \frac{c - Q_D}{d} \quad / \text{As there is passage, supply changes.}$$

$$\frac{Q_{LTH} - \theta * Q_{LTH} - a}{b} = \frac{c - Q_{D,LTH}}{d}$$

$Q_{2,LTH} < Q_{1,LTH} \rightarrow \boxed{P_{2,LTH} > P_{1,LTH}}$  /No equilibrium price is formed. The degree by which the LTH price increases in the second case depends on the passage rate, i.e. the rate of increase of the parameter  $\theta$ .

Adaptation lasts (i.e.  $\theta$  increases) until the price in the short-term housing rental market is equal to the price in the long-term housing rental market, i.e. until the ratio of supply that switches from the long-term housing rental market to the short-term housing rental market is such that  $P_{2,STH} = P_{2,LTH}$ .

The damage to the interests of the two interest groups already mentioned in the study can be clearly seen from the model. Falling prices in the short-term housing rental market adversely affect hotels and reduce their revenues. As for the increase in the long-term housing rental market price, it means an additional cost for those sections of society who want to live in a sublease for a longer period of time. The set of these people is typically a group of students, young career starters, but anyone who cannot afford to buy their own property, i.e. vulnerable social groups, can be involved.

Due to the low proportion of houses advertised on Airbnb, the prices of the two markets in Hungary did not converge to a large extent. In addition, of course, the short-term housing rental market price is affected by many other factors than those included in the model, so – similarly to the long-term housing rental market – the price growth trend of recent years can be observed in the short-term housing market. Regardless of this, we believe that in order to avoid the blurring of the two markets, it is necessary to regulate the short-term housing rental market in Hungary, especially in Budapest.

#### 4.2. Spatial model in the housing market

In the previous chapter, we reviewed the relationship between market prices in the short- and long-term housing rental market within a microeconomic framework. In the following model, we try to extend these results by adding new variables to the model. The purpose of the model building is to examine the spread and clustering of Airbnb houses. The model tries to represent Budapest, so the assumptions are, as far as possible, adjusted to the Budapest environment. During the construction of the model, we used the following assumptions:

1. The homeowner rents out his apartment at either the STH market or the LTH market. The homeowner assumes that the supply and demand conditions observed at the previous date will continue to exist at the next date. ( $E(Q_S^t) = Q_S^{t-1}$  és  $E(Q_D^t) = Q_D^{t-1}$ ) Conscious of the expected demand and supply, the consumer calculates the expected prices for the next year in the STH and LTH market.

2. The homeowner has a utility function in both the STH market and the LTH market and is always active in the market where its utility function is higher. Based on the utility function, homeowners determine the aggregate supply of the market and thus the price for the next period, which may differ from expectations.

3. Transition between the STH and LTH markets is only possible with transaction costs ( $F_{STH}, F_{LTH}$ ). The transaction cost of the homeowner is higher when entering the STH market than when entering the LTH market ( $F_{STH} > F_{LTH}$ ). This is because at the beginning of the simulation, all homeowners have their homes rented for long-term, and due to Airbnb's lower profile and initial non-regulation, the homeowner assigns a higher cost to moving here.

4. The average consumer is rational, but individual consumers may misjudge their expected utility in the STH and LTH market. Thus, a random variable ( $\varepsilon$ ) appears in the function of each consumer, following a standard normal distribution ( $N(0,1)$ ).

Under the following conditions, the prices and revenues of the two housing rental markets are not necessarily equal in equilibrium, which is typical of short-term and long-term housing rental in Budapest (Torontáli 2015). In the model, prices in the STH market are denoted by  $\hat{p}$ , while prices in the LTH market are denoted by  $p$ . The essence of the spatial model is that the location of each apartment determines their profit and the decision of the homeowners to operate in the STH or LTH market:

1. There are a total of 200 flats on the market, of which 100 flats are located in 10 inner districts and 100 flats are located in 10 outer districts. There are a total of 10 apartments in each district and each homeowner has one apartment.

2. The inner districts are located near tourist destinations, while the outer districts are further away from them. For this reason, the demand for flats in outer districts is lower at certain prices in both the STH and the LTH markets ( $c^2 < c^1$ , and  $d^2 > d^1$ ) so the prices formed here ( $p^2, \hat{p}^2$ ) are lower than the prices in the inner districts ( $p^1, \hat{p}^1$ ).

3. If someone in his district enters the STH market, the profit function of the other STH homeowners will increase. The underlying logic is that if the neighbour is already active in the STH market, aversion to it will decrease for the homeowner, and more adjoining homes may increase prices. Furthermore, if more apartments switch to STH market activity, this reduces the chances that other residents will be able to take effective action against them. In the outer districts, the neighbour effect ( $\alpha^2$ ) is weaker than in the inner districts ( $\alpha^1$ ). This is because there are more family houses in the outer districts where the neighbourhood effect is less felt than in a condominium.

At the starting point, therefore, an inner district houseowner is faced with the following two utility functions:

$$u_{STH}^1 = \hat{p}_{STH}^1 + k * \varepsilon(0,1) + n * \alpha^1 - F_{STH}$$

$$u_{LTH}^1 = p_{LTH}^1 + k * \varepsilon(0,1)$$

where  $\hat{p}_{STH}^1$  and  $p_{LTH}^1$  are the prices in the STH and LTH markets,  $\varepsilon$  is the random term,  $k$  is a corresponding constant,  $n$  is the number of STH homeowners in the district, and  $F_{RTL}$  is the cost of switching from the LTH market to the STH market. Thus, a homeowner operates in the LTH market as long as  $u_{LTH}^1 > u_{STH}^1$  exists in each decision situation. If the inner district houseowner is operating in the STH market, it will face the following two utility functions on the next period:

$$\hat{u}_{STH}^1 = \hat{p}_{STH}^1 + k * \varepsilon(0,1) + n * \alpha^1$$

$$\hat{u}_{LTH}^1 = p_{LTH}^1 + k * \varepsilon(0,1) - F_{LTH}$$

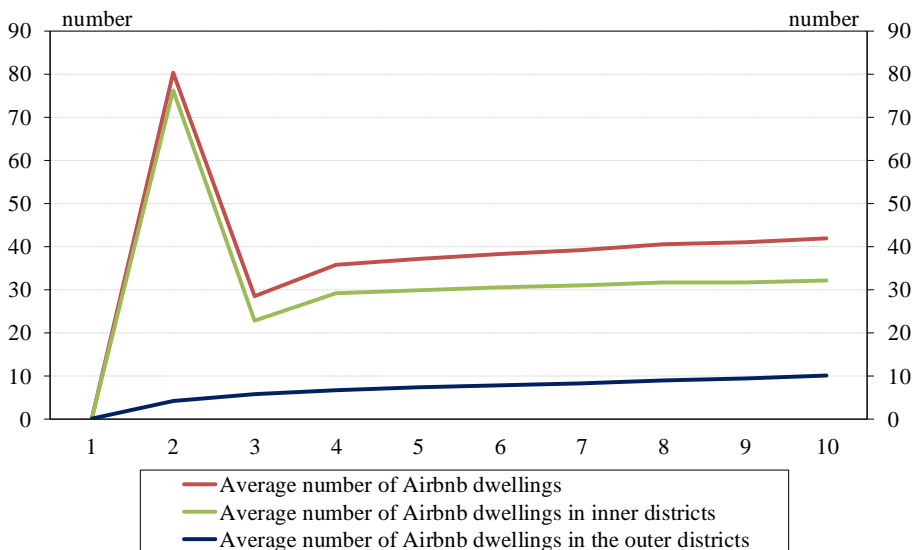
The homeowner operates in the STH market as long as  $\hat{u}_{STH}^1 > \hat{u}_{LTH}^1$  exists in each decision situation. The decision function of homeowners living in the outer district is similar, only calculated at the given external prices ( $\hat{p}_{STH}^2$ , and  $p_{LTH}^2$ ) (see Annex A.1).

At the starting point of our model, each homeowner operates in the LTH market. Assuming supply and demand from period 0, all homeowners calculate their

utility function in period 1, and those homeowners whose utility in the STH market exceeds that in the LTH market will operate in the STH market in the next period. In period 2, assuming supply and demand from period 1, all homeowners determine their utility function and choose to operate in the STH or LTH market. During one run of the model, we assume a total of 1000 periods, i.e., one homeowner has a total of 1000 decision points when deciding whether to rent his home in the STH or LTH market. A total of 50 runs of the model were used and the averages of these runs were analysed in order to filter out and fritter away any outliers for each run.

Examining the average of the 50 runs and the individual elements of the runs, it can be basically concluded that at the very beginning of the simulation, the number of dwellings rented in the STH market follows large jumps from one period to the next. This is because homeowners include the market price determined by supply and demand at the previous period in their utility function, so a search for equilibrium takes place in the first few decision points. Due to the non-equilibrium distribution (STH market: 0 flats; LTH market: 200 flats), the expected and actual market prices of STH and LTH fall far apart (see Figure 2). Furthermore, it can also be observed that firstly there is a greater need for the establishment of Airbnb apartments in the inner districts, where due to higher demand, the homeowners may achieve a higher market price. However, after the initial search for equilibrium, the market becomes stable, as after the tenth decision point there is an average of 41.94 apartments operating in the STH market, which increases to 55.1 during a slow rise after the hundredth decision point and to 61.94 after the thousandth decision point. After the initial search for equilibrium, the market processes are dominated only by the neighbour effect and the random term, because without these the equation of the model can be solved (for deduction, see Annex A.3).

Figure 2 The average number of Airbnb homes formed after 50 runs in the first 10 decision points



Source: Own construction

Analysing the results of the simulation, the effect of the clustering can be well observed, the investigation of which was our goal. If we compare the distribution of dwellings at the early decision points with those observed at later points, we can observe the possible existence and speed of clustering (Table 2).

Increasing the number of decision points, the concentration of flats of the STH market can be observed in the inner districts, because running the simulation fifty times, after the 10th decision point, the inner district with the largest STH market had on average 8.46 flats, and after the 1000th decision point all homeowners (10) were active in the STH market. A similar trend took place in the outer districts, as the value of this indicator increased from 2.86 to 8.14. At the same time, districts where initially fewer flats were in the STH market were gradually pushed out of the market, at the 1000th decision point, short-term housing rental in the three inner districts with the smallest STH market practically ceased. By performing the simulation for more decision points, the densification continues and some parts of both the inner and outer districts have almost solely apartments operating in the STH or LTH market. That is, in the presence of a neighbour effect, clustering also occurs in homogeneous districts.

Table 2 After decision points 10, 100 and 1000, the average number of homeowners in the STH market in each district, in descending order by district

	Inner districts			Outer districts		
	10.	100.	1000.	10.	100.	1000.
1	8.46	9.96	10	2.86	5.74	8.14
2	6.26	8.62	9.84	1.92	3.6	5.26
3	4.92	6.26	9.12	1.52	2.34	2.7
4	3.8	4.04	5.12	1.32	1.78	1.98
5	3.1	3.2	2.84	0.88	1.3	1.32
6	2.36	2.32	1.26	0.5	0.8	0.84
7	1.52	1.44	0.52	0.2	0.52	0.64
8	1.14	1.08	0.14	0.12	0.18	0.2
9	0.64	0.62	0.06	0	0.02	0.02
10	0.16	0.16	0	0	0	0

Source: Own construction

In Budapest, due to the different transport and tourism characteristics of the individual districts, the initial density points (e.g.: VI, VII Districts) are given, but in the case of the existence of the neighbour effect, the model predicts the continuous strengthening of the STH market here. Thus, in the absence of regulatory intervention, areas will emerge in the city where long-term housing rental will be completely eliminated due to the crowding-out effect of short-term housing rental. In the presence of a neighbour effect, more and more homeowners are switching to short-term housing rental, which is leading to an increase in tourists and noise in individual housing units. This can force

residents living there to move to other districts. They find a buyer for their flats due to the strengthening of the STH market and with their relocation they only promote that the proportion of STH flats in the housing stock of the given district increases even more, thus the district becoming a party district (Szabó 2016). Thus, the regulator should definitely take action if they want to avoid the formation of a party district and the crowding out of the residents from the inner quarters.

## 5. Regulatory proposals

When designing the regulation, we took into account and examined several aspects: 1. the issue of taxation and legality; 2. its impact on house prices; 3. downtown residential areas becoming party districts.

First of all, we formulate our views on the issue of taxation and legality. The most important aspect in this matter from our point of view is the legalization of the apartments advertised and rented out on Airbnb, and thus the realization of tax revenue. We have listed several international examples where Airbnb has worked with various cities and Member States<sup>8</sup> and collects the tax itself from advertisers on its site and then forwards it to the authorities. This would be a favourable solution for Hungary/Budapest, as it would also reduce the costs of tax collection, in addition to receiving tax revenues. All this could be solved in return so that decision-makers do not make it impossible for Airbnb to operate, legalize its existence in the country/city.

In addition, we believe that ensuring a level playing field in the short-term housing rental market is an important issue in this area. We consider it a legitimate criticism of the already legally and regulated types of accommodation (hotels, apartments, hostels, boarding houses, etc.) that the lack of regulation upsets the competitive balance and provides an undeserved competitive advantage for homeowners advertising on Airbnb. Overall, we believe that the Hungarian/Budapest regulations should seek that an apartment advertised on Airbnb meet the same conditions as an already legally operating apartment and be subject to the same tax liability.

As for the impact on house prices, we also believe that the Hungarian/Budapest market is ripe for regulation. This is illustrated by Table 3, in which we attempted to illustrate our observations under pre-coronavirus market conditions. We have to add to the presentation of the table that in contrast to Airbnb (where the average price appeared immediately after the filtered search for Budapest), we had to calculate these average values manually for booking.com and ingatlan.com. After filtered search, booking.com displayed five different price ranges, based on which we calculated a weighted average using the arithmetic mean of the class and the number of observations in the class.

In the case of ingatlan.com, no such inter-class frequency was available either. There we obtained the results manually, calculating the inter-class frequency by price (manually searching from class-to-class) and then calculating the weighted average. In the case of ingatlan.com data, only the downtown (V, VI, VII, VIII, and IX) districts were taken into account, so we got 5585 results. The need for regulation is also

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<sup>8</sup> Available at Airbnb's website: <https://www.airbnb.hu/help/article/653/in-what-areas-is-occupancy-tax-collection-and-remittance-by-airbnb-available>

supported by the fact that the number of active apartments for rent advertised on the Airbnb website has already exceeded this number, which meant 7457 active apartments for rent in Budapest in 2017, which were advertised on the website by 4266 different individuals (Airdna 2017).<sup>9</sup> Of the 4,266 individuals, 1,311 advertise more than one apartment on the Airbnb website (Airdna 2017), with our regulations we also want to restrict apartments purchased primarily for investment purposes.

Table 3 Price comparison calculated on the basis of the data of the most popular websites dealing with various short-term and long-term housing rental in Budapest

Starting date	Period of time	Booking.com	Airbnb.hu	Ingatlan.com
July 15, 2017.	1 day	HUF 39,175	HUF 28,404	HUF 10,700
	1 week	HUF 40,029	HUF 25,866	HUF 10,700
October 12, 2017.	1 day	HUF 29,523	HUF 20,604	HUF 10,700
	1 week	HUF 28,480	HUF 16,847	HUF 10,700
January 1, 2018.	1 day	HUF 30,331	HUF 21,774	HUF 10,700
	1 week	HUF 28,290	HUF 17,027	HUF 10,700
April 12, 2018.	1 day	HUF 32,867	HUF 23,216	HUF 10,700
	1 week	HUF 31,080	HUF 17,722	HUF 10,700

Note: The data was downloaded from the websites of the respective companies. The average prices were calculated from the prices on the websites between 16:00 and 16:30 on 09/05/2017. The estimated value of overhead and common costs per day was added to the values of ingatlan.com for comparability. Some of the offers on booking.com also include the provision of breakfast (possibly other meals), they have not been treated due to the heterogeneity of the offers and the lack of aggregated data.

We based our restriction proposal on maximizing the daily number of short-term (less than 30 days) housing rentals per year which is common in international practice. We would like to achieve that the transition shown in the model between the short-term housing rental market and the long-term housing rental market is stopped and then reversed. By definition, this affects homeowners with investment purposes, as they can choose between short-term home rentals and long-term home rentals. By doing so, we are consciously not regulating the rentals of homeowners who want to rent out their own home used for living for a short period of time when they are not at home, as this could mean a favourable additional income for them. This is because their activities have only a minimal effect on changes in market prices, while the choice of investment homeowners is a determining factor in the development of prices in the two markets. The exact number of days in which we maximized short-term housing rentals within

<sup>9</sup> 9/5/2017 6:15 PM as available.



one year was determined based on the microeconomic model. As already mentioned, the aim of the regulation is to move investment homeowners back from the short-term housing rental market to the long-term housing rental market. This is the case if their attainable income from long-term housing rentals is at least equal to, but also exceeds, the attainable income from short-term housing rentals. For this, we use the data from the various websites. Both the one-day and the one-week data are important, we have calculated their average, as it is not possible to predict exactly for how many days the owner can rent out their apartment. We assume that Airbnb apartments would reach 90% occupancy in the summer even in the event of the regulation, as this is the main tourist season, the daily amounts attainable are higher, so homeowners' preference also lie in maximizing summer rental days. For this reason, the calculation of the limit was based on the average daily price experienced in the summer for the first 81 rented days, and then on the average price experienced for the rest of the year in the case of the remaining days until the restriction limit. As long-term housing rental is in practice typically for one or more years, we calculated a uniform daily price for them, regardless of the season.  $365 * 10\,700 = 81 * 27\,000 + (t - 81) * 19\,000$ , where  $t$  is the limit of the days that can be rented  $t=171.45$ , so based on 2017 data, in the case of a limit of 172 days, it is irrelevant to homeowners with investment purposes to provide supply in the long-term or in the short-term housing rental market.

As we believe that on the one hand, the prices of 2017 have already been affected by Airbnb, and since 2017 they have increased in Budapest until the appearance of the corona virus, so the strictest possible regulation is expedient for the future. It also lays the groundwork for strict regulation to ensure that homeowners actually return to the long-term housing rental market. In view of all this, we recommend setting the limit at 120 days a year. The weak point of the restriction set in days is the inelasticity to the changes in rents. It is precisely for this reason that we have chosen the stricter limit, as we consider the flexible regulation indexed to rents to be unfeasible, we believe that it would lead to dissatisfaction and uncertainty, thus jeopardizing the efficiency of housing markets.

Lastly, we are formulating a regulatory proposal due to the transformation of downtown districts into party districts and the consequent crowding out of residents. In our spatial simulation, we pointed out that the clustering of Airbnb dwellings is continuous if we assume that the neighbourhood effect is present and positive. The assumption of the existence and positive nature of this effect is well-founded, as homeowners, if faced with the operation of short-term housing rentals, find it easier to switch from long-term housing to Airbnb. Furthermore, with the formation of larger blocks, homeowners are already more protected from other owners making it impossible to operate. The previously proposed 120-day annual limit will in any case reduce the formation of clusters, as it pushes those interested in investment-oriented short-term housing rentals to the background and sharing oriented home renters would come to the forefront.

As a result of the regulation, even in extreme cases in a condominium, only a maximum of 1/3 of the flats could operate as Airbnb flats per year on average, which reduces the magnitude of the crowding-out effect. Furthermore, as Airbnb apartment operators are also residents, it is in their best interest that the noise and garbage levels in the condominium do not increase significantly. Here, it can also be important to

expand regulatory elements, drawing on international examples: maximizing the number of guests that can be accommodated and the mandatory designation of a person living near the rented apartment, even a neighbour, to whom a complaint can be made. Thus, with the previously formulated regulation – possibly with the introduction of a maximum number of people that can be accommodated and a mandatory appointment of a person – the formation of party districts could be avoided and the displacement of homeowners from their property would stop.

## **6. Conclusion**

In the study, we first introduced the concept of the sharing economy as well as the operation of Airbnb. Subsequently, we reviewed the international (United States and European Union) and Hungarian regulatory examples related to short-term housing rentals. We then used two models to examine the prices observed in the short- and long-term housing rental market and the location of dwellings in the short-term housing rental market. Finally, based on the results of the model, we formulated regulatory advice that could reduce the negative externalities caused by Airbnb.

Our first main hypothesis was that if an apartment can only be used for Airbnb for a certain period of time in a year, it has a significant effect on market processes. In the first microeconomic model, we pointed out that with the appearance of Airbnb, rental prices may increase in the long-term housing market.  $\theta$  ratio of homeowners transition from the long-term housing rental market to the short-term housing rental market, as a result of which an equilibrium price is formed in the two markets. However, by maximizing the number of days available for rent, different prices can be achieved in the long- and short-term market, as well as a reduction in short-term housing rental with investment purposes. Thus, our first hypothesis has been proven, maximizing the number of days available to rent can have a significant impact on the price dynamics of the short- and long-term housing rental market.

Our second hypothesis is that in the long run, the location of Airbnb flats will become denser, so the inhabitants of some parts of the districts may be completely displaced, and the given areas may become party districts. This can be an important issue because the living conditions of local residents can become impossible due to the party districts, which can lead to the introduction of regulations that take into account the interests of local residents. We examined this statement with a spatial model, where the homeowner decided to operate in the market of short-term or long-term housing rental by maximizing its utility function. The model was run 50 times, with one homeowner having 1,000 decision points per run. Based on the length of the run and the size of the number of runs, we found that, with the present parameters, Airbnb dwellings are continuously becoming denser in some districts over time. This points out that the process of Airbnb homes becoming denser cannot be avoided neither in a consolidating, shrinking, or fast-growing market, if the value of the neighbourhood effect is positive. This confirms our hypothesis, in the future the development of party districts and the displacement of local residents from the inner districts may continue in Budapest.

In the last chapter, we tried to provide a framework for regulating the short-term housing market in Budapest. We drew ideas from international examples to solve

taxation and legality. In our view, an agreement with Airbnb could significantly increase tax revenues and reduce the number of non-paying Airbnb-ers. Furthermore, we consider it important that a similar set of rules be established for Airbnb apartments and smaller apartments so that the conditions of the competitive market can prevail. In our second proposal, we maximized the rentability of an apartment in the short-term housing rental market in 120 days. In line with our model, this can result in the investment-oriented homeowners being crowded out of the Airbnb market and in a reduction in the growth rate of rental prices. This proposal can also help to eliminate the risk of party districts forming in Budapest and to cease the displacement of local residents.

It is important to note that the following measures, while eliminating the negative externalities arising from the operation of Airbnb and strengthening the sharing nature (positive externalities) in Budapest, reduce the magnitude of the other two positive externalities. As a result of the regulation, a decreasing supply and an increasing price would develop in the short-term housing rental market, and as a result, fewer foreigners would be expected to come to Hungary. Furthermore, the annual limit of 120 days would reduce the income of homeowners. Thus, our regulatory framework provides a solution to eliminate negative externalities at a price that would reduce the benefits of Airbnb in the meantime. Thus, it is definitely worthwhile to examine the costs of the possible restrictions in a later analysis.

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## References

- Airbnb (2016): *Airbnb and City of Lisbon Sign Agreement on Tourist Tax and Responsible Home Sharing*. <https://lisbon.airbnbcitizen.com/airbnb-and-city-of-lisbon-sign-agreement-on-tourist-tax-and-responsible-home-sharing/> Accessed: May 15, 2017.
- Airbnb (2017): *In what areas is occupancy tax collection and remittance by Airbnb available?* <https://www.airbnb.hu/help/article/653/in-what-areas-is-occupancy-tax-collection-and-remittance-by-airbnb-available> Accessed: May 5, 2017.
- Airdna (2017): <https://www.airdna.co/vacation-rental-data/app/hu/default/budapest/overview> Accessed: May 5, 2017.
- Airdna (2021): <https://www.airdna.co/vacation-rental-data/app/hu/default/budapest/overview> Accessed: May 4, 2021.

- Alfaro, M. (2017): *Texas proposal would keep cities from restricting short-term home rentals*. <https://www.texastribune.org/2017/02/25/bill-would-overrule-local-legislation-over-short-term-rentals/> Accessed: May 4, 2021.
- Badcock, J. (2016): *Barcelona to fine Airbnb and HomeAway €600,000 each for offering 'illegal' accommodation*. <http://www.telegraph.co.uk/news/2016/11/24/barcelona-fine-airbnb-homeaway600000-offering-illegal-accommodation/> Accessed: May 4, 2021.
- Bailey, M. P. (2015): *'Airbnb' rules set for legal short-term rentals*. <http://www.elpasotimes.com/story/news/politics/metro-government/2015/12/17/council-approves-airbnb-ordiance/77521394/> Accessed: May 4, 2021.
- Barchenger, S. – Garrison, J. (2016): *Judge: Nashville's Airbnb law unconstitutional*. <http://www.tennessean.com/story/news/2016/10/21/judge-metros-airbnb-law-unconstitutional/92431324/> Accessed: May 4, 2021.
- Benner, K. (2016a): *Airbnb Sues Over New Law Regulating New York Rentals*. <https://www.nytimes.com/2016/10/22/technology/new-york-passes-law-airbnb.html?module=ArrowsNav&contentCollection=Technology&action=kypress&region=FixedLeft&pgtype=article> Accessed: May 4, 2021.
- Benner, K. (2016b): *Airbnb Ends Fight With New York City Over Fines*. <https://www.nytimes.com/2016/12/03/technology/airbnb-ends-fight-with-new-york-city-over-fines.html> Accessed: May 4, 2021.
- Carville, O. – Roof, K. – Tse, C. (2020): *Airbnb Valuation Reaches \$100 Billion in Trading Debut Surge*. <https://www.bloomberg.com/news/articles/2020-12-10/airbnb-s-47-billion-value-faces-debut-test-in-doordash-s-wake> Accessed: May 4, 2021.
- Boehm, E. (2016a): *Chicago's Airbnb Rules Are Unconstitutional Many Times Over, Lawsuit Argues*. <http://reason.com/blog/2016/11/15/chicago-hit-with-second-lawsuit-over-air> Accessed: May 4, 2021.
- Boehm, E. (2016b): *Airbnb bill passes in Virginia, but won't take effect until 2017*. <http://watchdog.org/259285/airbnb-virginia-bill-passes/> Accessed: May 12, 2017.
- Boyle, R. (2015): *New rules for Airbnb hosts in Brussels*. <http://www.xpats.com/new-rules-airbnb-hosts-brussels> Accessed: May 4, 2017.
- Coldwell, W. (2016): *Airbnb in Paris to warn hosts over illegal listings*. <https://www.theguardian.com/travel/2016/mar/31/airbnb-in-paris-to-warn-hosts-over-illegal-listings> Accessed: May 4, 2021.
- Comprehensive Survey (2016): *From Air Mattresses to Unregulated Business: An analysis of the other side of Airbnb*. [https://www.ahla.com/sites/default/files/Airbnb\\_Analysis\\_September\\_2016\\_0.pdf](https://www.ahla.com/sites/default/files/Airbnb_Analysis_September_2016_0.pdf) Accessed: May 4, 2021.
- Curia of Hungary's BH Resolution No. 117.
- DutchNews (2016): *After Amsterdam, other Dutch cities consider rules to deal with Airbnb*. <http://www.dutchnews.nl/news/archives/2016/05/after-amsterdam-other-dutch-cities-consider-rules-to-deal-with-airbnb/> Accessed: May 4, 2021.

- DutchNews (2017): <http://www.dutchnews.nl/news/archives/2017/02/amsterdam-hits-illegal-airbnb-landlord-with-e300000-fine/> Accessed: May 4, 2021.
- Gabay, B (2020): [https://index.hu/gazdasag/2020/12/12/airbnb\\_lakaskiadas\\_budapest/](https://index.hu/gazdasag/2020/12/12/airbnb_lakaskiadas_budapest/) Accessed: May 4, 2021.
- Garrison, E. (2016): *Sacramento approves restrictions on short-term rentals such as Airbnb.* <http://www.sacbee.com/news/business/article55560300.html> Accessed: May 4, 2021.
- Garrison, J. (2017): *State bill would override Nashville on short-term rental rules, block ban.* <http://www.tennessean.com/story/news/politics/2017/02/09/state-bill-would-override-nashville-short-term-rental-rules-block-ban/97699934/> Accessed: May 4, 2021.
- Johansson, J. (2016): *Stricter regulations for AirBnB accomodation countrywide* <http://www.brusselstimes.com/business/7252/stricter-regulations-for-airbnb-accomodation-countrywide> Accessed: May 4, 2021.
- Kassam, A. (2014): *Airbnb fined €30,000 for illegal tourist lets in Barcelona.* <https://www.theguardian.com/technology/2014/jul/07/airbnb-fined-illegal-tourist-lets-barcelona-catalonia> Accessed: May 4, 2021.
- Kerr, D. (2017): *Airbnb gets free rein in Arizona thanks to new law.* <https://www.cnet.com/news/airbnb-gets-free-rein-in-arizona-says-new-law/> Accessed: May 4, 2021.
- Kousounis, S. (2016): *Tax planned on Airbnb-style rentals.* <http://www.ekathimerini.com/209615/article/ekathimerini/business/tax-planned-on-airbnb-style-rentals> Accessed: May 4, 2021.
- Lentino, C. (2016): *The city's new ordinance will punish visitors to the city with a 21 percent hotel tax bill.* <https://www.illinoispolicy.org/chicago-city-council-enacts-airbnb-regulations/> Accessed: May 5, 2017.
- Luxemburger Wort (2016): *Luxembourg seeks to close Airbnb loophole.* <http://www.wort.lu/en/business/legal-framework-on-holiday-rentals-luxembourg-seeks-to-close-airbnb-loophole-568bae0c0da165c55dc50a9b#> Accessed: May 14, 2021.
- Marotti, A. (2016a): *Chicago's Airbnb home-sharing rules are 'draconian,' lawsuit says.* <http://www.chicagotribune.com/business/ct-airbnb-shared-housing-lawsuit-1116-biz-20161115-story.html> Accessed: May 4, 2021.
- Marotti, A. (2016b): *Chicago Ordered to Put Airbnb Regulations on Hold.* <http://www.governing.com/topics/urban/tns-airbnb-chicago-judge.html> Accessed: May 5, 2017.
- McCarthy, N. (2016): *Which city have the most Airbnbn Listings.* <https://www.statista.com/chart/5204/which-cities-have-the-most-airbnb-listing/> Accessed: May 4, 2021.

- Minder, R. – Scott, M. (2014): *Sharing Economy Faces Patchwork of Guidelines in European Countries*.  
[https://www.nytimes.com/2014/09/22/technology/sharing-economy-faces-patchwork-of-guidelines-in-european-countries.html?\\_r=0](https://www.nytimes.com/2014/09/22/technology/sharing-economy-faces-patchwork-of-guidelines-in-european-countries.html?_r=0) Accessed: May 4, 2021.
- Njus, E. (2014): *Portland legalizes Airbnb-style short-term rentals*.  
[http://www.oregonlive.com/front-porch/index.ssf/2014/07/portland\\_legalizes\\_airbnb-styl.html](http://www.oregonlive.com/front-porch/index.ssf/2014/07/portland_legalizes_airbnb-styl.html) Accessed: May 4, 2021.
- O’Sullivan, F. (2015): *Tourist-Heavy Barcelona Is Cracking Down on Airbnb*.  
<http://www.citylab.com/housing/2015/12/barcelona-airbnb-tourism/421788/> Accessed: May 4, 2021.
- Olander, S. (2007): Stakeholder impact analysis in construction project management. *Construction Management Department*, 25, 3, 277–287.
- Oltermann, P. (2016): *Berlin ban on Airbnb short-term rentals upheld by city court*.  
<https://www.theguardian.com/technology/2016/jun/08/berlin-ban-airbnb-short-term-rentals-upheld-city-court> Accessed: May 4, 2021.
- Parliament (2020): *A rövid távú szálláshely kiadással összefüggő egyes törvények módosításáról*. [https://www.parlament.hu/web/guest/iromanyok-lekerdezesep\\_p\\_id=hu\\_parlament cms\\_pair\\_portlet PairProxy INSTANCE\\_9xd2Wc9jP4z8&p\\_p\\_lifecycle=1&p\\_p\\_state=normal&p\\_p\\_mode=view&p\\_auth=bnyHGarc&\\_hu\\_parlament cms\\_pair\\_portlet PairProxy INSTANCE\\_9xd2Wc9jP4z8\\_pairAction=%2Finternet%2Fcplsql%2Fogy\\_irom.irom\\_adat%3Fp\\_ckl%3D41%26p\\_izon%3D11328](https://www.parlament.hu/web/guest/iromanyok-lekerdezesep_p_id=hu_parlament cms_pair_portlet PairProxy INSTANCE_9xd2Wc9jP4z8&p_p_lifecycle=1&p_p_state=normal&p_p_mode=view&p_auth=bnyHGarc&_hu_parlament cms_pair_portlet PairProxy INSTANCE_9xd2Wc9jP4z8_pairAction=%2Finternet%2Fcplsql%2Fogy_irom.irom_adat%3Fp_ckl%3D41%26p_izon%3D11328) Accessed: May 4, 2021.
- Portfolio (2021): *Elkészült a VI. kerületi Airbnb szabályozás - Úgy tűnik, mégsem lesz időtartam-korlátozás*.  
<https://www.portfolio.hu/ingatlan/20210325/elkeszult-a-vi-keruleti-airbnb-szabalyozas-ugy-tunik-megsem-lesz-idotartam-korlatozas-475818> Accessed: May 4, 2021.
- Sikich, C. (2017): *Indiana House passes bill to protect Airbnb rentals*.  
<http://www.indystar.com/story/news/local/hamilton-county/2017/02/14/indiana-house-passes-bill-protect-airbnb-rentals/97908012/> Accessed: 2017-05-12 May 4, 2021.
- Stucklin, M. (2015): *Five-Day Holiday Rental Limit Challenged In Madrid*.  
<https://www.spanishpropertyinsight.com/2015/04/09/five-day-holiday-rental-limit-challenged-in-madrid/> Accessed: May 4, 2021.
- Szabó, F. (2016): *Már látjuk mi lesz az erzsébetvárosi bulinegyed helyén*.  
[http://hvg.hu/itthon/201650\\_bulinegyed\\_elvanderlas\\_ejszakai\\_élet\\_megszoksz\\_vagy\\_megszoksz](http://hvg.hu/itthon/201650_bulinegyed_elvanderlas_ejszakai_élet_megszoksz_vagy_megszoksz) Accessed: May 23, 2017.
- TheLocal (2017): *AirBnB in talks on Copenhagen rental cap*.  
<https://www.thelocal.dk/20170221/copenhagen-in-talks-with-airbnb-over-rental-cap> Accessed: May 4, 2021.
- Torontáli, Z. (2015): *Tombol az Airbnb-láz: már a magyarok is milliokról álmodoznak*.  
[http://hvg.hu/ingatlan/20150702\\_Megvesztek\\_a\\_magyarok\\_mindenki\\_az\\_Airbnb](http://hvg.hu/ingatlan/20150702_Megvesztek_a_magyarok_mindenki_az_Airbnb) Accessed: May 4, 2021.

- Vasagar, J. (2014): *Berlin housing law threatens sharing economy by restricting rents*. <https://www.ft.com/content/1e8299a0-d065-11e3-af2b-00144feabdc0>  
Accessed: May 14, 2017.
- White, A. (2016): *New Regulations in Austin Could Ban Airbnb, HomeAway Rentals in the City*. <https://www.pastemagazine.com/articles/2016/02/new-regulations-in-austin-could-impact-airbnb-home.html> Accessed: May 4, 2021.
- Woolf, N. (2016): *Airbnb regulation deal with London and Amsterdam marks dramatic policy shift*.  
<https://www.theguardian.com/technology/2016/dec/03/airbnb-regulation-london-amsterdam-housing> Accessed: May 13, 2017.

## Annex

**Annex A.1.:** The homeowner's utility function in the outer districts

If the landlord was active in the LTH market in the previous period:

$$u_{STH}^2 = \hat{p}_{STH}^2 + k * \varepsilon(0,1) + n * \alpha^2 - F_{STH}$$

$$u_{LTH}^2 = p_{LTH}^2 + k * \varepsilon(0,1)$$

The homeowner is active in the LTH market as long as the  $u_{LTH}^2 > u_{STH}^2$  inequality holds in each period.

If the landlord was active in the STH market in the previous period:

$$\hat{u}_{STH}^2 = \hat{p}_{STH}^2 + k * \varepsilon(0,1) + n * \alpha^2$$

$$\hat{u}_{LTH}^2 = p_{LTH}^2 + k * \varepsilon(0,1) - F_{LTH}$$

The landlord is active in the STH market as long as the inequality  $\hat{u}_{STH}^2 > \hat{u}_{LTH}^2$  persists in each period.

**Annex A.2.:** Parameters used during the simulation

Parameters of demand functions:	$c^1$	110
	$c^2$	100
	$d^1$	4,5
	$d^2$	6
Additional parameters of the utility function:	$k$	2
	$F_{STH}$	20
	$F_{LTH}$	2
	$\alpha^1$	1
	$\alpha^2$	0,5

**Annex A.3.:** Equilibrium solution of the model without neighbour effect and random effect

The landlord's choice if he/she was active in the LTH market::

$$u_{STH} = \hat{p}_{STH} - F_{STH}$$

$$u_{LTH} = p_{LTH}$$

The landlord's choice if he/she was active in the STH market:

$$u_{STH} = \hat{p}_{STH}$$

$$u_{LTH} = p_{LTH} - F_{LTH}$$

The system will be balanced if it is not worthwhile for any landlord to switch, that is, for each STH homeowner, there is an inequality  $u_{STH} > u_{LTH}$ , and for LTH homeowners, there is an inequality  $u_{LTH} > u_{STH}$ . That is  $\hat{p}_{STH} - F_{STH} > p_{LTH}$  and  $\hat{p}_{STH} < p_{LTH} - F_{LTH}$ . The price of  $\hat{p}_{STH}$  and  $p_{LTH}$  depends on the supply of STH in the previous year, which is unchanged in equilibrium (N), so the problem to be solved is:

$$\frac{c - N}{d} - F_{STH} < \frac{c - 100 + N}{d}$$

$$\frac{c - N}{d} > \frac{c - 100 + N}{d} - F_{LTH}$$

Solving the equation with the parameters in Annex A.2, the solution for N is obtained. Because of the transition costs, N will be in equilibrium in an interval, for example, for an inner districts, the solution to the equation is  $5 < N < 54.5$ . In other words, if the number of dwellings offered on the STH market in the inner districts is within the following range, no one will move to the other market.