On the relationship between short-term rentals and gentrification: the case of Airbnb in Munich (Germany)

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ABSTRACT This paper explores the relationship between Airbnb and gentrification by studying Munich, which is at the forefront of the short-term rental market in Germany. We investigate both the Airbnb market and the functional rent gap, providing a spatial comparison. The results show an overlapping of gentrification and Airbnb in the central districts, but there are also functional rent gaps in the peripheries. However, high Airbnb densities do not always go hand in hand with gentrification. We also identify a considerable seasonality on the Airbnb market, that adds a temporal dimension to the phenomena. Drawing on this, we call for a city-wide monitoring of these aspects to increase transparency and provide a database for urban policy. By exploring the case of Munich, we contribute to the ongoing discussion, as other (German) cities develop in the same direction on the Airbnb market as the Bavarian capital. Apart from that, our quantitative model is also transferable to other cases.

KEY WORDS Airbnb – sharing economy – short-term rentals – gentrification – rent gap – Munich

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1. Introduction

There is a vivid discussion on short-term rental platforms in academia. Due to their growing professionalism on the market, platforms such as Airbnb are regarded as part of platform capitalism (Srnicek 2017). Airbnb initiated a profound change, one that extends beyond the tourism industry (Reinhold, Dolnicar 2017; Zervas, Proserpio, Byers 2017). Multifold impacts are also seen in neighborhoods and on local housing markets. As Airbnb takes units out of the traditional housing sector and shifts them to the tourism market, the increasing number of listings provokes a severe shortage of affordable housing in cities (Lee 2016). From a business perspective, this shift comes as no surprise since short-term rentals easily generate higher profits than regular long-term rentals. This mechanism can be understood by Neil Smith's concept of the rent gap (Smith 1979), ultimately leading to gentrification.

Within the academic discourse, different ideas exist on how to approach these trends. While some scholars use gentrification concepts to explore touristification through short-term rental platforms (Yrigoy 2019, Mermet 2017), others argue for a more precise use of these concepts (Sequera, Nofre 2018). Despite this, we

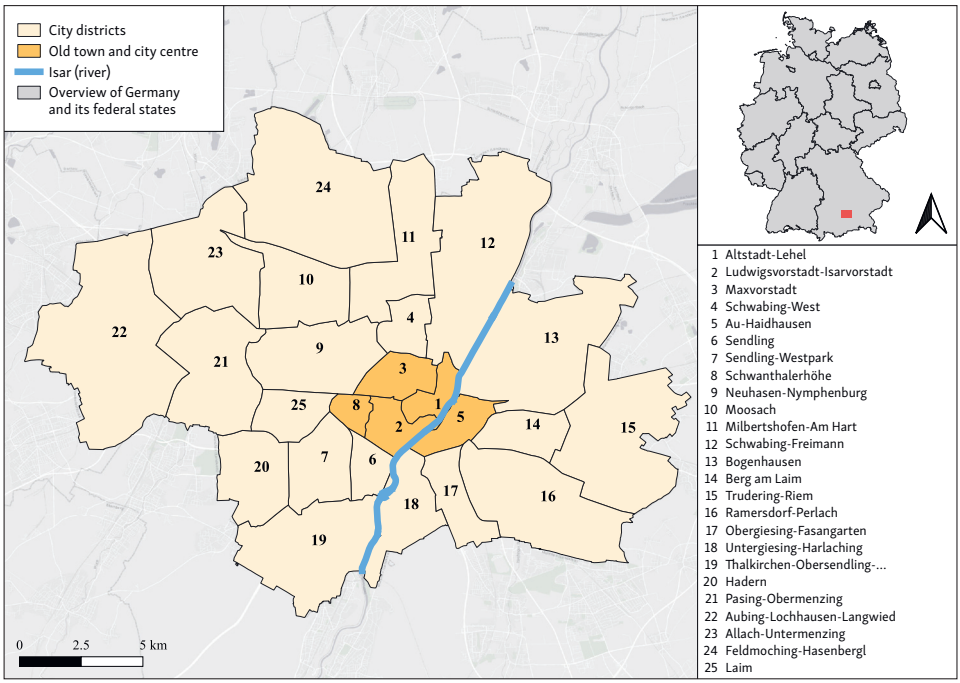


Fig. 1 – Geographical setting and administrative structure of Munich. Our own elaboration based on ArcGIS Hub (2011) and Landeshauptstadt München (2021b), license: dl-de/by-2-0AA.

see a clear link between these two key processes in urban development, and this paper presents the case study of Munich to further investigate this relationship. Although there are several short-term rental platform companies (e.g. HomeAway and VRBO) we will focus on Airbnb as the largest of these platforms. After Berlin, Munich (see Fig. 1) has the second highest number of Airbnb listings among German cities but the highest number of listings per capita (BMWE 2017, p. 18). This places Munich at the top of the Airbnb market in Germany. Simultaneously, Munich has shown a stronger growth in the numbers of visitors than any other large German city, attracting 24% more tourists in 2019 compared to 2015 (Statista 2021a). On the German housing market, Munich has the highest prices (19,58 €/m²; Empirica 2020). Consequently, the gentrification debate in Munich is very topical (Draxel, Hoben 2019; Hoben 2017; Guyton 2017; Löw, Steets 2014).

However, the question remains as to how these processes are linked to each other. To date, no study covering the entire city of Munich has been conducted yet. The city's statistics agency published a report on Airbnb, but it is kept short and does not link the findings to gentrification processes (Statistisches Amt München 2018).

Given this research gap, the aim of this paper is to analyze the spatial linkages between gentrification and Airbnb. Not only do we seek to contribute to the critical discussion on short-term rentals and displacement in Munich, but the methods proposed in this paper will also be transferable to other case studies and allow us to examine the dynamics through the lens of both gentrification and short-term rental platforms. We thus contribute to the methodological question of how these trends can be assessed. Our approach is described as follows. Section two presents the theoretical background of this study. Section three describes the case, methods and the materials. Section four discusses our results, while section five draws a conclusion based on them.

2. Gentrification and Airbnb

2.1. Phases and waves of gentrification

Gentrification is understood as a process of both upgrading and displacement (Lees 2008). We are currently observing a new wave of gentrification. This latest wave describes how "finance is taking a stronger foothold through the rise of corporate landlords and platform capitalism" (Aalbers 2018, p. 6) in gentrification. Housing has become a financial asset as the product of long-term deregulation and neoliberalization (Fernandez, Aalbers 2016).

Aalbers' findings were based on what Hackworth and Smith called "the changing state of gentrification" (2001, p. 464), where they observed how places, the role of the state and developers changed in the second half of the twentieth century. In

a city, one will probably find several examples of these waves from a retrospective, but each wave might contain different phases of gentrification (Friedrichs 1998)[1]. We will follow this phase model to understand gentrification in our case study and we will later develop an approach to identify each phase quantitatively (see section 3.3.).

In the initial phase of gentrification, a minority with a higher status (pioneers) moves into neighborhoods previously spared from gentrification. The accompanying socio-structural change has only a minor impact. The pioneers, who are willing to take risks, generally have few financial resources, which is why immigration does not have a significant impact on rents, land, and property prices (Friedrichs 1998).

The pioneer and gentrifier phase combines phase two and three according to Friedrichs' model. In addition to pioneers, gentrifiers are now moving into the areas. The social structure in the neighborhoods changes because of the continued growth of higher-income groups (Blasius, Friedrichs, Rühl 2016, p. 55). The purchasing power increases, and at the same time the first households with a low social status are pushed out of their residential environment. Due to the growing attractiveness of the city districts, rental and purchase prices increase (Friedrichs 1998).

In the late gentrification phase, mostly gentrifier households move in and the level of in-migration falls slightly. In addition to the residents, pioneers are also displaced. The neighborhoods are now considered attractive residential areas with a correspondingly large number of high-income groups. The situation on the housing market remains tense. Investors increasingly purchase buildings and convert them into condominiums (Friedrichs 1998, Clay 1979).

2.2. (How) Does Airbnb change gentrification?

The most current wave of gentrification described in section 2.1. asserts that transforming flats to short-term rentals is one way of increasing profits (Aalbers 2018, p. 6). However, there is nothing new about tourism elevating housing prices, even in the pre-short-term rental platform era. We must not forget that tourism in general leads to an "intensification of land use [that] increases property prices" (Cocola-Gant, Gago, Jover 2020, p. 123). In this sense, Gotham already coined the term "tourism gentrification" (2005, p. 1099) two decades ago, describing how a gentrifying neighborhood is linked to tourism. Since then, gentrification and tourism have proven to be intertwined phenomena (Hübscher 2021; Cocola-Gant, Gago, Jover 2020). Nevertheless, the holiday rental sector has become a new battlefront in recent years (Cocola-Gant 2016).

[1] Friedrichs' model is based on Clay (1979), but adapted to the German context.

With regards to short-term rental platforms and gentrification, scholars notice different shades in their relationship. Some argue that gentrification is induced by short-term rental platforms such as Airbnb (Yrigoy 2019; Wachsmuth, Weisler 2018). Others specify that short-term rental platforms provoke digitally-mediated tourism gentrification" (Robertson, Oliver, Nost 2019, p. 1). We also found contributions that see in short-term rental platforms a "new form of urban displacement" (Amore, De Bernardi, Arvanitis 2020, p. 1), that goes "deeper than the influx of affluent residents" (Chamusca et al. 2019, p. 8). However, the question of "which came first" (Rabiei-Dastjerdi, McArdle, Hynes 2022) remains an open one. Hence, one might even turn the much-observed direction around and ask if gentrification fosters the proliferation of short-term rental platforms?

What has been researched to a larger extent is the impact of short-term rental platforms on gentrification, such as the different aspects of short-term rental platform induced displacement. Short-term rental platform are one of the drivers of rising rents, as they decrease the number of available housing units (Lee 2016). Not only does this fuel direct or exclusionary displacement in Marcuse's (1985) sense. The cultural and structural changes due to increasing tourist uses may even encourage inhabitants with housing property to sell their flats (displacement pressure; Cocola-Gant, Gago, Jover 2020). Consequently, short-term rental platform have intensified the ongoing dispossession (Gutiérrez, Domènech 2020), but it remains a challenge to empirically measure such displacement processes (Easton et al. 2020). Although we follow Sequera's and Nofre's (2018) argument of the blurring lines between gentrification and touristifcation, we argue that classic gentrification concepts offer powerful approaches, such as the rent gap, to understand the impact of short-term rental platforms on upgrading and displacement. Seen from the supply side of gentrification theory (Smith 1979), short-term rental platforms can produce 100% more income than a traditional rental (Ardura Urquiaga, Lorente-Riverola, Ruiz Sanchez 2020, p. 3108). This "new form of rent gap" (Wachsmuth, Weisler 2018, p. 1149) differs from Neil Smith's original idea of the rent gap as "the disparity between the potential ground rent level and the actual ground rent capitalized" (Smith 1979, p. 545), because it now refers to a gap between two different markets (regular housing market and short-term rental platform market). However, rent gap theory still applies, as "a potential shift from a residential to a touristic use of housing creates a 'highest and better use'" (Yrigoy 2019, p. 12). Accordingly, we frame this new gap between housing and short-term rental platform market as a functional gap in this paper.

Our proposal is not to explain one concept (gentrification) with the other (touristification). Instead, we explore the interrelation in a quantitative manner and regard them as two processes that are "closely intertwined" (Freytag, Bauder 2018, p. 4). Hence, we will not investigate which process has taken place first (Rabiei-Dastjerdi, McArdle, Hynes 2022). We will rather discuss the current

overlapping (Cocola-Gant, Gago, Jover 2020), which from a practical point of view is what should concern cities and local governments first. Based on what the studies mentioned above observe, our hypothesis is that the proliferation of Airbnb in Munich indeed leads to a rising functional rent gap, and thus parallels or even fuels gentrification processes.

We thus present the following research objectives:

- analyzing the Airbnb supply in Munich to understand its geographies and structures
- identifying gentrification processes in the city by means of the functional rent gap
- overlapping these two processes on a spatial level to investigate the linkages between gentrification and Airbnb

3. Case study and methods

3.1. Munich: setting the frame

Munich is a compelling case to study, as it is one of the tightest housing markets in Germany (which is shown by high prices, high growth rates, and very low vacancy rates, see Table 1). A strong population growth that consisted both of national and international immigration influx turned Munich into the city with the second highest share of foreigners among large German cities (Statistische Ämter des Bundes und der Länder 2022). It is thus not surprising at all, that gentrification has occurred in the city intensively. Until the 1990s, gentrification was observed in inner-city neighborhoods such as Schwabing and Lehel. Here, gentrification is the result of "the professionalised middle class becoming a well-funded actor on the real estate market" (Franz, Torri 2017, p. 73), which is linked to the economic strength and diversity in the region. However, this "professionalisation-led gentrification" (Franz, Torri 2017, p. 82) in inner-city areas has later been overlain by second or even third waves of gentrification (Hackworth, Smith 2001), which is why now even middle-class tenants are affected (Referat für Stadtplanung & Bauordnung 2017a, p. 5). Apart from that, "gentrification has also gradually spread [...] through the urban region" (Ranci 2017, p. 241). Currently, quarters such as Schwabing, Giesing and Glockenbachviertel are the most discussed gentrification hotspots in the city (Draxel, Hoben 2019; Hoben 2017; Guyton 2017).

At the same time, affordable housing in Munich has become rare. The amount of social housing units declined continuously over the last decades, although the city administration claims to influence the prices directly or indirectly of about 10.4% of all housing units due to municipal housing companies and other instruments (Landeshauptstadt München 2021a). However, Munich's administration

Table 1 – Key numbers on housing market and socio-demographic aspects in Munich. Own elaboration based on Statista (2022) and Statistische Ämter des Bundes und der Länder (2022).

Socio-demographic data			Growth [%]
	2000	*2020*	
Population	1,210,223	1,488,202	23.0
	2000	*2019*	
Share of foreigners [%]	22.6	28.5	57.6
	2001	*2019*	
Share of unemployment [%]	4.5	3.5	-22.2
Housing market			
	2016	*2021*	
Housing prices per sqm [€]	6,799	11,006	61.9
	2012	*2022*	
Rental prices per sqm [€]	11.41	17.77	55.7
	2010	*2020*	
Number of housing units	750,409	813,850	8.5
share of housing units with 1 or 2 rooms	21.7	32.1	60.7
share of housing units with 3 or more rooms	78.3	67.9	-6.0
	2006	*2020*	
Share of vacant housing units [%]	2.2	0.2	-90.9

is also aware of the impacts of short-term rental platforms on the housing market. There is a limit on the number of days that an apartment can be rented on short-term rental platforms (56 days per year) and a task force controlling it (Landeshauptstadt München 2022).

3.2. Analyzing the geographies of Airbnb

Based on the research objectives presented in sections 1 and 2, our quantitative approach is divided into three steps. First, an overview of the Airbnb market and the supply structure is given. We obtained data (November 2017 to November 2020) from the leading provider of vacation rentals "AirDNA" and the platform "Inside Airbnb". The year 2019 has been chosen as the reference year for the mean calculations, as it is not affected by the COVID-19 pandemic. The following parameters were analyzed: Seasonality, spatial distribution, types of offers (size/whole unit/shared room/private room), prices, Airbnb density[2], illegal rentals, and the impact of the COVID-19 pandemic.

[2] In this paper, we define density as the share of whole Airbnb rentals in the housing stock.

In the second step, we examined whether there is a link between Airbnb and gentrification in the context of a functional rent gap opening. Here, we investigated the profitability of Airbnb rentals in comparison to long-term rentals in Munich. The procedure is based on the Airbnb rent gap calculations by Yrigoy (2019) and Wachsmuth and Weisler (2018). These scholars used the rental income on the local housing market (actual ground rent) and the income on the short-term rental platform market (potential ground rent) as proxies. Rental prices without operational costs form the data basis for the actual ground rent. They provide an appropriate indication of the current situation and developments in the housing market (Referat für Stadtplanung & Bauordnung 2020, p. 6). The potential ground rent is defined as the median monthly revenue generated by all listings (whole units) with at least one booked day in the previous month. Data were available on the AirDNA MarketMinder.

Our proposed methodology has limitations. The data for the analysis was obtained from two platforms (AirDNA and Inside Airbnb) that use different data gathering methods. With regards to the rent gap analysis, it should be noted that the Airbnb revenue figures are only meaningful in part. The monthly Airbnb income is more equivalent to a rent including additional costs. We assume that ancillary costs are included in most cases. Comparability with rents excluding additional costs is therefore only partly possible. However, due to the non-transparent data situation, an analysis taking into account the aforementioned factors was not possible at the time of the study.

3.3. Modelling an index to measure gentrification

In the third analytical step we examined the spatial correlation between gentrification progress and Airbnb density at the district level. We assumed that a higher gentrification phase in a district, is paralleled by a higher Airbnb density. For this purpose, it was necessary to operationalize the gentrification progress in Munich. In the literature, several models are used to assess gentrification (Schulz 2017; Döring, Ulbricht 2016; Holm, Schulz 2016; Newman, Wyly 2006; Freeman 2005; Atkinson 2000). In this case, an index- and indicator-based analysis in reference to the publications of Döring and Ulbricht (2016) and Holm and Schulz (2016) was applied, which we modified and adapted to our case. Applying this model, we explore the most current phase in Munich's gentrification trajectory (2014 to 2020), although gentrification processes have already taken place before that (see section 3.1.; Draxel, Hoben 2019; Hoben 2017; Guyton 2017; Löw, Steets 2014).

Based on the index formation of Holm and Schulz (2016), we firstly elaborated the typical characteristics of gentrification. In doing so, the specifications according to Glass (1964), Davidson and Lees (2005), and Friedrichs (1998) were

Table 2 – Indices and the corresponding indicators

Indices	Corresponding quantitative indicators	Source
Mobility index	– average duration of residence at current address in years – mobility*	Statistisches Amt München 2021a; Statistisches Amt München 2021b
Social index	– purchasing power per inhabitant (€) – number of unemployed inhabitants – share of non-Germans (%)	Statistisches Amt München 2021c, Statistisches Amt München 2021d, GfK 2020
Housing index	– rent without operational costs (€) – purchase prices for existing stock (€)	Referat für Stadtplanung & Bauordnung 2020

* The mobility ratio is the sum of total inflows and outflows of residents with primary residence per 1,000 residents with primary residence (mean number of residents) from January to December. Both extra-urban (beyond the city boundaries of Munich) and intra-urban inflows and outflows (= moves within the city area, also within the spatial unit) are taken into account.
Source: own elaboration

considered. Overall, neighborhoods that undergo a gentrification process are exposed to socio-economic, demographic, and housing changes. Therefore, we defined a mobility index, a social index, and a housing index based on quantitative indicators to capture the multidimensional concept of gentrification for Munich (Table 2). This model has certain limitation: It does not measure with certainty displacement induced by gentrification processes. However, in the light of the existing methodological difficulties to do so (Easton et al. 2020), we regard this model as a valuable approach to assess the progress of gentrification in Munich.

In the next step, a point system was established to determine the progress of gentrification at the district level (Fig. 2). For this purpose, the percentage changes to the respective starting year are calculated for each indicator at the city district level. The percentages of change can then be used to determine the average in Munich, which in this case is assigned 0 points as an orientation value. If an indicator speaks for gentrification, then it is assigned positive values. If the opposite is the case, points are assigned in the negative range. As in Döring and Ulbricht (2016), the points are assigned according to the standard deviation principle.

The indicators are then combined into the three indices by totaling the respective points (Table 3). To determine the progress of gentrification, the districts of

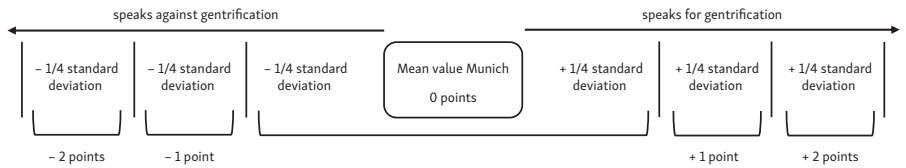


Fig. 2 – Point calculation model to analyze the phases of gentrification. Our own elaboration based on Döring and Ulbricht (2016, p. 23).

Table 3 – Gentrification phases and their indices ranking

Gentrification Phases	
Initial phase of gentrification (low progress of gentrification)	Low to medium mobility index Low social index Low housing index
Pioneer and gentrifier phase (medium gentrification progress)	Medium to high mobility and social index High housing index
Late gentrification phase (high gentrification progress)	Low to medium mobility index High social and housing index

Source: own elaboration

each index are grouped according to a ranking system based on the points. We did not adopt the classification according to Döring and Ulbricht (2016). Instead, we applied our own subdivision based on the phase model of Friedrichs (1998, p. 60; see section 2.1).

A system adapted to the rankings was used to assign the "high", "medium", and "low" scores. All indices except the housing index have a total of 25 rankings. Therefore, they were divided into three equal-sized classes:

- high: rank 1 to 7
- medium: rank 8 to 16
- low: rank 17 to 25

There were urban districts that could not be assigned to any of the phases. When measuring gentrification, not all indicators cover the six-year period due to data gaps. However, since in most cases only one year's data are missing, the impact on the result is considered to be negligible. Apart from this, our model rather grasps what we call "relational gentrification", because it compares all the districts to each other based on different parameters. Based on our data, we cannot claim that each district passes through the different gentrification phases uniformly. This must be explored by further studies.

4. Results and discussion

4.1. Airbnb market

In Munich, we detect a prospering Airbnb market. With 8,500 Airbnb listings and an average daily rate of €94, Munich surpasses other major German cities such as Hamburg (5,500/ €88), and Cologne (6,200/ €81; Statista 2021b; AirDNA 2020). Nevertheless, compared to major European cities such as Amsterdam (€176) or Barcelona (€130), prices in Munich are moderate (AirDNA 2020). The majority

of providers (57%) rent out entire apartments. This percentage is similar to cities with large amounts of tourists such as Berlin or Barcelona (AirDNA 2020).

The share of whole Airbnb rentals in the housing stock (Airbnb density) is 0.41%, which is low within the German context. By comparison, the proportions in Berlin and Hamburg are 0.66 and 0.61% (our own calculations based on Empirica 2019, p. 22; Amt für Statistik Berlin-Brandenburg 2020; Statistisches Amt für Hamburg und Schleswig-Holstein 2020). In other cities such as Santa Cruz de Tenerife (1.3%), Barcelona (0.95%), or New York (0.6%), the density is also significantly higher (Hübscher et al. 2020, p. 200; Garcia-López et al. 2020, p. 2). Airbnb density is highest in the city center of Munich. In Ludwigsvorstadt-Isarvorstadt and Altstadt-Lehel, the share of Airbnb listings compared to the total housing stock reaches 1.29 and 1.20%, respectively. The results are consistent with studies in Salzburg, Budapest, Madrid, and New York City. In these cities, the density is highest in the center and near the tourist attractions (Smigiel et al. 2020, p. 9; Ardura Urquiaga, Lorente-Riverola, Ruiz Sanchez 2020, p. 3105; Dudás et al. 2017, p. 27; Coles et al. 2017, p. 7). However, we also observe a relevant number of peripheral districts with medium densities north and northeast of the center, such as Tudering-Riem and Schwabing Freimann.

Furthermore, the calculations reveal that an average of 1,765 apartments in Munich are offered for rent more than 56 days a year. This means more than a quarter of all Airbnb offers in Munich are apartments that otherwise would be available on the housing market.

4.2. The seasonal and spatial rent gap in Munich

Until 2019, we observe an upward trend on income both on the Airbnb and the regular housing market. With COVID-19, the tide has turned: While the income on the regular housing market kept rising continuously by around five to six percent per year since 2017, income for short-term rentals on Airbnb fell in 2020 (see Fig. 3). Although rental prices on the housing market in Munich remained stable during the first months of the pandemic, studies in other cities show that prices are expected to increase, which is due to the growing importance of housing as a place to live and work (Wang 2021).

In addition, there is a striking seasonality on the Airbnb market. In the winter months, significantly fewer Airbnb units are rented out (32 % more listings in the third quarter compared to the first quarter of 2019) and lower prices are charged than in the summer (AirDNA 2020). Here, we observe how the world's largest folk festival "Oktoberfest" or trade fair events have an impact on the price and number of listings. Accordingly, the highest prices are seen in September and October (Fig. 3). This seasonality is observed in other destinations as well and

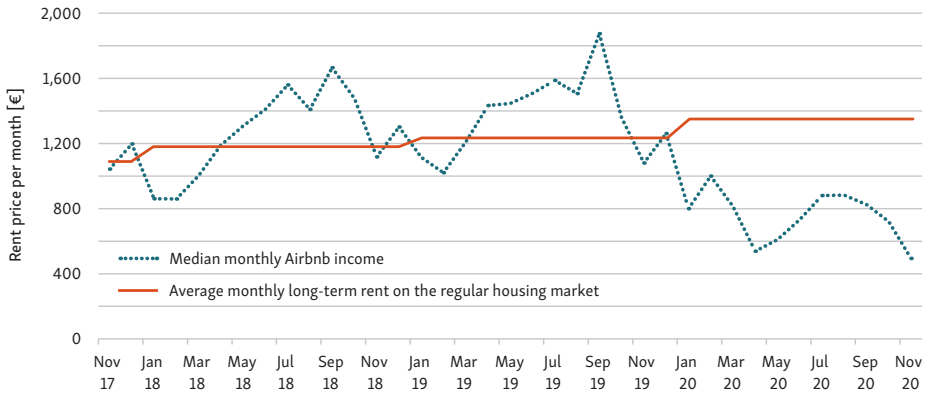


Fig. 3 – Functional rent gap in Munich. Our own elaboration based on AirDNA 2020; Referat für Stadtplanung & Bauordnung (2020, p. 16), Referat für Stadtplanung & Bauordnung (2019, p. 17), Referat für Stadtplanung & Bauordnung (2017b, p. 14), Referat für Stadtplanung & Bauordnung (2018, p. 14).

shows the temporal pressure due to tourism (Benítez-Aurioles 2020, p. 363). In Munich, the impact of seasonality on the Airbnb prices (84% difference between the most expensive and the cheapest month) is comparable to touristic regions such as Corsica, France (78%; Casamatta et al. 2022).

Hence, we identify a notable gap between Airbnb revenue and long-term rental income from spring to autumn in a pre-COVID-19 setting (Fig. 3). The highest functional rent gap is found in September 2019. On the contrary, in 2020, income for long-term rentals exceeds Airbnb revenue up to €850 in November 2020. This is the largest difference between both graphs in our period of investigation and reflects the volatility of the short-term rental platform market during the global pandemic. Considering the average revenue per year, renting out an apartment on the Airbnb market was 7% (2018) and 11% (2019) more profitable than offering it on the regular housing market. Detecting this functional rent gap per year, even considering the monthly fluctuations, helps to understand the motivation to offer apartments permanently on the Airbnb market. This is particularly relevant, as prices on the Airbnb market have recovered from the impacts of the pandemic: Revenue in May 2022 has already reached the pre-crisis level of May 2019 (AirDNA 2022).

This functional rent gap has also a spatial dimension. We compared the monthly income for a flat[3] with 80 sqm to the average income on the Airbnb market[4] in 2019,

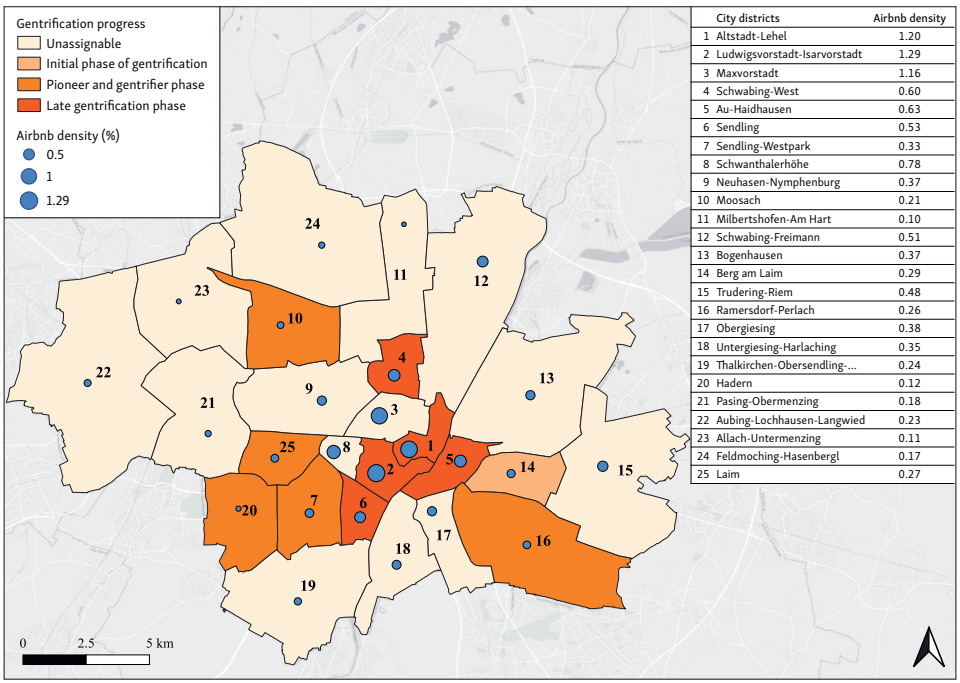
[3] In Munich, the majority of flats has a size between 60 to 80 sqm (Referat für Stadtplanung & Bauordnung 2020) and the city-wide average is 72.3 sqm (Kniepkamp 2018).

[4] As a majority of Airbnb rentals in Munich is offered for two (44%) or four guests (23%), we assume comparability to aforementioned numbers on the regular housing market (AIRDNA 2020).

and detected the highest gaps in the city center (Ludwigsvorstadt-Isarvorstadt, €168), the northeastern districts (€368 in Bogenhausen; €192 in Berg am Laim) and in the west of Munich (€171 in Allach-Untermenzing). Here, the risk of a further proliferation of Airbnb is particularly high. Moreover, Bogenhausen and Allach-Untermenzig are both rather peripheral districts that have not experienced gentrification so far. The Airbnb-induced functional gap is expected to change that.

4.3. The spatial link between gentrification and Airbnb

A total of 11 city districts were assigned to a gentrification phase (Fig. 4). Berg am Laim is in the early phase with little progress in gentrification. Some initial mobility movements are visible here, which suggests that pioneers are slowly discovering the neighbourhood (Friedrichs 1998, p. 59). This is confirmed by newspaper reports that speak of a vast dynamic in recent years (Kramer 2019). However, housing and socio-structural changes were not identified with the indicator-based



	City districts	Airbnb density
1	Altstadt-Lehel	1.20
2	Ludwigsvorstadt-Isarvorstadt	1.29
3	Maxvorstadt	1.16
4	Schwabing-West	0.60
5	Au-Haidhausen	0.63
6	Sendling	0.53
7	Sendling-Westpark	0.33
8	Schwanthalerhöhe	0.78
9	Neuhasen-Nymphenburg	0.37
10	Moosach	0.21
11	Milbertshofen-Am Hart	0.10
12	Schwabing-Freimann	0.51
13	Bogenhausen	0.37
14	Berg am Laim	0.29
15	Trudering-Riem	0.48
16	Ramersdorf-Perlach	0.26
17	Obergiesing	0.38
18	Untergiesing-Harlaching	0.35
19	Thalkirchen-Obersendling-...	0.24
20	Hadern	0.12
21	Pasing-Obermenzing	0.18
22	Aubing-Lochhausen-Langwied	0.23
23	Allach-Untermenzing	0.11
24	Feldmoching-Hasenbergl	0.17
25	Laim	0.27

Fig. 4 – Gentrification progress and Airbnb density (share of entire home Airbnb rentals in the housing stock) in Munich's districts. Our own elaboration (QGIS 2021) based on Landeshauptstadt München (2021b), AirDNA (2020), Inside Airbnb (2020) and Statistisches Amt München (2013), license: dl-de/by-2-0.

analysis. Due to its rank at 24th in the housing index, a transition to the next phase is not expected any time soon.

The urban districts of Sendling-Westpark, Moosach, Ramersdorf-Perlach, Hadern, and Laim are part of the pioneer and gentrifier phase. In these areas, gentrification is already further advanced. All three indices are at least in the medium to high range. Interestingly, this group contains inner-city and more peripheral districts. As described in Friedrichs' (1998) phase model, rental and purchase prices rise in this second phase. This increase is particularly high in Laim and Ramersdorf-Perlach. However, rent increases and modernizations are also reported in Sendling-Westpark and Moosach (Zick 2016, Gentner 2013). In addition, there is an increased mobility in the city districts, which suggests an influx of gentrifiers. This process is visible for example in Laim, where many academic families and single households have moved (Nisslmüller 2022). The high mobility rate, however, could also indicate displacement processes. A study by the City of Munich was able to demonstrate this in Ramersdorf-Perlach with the help of qualitative interviews (Referat für Stadtplanung & Bauordnung 2021, p. 15). The district of Schwabing-West can be assigned to the pioneer and gentrifier phase as well as to the late gentrification phase, representing a transitional phase.

Five urban districts were assigned to the late gentrification phase. These include Altstadt-Lehel, Ludwigsvorstadt-Isarvorstadt, Schwabing-West, Au-Haidhausen, and Sendling – all of them are located in the city center. Ludwigsvorstadt-Isarvorstadt occupies a top position. It ranks first in the social index and third in the housing index. At the same time, it ranks last in the mobility index, which indicates that mainly gentrifier households are now moving into the urban district. In accordance with Friedrichs' (1998) model, Ludwigsvorstadt-Isarvorstadt can thus be seen as a prime example of a completely gentrified district (Friedrichs 1998, p. 61). Furthermore, these five urban districts are most frequently mentioned by media reports in the context of gentrification (Stäbler 2020, Guyton 2017, Kronewiter 2017, Lotze 2017, Beer 2013, Ebitsch 2011, Meyer 2011).

The remaining 14 city districts could not be assigned to any phase, which is why we excluded these districts from the further steps of analysis (Table 3). It can be assumed that no gentrification-typical changes have taken place in the period investigated. Nevertheless, this implies that gentrification processes may have already taken place here at an earlier point in time or that the developments in the city districts do not correspond to the typical phases according to Friedrichs' (1998) model.

As already indicated in section 3.1, gentrification processes have been visible in Munich since the 1970s (Draxel 2022). Especially the inner-city districts of Munich have already been gentrified for the most part during the "professionalisation-led" gentrification wave (Franz, Torri 2017, p. 82). Consequently, some of the city districts that could be assigned to the third phase might have undergone

Fig. 5 – Different districts in Munich. Upper row, left to right: Hadern, Sendling, Altstadt-Lehel, Laim. Lower row, left to right: Giesing, Altstadt-Lehel. Source: the authors.

a second or third wave of gentrification (Hackworth, Smith 2001). Based on a report's finding, this applies to the districts Altstadt-Lehel (Fig. 5), Schwabing-West and Isarvorstadt-Ludwigsvorstadt (Referat für Stadt & Bauordnung 2017a, p. 5). Contrary to that, current gentrification processes are concentrated in districts around the downtown area, such as Giesing, Sendling, and Haidhausen (Draxel, Hoben 2019; Referat für Stadtplanung & Bauordnung 2017a, p. 5; Hoben 2017; Guyton 2017).

The spatial comparison demonstrates that in many districts a high Airbnb density is associated with advanced gentrification (Fig. 4). We tested this relationship applying the Spearman's Rank Correlation, which is a non-parametric test based on ranking positions (Zar 2012). Table 3 shows that there is a significant correlation between both variables. However, there are differences between the districts. In the inner-city area, where Airbnb density peaks, the signs indicate advances in the gentrification progress. Altstadt-Lehel and Ludwigsvorstadt-Isarvorstadt have the highest Airbnb density, with a share of 1.20 and 1.29%, respectively. Schwabing-West, Au-Haidhausen, and Sendling also belong to the late gentrification phase (Table 4). Here, the share of Airbnb units in the housing stock can also be classified as high, with values of 0.53 to 0.60%. In addition to the high Airbnb

Table 4 – Testing the relationship between Airbnb density and gentrification phase (city-wide rank positions) by means of the Spearman's Rank correlation (Zar 2012)

City districts	Airbnb density*	X Rank (Airbnb density)	Y Rank (Gentrification phase**)
Initial phase of gentrification			
Berg am Laim	0.29	7	11
Pioneer and gentrifier phase			
Sendling-Westpark	0.33	6	8
Laim	0.27	8	8
Ramersdorf-Perlach	0.26	9	8
Moosach	0.21	10	8
Hadern	0.12	11	8
Late gentrification phase			
Ludwigsvorstadt-Isarvorstadt	1.29	1	3
Altstadt-Lehel	1.20	2	3
Au-Haidhausen	0.63	3	3
Schwabing-West	0.60	4	3
Sendling	0.53	5	3

Notes: * The share of entire home Airbnb rentals in the housing stock.
** Districts placed on the same rank receive the medium rank.

$$r_s = \frac{6\sum_i d_i^2}{n(n^2-1)} = 0.8 \qquad t_{emp} = \frac{r_s}{\sqrt{(1-r_s^2)/(n-2)}} = 4.0$$

$$t_{crit}(df = 9;\ \alpha = 0.005) = 3.25 \qquad t_{emp} > t_{crit}$$

r_s – Spearman rank-order correlation coefficient; d – difference between rank X and Y; n – number of elements; t_{emp} – empirical value (t distribution); t_{crit} – critical value (t distribution); df – degrees of freedom; α – alpha (significance level)

density, Ludwigsvorstadt-Isarvorstadt, among others, has the highest number of Airbnb accommodations, the largest number of illegal rentals, as well as a large functional rent gap and a high daily rate. Likewise, Schwabing-West is one of the hotspots for Airbnb accommodations with one of the most elevated numbers of illegal listings. The same applies to Au-Haidhausen. In Altstadt-Lehel, an Airbnb overnight stay is most expensive. With regards to Airbnb density, we also see considerable differences within this group (Fig. 6).

The city districts that are in the pioneer and gentrifier phase, on the other hand, show few parallels with Airbnb density. The assumption that a later gentrification phase goes hand in hand with a higher Airbnb density cannot be confirmed here. Berg am Laim, which was assigned to an initial phase of gentrification, is also characterized by an Airbnb density in the medium range. The variety of Airbnb densities is highest within the group where no gentrification was detected (Fig. 6). Milbersthofen–Am Hart has the lowest number, as Airbnb rentals only account for

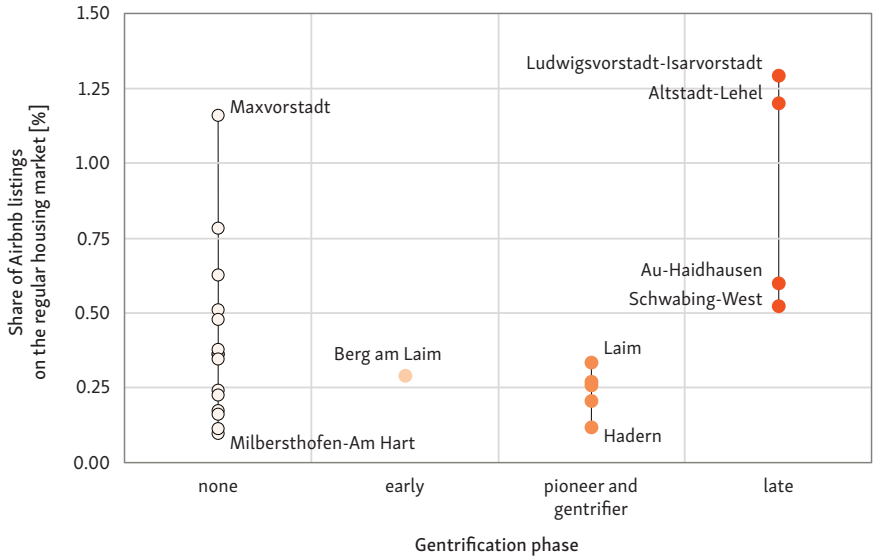


Fig. 6 – Gentrification phases and share of Airbnb listings on the regular housing market. Our own elaboration.

0.1% of the total hosing stock. Contrary to this, in Maxvorstadt we find the third highest value in the entire city (1.16%).

5. Conclusion

With Munich as the most developed Airbnb market within the German context, the city is a telling case to study and a national forerunner of short-term rental platform development. Here, we see Airbnb as one driver within the complex set of parameters that lead to the tense situation on Munich's housing market (Kayser 2020, Auspurg et al. 2017). With regard to gentrification, we detect different phases of the process in 11 out of 25 districts in Munich. In general, central districts are in more mature phases while some surrounding districts west and southeast of the center are in earlier phases. In the majority of the peripheral districts, we did not detect evidence of gentrification. The spatial distribution of Airbnb listings follows a similar pattern (Figure 4), with high Airbnb densities in the center and lower densities in the peripheries.

The question, of "which came first" (Rabiei-Dastjerdi, McArdle, Hynes 2022) remains unanswered. Our study rather confirms that gentrification and the proliferation of Airbnb are intertwined processes (Wachsmuth, Weisler 2018; Lee 2016; Cocola Gant 2016). Both lead to similar symptoms on the housing market, e.g.,

rising prices, a shortage of affordable housing, but also community conflicts and ultimately displacement in direct or indirect ways. This paper shows a significant correlation between both phenomena in the city of Munich (Table 3), but, this relationship comes along with different shades. The correlation is most obvious in the late gentrification phase, where districts show very high Airbnb densities. The relationship between gentrification and Airbnb is less obvious in the early and pioneer phases. Here, we would have expected higher Airbnb densities, but we cannot confirm this hypothesis given the small number of districts in these phases (Fig. 6).

In those districts that are assigned to the late gentrification phase, we believe that Airbnb comes as a new form of gentrification (Mermet 2022, p. 2) that adds tourists as a further stakeholder group within the "classic models" of the gentrification process (Friedrichs 1998, Clay 1979). At the same time, according to our model, a high Airbnb density is not a proxy for gentrification per se (Fig. 6), as there were several districts with high densities, but no gentrification signs. As for these cases, Airbnb and gentrification must be monitored carefully, since a growing functional rent gap and the observed spatial proliferation of short-term rental platforms can potentially open up these areas for gentrification. In the case of Munich, this is yet another hypothesis and must be proven in further studies. In this sense, our paper also shows that exploring the relationship between Airbnb and gentrification must be approached locally–as each city might show diverging patterns.

Analyzing the (functional) rent gap induced by Airbnb is a fruitful approach to understand how gentrification is fueled, and reveals both the spatial and temporal aspect of these phenomena. In this sense, we firstly confirm the existence of a functional rent gap both in the city center and also in peripheral districts that is induced by Airbnb. This is also shown by the relatively high Airbnb densities in peripheral districts, which is observed in other cities, too. In general, city centers seem to become saturated (Rabiei-Dastjerdi, McArdle, Hynes 2022, p. 5) or subject to more regulation than other districts (Nieuwland, Van Melik 2020). Secondly, there is an outstanding role of seasonal fluctuations on the Airbnb market in Munich. While the consequences of these fluctuations on the hotel market have already been investigated (Li, Srinivasan 2019), their impacts on the housing market remain rather underexplored. Here, more research must be done. We follow Mermet's observation of "temporary displacement during the peak season" (2017, p. 68) and we would like to raise the question whether this might hinder the permanent shift of flats to the short-term rental platform market.

Based on our study, we call for a continuous monitoring of these processes in order to support urban policymakers in Munich. Apart from that, a broader timespan to explore these phenomena is needed, as our study uses data from 2017 (Airbnb) and 2014 (gentrification) on. For further studies, it makes sense to trace

gentrification developments in Munich or other cities for a larger time window. For example, an analysis starting from the beginning of the global financial crisis in 2008 would be compelling, as it allows for a comparison of these phenomena against the background of both the financial crisis and the global pandemic–two very decisive moments of contemporary urbanism.

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