

Tourism accommodation and housing affordability: insight from a geo-spatial analysis in Athens and Thessaloniki, Greece

Abstract

Since Airbnb's launch in 2008, it and numerous successor platforms have grown exponentially. This for-profit housing-sharing economy has been linked to overtourism and worsening housing affordability worldwide. Against this backdrop, this paper examines spatial links between tourism accommodation and housing affordability in Greece's two largest cities, Athens and Thessaloniki, using detailed neighborhood-level data on Airbnb listings, conventional hotels, and average residential rents and sale prices. The paper first maps the geography of short-term rentals and average residential rents, then probes interlinkages through spatial analysis, and finally employs spatial and non-spatial regressions to disentangle these relationships. Findings highlight that the spatial patterns of short-term rental and residential markets differ between the two cities, yet consistently show a positive association between high densities of Airbnb listings and higher residential rents. Going deeper than most relevant studies' level of analysis, the paper documents how this relationship varies across parts of each city, while it emphasises the important role of nightly Airbnb prices. Finally, it confirms a strong link between residential rents and sale prices, which—besides reflecting the expected effects of building and neighborhood characteristics—also points to the influence of buy-to-rent investment. Overall, the paper refines literature on speculative investment and land values and contributes to the limited body of research on these dynamics in the Greek context.

Keywords: Airbnb, Big Data, touristification, evidence-based policy recommendations, real estate investment effects

Introduction

Since Airbnb's launch in 2008, numerous similar platforms have emerged, articulating the so-called sharing economy that pertains to accommodation (Zervas et al, 2017). Despite their initial purpose, however, these platforms have in recent years been associated with an intensifying housing affordability crisis by a wide variety of actors, including tenants' unions, metropolitan governments, research institutions and EU documents. Amid a 50% increase in house prices and more than 25% in rents since 2010,¹ this has become a crucial aspect of numerous political struggles across Europe.² Nevertheless, a part of literature, as well as Airbnb (2024) itself, have doubted the effect of these platforms on housing affordability.

Against this backdrop, our research's goal is to examine the geography of residential (i.e., long-term) rental markets vis-à-vis that of tourism accommodation (short-term rentals and conventional hotels), focusing on Greece's two largest cities, Athens and Thessaloniki. To do so, we first test whether average rents of residential apartments and short-term rentals display specific or random spatial allocation through spatial autocorrelation measures (Moran's I and Geary's C). Then, we inquire about possible spatial interlinkages between residential rents, Airbnb listings, and hotels, using novel spatial association measures (Lee's L; for use in medical research see Shreves et al., 2022) and widely used correlation metrics (e.g., Pearson's R). Last, we employ a comprehensive mix of spatial and non-spatial regression (see Wrede, 2022) to decipher the observed interlinkages. Data used refer to the neighborhood level and have been acquired by existing big datasets and through web scraping.

The findings confirm the relationship between residential rents and short-term rentals, clearly positioning the paper within a literature that often reports contradictory findings (opposing accounts include Such-Devesa et al., 2021; Fernando, 2019). They also confirm that sale prices—reflecting neighbourhood and building characteristics—are closely linked with residential rents; however, going beyond this expected observation, the paper points to the significant effect of buy-to-rent investment schemes. Moreover, the paper highlights the often-overlooked link between short-term rentals' pricing and residential rents, which has been addressed only indirectly (Iliopoulou et al., 2024). Importantly, stemming from data at a finer scale than the city/municipality level used in most related studies, the findings capture significant but commonly overlooked differences in the nature and intensity of the link between residential rents and short-term rentals across the inner city, suburban, and peri-urban areas (also see Wrede, 2022). Doing the above, the paper also contributes to the scarce relevant literature on the Greek context (exceptions include Gourzis et al., 2019).

The paper is structured as follows. First, it presents a review of the literature on overtourism and the sharing economy and their main positive and negative aspects of the short-term rental market. Upon laying out its methodology, it presents its empirical analysis, starting with the geography of the short-term and residential rental markets separately, before drawing spatial and statistical associations between average residential rents, Airbnb listings' density and average nightly price, and hotels' density, through various measures and types of regression. Following, it discusses the analysis's main findings. Last,

¹ Eurostat, Housing price statistics. Accessed at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Housing_price_statistics_-_house_price_index

² E.g., see Die Linke's "You Deserve More" campaign.

taking into consideration the current regulatory framework around short-term rentals and housing affordability, it puts forward a series of policy recommendations.

Geospatial analysis of overtourism, short-term rentals and rents: a brief review

Tourism's social, cultural, and economic significance has grown significantly since the first postwar decades. Specifically, amidst the recessive and deindustrialization pressures of the recent decades, many countries saw tourism's potential as a source of significant revenue. In this context, apart from rural destinations that had already developed a tourism product, many deindustrialized cities also pursued enhancing their attractiveness through highlighting their symbolic capital, such as their architectural and industrial heritage. Apart from industrial restructuring, advancements in transportation, information, and communication technologies have played a key role in intensifying tourism activity over the past decades (Bianchi, 2017). All the above conditions combined have led in many cases to overtourism, a term describing tourism activity exceeding certain "*physical, ecological, social, economic, psychological, and political thresholds*" (Peeters et al., 2018).

Overtourism trends peaked after the 2000s, when a crisis of overaccumulation turned into one of urbanization and coincided with the advent of online peer-to-peer accommodation platforms (Gourzis et al., 2022). This became particularly pronounced in cities as compared to rural areas. This is because online accommodation platforms greatly increased the accommodation capacity of urban tourism markets—where lodging needs were almost exclusively covered by conventional hotels. This not only rendered such destinations accessible to larger volumes of tourists but also more affordable. In contrast, rural destinations had cheap semi-formal and non-formal accommodation businesses operating alongside conventional hotels already for decades (Garay-Tamajón et al., 2022). The above resulted in a quite rapid reorientation of urban economies towards tourism. Short-term rentals cannot only be established with minimum investment (Wachsmuth and Weisler, 2018) but also can operate in areas where conventional hotels cannot, either due to zoning regulation or simply because of limited available space (Gouzis et al., 2019). The speed and reach of short-term rentals' proliferation has been so notable that it has been coined in literature as touristification (Cocola-Gant and Lopez-Gay, 2022), despite the term having been introduced earlier to indicate a broader reorientation of economies towards tourism (Ojeda and Kieffer, 2020).

Given their intensity and significance, literature has sought to quantify overtourism and touristification in many different ways. Nevertheless, it has been argued that specific thresholds beyond which tourism activity turns into overtourism cannot be imposed without considering the local context (Peeters et al., 2018). Another issue limiting quantitative research has been the lack of appropriate data, since tourism is quite complex as an industry. In fact, data scarcity does not concern only developing countries but those in the EU as well (Batista e Silva et al., 2018). Against this backdrop, big data promises more granular and complex insight and expectedly, its use has become increasingly common. Therefore, despite common problems associated with their operationalisation—such as ill-defined research objectives and calculation of irrelevant variables (Mendola and Volo, 2017)—big data has led to many comprehensive analyses around overtourism.

Within this literature, the effects of short-term rentals have been extensively examined. Until the mid-2010s, studies mainly focused on major US cities such as Los Angeles, New York, and Boston, but as the market spread to peripheral urban destinations, the scope of the literature broadened accordingly. Among the positive effects highlighted in literature has been the development of complex economies of scale around listings, comprising cleaning, transportation, and food and drink businesses, as well as supportive services to travelers (e.g., luggage storage, automatic laundromats; Gourzis et al., 2022). Moreover, the clustering of short-term rentals has been found to turn previously dangerous areas into vibrant hotspots (Kalogiorga et al., 2025). Equally important is that—during the first stages of a given market’s development—converting their assets into short-term accommodation has provided regular households with an additional source of income (Pettas et al., 2024). On the other hand, the proliferation of short-term rentals amidst a nascent or non-existent regulatory framework has been found to produce various negative effects on the physical, cultural, and economic landscape of cities. Importantly, population and businesses come under strong displacement pressures as landlords evict them—or induce them to leave with financial incentives—to convert their properties into short-term rentals and capture higher rents (Cocola-Gant, 2016).

Indirectly but equally important, the growth of short-term rentals drives displacement by pushing up rents. Rent increases often result from a reduced housing supply, as large numbers of units are removed from the residential market (Lee, 2016; Wachsmuth and Weisler, 2018). Part of the literature has specifically sought to quantify the links between short-term rentals, residential rents, and house sale prices. Indicatively, Garcia-López et al. (2020) found that the neighborhoods in the top decile in terms of Airbnb listings’ clustering in Barcelona have 7% higher actual rents and almost 20% higher actual sale prices than the city on average. For their part, Franco et al. (2021) isolated the effect of regulatory changes around the short-term rental market after 2014 in Portugal and estimated that they increased house prices by almost 35% and residential rents by above 10%. Beyond the EU South, Duso et al. (2020) estimated that each additional Airbnb in Berlin increases monthly residential rents by about €0.07 per m². In London, Benítez-Aurioles and Tussyadiah (2021) found for every 100 additional Airbnb listings within a given borough, residential rents increase by 0.008%-0.021% (depending on the size of the dwelling) and housing prices by 0.031%. Similarly, Barron et al. (2020) estimated that in the US as a whole, when Airbnb listings increase by 1%, residential rents follow by 0.018% and sale prices by 0.026%.

Despite the above, it must be noted that precise estimations at the neighborhood level can be challenging, since the effects of short-term rentals vary widely across geographical contexts, or even within a given city. Specifically, examining Berlin, Wrede (2022) found varying effects depending on the exact location, type, and quality of the converted apartments. Additionally, the expansion of the short-term rental market within a given neighborhood is known to produce significant externalities to adjacent ones (Lee et al., 2024). Lastly, such quantifications miss out on many indirect effects. Indicatively, the mere potential for higher yields provided by online accommodation platforms can change landlords’ perceptions of their properties profoundly. Specifically, properties are being viewed as “*cash cows*” even if they are never converted to short-term rentals (Horn and Merante, 2017).

Sample, data, and methods

In the analysis that follows, we scrutinize the uneven geography of Airbnb listings vis-a-vis that of residential rents at the neighborhood level.³ Specifically, five data types are used: (i) the average monthly rents of residential apartments, (ii) the density and (iii) average nightly prices of Airbnb listings, (iv) the density of conventional hotels, and (v) the average sale prices of residential apartments. Airbnb data for the listings located within the municipality of Athens and Thessaloniki's Urban Area were obtained from Inside Airbnb,⁴ while for the rest of the study areas, data were obtained through web scraping in [Airbnb.com](https://www.airbnb.com). All Airbnb data refers to December 2024, keeping only the active listings.⁵ Data on conventional hotels was obtained through web scraping in [Booking.com](https://www.booking.com) in March 2025, filtering out all other property types but hotels.⁶ Data on residential rents and sale prices was acquired from [Spitogatos.com](https://www.spitogatos.com), the largest Greek real estate platform, referring to the same set of neighbourhoods during the 12-month period between July 2023 and 2024.

The geographical scope of the analysis covers Athens's Urban Area and Thessaloniki's Metropolitan Area (*study areas* 1 and 2 respectively), with the final sample of neighborhoods being cleaned from those with no data on residential rental prices.⁷ Due to data sparsity and to ensure the statistical significance of our results, parts of the analysis are narrowed down to the Municipality of Athens and Thessaloniki's Urban Area⁸ (*focus areas* 1 and 2 respectively). Table 1 presents basic statistics for each *study* and *focus* area, while their boundaries are clearly delineated in all Maps.

The empirical analysis is divided into three parts. First, we examine the geography of average residential rents and Airbnb listings by identifying statistically significant spatial clusters of each variable using Local Anselin Moran's I (Maps 1 and 2). In addition, Global Moran's I⁹ and Geary C,¹⁰ as well as their p-values,¹¹ are used to identify statistically strong and significant spatial autocorrelations (Table 2). Second, to look into the co-locations of strong positive or negative spatial associations between our key variables we apply Lee's L bivariate spatial association index. Specifically, two variable pairs are examined: average residential rents on the one hand, and on the other, Airbnb listings' density and average nightly Airbnb prices (Maps 3 and 4). Regarding both Local Moran's I and Lee's L, spatial relationships are defined through the K-nearest neighbors method.¹² Third, we conduct two types of regression: linear (non-spatial) and spatial (spatial lag model), using the average rent price as the dependent variable and the remaining ones as independent predictors. Linear regression estimates rent prices in each neighborhood based solely on the values of the independent variables, while spatial

³ As delineated by the real estate platform [Spitogatos.gr](https://www.spitogatos.gr) (see Maps 1-4). Data coming from other sources (e.g., [insideairbnb.com](https://www.insideairbnb.com)) were processed so it refers to these neighborhoods.

⁴ A platform publishing already processed Airbnb data. Accessed at: [insideairbnb.com](https://www.insideairbnb.com).

⁵ Namely, those having at least one rating during the past 12 months, i.e., December 2023.

⁶ The difference in the temporal reference of these datasets was due to the time required for data collection and did not affect the research, as the operation of hotels in both cities exhibits no significant seasonality.

⁷ Namely, of the 643 neighborhoods in Athens 497 were kept, while of the 101 neighborhoods in Thessaloniki, 79 were kept.

⁸ As delineated in their respective Regulatory Frameworks: L.4277/2014 for Athens and L.1561/1985 for Thessaloniki.

⁹ Taking values from 0 to 1; the higher the value the higher the autocorrelation.

¹⁰ Taking positive values; the lower the value the higher the autocorrelation.

¹¹ We consider a value smaller than 0.05 to indicate significant statistical confidence

¹² For reasons of local geography, k=35 in Athens and k=8 in Thessaloniki.

regression incorporates spatial dependencies by accounting for rent prices in neighboring neighborhoods, thus capturing the influence of spatial autocorrelation on rent price levels.

It should be noted that residential apartment sale prices were used as an independent variable, since they can be deemed as a suitable proxy of the condition and characteristics of a neighbourhood's housing stock (age, floors, dilapidated buildings, etc.) and urban amenities (e.g., proximity to subway stations, urban green, etc.).

Insert Table 1 around here

Empirical analysis

The geography of residential and short-term rental markets

Regarding average residential rents in Athens (see Map 1, left), high rents are clustered across the central areas, as well as the northern (e.g., Filothei, Psychiko, Kifisia) and southern suburbs (e.g., Glyfada, Vouliagmeni). High-low outliers¹³ are observed in western suburbs (e.g., Peristeri, Peiraias), while low-high outliers¹⁴ around the central municipality (e.g. Kalithea) and across some northern and southern suburbs. Lastly, low-low clusters are observed in the northern part of the central municipality and across most western areas. Global Moran's I and Geary's C (see Table 2) confirmed a strong spatial autocorrelation across the entire Urban Area (Study Area 1) but especially in the central municipality (Focus Area 1). For its part, Airbnb listings (see Map 1, right) mostly cluster in central areas around the Acropolis Hill and southeast of them (e.g. Kallithea). High-low outliers¹⁵ are mainly observed in southern suburbs (e.g. Glifada, Vouliagmeni), while low-high outliers¹⁶ south of the central municipality (e.g., Kato Petralona). Around high-high clusters Airbnb activity displays a randomized allocation (e.g., Nea Smirni, Palaio Faliro). Low-low clusters cover most peri-urban areas. Global Moran's I and Geary C (see Table 2) again show a strong spatial autocorrelation for Airbnb listings' density, but more in the Urban Area (Study Area 1) than the central municipality (Focus Area 1), indicating that the spatial allocation of Airbnb listings is not strictly defined in the inner city.

Regarding average residential rents in Thessaloniki (see Map 2, left), high rents are clustered in the city center (i.e., around Aristotelous Square and Lefkos Pyrgos) and east of it (e.g., Kalamaria). High-low outliers are observed near Thermaikos while there are no low-high outliers. As in Athens, low-low clusters extend across much of the city's periphery (e.g., Oreokastro). Global Moran's I and Geary C (see Table 2) confirm this lack of outliers, as they indicate strong spatial autocorrelation. In contrast to Athens, Thessaloniki's Urban Area (Focus Area 2) exhibits a less defined spatial distribution of rents compared to the wider Metropolitan Area (Study Area 2). Airbnb listings (see Map 2, right) are centrally concentrated around Aristotelous Square and Lefkos Pyrgos. Around them there are a few low-high outliers while there are no high-low outliers. Low-low clusters extend across western (i.e. around the Delta area) and

¹³ Namely, expensive areas surrounded by affordable ones.

¹⁴ Namely, affordable areas surrounded by expensive ones.

¹⁵ Namely, areas with intense Airbnb activity surrounded by areas with low activity.

¹⁶ Namely, areas with low Airbnb activity surrounded by areas with intense activity.

southeastern suburbs (e.g., Themi, Thermaikos). In general, Thessaloniki exhibits no significant sprawl of Airbnb activity, especially in comparison to Athens. Global Moran's I and Geary C (see Table 2) reflect this, as their values are generally higher in Thessaloniki's Metropolitan Area (Study Area 2).

Insert Table 2 around here

Insert Map 1 around here

Insert Map 2 around here

Spatial associations between residential rents, short-term rentals, hotels, and sale prices

Table 3 shows that in Athens's Urban Area (Study Area 1) residential rents do not particularly correlate with Airbnb listings' and hotels' density, although they do with nightly Airbnb prices (0.48). In contrast, the density of Airbnb listings correlates strongly with that of conventional hotels (0.83). As expected, average sale prices are strongly correlated with average rent prices (0.78), while they also have significant correlation with Airbnb prices (0.51). When narrowing down to the Municipality of Athens (Focus Area 1), the correlations of residential rents with Airbnb listings' density (0.56) and prices (0.63), as well as density of hotels (0.50) and sale prices (0.92) become much stronger. Importantly, beyond Pearson's R non-spatial associations, bi-variate Moran's I highlights the dual nature of the relationships: statistically significant and spatially patterned. Map 3 confirms several clusters of high Airbnb density and high residential rents across the inner city and south of it. For their part, co-locations of high Airbnb activity and low residential rents are observed in low-status central neighborhoods in the northern part of the central municipality. On the other hand, co-locations of low Airbnb activity and high residential rents mostly concern high-status northern (e.g. Kifisia, Marousi) and southern suburbs (e.g., Glyfada, Vouliagmeni). Clusters of both low Airbnb activity and residential rents extend across low-status western (e.g. Ilion, Peristeri) and south-western suburbs (e.g., Nikaia, Keratsini), as well as Peiraias. Map 3 reveals that clusters of high nightly Airbnb prices and high residential rents are located not only in touristy central and southern Athens but also in high-status residential southern and northern suburbs. Hardly any clusters of high Airbnb prices and low rents exist, while there are many more co-locations of low Airbnb prices and high residential rents, located in areas that are central, but somewhat away from tourist attractions. Low-low clusters are again observed across the city's low-status western suburbs.

Table 3 shows that in Metropolitan Thessaloniki (Study Area 2), correlations between residential rents and Airbnb activity (0.63) are much stronger than in Athens, while those between Airbnb listings' and hotels' density are similarly strong (0.80). Again, as expected, sale prices display the strongest correlation with rent prices (0.78) and a bit lower with Airbnb prices (0.54). When narrowing down to the Urban Area (Focus Area 2), most statistical associations become stronger, following the patterns observed in the Municipality of Athens (Focus Area 1). Nevertheless, it must be noted that in general, sale prices in this

city do not correlate as strongly with residential rents as they do in Athens. Similarly, nightly Airbnb prices and residential rents do not correlate, coming in contrast to what was observed in Athens. Map 4 shows that intense Airbnb activity in Thessaloniki is combined with high rents only in the city center (between Aristotelous Square and Lefkos Pyrgos) and in the high-status parts of Pylaia. Similarly, in the western and northern periphery, a low density of Airbnb listings co-locates with low residential rents. Apart from that, there is a high occurrence of outliers. Specifically, in the western and eastern parts of the city center (e.g., Kalamaria) residential rents are relatively high while Airbnb activity is low, whereas the opposite is observed in most of the city's eastern periphery (e.g., Thermi, Thermaikos). Similarly, high nightly Airbnb prices and high residential rents co-locate only in the city center, with central neighborhoods to the east combining low nightly Airbnb charges with high rents. Low-low clusters cover again much of the city's periphery.

Insert Table 3 around here

Insert Map 3 around here

Insert Map 4 around here

Deciphering the links between residential rents, short-term rentals, hotels, and sale prices

For assessing the performance of both spatial and non-spatial regression we use the Root Mean Square Error (RMSE) metric,¹⁷ which quantifies the prediction error, and the R-squared metric, which indicates the fit of the regression¹⁸ (see Table 4). For completeness, we also report the Akaike Information Criterion (AIC) that captures both model accuracy and complexity¹⁹; AIC can be used for a relative comparison of models for the same focus area, rather than as an absolute measure of performance. Moreover, a sensitivity analysis is conducted for spatial regression by testing a range of scenarios (#1 to #8), each incorporating different combinations of independent variables, with Scenario #5 accounting for all key variables. All coefficients and standard errors for each scenario are detailed in Table 5 in the Appendix.

As expected, Scenario #5 yields the best performance in all geographical contexts. In contrast, Scenario #1 uses the least information, relying solely on the rent prices of adjacent areas while omitting all independent variables. Although its performance is understandably lower, it is noteworthy that it still outperforms simple (non-spatial) regression in the Athens use cases. This underlines the importance of accounting for spatial dependencies; incorporating average residential rents from adjacent areas alone provides valuable information that significantly improves the accuracy of rent predictions at the neighborhood level.

¹⁷ Lower values indicate better performance (optimal is 0).

¹⁸ Higher values indicate better performance (optimal is 1).

¹⁹ Lower values indicate better performance and/or lower model complexity (i.e. higher robustness).

Considering the average sale prices of residential apartments as an independent variable improves performance (see Scenarios #4 vs. #5). Moreover, its contribution is higher than that of the Airbnb- and hotel-related variables (see Scenarios #2, #6, #7, vs. #8). The above are rather expected since sale prices summarise a wide variety of building- and neighbourhood-related factors that drive rents (as discussed above), while equally important, land values are inextricably linked with rents (D’Lima and Schultz, 2022). However, this finding is also due to this variable being closely linked with Airbnb and hotel-related dynamics (see Table 3).²⁰ The above show that sale prices are clearly influential, yet model performance improves further when all variables are included (Scenario #5), demonstrating that the additional predictors capture meaningful variation beyond what sale prices alone explain (Scenario #8).

Insert Table 4 around here

When looking at the Municipality of Athens (Focus Area 1), Scenario #5 achieves a relatively good performance, with an RMSE of 1.01 (which corresponds to an average error of less than 10% given that the mean average rent price is 10.6, see Table 1), and an R² of 0.80. As such, spatial regression explains a substantial portion of the variation in rent prices, expressed by the following formula (see Table 5 in the Appendix for the detailed coefficients for all scenarios):

$$p_{rent} = 0.0005*d_{Airbnb} + 0.020*p_{Airbnb} + 0.0034*d_{hotel} + 0.0007*p_{sales} + 0.54*W + 2.87$$

where *d* and *p* denote the density and average price variables, either of residential rents, Airbnb listings, or hotels, while *W* is the spatial lag of residential rent prices (i.e., average rent in neighboring areas). The model fit is further depicted in Figure 1 (left).

Insert Figure 1 around here

It should also be noted that Scenario #2, which just adds Airbnb listings’ density to the spatial lag achieves a much better performance compared to Scenario #1 (only spatial lag). This suggests that Airbnb density alone contributes significantly to explaining rent price variations. Specifically, the regression of Scenario #2 is expressed by the following formula:

$$p_{rent} = 0.002*d_{Airbnb} + 0.73*W + 2.44$$

According to the above, when $\Delta d_{Airbnb}=100$ (i.e., that for each 100 Airbnb listings per km²), the expected change in rent price would be $\Delta p_{rent}=0.2$ (with the average rent price being €10.6/m², 0.2 represents a roughly 2% increase in rent). Moreover, spatial spillover effects captured by the 0.73 coefficient compound this trend.

²⁰ Acknowledging these endogeneity and multicollinearity issues, this variable was added on top of the rest in regression to check its impact on the overall analysis.

For their part, Scenarios #3 and #4 (adding Airbnb prices and hotel density respectively) offer only limited added value, by slightly reducing the RMSE. Comparing Scenarios where only one independent variable is included (#2, #6, #7 and #8), we see that Airbnb density (#2) and hotel density (#7) contribute similarly, while sale prices (#8) has a more significant contribution. In contrast, average Airbnb prices (Scenario #6) provide considerably less predictive power in this context, suggesting that this variable is less informative in the spatial regression context.

Broadening our scope to consider the whole Athens Urban Area (Study Area 1), both spatial and linear regression can only achieve moderate accuracy (see Table 4). Beyond that, in this context, all variables—including Airbnb prices—have similar predictive power.

When looking at the Thessaloniki Urban Area (Focus Area 2), Scenario #5 achieves relatively good performance, with an RMSE of 0.53 (corresponding to an 8% error given that mean rent is €7.32/m², see Table 1) and an R² of 0.80. Specifically, this scenario is expressed as:

$$p_{rent} = 0.0015*d_{Airbnb} + 0.0071*p_{Airbnb} + 0.0133*d_{hotel} + 0.0006*p_{sales} + 0.51*W + 1.92$$

Compared to the respective formula for the Municipality of Athens, the spatial component (W) has a similar effect, as do most other findings. Nevertheless, a notable difference of this context is that Scenario #3 (adding average Airbnb prices) considerably improves regression's accuracy in comparison to Scenario #2 (Airbnb listings' density).

Broadening our scope to the entire Metropolitan Area of Thessaloniki (Study Area 2), RMSE for Scenario #5 is higher by around 15% (i.e., larger errors in the predicted values for rents) but R² is slightly improved. More specifically, spatial regression for this context shows that qualitatively, all key variables and their spatial characteristics affect average rent prices in a similar way as in Thessaloniki's Urban Area.

Discussion

In our analysis we examined the spatial links between housing affordability and tourism accommodation. Our findings revealed marked differences between the two cities' housing markets. Nevertheless, in both cities except for the greater Athens Urban Area, high densities of Airbnb listings were spatially associated with elevated residential rents. With the strength of this association varying across geographical contexts, another crucial association was observed, that between nightly Airbnb prices and residential rents. Compared to the above, an—even clearer—association between residential rents and housing sale prices; besides reflecting the expected effects of building and neighborhood characteristics on residential rents, this association also points to the influence of housing assetization. Below we attempt a theoretically-informed interpretation of our main findings and discuss their broader implications. Closing, drawing on the present regulatory framework in Greece and more broadly in the EU, we put forward actionable policy advice.

Beginning, residential rental markets in both Athens and Thessaloniki show similar patterns of geographic clustering, with only a few outliers in rent levels. This mirrors the social mixing typical of Greek cities, exemplified by vertical social segregation; namely, different social strata often occupy different floors

within the same multi-story apartment buildings (Leontidou, 1990). In contrast, the geography of short-term rentals differs notably between the two cities. Athens's short-term market, which first emerged around the Acropolis around 2012-2013, has expanded outward in successive waves. This outward expansion echoes patterns in many other cities across the EU (Reichle et al., 2023) such as Barcelona, where the market also surged in the city center in the early 2010s and has since spread into numerous seaside neighborhoods (Gutiérrez et al., 2017; Garcia-López et al., 2020). In Thessaloniki, by contrast, short-term rentals remain concentrated in the central districts, with very little activity extending into outer neighborhoods. This on the one hand can be attributed to the absence of a subway system until very recently²¹, but more profoundly, it reflects a less matured market. Indeed, the first significant clusters of Airbnb activity there did not appear before mid- to late-2010s (Katsinas, 2021), while its share in the domestic market is substantially smaller than Athens's (5% as opposed to 15% in terms of nights spent at short-term rentals).²² Nevertheless, the market exhibits clear signs of expansion in recent years, resonating with similar trends in other European destinations with similarly low land values, as Buzzacchi et al. (2020) note for Italy. Similarly, the attractiveness of Athens's housing market for international investors in the mid-2010s stemmed precisely from its lower land values in comparison to competing South EU destinations (Alexandri and Hodkinson, 2025). Beyond geography, differences in the stage of development between the two Greek cities are also reflected in their different extent of professionalization (Pettas et al., 2024). Over-mature markets that have not been subject to strict regulation—as for instance Los Angeles—tend to exhibit greater shares of entire homes over private rooms and prevalence of owners of multiple listings (Lee, 2016).

Despite the above-mentioned differences, our analysis highlighted that both cities—their central parts in particular—share a strong spatial link between the average level of residential rents and the density of Airbnb listings. This is a rather expected finding, given that it resonates with much of the relevant literature (see Garcia-López et al., 2020, for Barcelona; Franco et al., 2021, for Portugal; Duso et al., 2020, for Berlin). Nuancing this link, however, we found that it remained strong only when we expanded our scope to cover the entire Urban Area of Thessaloniki (Study Area 2), with this not being the case in Athens. Rather than claiming that short-term rentals have a stronger causal effect upon rents in Thessaloniki, we argue here that this is because of the city's underdeveloped short-term market. Specifically, Airbnb listings there cluster in already high-rent areas across the city center. In contrast, listings in Athens have long spread not only into already expensive touristy areas in the southern suburbs (e.g., Vouliagmeni, Elliniko, Alimos) but also into almost all disinvested districts in the city's center (e.g., Kipseli and Exarcheia). Although considerable pressure has been exerted in recent years upon the latter areas' housing markets, rents have not reached the level of adjacent areas yet (Alexandri and Hodkinson, 2025), hence the weaker link mentioned above. Nevertheless, even in this context, we showed that increases in listings density are associated with rises in residential rents.²³ Indicative of this pressure, a recent legislation prohibits new short-term rentals to operate within Athens's first, second, and third municipal districts (Money Review, 2024b).²⁴

²¹ It opened in December 2024.

²² Data on Athens refers to its four central sectors and on Thessaloniki to the pertinent NUTS3 area. Drawn from https://ec.europa.eu/eurostat/databrowser/view/tour_ce_oan3_custom_16772836/default/table?lang=en

²³ As indicated by regression formulas.

²⁴ Specifically, L.5170/2025.

Beyond the aforementioned link, the two cities were also found to also differ regarding that between residential rents and nightly Airbnb prices. Specifically, this link is more pronounced in Athens, which is unsurprising when observing the city's tourist core. It has been widely argued that proximity to historic landmarks—such as the Acropolis Hill—and vibrant nightlife spots produce high yields when apartments are rented out as short-term rentals (Shokoohyar et al., 2020). Yet, we also observed this relationship in the city's high-status suburbs, despite their distance from major attractions and lower occurrence of recreational uses. Specifically, in the southern suburbs (e.g., Vouliagmeni), this correlation reflects proximity to the waterfront; especially since the aftermath of COVID-19, this trait has boosted demand from both wealthier tourists and digital nomads (Gourzis et al., 2022). In northern suburbs (e.g., Kifisia), higher Airbnb prices seem to (primarily) mirror local affluence, while they could also pertain to alternative tourism types like medical tourism, linked to nearby high-quality facilities.²⁵ Therefore, although these areas share a similarly strong correlation between nightly Airbnb prices and average residential rents, we must note that the effect of the former upon the latter takes profoundly different forms depending on the context. Similarly, Wrede (2022) observed that the relationship between residential and short-term rental markets takes many different forms depending on the location, type, and quality of the local apartment stock that is converted into short-term rentals.

Building on this insight, we emphasize the importance of the gap between the capitalized rent under extant uses and the potential rent under the most efficient use. In the context of touristification, extant uses refer to long-term (residential) rentals, while the most efficient use is typically short-term rentals (Gourzis et al., 2019). Within the Athens Urban Area, such gaps vary substantially across neighborhoods. Specifically, rents in affluent suburbs were already high before the advent of the short-term rental market. In contrast, rents in the inner city rose through successive waves of gentrification, mainly from the 2000s onward (Alexandri and Hodkinson, 2025). After the mid-2010s these processes increasingly gave way to touristification, mirroring similar transitions observed in many southern European cities (see Cocola-Gant and Lopez-Gay, 2020, on Barcelona). As becomes evident, the effect of the above transitions has been much more impactful in previously disinvested or barely gentrified areas than already established urban tourism spots (Gourzis et al., 2022). It is worth noting that many quantitative studies, lacking fine-grained analysis and theoretical grounding, fail to detect emerging rent gaps driven by the proliferation of short- and medium-term²⁶ rentals (Wachsmuth and Buglioni, 2024).

Moreover, we must note that while controlling for omitted variable bias, we found that housing sale prices have a stronger correlation with residential rents than Airbnb listings. In some cases, the influence of sale prices even diminishes the statistical significance of Airbnb activity, aligning with other analyses that observe similar effects when additional variables are introduced (see Ferrando, 2019). However, as discussed in the empirical section, this does not diminish the role of short-term rentals in shaping the geography of residential rents. Instead, it highlights four key conditions. First, this underscores that residential rents are—expectedly—more closely linked to housing sale prices than to Airbnb listings. In Greece, the price-to-rent ratio is approaching pre-crisis levels about 15 years later, vividly reflecting the devastating impact of the Greek crisis on house values, which far exceeded its effect on rent levels (Gatopoulos et al., 2025). Second, this relationship reflects the expected rate of return for buy-to-rent investors (D'Lima and Schultz, 2022), which, within a context of housing assetization, tends to accelerate (Alexandri and Hodkinson, 2025). This condition has become especially significant in recent years, given

²⁵ E.g., the Hygeia private hospital. Drawn from <https://www.elitour.org/members/hygeia/>

²⁶ Which are included in the Airbnb listings accounted for in our analysis.

that strong international investors have been increasingly involved in local housing markets, attracted by numerous residence-by-investment schemes (e.g., Golden Visas, non-domicile tax regimes). Particularly in Southern Europe, these schemes expanded exponentially after the 2008/2009 global financial crisis (Alexandri and Hodkinson, 2025). The Greek Golden Visa program, in particular, has attracted substantial investment due to its relatively low cost compared to comparable schemes in countries like Italy and Spain (Gourzis et al., 2019). Third, and equally significant, many of the dwellings acquired through such schemes have been directed into the short-term rental market, resulting in phenomena like entire apartment buildings being converted into short-term rentals (referred to as “ghost hotels”; Gourzis et al., 2019). In the context of Athens, it has been suggested that the “vast majority” of apartments obtained via the Golden Visa program are now being used as Airbnb listings (Bakas, 2024). Although this estimate is not official, recent legislation has banned new properties from being used as short-term rentals²⁷ (Money Review, 2024b). In our analysis, the observed correlation between Airbnb listing density and sale prices may be linked to the above. Considering some degree of multicollinearity and the context described, it is plausible that part of the significance attributed to sale prices in our regression could stem from the influence of the short-term rental market. Relatedly, numerous studies have shown that the effect of short-term rentals is generally more pronounced on sale prices than on residential rents (Benítez-Aurioles and Tussyadiah, 2021; Barron et al., 2020). The final condition is specific to the Greek context. Market stakeholders have argued that, in recent years, sale prices have been significantly influenced by low-interest loans issued under state policies designed to help (primarily young) citizens acquire their first primary residence²⁸ or assist property owners in renovating and renting out their dwellings.²⁹ Similarly, a rent reimbursement given to households with low annual incomes³⁰ is expected to generate inflation tendencies on rents (Money Review, 2024a).

Closing, it is essential to acknowledge some limitations of the research at hand. First, changes in residential rents over time would be more appropriate than annual average rents, given the dynamic relationship between residential and short-term rental markets. Second, additional data on the characteristics of neighborhoods, buildings, and population would decipher the *complex nexus of links* between residential and short-term rentals markets. Both limitations above stemmed from the lack of data at the level of granularity that we conducted our analysis. Lastly, data across different geographical scales and qualitative analysis would provide insight into the indirect effect of online accommodation platforms upon localized residential markets, regardless of the density of short-term rentals therein (Horn and Merante, 2017). Our analysis merely touched upon this issue through the spatial coefficient in the regression formulas (W).

Policy recommendations

²⁷ Specifically, L.5100/2024

²⁸ The program “My Home” for instance has pledged €3 billion in total to finance young people for buying their first primary residence through interest-free or low-interest loans. Drawn from: <https://greece20.gov.gr/en/home-loans/#:~:text=The%20%E2%80%9CMy%20Home%20II%E2%80%9D%20program,interest%2Dfree%2C%20provided%20by%20RRE>

²⁹ The program “Renovate and Rent”. Drawn from: <https://www.gov.gr/en/ipiresies/periousia-kai-phorologia/epidoteseis-politon/anakinizo-noikiazo>

³⁰ Specifically, L.5217/2025.

Despite recent efforts to formalize the short-term rental market, curb its sprawl, and provide financial support to mitigate housing unaffordability, policymakers remain relatively hesitant to adopt more decisive measures (Adamopoulou et al., 2025). Indicatively, the retroactive effect of a proposed provision that would have restricted licenses solely to dwellings that can be used as primary residences³¹ was ultimately withdrawn, allowing approximately 20,000 such listings to continue operating (Roussanoglou, 2025). Moreover, although the Council of State has recently been asked to rule on the permissibility of short-term rentals in Plaka—a culturally and architecturally significant area where hotels are prohibited—its previous decisions have classified the short-term rental market as an “*informal tourist concentration*” and thus not subject to the zoning regulations governing tourist accommodation (Sayas, 2024).

Besides its limitations that warrant further investigation, our above analysis should serve as a basis for actionable policy advice. First, in order to curb the outflow of properties from the residential rental market, context-sensitive caps on the density of short-term rentals should be implemented beyond areas already designated as “touristified”.³² This measure is particularly important given that our analysis shows the sprawl of short-term rentals far exceeds that of conventional hotels. Second, regulations on the nightly prices of short-term rentals should be introduced, with these limits linked to their density within specific areas. Such measures are necessary because short-term rentals influence rents not only by reducing available residential uses but also through the mere threat of conversion (Horn and Merante, 2017). In fact, this threat is amplified by the widening rent gaps caused by investment strategies that are, at least partially, disconnected from actual returns, which depend heavily on factors such as the listing’s location, property type, size, and floor level (Shokoohyar et al., 2020). Third, considering that much of the regulatory framework surrounding the Hotel Contract was established in 1986, an update is deemed essential. Moreover, given that this framework is much stricter than the obligations imposed on short-term rentals, aligning the regulations for both forms of accommodation is equally necessary (Kandyli, 2023). The call to tighten regulations governing the operation of the short-term rental market has been voiced by numerous groups and organizations, including the Development Corporation of the City of Athens (Kalogiorga et al., 2025). Fourth, since Apartment Building Regulations are not always recognized as formal tenant decisions with the legal authority to address issues related to short-term rentals—despite these rentals operating within the same apartment building (Sarchosi, 2023)—it is necessary to refine these regulations. Such adjustments would help resolve many conflicts among tenants caused by nuisances associated with short-term rentals, including the use of common areas, building infrastructure, and noise during quiet hours (Gourzis et al., 2022). Fifth, both cities under study currently lack a Destination Development, Management, and Marketing Organization (DDMMO). Establishing such entities could enable a more integrated, multidimensional approach to addressing the opportunities and challenges of tourism at the metropolitan level (Kalogiorga et al., 2025). Lastly, in light of the widespread informality and precarity of work associated with the operation of short-term rentals—particularly in tasks such as cleaning, guest check-in/out, and transportation (Gourzis et al., 2022)—employment protection legislation should be strengthened. Moreover, its enforcement should be ensured through more frequent and systematic inspections by the Labour Inspectorate.

³¹ Namely, those having—among others—natural lighting, ventilation, and air conditioning. Amendment in L.5170/2025.

³² Under the abovementioned L.5170/2025.

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Appendix

Insert Table 5 around here