Professional Transformation in Urban Short-Term Rentals: Mapping Airbnb's Core-Periphery Evolution

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Abstract

This study examines the spatial evolution of Airbnb's professionalization in major global cities, revealing both universal trends and local nuances. By analyzing listing densities and review activities, the research identifies three fundamental patterns:

Firstly, professionalization follows a distinct center-periphery gradient. Professional hosts predominantly concentrate in central tourist areas before expanding outward, a pattern consistent with observations in cities like Barcelona, Warsaw, and Berlin. This suggests that professional operators initially capitalize on the high demand and visibility of central locations.

Secondly, there is a significant temporal dimension to this evolution. The transition from independent to professional hosting typically begins in high-value central districts and gradually spreads to peripheral areas. This sequence aligns with the "rent gap" theory in platform-mediated markets, indicating that economic incentives drive the spatial diffusion of professional hosting practices.

Thirdly, a consistent relationship exists between market density and levels of professionalization. City centers are characterized by clusters with both high listing densities and high professionalization rates, while peripheral areas tend to have lower densities and are dominated by independent hosts. This dynamic underscores the role of location advantages in the success of professional hosts.

These findings suggest that, contrary to the democratizing potential of platforms like Airbnb, professional operators may reinforce existing spatial hierarchies within cities. The expansion of professional hosting appears to amplify spatial inequalities, potentially impacting urban cohesion and housing affordability. The identification of transition zones—areas with high listing densities but stable proportions of independent hosts—provides valuable insights into market maturation and spatial transformation processes.

Contents

1 Introduction

The emergence of Airbnb has profoundly reshaped urban tourism ecology, enabling tourists to access accommodations beyond traditional hotels and deeper into urban spaces, while allowing hosts to monetize their idle residential resources through temporary access rights (Frenken & Schor, 2019). After 17 years of development since 2007, Airbnb has evolved into a mature market spanning multiple countries and regions, from cities to forests and even deserts. While Airbnb has provided relief for hosts under housing price pressures and benefited budget-conscious travelers seeking authentic local experiences, its flexible short-term rental policies have also brought numerous advantages to consumers, such as entire villas accommodating large families and long-stay discounts meeting digital nomads' needs (Guttentag et al., 2018).

Existing research indicates that professional hosts managing multiple Airbnb listings are primary drivers of gentrification in attractive urban areas (Wachsmuth & Weisler, 2018). Furthermore, the spatial distribution patterns of professional hosts' listings in relation to attractions closely mirror those of hotels (Gyódi, 2023). The gradual occupation of urban tourist district properties by corporate participants leads to housing supply constraints and uneven concentration of tourism district gentrification, making it difficult for original tenants to maintain their residency (Gurran et al., 2020).

These patterns suggest that Airbnb has increasingly deviated from its original sharing economy concept in some oversaturated areas. The massive demand for more affordable, private, and neighborhood-integrated accommodations in popular urban tourist areas has naturally spawned real estate companies engaging in "spatial arbitrage business." Beyond tourists and hosts, other stakeholders including governments and local residents are forced to retreat from communities due to rising rents, tourist misbehavior, and over-tourism (Garcia-López et al., 2020).

These phenomena reflect the negative urban impacts of short-term rental markets' profit-seeking and short-sightedness. Popular tourist cities like Barcelona have experienced soaring housing prices, community imbalances, and regulatory difficulties (Nieuwland & Van Melik, 2020). However, if Airbnb's development patterns could be anticipated, enabling proactive spatial regulation and short-term rental policies, cities might avoid reaching such critical points requiring complete prohibition. Similar to forest fire management, sustainable development requires maintaining appropriate density.

While numerous academic studies have demonstrated how urban spatial resources influence Airbnb revenue and location choices, as well as its various negative externalities on urban spatial and socioeconomic patterns (Jiao & Bai, 2020; Lee & Kim, 2023), few studies have systematically examined the dynamic spatial evolution process and patterns of Airbnb listings. Understanding this evolution is crucial for refined short-term rental market control, as different regions and market entities require targeted management approaches (Hübscher & Kallert, 2023).

This research focuses on Airbnb's geographical evolution, where listings distribute across urban spaces in response to tourist demands, urban social activities, and real estate market changes. They initially cluster around public transit stations and popular tourist attractions to maximize proximity to the tourism market (Gutierrez et al., 2017). Additionally, listings form clusters at the urban scale, creating spatial structures that trace tourist footprints. Finally, listings exhibit spatial interactions, where successful properties attract and drive the emergence of nearby listings (Sun et al., 2021). To gain a deeper understanding of the evolution of Airbnb's specialization space, this paper proposes two hypotheses:

1. What are the differences in the spatial evolution patterns of listings for professional hosts and non-professional hosts?

2. Will Airbnb's market space structure evolve towards specialization, presenting a "core-edge" evolutionary order, completing the professional transformation first in the city's high-quality locations?

2 Literature review

2.1 Spatial Economics of Short-term Rental Markets

The emergence of platform-mediated short-term rentals (STRs) has fundamentally transformed how tourist accommodations are distributed within urban spaces, challenging traditional theories of tourism geography that primarily focused on hotel districts. Understanding the spatial evolution of STR markets has become increasingly crucial for predicting their impact on urban development and implementing effective regulatory policies. Initial research focused on documenting basic spatial distribution patterns across European cities, revealing important variations in how STR markets develop in different urban contexts. Gutiérrez et al. (2017) pioneered the use of spatial statistics to analyze Barcelona's STR landscape, demonstrating how listings initially cluster around tourist cores before spreading into residential areas. Similar center-periphery patterns emerged in Warsaw (Gyódi, 2017) and Berlin (Schäfer Braun, 2016), though with interesting local variations. Studies of Italian cities added more complexity to this picture - Florence showed high concentrations in residential areas adjacent to the historic center, while Milan developed a more dispersed pattern that challenged simple center-periphery models (Picascia et al., 2017; Garcia-Ayllon, 2018).

Beyond basic distribution patterns, researchers have discovered that STR geography is shaped by a complex interplay of tourism infrastructure and neighborhood characteristics. While traditional hotels cluster tightly in business districts, STR listings spread more organically through residential areas that offer tourist appeal. This dispersion often follows tourist activity patterns rather than traditional urban development trajectories, with proximity to attractions proving more influential than distance to city centers (Gyódi Nawaro, 2021). Several studies across European cities have shown how STRs activate previously untapped accommodation potential in residential neighborhoods, creating new patterns of tourist space that blur traditional boundaries between tourist and residential areas (Adamiak et al., 2019; Eugenio-Martin et al., 2019).

The evolution of STR markets is also heavily influenced by local conditions and regulatory environments. Neighborhood demographic factors play a surprising role in shaping listing density, with creative class neighborhoods often serving as early adoption zones. Property values, socioeconomic characteristics, and existing tourism infrastructure all contribute to complex patterns of STR development. Regulatory frameworks add another layer of complexity - stricter regulations tend to concentrate development in tourist-oriented areas, while more permissive environments allow for broader spatial dispersion (Morales-Pérez et al., 2020; Gil Sequera, 2022).

2.2 Professional Hosting and Market Evolution

As STR markets mature, the role of professional hosts has become increasingly significant in shaping spatial organization patterns. These hosts, managing multiple properties, tend to develop distinct spatial strategies that both respond to and influence urban tourism landscapes. Their listings often form concentrated clusters in prime locations, creating informal "STR districts" that offer standardized, high-quality accommodation experiences. This clustering behavior, while not entirely new to the market, has intensified as professionalization increases (Endrich et al., 2022; Gil Sequera, 2022).

Interestingly, professionalization patterns vary significantly across European regions, reflecting different stages of market maturity and local conditions. Western European cities typically show lower levels of professionalization compared to their Southern European counterparts, suggesting that cultural and regulatory contexts play important roles in shaping market evolution. This regional variation extends to revenue patterns as well - while professional hosts generally achieve higher revenues than casual operators, the magnitude of this advantage varies considerably by location and market conditions (Serrano et al., 2020; Cocola-Gant et al., 2021).

2.3 Spatial Dynamics and Market Maturation

The way STR markets evolve through urban space tells an intriguing story of how tourism patterns and residential neighborhoods increasingly intertwine. Markets typically begin in established tourist areas, where visitor demand is most predictable, before gradually spreading into neighborhoods that offer more authentic local experiences. This evolution reflects growing sophistication among both hosts and travelers, as the market discovers new ways to match diverse visitor preferences with local spatial assets (Wachsmuth Weisler, 2018; Benítez-Aurioles Tussyadiah, 2020).

The relationship between professional and casual hosts adds another layer to these spatial dynamics. As markets mature, professional operators often establish strong positions in prime locations, leveraging their market knowledge and operational efficiency. However, this doesn't simply push casual hosts to the periphery - instead, it creates a more nuanced pattern where different types of hosts find their own niches within the urban fabric. Some casual hosts thrive by offering unique experiences in residential areas, while others succeed in tourist cores by maintaining distinctive personal touches (Gil Sequera, 2020; Dogru et al., 2022).

These spatial patterns become particularly interesting in historic city centers, where STR operations can significantly influence neighborhood character. Professional listings often concentrate in areas offering optimal combinations of tourist appeal and infrastructure access, but their impact varies considerably depending on local context. Some neighborhoods see rapid transformation in their retail and service offerings, while others maintain a more balanced mix of tourist and local amenities (Cocola-Gant Gago, 2021; Katsinas, 2021).

2.4 Areas for Further Inquiry

While we've learned much about how STR markets function spatially, several fascinating questions remain unexplored. The interaction between professionalization trends and spatial distributions over time deserves closer attention - we know these factors are related, but the specific mechanisms driving their relationship remain unclear. This is particularly true regarding how professional hosts influence market evolution and spatial expansion patterns (Cocola-Gant et al., 2021; Gil Sequera, 2022).

Location characteristics and market evolution patterns represent another rich area for investigation. Different urban contexts clearly influence how markets professionalize, but we don't fully understand the sequences and mechanisms involved. The role of spatial agglomeration effects is particularly intriguing - how do professional and non-professional listings interact spatially over time? Do they compete, complement each other, or both depending on circumstances? (Endrich et al., 2022; Morales-Pérez et al., 2020)

The field would benefit from more comprehensive theoretical frameworks that capture both spatial and temporal dimensions of STR market evolution. While economic geography offers valuable insights

about location patterns, it doesn't fully explain the dynamic processes through which markets mature and spatial patterns emerge. Understanding these dynamics is crucial not just for academic knowledge, but for helping cities better manage the ongoing evolution of their tourist accommodation landscapes. This study aims to address these questions by examining how professional and non-professional STR listings evolve spatially over time. Using advanced spatial statistical techniques, including global and local Moran's I, the research will explore whether market development follows predictable patterns and how different types of hosts influence spatial evolution. The findings will contribute both to our theoretical understanding of how STR markets mature and to practical insights for urban policy development.

3 Dataset and Methodology

3.1 Airbnb Listing Datasets

Through the Airbtics platform, I ranked cities by their number of listings in 2024 and selected the top 9 cities from different countries to ensure diversity in this analysis. The rationale for analyzing multiple cities stems from the fact that the spatial distribution of Airbnb listings is heavily influenced by local factors. These complex, intertwining factors, including short-term rental policies, real estate economic conditions, and Airbnb platform preferences, subtly affect the spatial distribution of listings. Selecting cities with high listing volumes helps better identify common patterns in listing professionalization.

City	Listings (k)
Paris	95
London	96
New York City	37
Madrid	27
Istanbul	31
Buenos Aires	36
Bangkok	23
Mexico City	26
Melbourne	25

Table 1: Number of listings in the city

The dataset for this research is sourced from Inside Airbnb, with data collected up to July 2024, comprising listings data tables from 9 urban locations. The data tables contain information primarily consisting of property attributes, host characteristics, booking order properties, and listing reviews, with basic distributions shown in Figure 1. While this dataset is rich in diverse information, with variable distributions reflecting local characteristics of different cities, given the research focus, this study primarily involves the following variables:

- First review: The timestamp of a listing's first review

Obtaining Airbnb datasets from different time points is challenging, requiring substantial resources and effort. Given this constraint, this study uses the first review timestamp as a proxy for when a listing officially entered the market. The timing of the first review approximately reflects when a property began active operation and can capture the initial phase of listing deployment. However, it does not necessarily represent the actual listing creation date, as properties might exist on the platform for some time without receiving reviews, or hosts might experience extended periods without guests. Additionally, the timing of first reviews may be influenced by seasonal fluctuations. For instance, listings published during peak tourist seasons might receive reviews earlier, while those published during off-peak periods might experience delays. Consequently, the temporal analysis in this study cannot fully account for listings that have not received reviews post-publication and disregards spatiotemporal information prior to the first review. Nevertheless, the advantage lies in first reviews indicating when properties became actively utilized and gained market recognition.

- Latitude and longitude: Approximate listing locations

These record the approximate locations of Airbnb listings. The use of approximate locations is necessitated by Airbnb's policy of only providing precise locations at booking commencement; otherwise, locations are approximated within a 300-meter radius circle.

- Host listings count: Number of active listings per host

This variable represents the current number of actively operated listings per host, rather than historical listing counts, maintaining logical consistency with the first review variable.

- Review number: Quantity of reviews per listing

This serves as a crucial indicator for identifying Airbnb listing spatial distribution hotspots, representing the degree of market acceptance and serving as a proxy for tourist density.

3.2 Airbnb Listing Classification

Spatial distribution differences between individual and professional hosts' listings on Airbnb have been extensively documented in literature. A conventional approach involves categorizing host professionalization based on the number of listings owned, with specific distinction for single-listing hosts (Abrate, 2022). Furthermore, host professionalization levels demonstrate positive correlations with variables indicating listing activity, such as annual availability and monthly new review counts (Endrich et al., 2022; Serrano et al., 2020).

In this study, hosts are categorized into four distinct groups. Hosts operating only one active listing constitute a separate category (hereafter referred to as independent hosts). The remaining hosts are ranked within their respective cities based on their number of active listings: the top 10th percentile (hereafter large-scale hosts), those between the 10th and 35th percentiles (hereafter medium-scale hosts), and the remainder classified as small-scale hosts. This classification typically produces a pyramid-like distribution of listings across most cities, approximating ratios of 5%, 15%, 30%, and 50%. The unique characteristics of single-listing hosts necessitated their exclusion from the percentile-based ranking method. Following the long-tail effect principle, this classification approach effectively reflects actual market structures across different countries and provides initial quantification of Airbnb's professionalization and diversification.

To preliminarily illustrate the spatial distribution disparities between independent and professional hosts' listings, Table 1 presents the quantity and proportion of listings across different categories for each city, along with their respective means for activity-related variables. The results demonstrate

a positive correlation between the number of listings owned by hosts and listing activity variables, validating the rationality of the professional categorization methodology employed.

City	Listings Category	Proportion (%)	Average Availability	Average Reviews
Bangkok	Multiple Listings(79+)	9.51	277.22	11.43
	Single Listing	9.62	194.98	7.17
BuenosAires	Multiple Listings(75+)	9.95	261.29	13.6
	Single Listing	29.18	193.18	11.16
Istanbul	Multiple Listings(39+)	9.67	222.01	7.39
	Single Listing	14.26	229.02	9.33
London	Multiple Listings(46+)	9.91	154.75	6.79
	Single Listing	37.96	84.96	5.44
Madrid	Multiple Listings(96+)	9.74	232.13	14.46
	Single Listing	26.81	118.29	17.15
Melbourne	Multiple Listings(92+)	9.97	209.57	12.3
	Single Listing	27.93	90.81	10.38
MexicoCity	Multiple Listings(81+)	9.04	280.82	19.51
	Single Listing	19.58	194.99	13.37
NewYorkCity	Multiple Listings(68+)	9.9	214.23	3.32
	Single Listing	41.9	83.87	3.18
Paris	Multiple Listings(50+)	9.98	173.18	8.16
	Single Listing	60.22	92.12	6.16

Table 2: The proportion of listings from individual hosts and large hosts

3.3 Methodology

This research employs Bivariate Local Moran's I analysis to examine the professionalization characteristics of the Airbnb short-term rental market. Bivariate spatial correlation measures the relationship between one variable and the average value of another variable in neighboring areas (spatial lag). This methodology not only identifies local spatial clusters but also reveals spatial association patterns between different variables (Anselin 1995). This approach offers unique advantages for understanding the professionalization process in the short-term rental market: it simultaneously captures the spatial associations between market structure (listing density) and market behavior (degree of professionalization), thereby revealing the spatial dynamics of professionalization.

3.3.1 Fuzzy positioning of listings

Spatial analysis at the urban scale faces two key challenges: the inherent fuzziness of Airbnb listing coordinates and intra-urban spatial heterogeneity. To address these challenges, the study adopts a grid-based spatial analysis approach. First, the research area is determined by calculating the latitude and longitude ranges of each city, followed by dynamic grid size determination based on city area, ensuring approximately 10,000 grid cells per city. This adaptive grid division method ensures both

comparability of results across different cities and adaptability to intra-urban spatial variations (Batty 2017). To address coordinate fuzziness, the study innovatively employs areal interpolation: establishing 300-meter radius buffers around each listing and projecting attribute values onto grids through areal weighting. This method, derived from geographical research on the Modifiable Areal Unit Problem (MAUP) (Openshaw 1984), effectively minimizes information loss during point-to-area data conversion.

3.3.2 Listing professional index

The study constructs the nearby30_1hostratio_ratio indicator to quantify professionalization. This indicator reflects professionalization trends by comparing temporal changes in the proportion of independent hosts among 30 nearest neighbors of each listing. The indicator design is based on two geographical theoretical assumptions: spatial dependence (professionalization exhibits spatial contagion effects) and temporal accumulation (professionalization is a gradual process). The study calculates three key indicator groups for each listing:

- Spatial proximity indicators (nearby30_distance) - Market activity indicators (nearby30_review_number)
- Professionalization degree indicators (nearby30_1hostratio)

Each indicator has past and future versions, representing data before and after the central listing's appearance, with their ratio indicating changes in surrounding listings.

3.3.3 Spatiotemporal analysis

Based on this data foundation, the study conducts Bivariate LISA analyses of listing density and review intensity against professionalization degree. However, as this research aims to explore common patterns, consistent time windows are not required, instead focusing on:

- Evolution characteristics of different spatial unit types - Dynamic changes in spatial clustering patterns - Spatial differentiation of market structure

4 Results

4.1 Airbnb overall professionalization process

Through temporal analysis of Airbnb markets in major global cities illustrated in Figure 1, the study reveals that the professionalization process exhibits significant universal characteristics while demonstrating distinct regional variations. The data indicates that, except for Istanbul and Buenos Aires, all studied cities show an annual increase in market share for large-scale and medium-scale hosts, confirming the global commonality of Airbnb market professionalization. This aligns with Adamiak's (2019) findings on short-term rental market structural evolution.

However, examination of global node cities reveals a noteworthy phenomenon: London, New York, and Paris demonstrate unique market structures where independently-operated listings maintain dominance and exhibit robust growth patterns. This anomaly can be rationally explained from an institutional perspective: these cities have established comprehensive short-term rental regulatory frameworks and demonstrated strong policy implementation capacity, effectively controlling professional hosts' operational scale (Nieuwland & van Melik 2020).

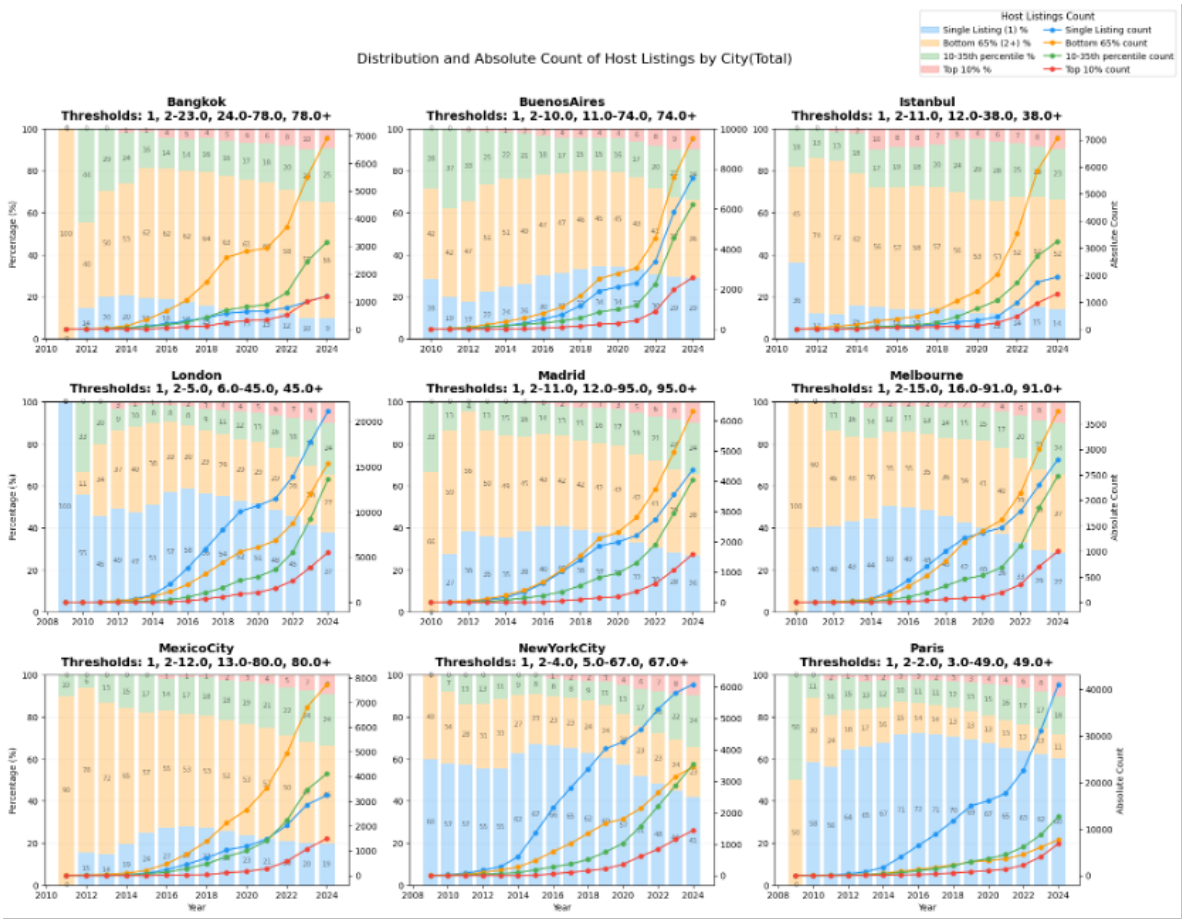

Figure 1: Distribution and Absolute Count for Different professional levels Host Listings(total)

From a temporal perspective, Figure 2 reveals a crucial turning point: the 2019 COVID-19 outbreak created a systemic shock to the global Airbnb market. However, as pandemic impacts subsided, markets across cities demonstrated strong recovery trends. Notably, in 2014, cities including London, Melbourne, New York, and Paris experienced significant growth in independent host listings, but this growth momentum notably slowed by 2016. This synchronous change reflects the effective implementation of short-term rental regulations in major global cities, validating the role of urban governance capacity in shaping market structure. In contrast, other cities encountered pandemic impacts before implementing control measures, leading to natural market growth deceleration.

Overall, this phase verifies the general trend of Airbnb market professionalization while revealing its complexities. The phenomenon of independent host dominance in key cities and variations in development pace across different cities reflect deep interactions between short-term rental market development, urban governance capacity, and policy environment.

It is important to note that the widespread decrease in growth observed in 2024 is attributable to data collection ending in July 2024, reflecting only the first seven months of market performance. This data characteristic requires careful consideration when interpreting related trends.

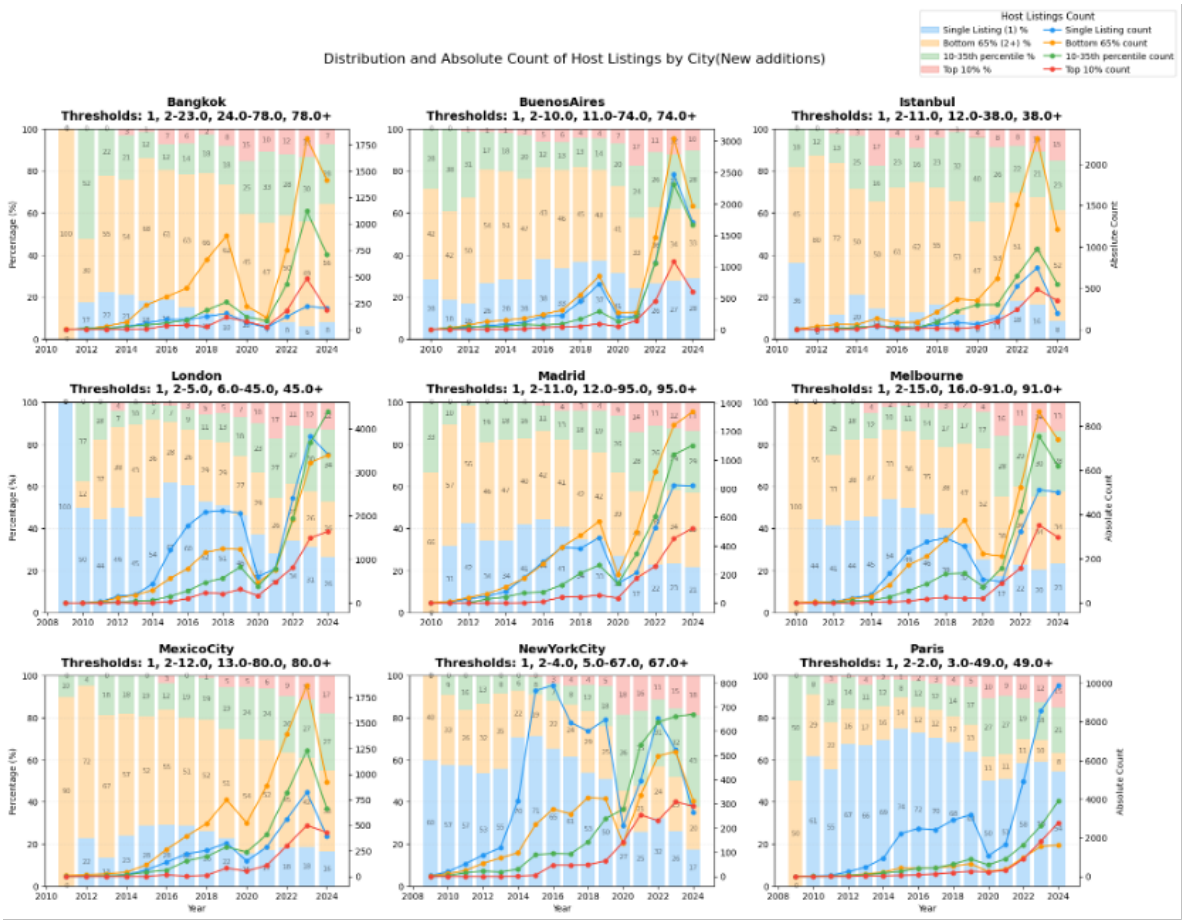

Figure 2: Distribution and Absolute Count for Different professional levels Host Listings(new addtions)

4.2 Spatial distribution preferences of listings

This section focuses on the key dimension of tourist numbers (review counts) surrounding listings. By analyzing the average review counts of the 30 nearest neighbors for each listing across nine global cities from 2014 to 2024, it reveals the spatial selection logic during professionalization.

Figure 3 shows that 2014 data demonstrates clear spatial selection strategies by professional operators: large-scale hosts tend to choose locations with higher review activity. In Madrid, large-scale hosts' (top 10%) listings show higher average neighboring review counts (247.232) compared to independent hosts (208.183); Bangkok (151.591 vs 85.272) and London (129.891 vs 99.867) exhibit similar patterns. This spatial preference reflects professional operators' rational choice in the market's early stages: prioritizing areas with established stable customer bases to reduce market development costs and operational risks. This phenomenon aligns with Quattrone et al.'s (2016) findings on spatial selection mechanisms in short-term rental markets.

By 2019, spatial activity differences between host types began converging. In London, for example, the advantage in neighboring review counts for large-scale hosts significantly decreased (57.503 vs 43.161). This change relates to natural market expansion: as core areas saturate, all host types expand into peripheral areas, reducing regional differences in spatial activity. This process corresponds with the spatial diffusion patterns observed by Wegmann and Jiao (2017).

Different cities show differentiated development patterns. Mexico City's 2019 data shows relatively similar neighboring review counts across host types (112.748, 113.003, 113.304, 128.426), indicating balanced spatial distribution. In contrast, Istanbul's contemporary data (69.142, 83.860, 86.899, 93.443) shows an increasing trend with host scale. By 2024, the market exhibits new characteristics: while overall review activity appears lower due to the July data cutoff, spatial distribution patterns become clearer. In New York, for example, neighboring review counts from independent to large-scale hosts are 34.653, 37.351, 34.201, and 25.427 respectively, reflecting increased convergence in spatial preferences across host types.

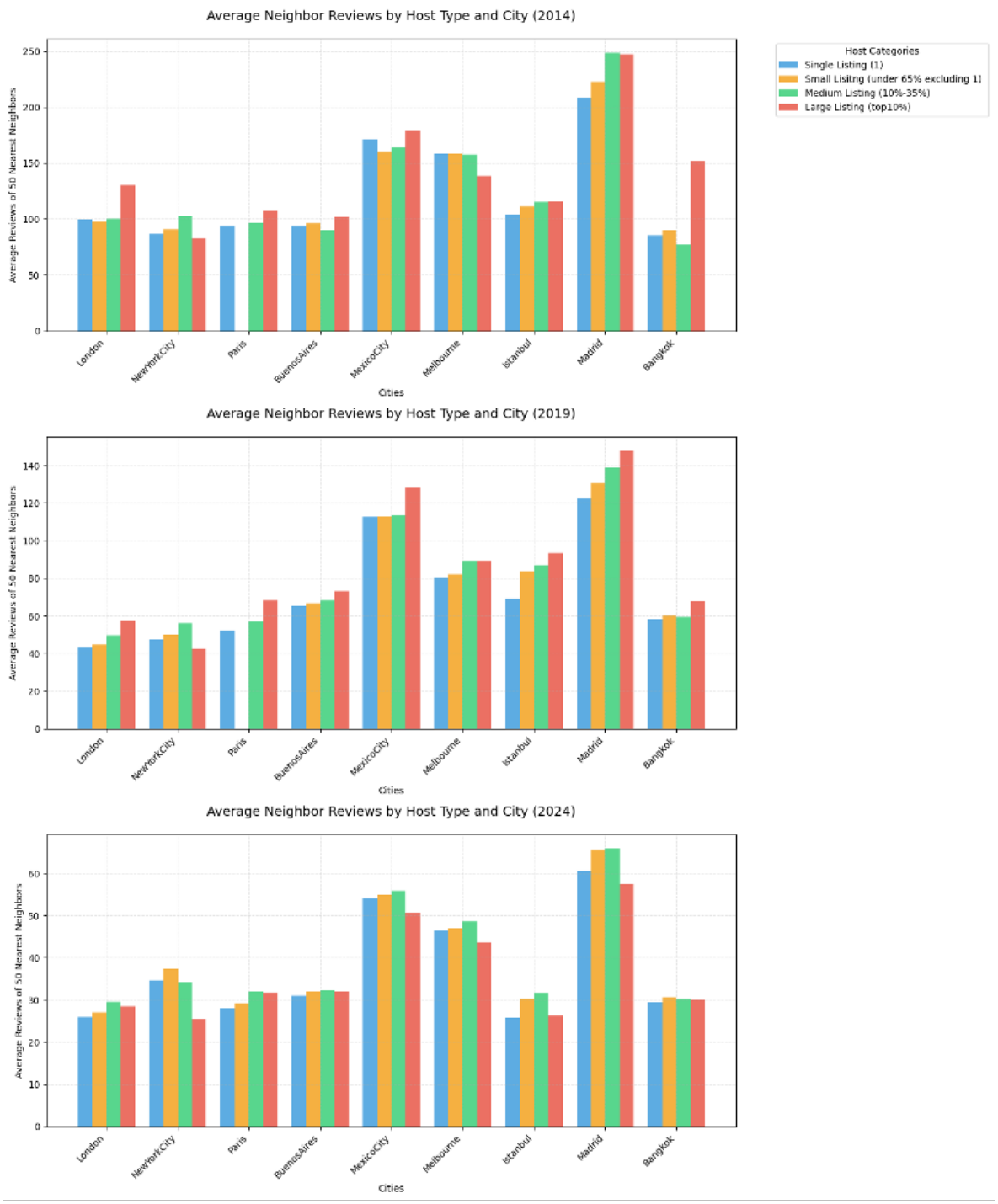

Figure 3: Average Neigbor Review number by Host type and City

Figure 4 shows the proportion of the top5% housing types with the highest nearby30_distance_ratio value in each city. It can be clearly seen from the figure that even in cities such as London, New York,

and Paris where independent landlords account for a large proportion of listings, professional landlords still dominate in such rankings. This shows that professional landlords' listings are sources are better at causing clustering effects, further confirming their spatial acuity.

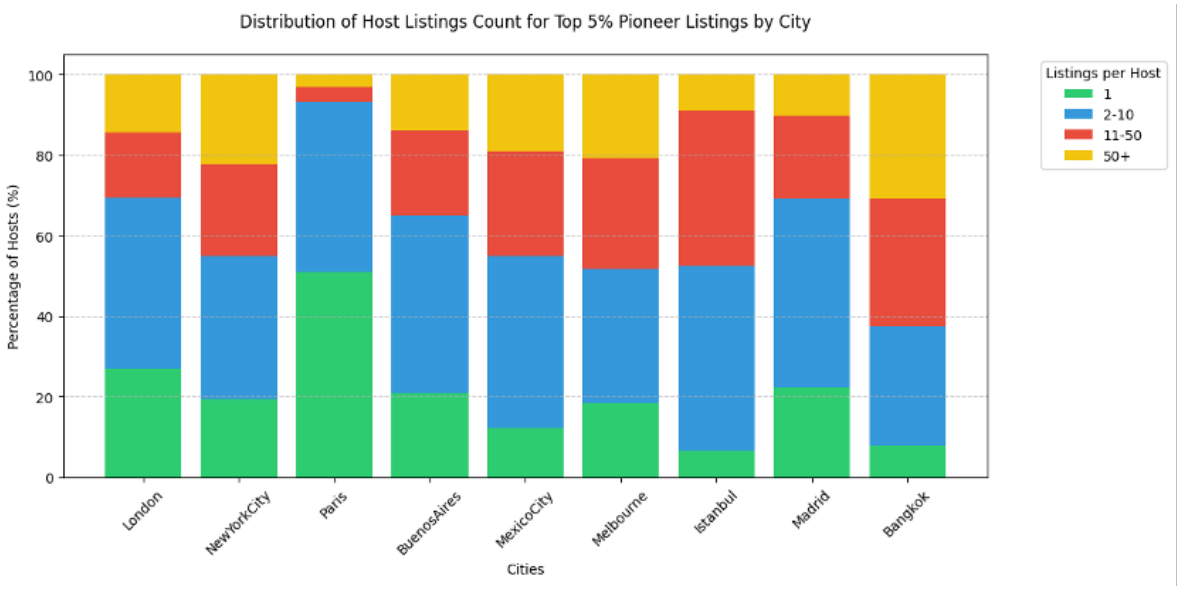

Figure 4: Distribution of Host Listings Count for Top5% Pioneer Listings

4.3 Spatial distribution of Airbnb's professionalization process

To gain deeper insights into the spatial distribution characteristics of Airbnb professionalization, this study employs bivariate local Moran's I analysis to examine spatial autocorrelation. The analysis investigates spatial associations between review counts and listing density in relation to nearby30 1hostratio ratio. This ratio serves as a key indicator of professionalization, measuring the proportion change of independent hosts among the 30 nearest listings before and after a specific listing's appearance. An increase in this indicator suggests a declining proportion of independent hosts in the area, indicating deepening professionalization; conversely, a decrease reflects enhanced market participation by independent hosts. This methodological approach provides a nuanced understanding of the dynamic spatial relationships while accounting for both temporal and geographical dimensions of market evolution.

In the research design, listing quantity and review counts represent spatial distribution characteristics of supply and demand sides, respectively. This dual-dimensional analytical framework not only validates that Airbnb professionalization results from both supply and demand dynamics but also provides novel perspectives for understanding spatial mechanisms of professionalization. This approach acknowledges the complex interplay between market forces and spatial patterns, moving beyond simplified linear explanations of platform economy development. Furthermore, this framework enables us to capture the nuanced ways in which professionalization processes manifest across different urban contexts and scales.

Through local Moran's I analysis, the study identifies four significant spatial typologies, each representing distinct patterns of market development and professionalization:

· High-High (red): Areas characterized by high listing density or review counts coupled with accelerating decline in independent host proportions (increasing professionalization). These regions represent professionalization hotspots and likely attract commercial operators. These areas often coincide with established tourist districts and central business districts, suggesting a strong correlation between urban centrality and professionalization intensity. The concentration of professional operators in these zones may be attributed to both market optimization strategies and the advantages of spatial agglomeration economies.

· Low-Low (blue): Areas with lower listing density and review counts, maintaining stable or increasing independent host proportions. These typically represent traditional residential areas with low density and market activity, and low professionalization levels. Due to peripheral location or limited tourism resources, they attract minimal professional operator attention. However, these areas play a crucial role in maintaining market diversity and supporting authentic sharing economy principles, potentially serving as buffers against excessive commercialization.

· High-Low (yellow): Areas of high listing density but stable independent host proportions. Despite abundant listings, these areas maintain substantial independent host participation. They may represent emerging short-term rental zones with tourism economic potential but limited commercial operation penetration. These transition zones offer valuable insights into the dynamics of market evolution and the factors that either facilitate or inhibit professionalization processes.

· Low-High (light blue): Areas with low listing density and market activity but increasing professionalization levels. These represent new territories being developed by professional operators, where residents generally refrain from participating in the sharing economy. These areas warrant particular attention as they may indicate emerging patterns of market expansion and potential future development trajectories.

The spatial analysis results in Figure 5 reveal significant urban structural variations: London, Mexico City, and Madrid exhibit typical monocentric spatial patterns, while New York demonstrates polycentric characteristics. This structural diversity reflects the influence of historical urban development patterns and local market conditions on platform economy spatial organization. However, despite these structural differences, LISA spatial distribution patterns show remarkable consistency: High-High areas typically concentrate in urban cores, while Low-Low areas distribute around urban peripheries, forming distinct concentric patterns. This spatial configuration both reflects the enduring explanatory power of traditional location theory and reveals new characteristics of spatial differentiation in the platform economy era.

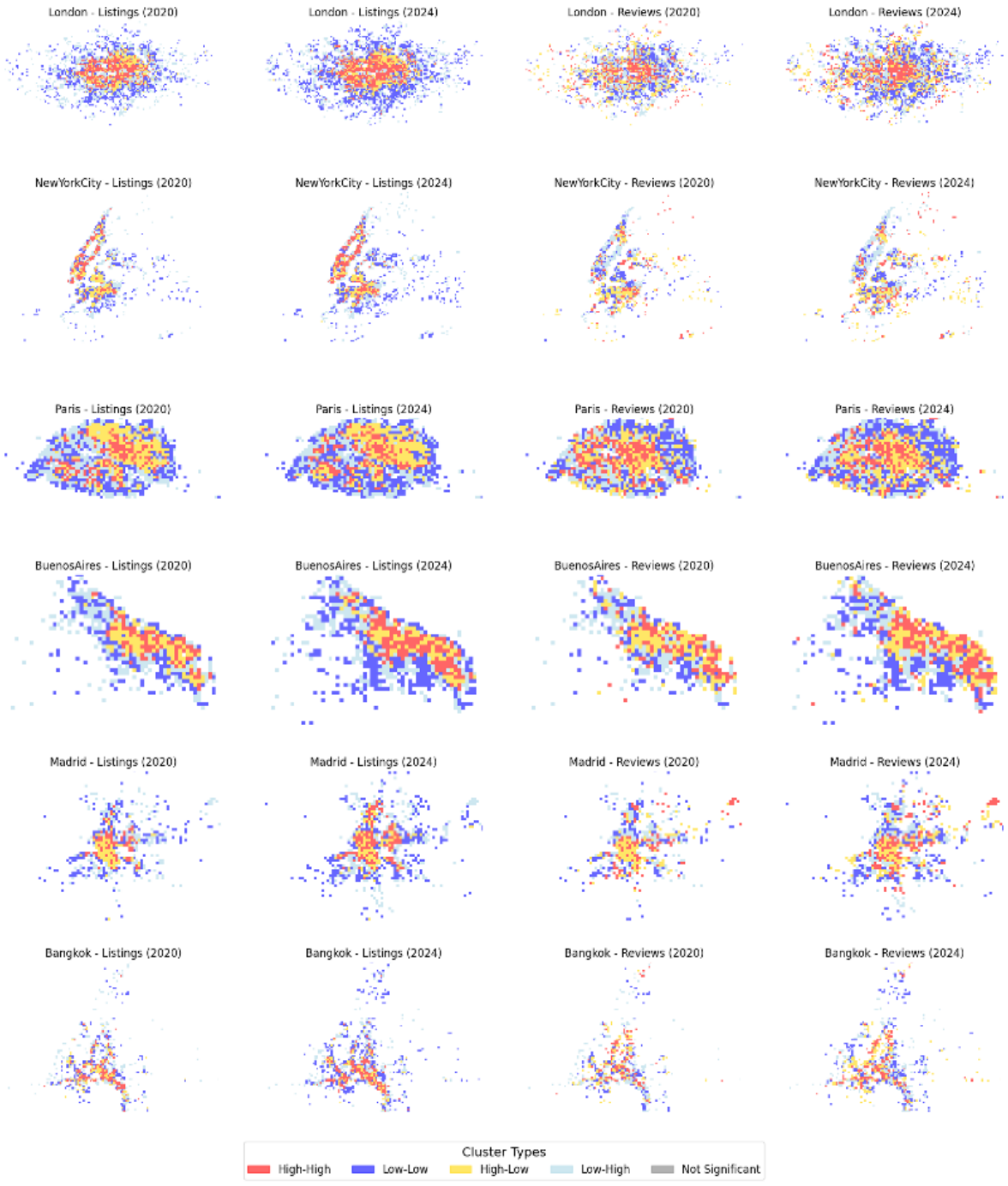

Figure 5: Spatial correlation analysis between the number of reviews, number of listings, and degree of specialization (based on the bivariate local Moran's I index)

A key finding from Figure 5 is that market professionalization exhibits a characteristic "core-periphery" structure. In urban centers, the interwoven distribution pattern of High-High clusters (red) and High-

Low transition zones (yellow) provides compelling empirical support for "place entrepreneur" theory (Logan and Molotch, 1987). Professional operators demonstrate clear core location preferences, a strategic choice highly consistent with observations of capitalization processes in the platform economy (Aalbers, 2019). This spatial selectivity reflects both rational economic decision-making and the broader dynamics of urban capital accumulation. However, this spatial selection behavior may reinforce existing urban spatial inequalities and, to some extent, exacerbate resource allocation imbalances. This observation prompts deeper consideration of spatial justice issues in the platform economy and raises questions about the role of digital platforms in either mitigating or reinforcing urban inequalities.

In the dynamic process of spatial evolution, the research observes a theoretically significant phenomenon: as the temporal dimension progresses, the transition zone between High-High (red) and Low-Low (blue) areas shows a continuous contraction trend. This dynamic change aligns with platform capitalism's spatial effects theory (Langley and Leyshon, 2017) while suggesting potential deep structural market transformation. The continuous reduction of transition zones not only indicates intensifying spatial differentiation but also suggests potential market monopolization, posing systematic threats to small-scale independent hosts' market survival. This trend raises important questions about market sustainability and the long-term viability of platform-based sharing economies.

The research findings further reveal that the professionalization process exhibits distinct temporal-spatial characteristics, suggesting a complex relationship between market maturity and spatial organization (Zervas et al., 2017). The observed patterns of spatial polarization and market concentration in core areas indicate potential challenges for market sustainability and social equity. These developments necessitate careful consideration of policy interventions to ensure balanced market development while preserving the original spirit of the sharing economy.

From a theoretical perspective, the study's findings contribute to ongoing debates about the nature of platform economies and their spatial implications. The observed patterns suggest that platform-mediated markets may not necessarily lead to more distributed or democratized economic opportunities, as initially promised by sharing economy advocates. Instead, they may reproduce and potentially intensify existing patterns of spatial inequality and market concentration. This theoretical insight calls for a more nuanced understanding of platform economy dynamics and their relationship to urban spatial structures.

The research conclusions carry significant implications for urban policy and governance. First, they suggest the need for spatially differentiated regulatory approaches that account for varying levels of market professionalization and local context. Second, they highlight the importance of monitoring and potentially intervening in transition zones to prevent excessive market concentration. Finally, they underscore the need for proactive policies to protect independent hosts and maintain market diversity, particularly in areas experiencing rapid professionalization.

These findings contribute to both theoretical understanding and practical management of platform-based short-term rental markets. They suggest that while professionalization may bring certain efficiencies, it also poses risks to market diversity and social equity. Future research might productively explore the long-term implications of these spatial patterns and investigate potential policy interventions to ensure more balanced market development.

4.4 Spatial Evolution Patterns and Growth Analysis

While these cities all fit the core-periphery growth model, a look at their detailed growth rates reveals a number of interesting things. Quantitative analysis of spatially correlated growth rates reveals different patterns of market evolution in different urban contexts. This section examines these patterns in terms

of listing density and review activity, providing insights into the spatial dynamics of Airbnb market specialization across cities.

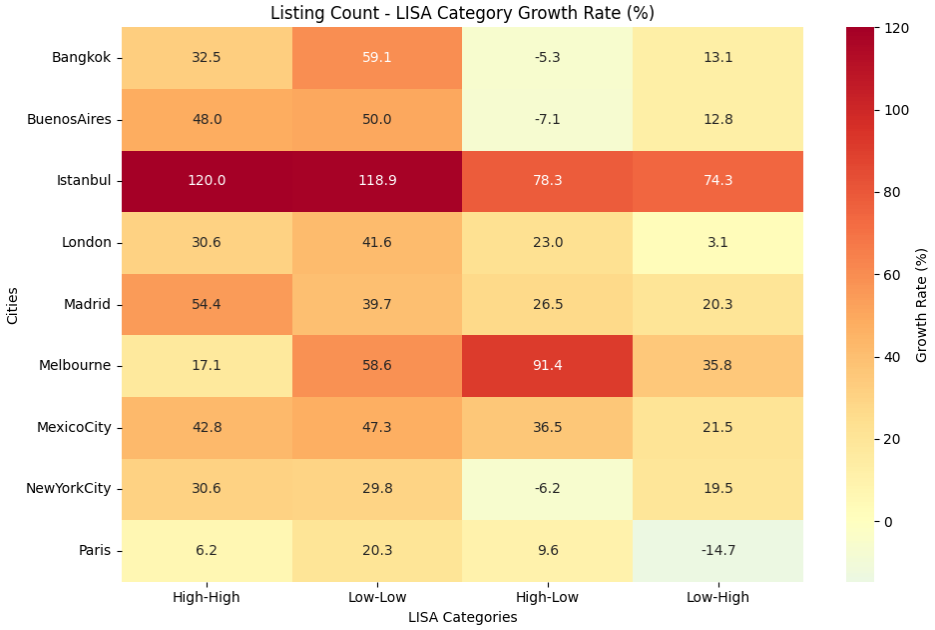

Figure 6: LISA Category Growth Rate(%) - Listing Count

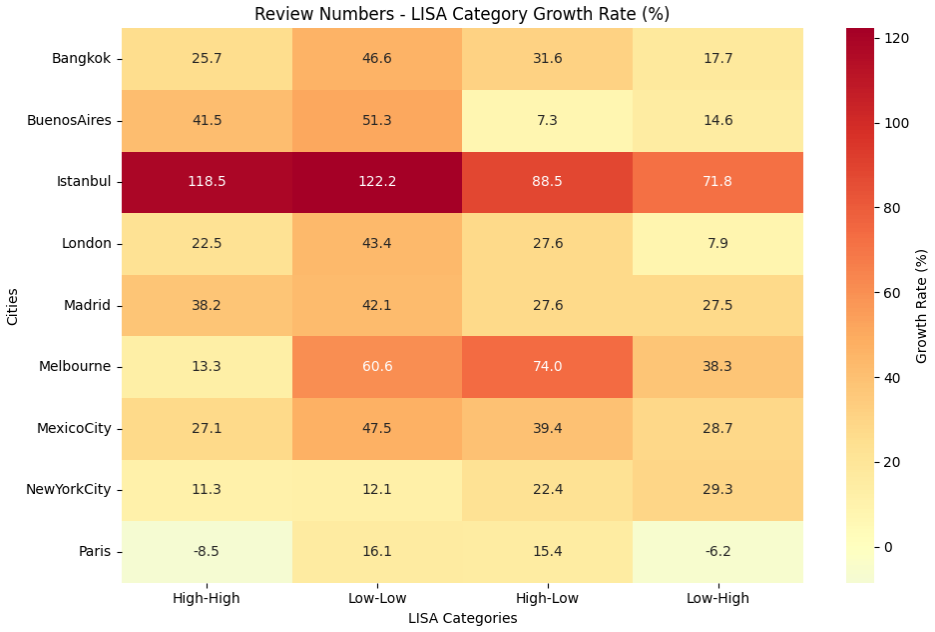

Figure 7: LISA Category Growth Rate(%) - Review Count

4.4.1 Listing Density Evolution

Istanbul demonstrates exceptional growth across all LISA categories, with particularly strong increases in High-High (120.000%) and Low-Low (118.881%) clusters, indicating rapid market polarization. This aligns with (Dudás et al., 2020) findings regarding accelerated market segmentation in emerging platform economies. The balanced growth across categories suggests a comprehensive market transformation process, supporting (Ioannides et al., 2019) observations about rapid short-term rental market maturation in developing urban contexts.

Melbourne presents an interesting case of asymmetric growth, with High-Low clusters showing remarkable expansion (91.358%) while High-High clusters exhibit modest growth (17.054%). This pattern suggests a unique development trajectory where professional operators are expanding into previously independent host-dominated areas, consistent with (Gurran and Phibbs, 2021) analysis of hybrid market evolution in Australian cities.

Paris, in contrast, shows notably conservative growth rates across all categories (High-High: 6.162%, Low-Low: 20.298%), with negative growth in Low-High clusters (-14.710%). This pattern reflects the impact of stringent regulatory frameworks, supporting (Aguilera et al., 2020) research on policy-driven market stabilization in European capitals.

4.4.2 Review Activity Dynamics

The review-based growth patterns reveal complementary insights into market evolution. Istanbul maintains strong growth across all categories (High-High: 118.519%, Low-Low: 122.222%), indicating that operational intensity aligns closely with spatial distribution patterns. This comprehensive growth supports (Kadi et al., 2021) findings regarding the correlation between spatial expansion and operational intensification in emerging markets.

New York City presents an intriguing pattern of balanced but moderate growth across categories (High-High: 11.343%, Low-Low: 12.075%), with stronger growth in peripheral categories (Low-High: 29.318%). This suggests a mature market experiencing selective peripheral expansion, consistent with (Wachsmuth and Weisler, 2018) analysis of market evolution in highly regulated environments.

Paris exhibits negative growth in High-High clusters (-8.501%) while maintaining modest growth in Low-Low areas (16.054%), indicating a potential market rebalancing effect. This pattern aligns with (Ferreri and Sanyal, 2021) observations about regulatory impacts on market dynamics in global cities.

4.4.3 Cross-Pattern Analysis

Comparing listing density and review activity growth patterns reveals several key insights:

1. Regulatory Impact: Cities with stringent regulations (Paris, London) show consistently lower growth rates across both metrics, supporting (Semi and Tonetta, 2021) findings on policy effectiveness in shaping market evolution.

2. Market Maturity Indicators: Established markets (New York, London) demonstrate more balanced growth patterns compared to emerging markets (Istanbul, Bangkok), consistent with (Cocola-Gant, 2020) framework of market maturation stages.

3. Spatial Justice Implications: The growth patterns suggest increasing spatial polarization in most

cities, raising concerns about equitable urban development, as highlighted in (Yrigoy, 2019) critical analysis of platform urbanism.

These findings contribute to our understanding of how short-term rental markets evolve spatially, while highlighting the complex interplay between regulatory frameworks, market maturity, and urban spatial structure. The analysis reveals that while general patterns of professionalization are evident across cities, local contexts significantly influence the specific trajectories of market evolution.

5 Conclusion and discussion

This research provides novel insights into the spatial evolution of Airbnb's professionalization process across major global cities, revealing both universal patterns and local variations. The study's findings contribute to our understanding of how platform economies reshape urban spaces and highlight important implications for urban governance and policy development.

5.1 Key Findings and Theoretical Implications

The research reveals three fundamental patterns in the spatial evolution of Airbnb markets. First, professionalization exhibits a clear center-periphery pattern across all studied cities, with professional operators initially concentrating in central tourist areas before gradually expanding outward. This pattern was first observed in Barcelona (Gutiérrez et al. 2017), with similar center-periphery dynamics later documented in Warsaw (Gyódi 2023) and Berlin (Schäfer & Braun 2016).

Second, the study identifies a significant temporal dimension to market professionalization. The conversion from independent to professional hosting follows patterns similar to those documented in Lisbon (Cocola-Gant & Gago 2019), where professionalization typically begins in high-value central locations before spreading outward. This spatial sequence aligns with broader observations about the "rent gap" theory in platform-mediated markets (Wachsmuth & Weisler 2018).

Third, the research reveals an interesting dynamic between market density and professionalization levels. High-High clusters consistently appear in city centers, while Low-Low clusters dominate peripheral areas. This pattern supports recent findings about the spatial concentration of platform economy activities in prime urban locations (Aalbers 2019) and aligns with observations about the role of location advantages in short-term rental markets (Morales-Pérez et al. 2020).

5.2 Spatial Mechanisms and Market Evolution

While platforms like Airbnb theoretically could democratize tourism accommodation across cities, the observed spatial patterns suggest that professional operators tend to reinforce existing spatial hierarchies. This observation provides contemporary support for Logan and Molotch's (1987) classic theory about how market forces reshape urban spaces, while also reflecting more recent findings about platform capitalism's spatial effects (Langley Leyshon 2017). The analysis of transition zones (High-Low areas) between core and peripheral areas provides particularly valuable insights. These zones, characterized by high listing density but stable independent host ratios, show patterns similar to those observed in European cities (Adamiak et al. 2019). Recent studies in Florence and Milan have demonstrated how these transition zones often serve as indicators of market maturation (Picascia et al. 2017).

5.3 Policy Implications and Urban Governance

The clear spatial patterns of professionalization suggest that blanket city-wide regulations may be less effective than spatially targeted approaches. This aligns with findings from Amsterdam, Berlin, and London (Nieuwland van Melik 2020), where spatially differentiated regulations have shown promise. The effectiveness of such targeted approaches has been further demonstrated in Barcelona's regulatory experiments (Cocola-Gant Gago 2021).

Studies of regulatory responses in European cities suggest different areas within cities may require distinct regulatory frameworks (Gil Sequera 2022). The transition zones identified in our research particularly warrant careful policy attention, as these areas often experience the most rapid market changes (Katsinas 2021).

5.4 Limitations and Future Research Directions

While this study provides valuable insights, several limitations should be acknowledged. The reliance on first review dates as a proxy for market entry timing follows established methodological precedents (Zervas et al. 2017) but may not capture the full complexity of listing evolution. Additionally, while the study captures spatial patterns effectively, it cannot fully explain the causal mechanisms behind these patterns, a limitation noted in similar research (Endrich et al. 2022).

5.5 Broader Implications for Urban Theory

This research contributes to broader debates about how digital platforms reshape urban spaces. Our findings support recent theoretical work suggesting that while platforms like Airbnb introduce new dynamics into urban markets, they often reinforce rather than disrupt existing spatial hierarchies (Langley Leyshon 2017). This observation aligns with studies of platform economy impacts in other European cities (Adamiak et al. 2019).

5.6 Future Research Agenda

While this research has established the general "core-transition-periphery" pattern of Airbnb's spatial professionalization across major cities, several critical areas warrant further investigation to deepen our understanding of this phenomenon:

First, there is a pressing need to integrate this evolutionary pattern with specific urban spatial structures. While our research has revealed the general trajectory of professionalization, it has not fully accounted for how this pattern interacts with different urban morphologies, transportation networks, and land-use patterns. Future studies could examine how factors such as polycentricity (Garcia-López 2019), transit accessibility (Domínguez-Pérez et al. 2021), and historical development patterns influence the spatial evolution of short-term rentals. This could help explain why some cities deviate from the typical core-periphery pattern and provide insights into how urban structure mediates platform economy development.

Second, future research should focus on quantifying professionalization processes at finer spatial scales. Our macro-level analysis could be complemented by detailed neighborhood-level studies that track the evolution of specific listing types and host behaviors. This might involve developing new metrics for measuring professionalization intensity at the street or block level, similar to recent methodological innovations in studying urban change (Arribas-Bel Garcia-López 2021). Such micro-scale analysis could reveal important variations in how professionalization unfolds across different urban contexts and help identify critical thresholds in market development.

Third, while our study has confirmed that professional hosts demonstrate pioneer characteristics and heightened spatial awareness in their location decisions, future research could explore the specific decision-making processes that drive these patterns. This might involve mixed-method approaches combining spatial analysis with qualitative research into host strategies, similar to recent work on

platform entrepreneurship (Stabrowski 2022). Understanding these micro-level decisions could help explain macro-level patterns and provide insights for policy development.

Additionally, longitudinal studies tracking individual listings over time could help identify specific professionalization pathways and better understand the factors that influence property conversion from casual to professional use. This could build on recent work examining the relationship between property characteristics and platform success (Celata & Romano 2022), while adding a crucial temporal dimension.

Finally, future research should examine how external shocks, such as the COVID-19 pandemic or regulatory changes, affect these spatial patterns. While our study has shown how professionalization follows a "core-periphery" structure, we need to better understand how resilient these patterns are to major market disruptions and policy interventions (Gil & Sequera 2022).

These research directions would not only advance our theoretical understanding of how digital platforms reshape urban spaces but also provide practical insights for urban planners and policymakers seeking to manage the growth of short-term rentals in their cities.

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