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Emerging Rental Markets: A Geospatial and Economic Analysis of Urban Housing in India

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Abstract

Purpose – Understanding the urban rental housing market is essential for stakeholders such as real estate developers, landlords, tenants, and policymakers. This study aims to analyze rental housing trends in three major Indian cities—Mumbai, Delhi, and Pune—by employing quantitative price analysis and geospatial evaluation. Given the rising global concerns over housing affordability, this research offers insights applicable to rapidly urbanizing regions worldwide.

Design/methodology – This study utilizes a dataset of over 13,910 rental listings sourced from *makaan.com* in April 2024, making it one of the most recent assessments of India's rental market. A combination of statistical price analysis and geospatial mapping is applied to examine spatial disparities and socio-economic influences on rental distribution.

Findings – The results indicate substantial variations in rental pricing structures. Delhi exhibits the highest price diversity, Mumbai shows a more compact rental pricing pattern, and Pune maintains relative price homogeneity. The spatial analysis further highlights stark intra-city price disparities, emphasizing socio-economic divisions and housing accessibility challenges.

Research limitations/implications – While this study provides valuable insights into India's rental housing sector, future research could extend the scope by integrating additional variables such as migration patterns, policy interventions, and long-term economic shifts. The findings hold relevance for global urban policymakers, housing researchers, and real estate investors seeking to understand rental market dynamics in emerging economies.

Originality/value – By leveraging geospatial analysis and urban economic theory, this study contributes to the broader discourse on rental market sustainability, housing affordability, and urban planning. The research provides comparative insights applicable beyond India, aligning with global concerns about housing crises in rapidly expanding metropolitan regions.

Keywords- Urban rental housing, affordability crisis, geospatial analysis, real estate trends, Mumbai, Delhi, Pune, housing policy, spatial inequality, rental market analysis

Paper type – Research paper

Introduction:

India is home to over a billion people. As the population continues to rise, the demand for housing has surged, impacting real estate prices in the country (**Aggarwal, 2024**). In many cities, the cost of home ownership has escalated to such an extent that purchasing a home has become very difficult (**Gupta & Agnihotri, 2024).** The rental housing market has become a critical component of urban living as it offers a feasible alternative to home ownership.

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This research paper delves into the dynamics of the rental housing market in three Indian cities: Mumbai, Delhi and Pune. By comparing these cities, the study seeks to uncover the similarities and differences in their rental markets, providing insights into the diverse living conditions and options available to urban dwellers. However, the significance of this research extends beyond India's borders, as the challenges faced by these cities reflect broader global trends. This makes the study particularly relevant for international urban policy discussions.

Global Relevance of the Study

Urban rental housing is a critical issue worldwide, with cities across developed and developing nations facing increasing pressure from rapid urbanization, affordability crises, and policy inefficiencies. This study focuses on Mumbai, Delhi, and Pune—three of India's most significant urban centers—to examine the challenges and dynamics of rental housing. The selection of these cities is not only relevant to India's housing market but also carries broader global implications. Mumbai and Delhi rank among the top ten most populous cities in the world, facing rental affordability challenges similar to those in New York, London, and São Paulo. Pune, a rapidly growing IT hub, mirrors the housing pressures seen in Silicon Valley and Shenzhen, where technology-driven migration fuels demand for rental accommodation.

The insights from this study are relevant to international urban planners, policymakers, and economists, as India's rental housing market presents unique challenges that are mirrored across other emerging markets in Asia, Africa, and Latin America. For instance, informal rental housing—prevalent in India—is a dominant housing solution in cities like Nairobi, Mexico City, and Jakarta, where low-income and migrant populations rely on unregulated rental options. Additionally, India's evolving housing policies, such as the **Model Tenancy Act (2019)** and Pradhan Mantri Awas Yojana (PMAY), offer policy frameworks that could inform rental housing reforms in other nations.

Moreover, India's real estate sector is projected to reach $1.5 trillion by 2034 (**Business Standard, 2024**), making it a critical case study for global real estate markets. The affordability crisis in Indian cities is reflective of a broader trend where the rental-to-income ratio in urban areas exceeds sustainable levels, a pattern also observed in Los Angeles, Sydney, and Berlin. By studying India's rental housing market, this research contributes to an international discussion on affordable urban living, housing market regulation, and sustainable urban growth strategies.

Given the global nature of urban housing challenges, this study offers valuable lessons on managing housing affordability, informal rental markets, and policy-driven housing interventions. The findings can be used to guide urban housing reforms in other densely populated and rapidly urbanizing regions, making this research particularly relevant to an international audience.

Quantitative methods and geospatial evaluations will be used in this research to analyze a comprehensive dataset with rental property prices, types and features that are listed on www.makaan.com and were scraped from the web by **Bhavya Dhingra (2024).** The study will explore the traits of rental houses which are, size, price, location, type and amenities. It will offer a detailed report of what is currently available on the market. Together with geospatial analysis, this approach will highlight how geographical factors influence rental prices and living conditions across these cities.

The study aims to contribute valuable knowledge to stakeholders, including potential renters, real estate developers, urban planners, and policymakers. This will enable them to make informed decisions and strategies that align with the demands of India's urban population.

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Literature Review:

Understanding the factors influencing rental housing affordability requires an analysis of both global and local economic drivers. The rapid urbanization rates in Indian cities have resulted in a strain on housing infrastructures. Shaw's research discusses how migration to urban areas has led to increased demand for both owned and rental properties. The housing sector in India is experiencing a crisis in affordability, affecting both ownership and rental markets. The government has implemented various schemes to address housing problems, but gaps remain in meeting the needs of lower-income populations (**Mehta & Subramanian, 2022)**. The transformation of India's rental housing policy has been identified as a key mechanism to mitigate homelessness and improve affordability, particularly in the post-pandemic era **(Datta & Raman, 2024)**. **Raghav Aggarwal's report (2024)** in Business Standard highlights the increasing prices of houses and the difficulties of homeownership. The report reflects on economic expansion and its impact on the real estate section. The report projects that the value of the real estate market will reach $1.5 trillion by 2034 due to increased urbanization and rural-urban migration.

Tying these economic forecasts to empirical evidence, a recent study suggests that several macroeconomic factors have a significant impact on real estate prices (**Tandel *et al.*, 2016)**. These factors include rent, price-to-income ratio, price-to-rent ratio, urbanization, per-capita GDP, inflation, the share of population aged 15-64, GDP growth rate, broad money, and real exchange rate. On the other hand, the percentage share of employment in services has a negative effect on real estate prices. The influence of governmental policies on housing markets is also critical. This study segues into a broader conversation about policy which was supported by a study named "Factors Determining Regional Housing Prices: Evidence from Major Cities in India" by **(Mallick and Mahalik, 2015)**. This paper also discusses how policies shape urban housing markets, guiding urban planning and real estate development strategies. Based on these findings, it is recommended that the government should adjust macroeconomic policies such as inflation, broad money supply, real exchange rate, urbanization, and employment dynamics to control real estate prices.

In India's real estate, the relationship between urban poverty and housing affordability is a major topic of discussion. As **Kumar and Shukla (2022)** explain, affordable housing is difficult to attain by economically weaker populations. For urban migrants and the economically weaker sections (EWS), homeownership remains unattainable. A study on urban rental policies in India highlights that affordability, accessibility, and viability must be integrated into urban planning to ensure sustainable housing options for low-income groups **(Mehta & Subramanian, 2022).** Rental housing policies must be restructured to provide sustainable alternatives, particularly for low-income households and informal workers **(Naik, 2015).** The government has launched initiatives like Pradhan Mantri Awas Yojana (PMAY), to help low-income people deal with the rising cost of urban housing. However, these efforts are not enough because many stakeholders prioritize profits over social welfare. The problem is made worse because as people's income goes up, they spend a larger percentage on housing. This means that the urban poor have to spend a lot of their income on housing and have less money for other things they need. Real estate prices are also going up, which makes it harder for the urban poor to afford housing. This is why the literature suggests that changes are needed in the affordable housing sector to make it easier for the urban poor to find decent housing.

The paper titled **"Housing for All in India" by De La Maisonneuve & Dek** also highlights the acute shortage of affordable housing. House prices are high relative to public's disposable income.

Additionally, there are difficulties in accessing credit and strict regulations in place for the same. The urban housing shortage has notably worsened due to congestion in major cities and inadequate housing quality. All this particularly affects low-income groups. The paper also critiques the rental housing market's inefficiencies. It highlights the negative impact of rigid rent controls. There are strong renter protection laws and maintenance incentives for owners. These regulatory barriers, alongside weak property rights and cumbersome land acquisition processes, limit supply despite the existence of numerous vacant houses and stalled real estate projects. The paper suggests that there need to be market efficiency improvements through the clarification of property rights, easing of rent control, and zoning rules, as well as the reduction of transaction taxes, including stamp duties. Simplifying land use regulations and enhancing contract enforcement are also recommended. The paper praises the 2016 Real Estate Act for making the real estate market more honest and protecting buyers. It could also make it easier for people to get housing finance. The government's "Housing for All" program's aim was to have every Indian get a home by 2022, with a focus on ownership and helping vulnerable groups. The 2019 Model Tenancy Act is a good step for rental housing and supporting these groups. In conclusion, the paper suggests that housing policy should work with other urban development plans to help cities grow sustainably and inclusively. The government needs to make affordable housing for everyone by changing laws and making new plans. This will help reduce poverty, create equal opportunities, and make growth inclusive.

In addressing the profound urban housing challenges faced by low-income households in India, an analysis by **Roy and Meera ML (2020)** from the Indian Council for Research on International Economic Relations (ICRIER) highlights the escalating inadequacy in housing conditions and the burgeoning urban housing shortage. The role of informal rental housing markets is particularly significant, as they serve as crucial yet understudied housing solutions for low-income migrant workers in Indian cities (**Naik, 2015).** As of 2018, the urban housing deficit has dramatically risen, predominantly affecting the Economically Weaker Sections (EWS) and Low-Income Groups (LIG), which together account for nearly 97% of the shortage. This shortage is exacerbated by significant congestion, with many households living in cramped conditions that fall below standard living spaces per capita. The study emphasizes the necessity of a holistic policy approach that transcends traditional housing strategies. Instead of isolated interventions, it suggests integrating housing policy with broader socioeconomic initiatives, including health, education, and employment, to effectively enhance the living standards and economic stability of these vulnerable groups. Moreover, the recommendation to focus on rental housing options for these demographics, particularly through schemes like the Affordable Rental Housing Complexes (ARHCs), points to a strategic pivot towards more sustainable and inclusive urban development strategies.

The gap between the rich and the poor is widening in urban areas, and this is reflected in the property market. Unregulated land-use changes and speculation have inflated property values near urban centers, making housing increasingly unaffordable for middle- and lower-income groups. Recent studies suggest that housing affordability and quality have been declining for the middle class in urban India, as supply constraints and policy gaps continue to exacerbate the problem (**Sengupta, 2024).** According to a study by **Anastasiou, Kapopoulos, & Zekente in 2024**, the surge in property prices is benefiting the wealthy more than the middle and lower classes. This makes it harder for people on lower incomes to find affordable housing. The author suggests that this problem needs to be closely monitored, and that measures need to be taken to ensure that everyone has access to affordable housing. The study's implications resonate with the urban housing shortage trends discussed **by Roy and Meera ML (2020).**

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There is an urgent need for policies that prioritize affordable housing and reduce the inflationary pressure on urban property markets.

Research Methodology:

Detailed data on **rental properties** in the cities Delhi, Mumbai and Pune have been scraped from www.makaan.com by **Bhavya Dhingra(2024)** for public use. This data includes variables such as house type, size, location, price, and a description of the properties. There are 5000 listings in Delhi, 5000 listings in Mumbai, and 3910 listings in Pune. The data was sourced in April 2024, providing a recent snapshot of the rental housing market. Descriptive analysis on the rental prices in each city has been done to do comparisons. Geospatial data analysis to see the spatial distribution of rental prices has been done here to visualize the concentration and how they correlate to cities. The study will also include a comparative analysis across the three cities to highlight similarities and differences in the rental markets.

The quantitative analysis and geospatial analysis has been conducted in Python.

Analysis:

Price Analysis:

In order to compare the distribution of prices of houses in the three cities, histograms have been used.

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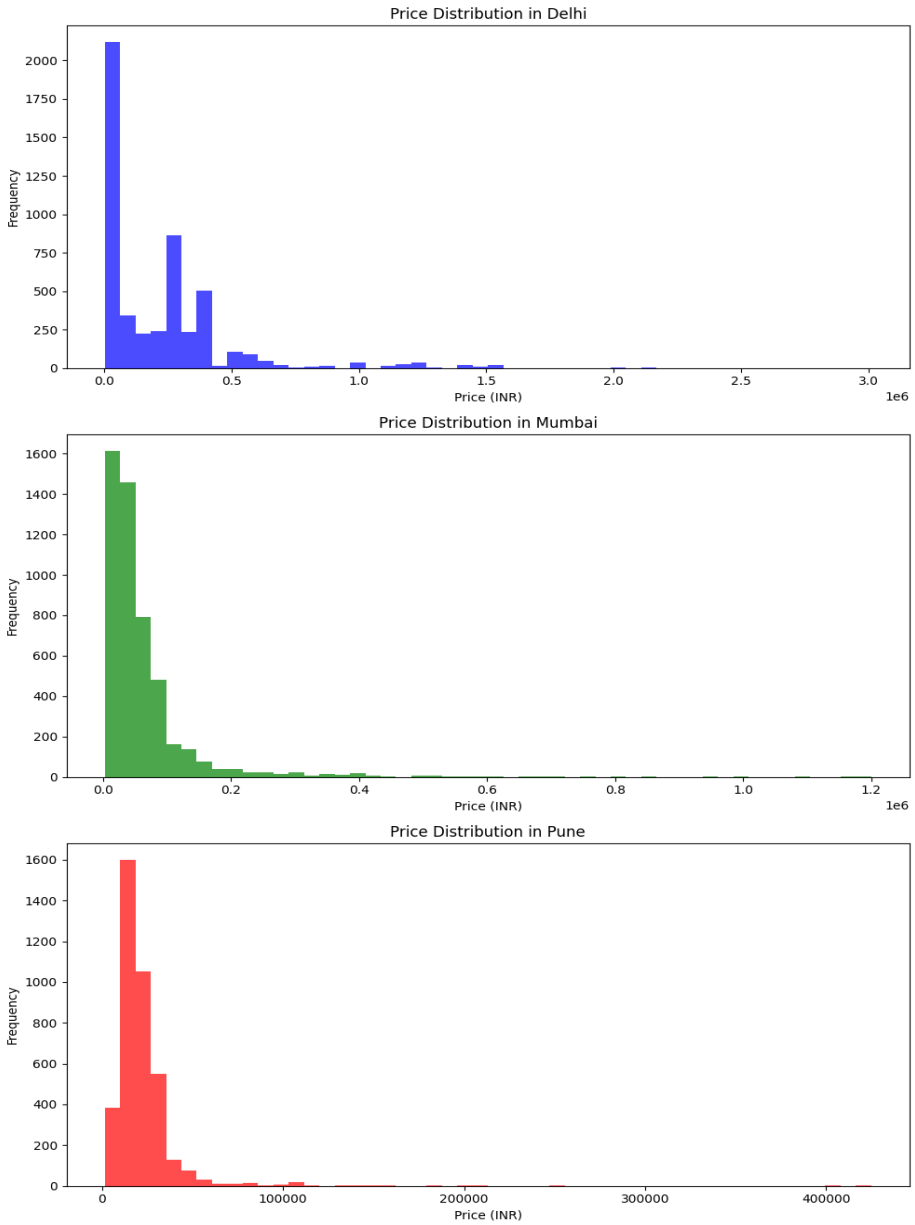

Figure 1: Histograms showing rental price distribution for Delhi, Mumbai and Pune

- *Delhi's Price Distribution for Rentals:*

The histogram shows a steep peak at the lower end of the price range, indicating a large number of properties with relatively low rental prices.

There's a long tail extending towards the higher price range, suggesting that while most rentals are inexpensive, there are a few properties with very high rental prices, likely luxury accommodations or rentals in high-demand areas.

- *Mumbai's Price Distribution for Rentals:*

Mumbai's distribution also shows a concentration of properties in the lower price range, but the distribution seems slightly more spread out than Delhi's, with a less steep drop-off.

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The tail of higher-priced rentals extends less far than Delhi's, suggesting that extremely high rental prices are less common in Mumbai, or the range of prices is more compact.

- *Pune's Price Distribution for Rentals:*

Pune's rental price distribution appears to be the most concentrated, with a sharp peak in the lower price range and the least extension into higher prices.

This could imply that Pune has a more homogeneous rental market with less variation in rental prices, or it may reflect a smaller market with fewer luxury rental options.

- *When comparing the Rental Price distribution of the three cities:*

The distributions for all three cities are right-skewed, indicating more properties at lower prices and fewer at higher prices.

The scales of the x-axis differ, complicating direct visual comparison. For instance, Delhi's histogram extends up to 3 million INR, while Mumbai's and Pune's are less than half of that. This could indicate a wider range of property prices in Delhi or the presence of extremely high-priced outlier properties. Comparing the three would be easier using Boxplots as the scale will be the same.

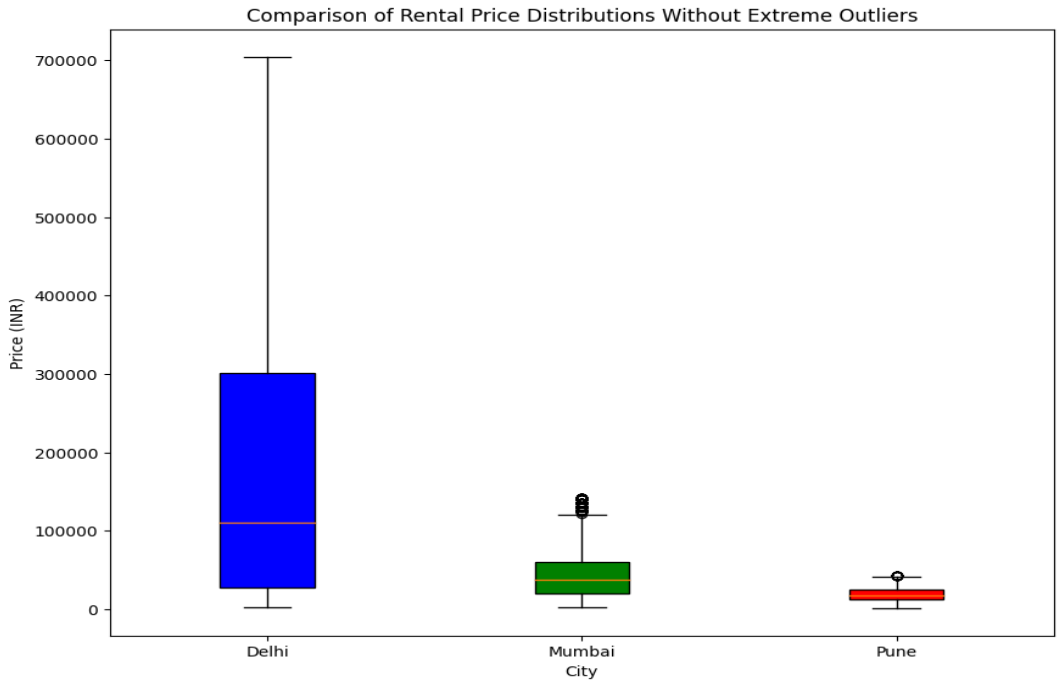

Figure 2: Boxplots showing rental price distribution for Delhi, Mumbai and Pune

The boxplot displays rental price distributions for Delhi, Mumbai, and Pune with **extreme outliers removed**. Based on the visual representation, here's an analysis of the distributions, medians, range, and outliers for each city:

- *Delhi:*

- The boxplot for Delhi shows a wide range of rental prices with the bulk of prices falling between approximately 100,000 and 300,000 INR.

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- The median price is around the 200,000 INR mark.

- There are a substantial number of high-end outliers, indicating the presence of significantly more expensive rental properties in Delhi compared to the other cities.

- *Mumbai:*

- Mumbai's distribution is more compact, suggesting less variation in rental prices.

- The median price in Mumbai appears to be just above 100,000 INR.

- There are some outliers, but they are closer to the upper quartile, which may indicate a more consistent upper-end market.

- *Pune:*

- Pune's boxplot is the most compact of the three, indicating a relatively narrow range of rental prices.

- The median price is notably lower than in the other cities, falling below 50,000 INR.

- Outliers are minimal, suggesting a more homogeneous rental market with most properties clustered around the median price.

Comparative Analysis:

- Median Prices: Delhi has the highest median rental price, followed by Mumbai, with Pune being the most affordable.

- Range of Prices: Delhi has the broadest range, indicating more diversity in the types of rental properties available, including a higher tier of luxury rentals. Mumbai and Pune show a more condensed market, particularly Pune, which has the smallest range and fewest outliers.

-Outliers: Delhi's outliers are more pronounced, and there's a greater quantity of them, which could imply a more substantial segment of luxury or highly-priced rentals. Mumbai has outliers as well, but they are fewer and not as extreme as Delhi's. Pune displays the fewest and least extreme outliers, suggesting less variation in high rental prices.

Most Expensive and least expensive Localities listed under Delhi with the average rent:

Location	Average Rent Per Month
Central Ridge Reserve Forest	2000000.00
Kasturba Gandhi Marg	1481531.50
Aurungzeb Road	1431967.00
Amrita Shergill Marg	1399905.38
Lodhi Road	1375465.88
Burari	5833.33
Shakurpur Colony	5000.00
Santnagar	4999.00
DDA	4500.00
Sector 34 Rohini	3600.00

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Table 1: Top five most expensive localities and top five least expensive localities in Delhi based on Average Rental Prices

This list provides a snapshot of the vast disparity in rental prices within Delhi, reflecting the diversity in housing options and socio-economic segmentation of the city's neighbourhoods:

- High-End Locations:

Central Ridge Reserve Forest: At the top of the list with an average rent of 2,000,000.00 INR, this area likely features luxury properties, possibly with expansive views or exclusive amenities.

Kasturba Gandhi Marg: A central location in Delhi with an average rent of 1,481,531.50 INR, known for its accessibility and high-end living spaces.

Aurungzeb Road: Commanding an average rent of 1,431,967.00 INR, this is another prime area, often chosen by the affluent for its status and location.

Amrita Shergill Marg & Lodhi Road: With rents averaging around 1,399,905.38 and 1,375,465.88 INR, respectively, these areas are synonymous with upscale residential properties and exclusive neighborhoods.

- Affordable Locations:

Burari: With an average rent of 5,833.33 INR, this locality represents one of the more affordable areas, likely offering basic housing options away from the city center.

Shakurpur Colony & Santnagar: These areas have average rents at 5,000.00 and 4,999.00 INR, respectively, suggesting they are also budget-friendly locations.

DDA & Sector 34 Rohini: With average rents of 4,500.00 and 3,600.00 INR, these neighborhoods likely offer economical living spaces, suitable for those on a tight budget or seeking value for mone

Most Expensive and least expensive Localities listed under Mumbaii with the average rent

Location	Average Rent Per Month
Jacob Circle	2000000.00
Marine Drive	525000.00
Walkeshwar	525000.00
Churchgate	358333.33
Napeansea Road	345000.00
Palghar	5000.00
Boisar	5000.00
Nalasopara West	4591.27
Hendre Pada	4500.00
Saphale	3650.00

Table 2: Top five most expensive localities and top five least expensive localities in Mumbai based on Average Rental Prices

The table lists locations in Mumbai, contrasting the higher-end and more affordable areas based on the average rent per month:

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- Premium Locations:

- Jacob Circle: Topping the list at 2,000,000.00 INR, it's likely characterized by luxury apartments or high-end accommodations, possibly with views or special amenities that justify this price point.

- Marine Drive & Walkeshwar: Both these locations have an average rent of 525,000.00 INR. Known for their scenic views and prime location, they are among the most prestigious addresses in Mumbai.

- Churchgate: With an average rent of 358,333.33 INR, Churchgate is a central location known for its proximity to business centers and historical significance.

- Napeansea Road: Averaging 345,000.00 INR, this location is also synonymous with upscale living, offering desirable residential options.

- Budget Locations:

- Palghar & Boisar: Both locations show an average rent of 5,000.00 INR. These are likely to be distant from the city's central business districts, offering more budget-friendly living spaces.

- Nalasopara West: With an average rent of 4,591.27 INR, it represents a suburban housing market that is more affordable.

- Hendre Pada: Averaging at 4,500.00 INR, this area may offer basic housing facilities targeting low to middle-income groups.

- Saphale: The most affordable on the list at 3,650.00 INR, it may attract those looking for the most economical housing options, likely to be quite far from the city center.

Most Expensive and least expensive Localities listed under Pune with the average rent

Location	Average Rent Per Month
Erandavana	400000.00
Erandwane	525000.00
Cummins College Road	100000.00
Landewadi	75000.00
Ashok Nagar	65000.00
Borhade Wadi	5500.00
Shikrapur	4500.00
Talegaon	4000.00
Sector No 28	4000.00
Law College Rd	4000.00

Table 3: Top five most expensive localities and top five least expensive localities in Pune based on Average Rental Prices

This data presents the average monthly rent for locations in Pune, showing a division between higher-rent and more economical areas:

- Higher-End Locations:

Erandwane: The highest average rent listed is in Erandwane at 525,000.00 INR, which suggests this may be an upscale residential area with larger or more luxurious housing.

Erandavana: Close to Erandwane, with an average rent of 400,000.00 INR, also indicating a preference for more affluent residents.

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Cummins College Road: With an average rent of 100,000.00 INR, this location likely caters to a mix of professionals and students, given its proximity to educational institutions.

Landewadi & Ashok Nagar: These areas have average rents of 75,000.00 and 65,000.00 INR, respectively, which may offer a blend of residential comfort and accessibility.

- Budget-Friendly Locations:

Borhade Wadi & Shikrapur: Average rents here are significantly lower at 5,500.00 and 4,500.00 INR, respectively. These locations are likely more peripheral with respect to Pune's center, offering more affordable housing.

Talegaon, Sector No 28, and Law College Road: These areas all have average rents around 4,000.00 INR, which suggests they might be suitable for those seeking the most economical living options, possibly including students and lower-income households.

Geospatial Analysis:

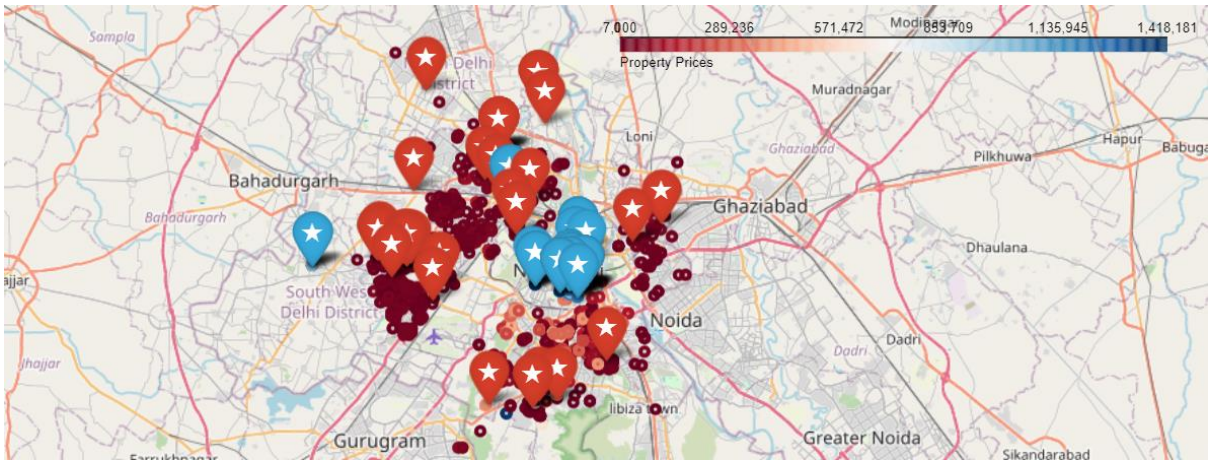

Figure 3: Geospatial distribution of rental properties with approximate prices in Delhi

This map displays the variation in rental property prices in Delhi-National Capital Region. It uses a color-coded system to show the difference in economic valuation of properties. Red points indicate properties with not very expensive rents. Blue points indicate properties with very expensive rents. Stars are labels for outliers. Red stars are the cheapest properties available for renting. And blue stars are labels for exorbitantly priced rents.

The map displays blue stars in central delhi which marks luxury housing or areas of high real estate value. These high-value properties reflect localized economic affluence.

There are many dark red dots in the north west and the north east part of the city.

There are many light red and dark blue dots in south Delhi. Indicating that this location has high end housing available.

Darkly shaded stars are concentrated around the central area of Delhi, indicating a higher value for real estate in proximity to the city's commercial centers and amenities. In contrast, the peripheral areas showcases scattered data points, representing more affordable housing options.

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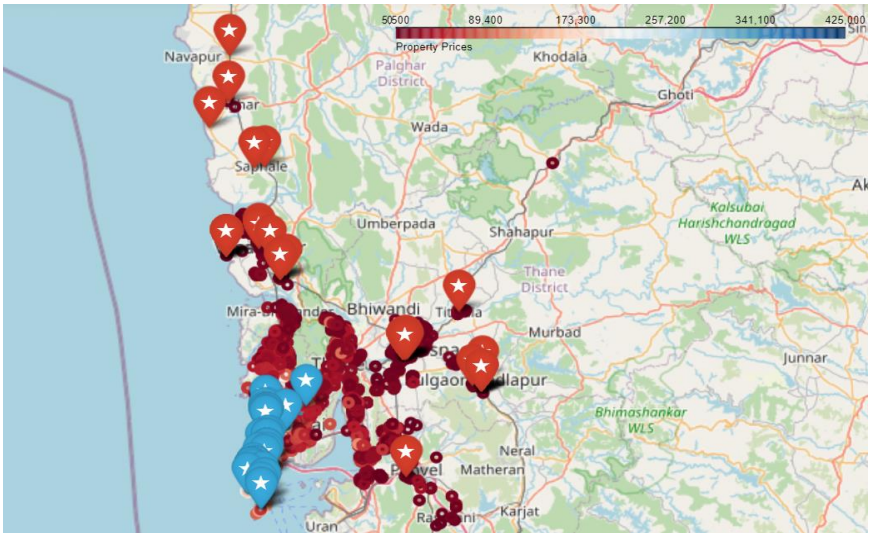

Figure 4: Geospatial distribution of rental properties with approximate prices in Mumbai

The map shows the cost of rental properties in different areas of Mumbai. The blue stars indicate expensive properties, mostly in central and south Mumbai, closer to the coast, while the red stars show cheaper properties on the outskirts of the city. This pattern is common in many cities, where properties near the center are more expensive than those on the outskirts.

The light red dots and blue dots are located mostly in the center of the city and in the the south of the city. In the far north and far north east, lies properties on the extreme outskirts of the city with cheaper rent rates.

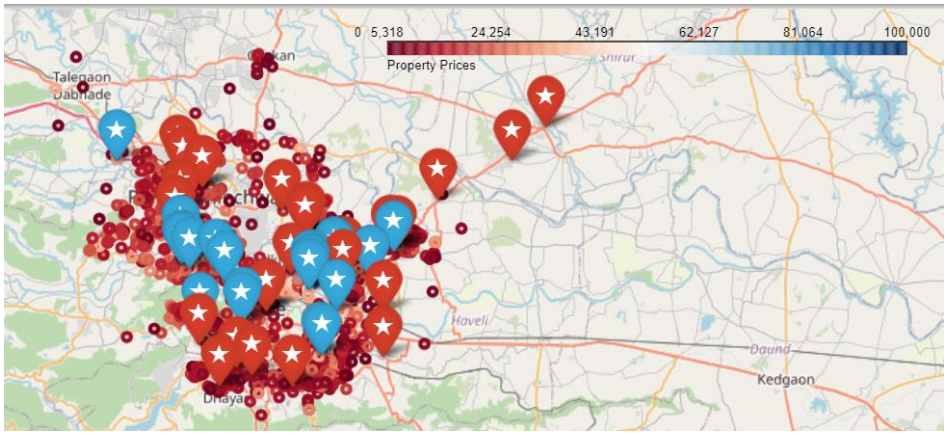

Figure 5: Geospatial distribution of rental properties with approximate prices in Pune

This map shows rental property prices in Pune's urban region. The map shows that the more expensive properties are located in central urban areas, where there are many amenities and business districts. In contrast, less expensive properties are located on the outskirts or in less central locations.

These differences in property values within relatively short distances indicate that Pune's urban landscape has a diverse economy.

To obtain a more complete understanding of these trends, it would be helpful to cross-reference this map with data on socioeconomic status, demographics, and infrastructure development. This information could provide valuable insights into the factors driving property values in different areas.

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This geospatial representation provides insights into the socio-economic dynamics of the region, which can be useful for urban planning and policy-making. It can help identify areas of high-cost living and potential gentrification. To maximize the efficacy of this analysis, additional socio-economic metrics such as average income levels, demographic profiles and accessibility of essential services can be added.

By observing the trajectory of these spatial patterns over time, this comprehensive approach to urban analysis can also shed light on the evolving narrative of urban development, property valuation trends, and the diffusion of housing affordability in the three mentioned cities and more.

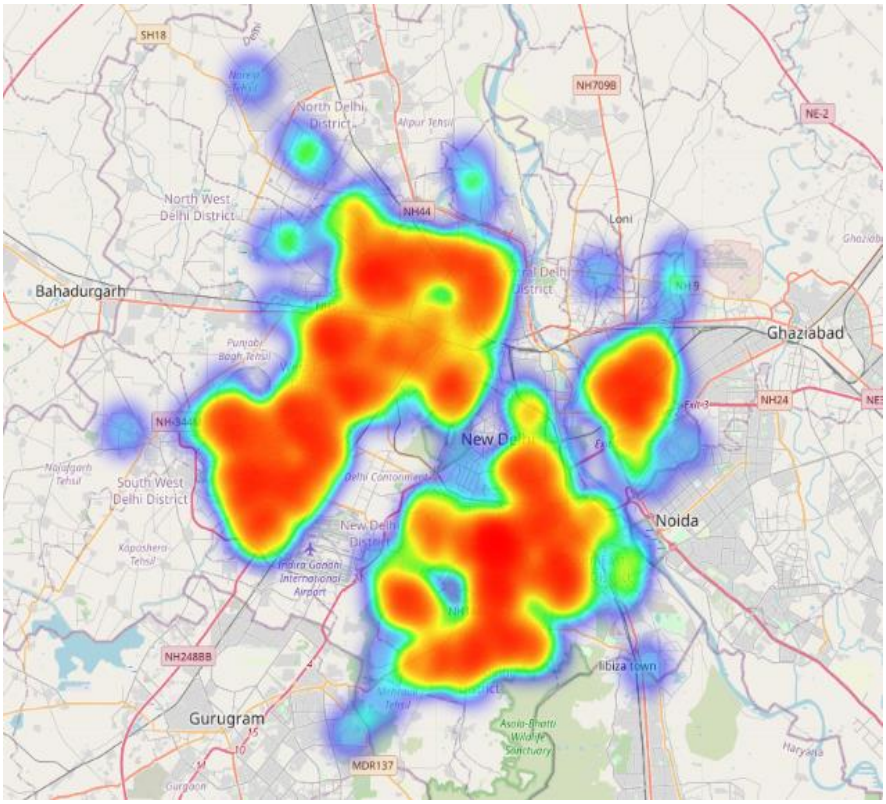

Figure 6: Heatmap of properties in Delhi

The heatmap illustrates the concentration of rental properties in the Delhi area. The areas with the highest concentration, depicted in red, suggest significant demand and/or a large number of available rental listings. These zones are primarily clustered around central Delhi and spread outwards, including parts of New Delhi and areas towards Noida. The orange to yellow regions indicate moderate concentrations, which might represent popular residential areas with a good balance of supply and demand for rental housing. Areas in blue depict lower concentrations of rental properties, potentially indicating either residential areas with fewer rental listings, less dense housing, or possibly less demand for rentals. The green to blue fringes on the outskirts may indicate suburban or peri-urban areas with even sparser rental housing availability, or they could represent the limits of the urban sprawl where the city transitions into the countryside or less developed areas.

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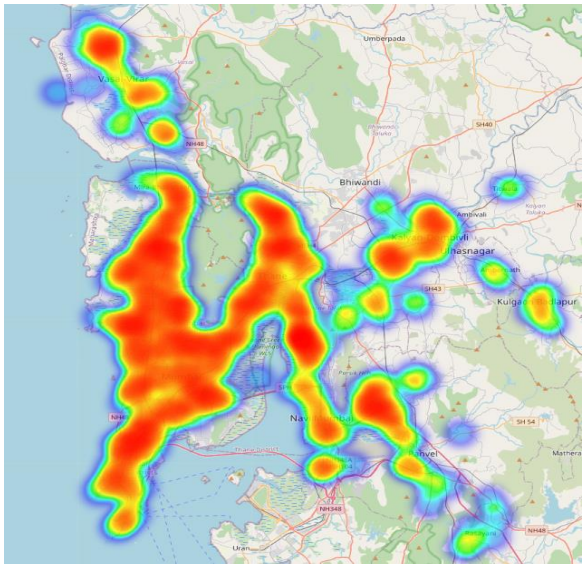

Figure 7: Heatmap of properties in Mumbai

The warmest areas (red to yellow) indicate the highest concentrations, which are likely the most in-demand or densely populated areas. These hotspots often align with major commercial or residential centers.

For example, there are intense clusters indicating high density in what seems to be the central business district and along certain transit routes, which is typical of urban settings where proximity to employment and amenities drives demand for housing. The cooler areas (green to blue) suggest less dense or perhaps more suburban or peri-urban areas with fewer rental properties listed.

It's important to note that high concentrations could also signal recent development booms or attractive real estate markets drawing in investors and renters alike. Conversely, low-density areas could indicate either emerging markets with potential for growth or less desirable locations. The map also suggests a clear delineation between high-density urban environments and surrounding areas, which could point to the boundary of effective commuting distances for the working population.

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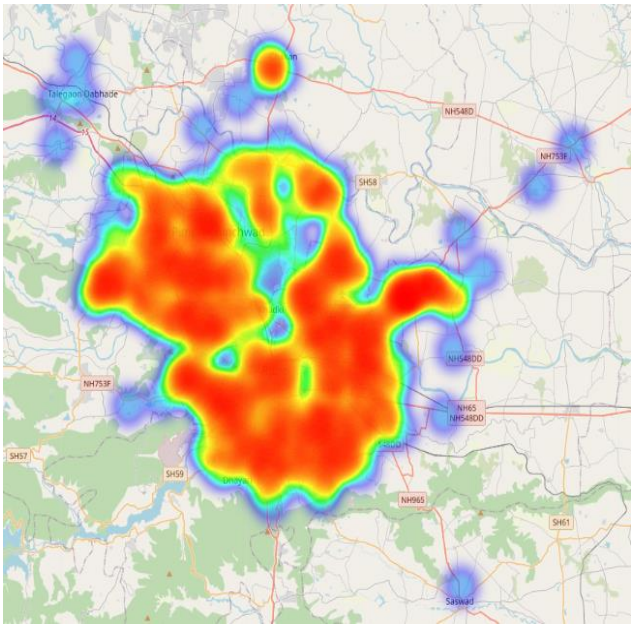

Figure 8: Heatmap of properties in Pune

This heat map likely illustrates the distribution and concentration of rental properties in Pune. The vibrant, warm colors—particularly the reds and oranges—indicate areas with the highest density of rental listings. These clusters could correspond to Pune's urban centers where residential and commercial activities are more intense, suggesting robust housing markets and potentially higher rental prices.

The areas with cooler colors (blues) indicate lower densities of rental properties, which could be attributed to a number of factors such as suburbanization, lower demand, or even less developed areas that are just beginning to attract attention from renters and investors.

From an urban planning perspective, this heat map can highlight regions within Pune that might be experiencing significant pressure on local infrastructure due to high population density. It also points to potential areas for further development or improvement of services to accommodate a growing population. Such detailed visual data is crucial for policymakers and city planners as they devise strategies to manage urban sprawl, improve transport connectivity, and ensure the equitable distribution of resources across the city.

Given Pune's role as a growing IT hub and a major education center, the heat map's dense areas may also reflect the influx of professionals and students seeking housing close to employment and educational institutions. This demand could drive initiatives for smart city development, focusing on sustainability and improved quality of life.

City	Area (sq. km.)	Number of Listings	Density of Listings per sq. km.
Delhi	1483	5000	3.37
Mumbai	603.4	5000	8.29
Pune	516.18	3910	7.57

Table 4: Area, No. of listings, density of listings per square km in 3 cities.

The calculated property density values for Delhi, Mumbai, and Pune provide interesting insights into the distribution of rental property listings in these cities. With 3.37 listings per square kilometer, Delhi

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shows a lower density compared to Mumbai's 8.29 and Pune's 7.57 listings per square kilometer. This discrepancy can be indicative of various underlying factors:

Urban Geography and Development Patterns: Mumbai and Pune may have a higher concentration of rental properties due to their more compact urban development, whereas Delhi, with its larger area, may have a more spread-out distribution of rental properties.

Market Dynamics: The higher density in Mumbai might reflect a more active rental market possibly due to the city's status as a major economic hub attracting a workforce from across the country. Similarly, Pune's educational and tech industries might be influencing its rental property density.

Population Demographics: The variation in property density could also mirror the cities' demographics and migration trends. Young professionals and students might be driving demand in certain areas of Mumbai and Pune, leading to a higher number of listings.

Real Estate Development: The number of listings could be a function of real estate development trends in each city. Mumbai's vertical expansion in the form of apartment buildings and high-rises could contribute to a higher listing density, while Pune's recent development boom might explain its numbers.

The lower density in Delhi, despite being a major metropolitan area, might be due to its expansive geographic spread and a potential preference for ownership rather than rental.

It’s crucial to note that listing density does not necessarily correlate with availability or affordability. Higher densities can sometimes indicate a saturated market with high competition and potentially higher prices, whereas lower densities might suggest a more balanced market or less developed rental infrastructure.

These figures alone don't paint the full picture of the housing markets in these cities. Additional factors such as price ranges, property types, and quality of living spaces also play critical roles in evaluating and understanding the health and appeal of a city's rental market.

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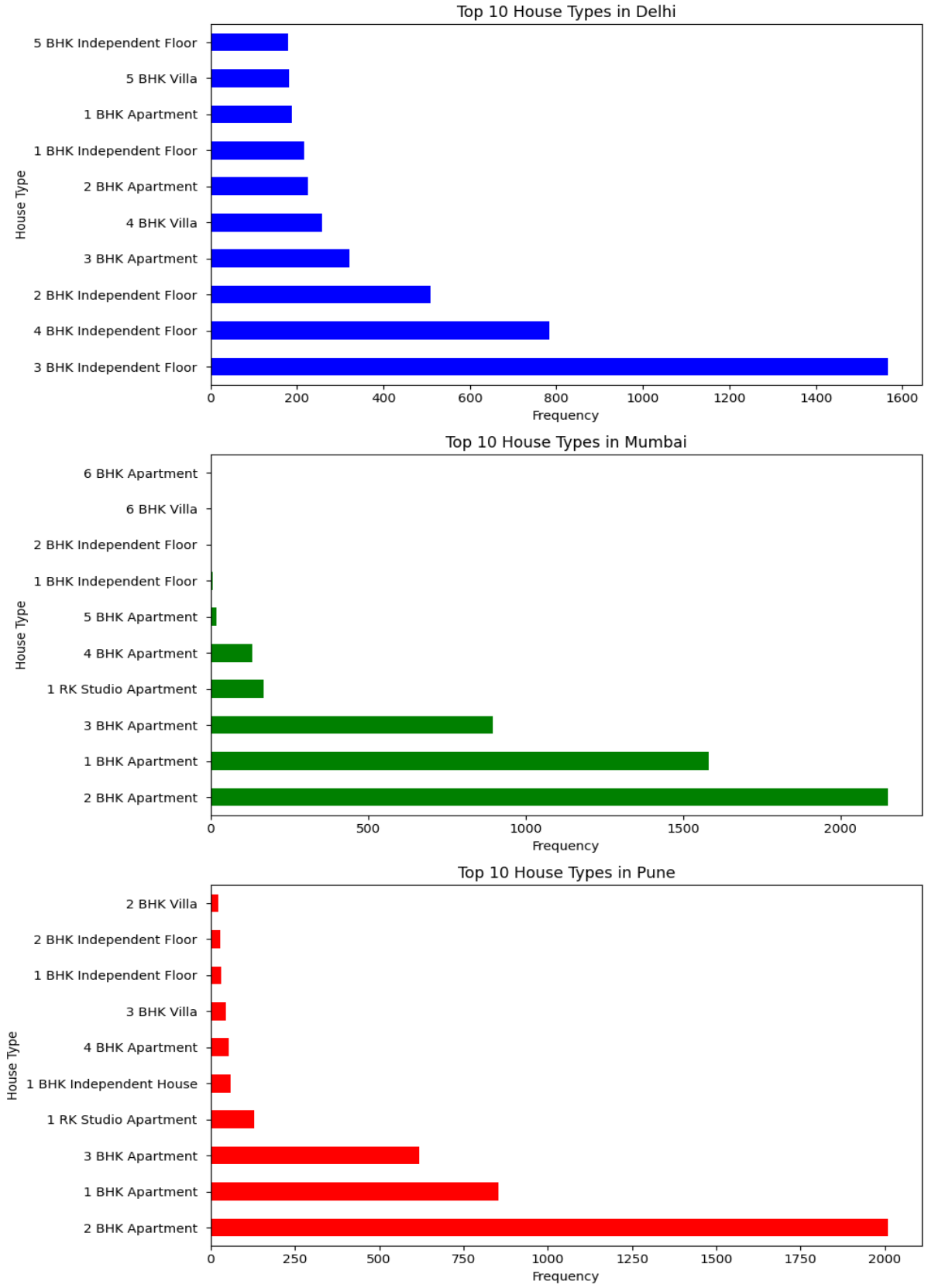

Figure 9: Histograms to display frequency distribution of House Types for the three cities

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The bar charts present the top 10 house types in Delhi, Mumbai, and Pune, categorized by the number of bedrooms and whether the property is an apartment, independent floor, or a villa.

Delhi:

- The most frequent house type is a 3 BHK (Bedroom-Hall-Kitchen) independent floor, followed by 4 BHK and 2 BHK independent floors.

- Villas are less common, with 5 BHK villas and independent floors appearing in smaller numbers.

- This indicates a preference for spacious independent living spaces in Delhi.

Mumbai:

- The most common types are 2 BHK and 1 BHK apartments, suggesting a higher demand for more compact living spaces, which is typical of Mumbai's denser urban environment.

- Larger apartments, such as 3 BHKs, are also common but less so than smaller apartments.

- The presence of 1 RK (Room-Kitchen) studio apartments highlights the market for single occupants or couples.

Pune:

- The 2 BHK apartment is the most common house type, followed closely by 1 BHK apartments and 3 BHK apartments.

- Villas and independent houses are less common, but there is a reasonable frequency of 1 BHK independent houses, which might suggest a market for more private yet affordable housing options.

- The frequency of larger apartments is lower than in Delhi, indicating that Pune's market is more oriented towards moderately sized homes.

Cross-City Comparison:

- Delhi shows a clear preference for larger, independent living spaces, whereas Mumbai and Pune favor smaller apartments, which may be due to differences in urban density, lifestyle preferences, and affordability.

- The presence of villas in all three cities indicates a niche market for luxury or standalone properties.

- Mumbai's rental market caters significantly to smaller households or individuals, possibly due to the city's high real estate prices and a large population of working professionals and students.

- Pune, while also showing a tendency towards smaller apartments, reflects a more balanced demand across various house sizes, which could be due to a mix of student population, IT professionals, and families looking for rental accommodation.

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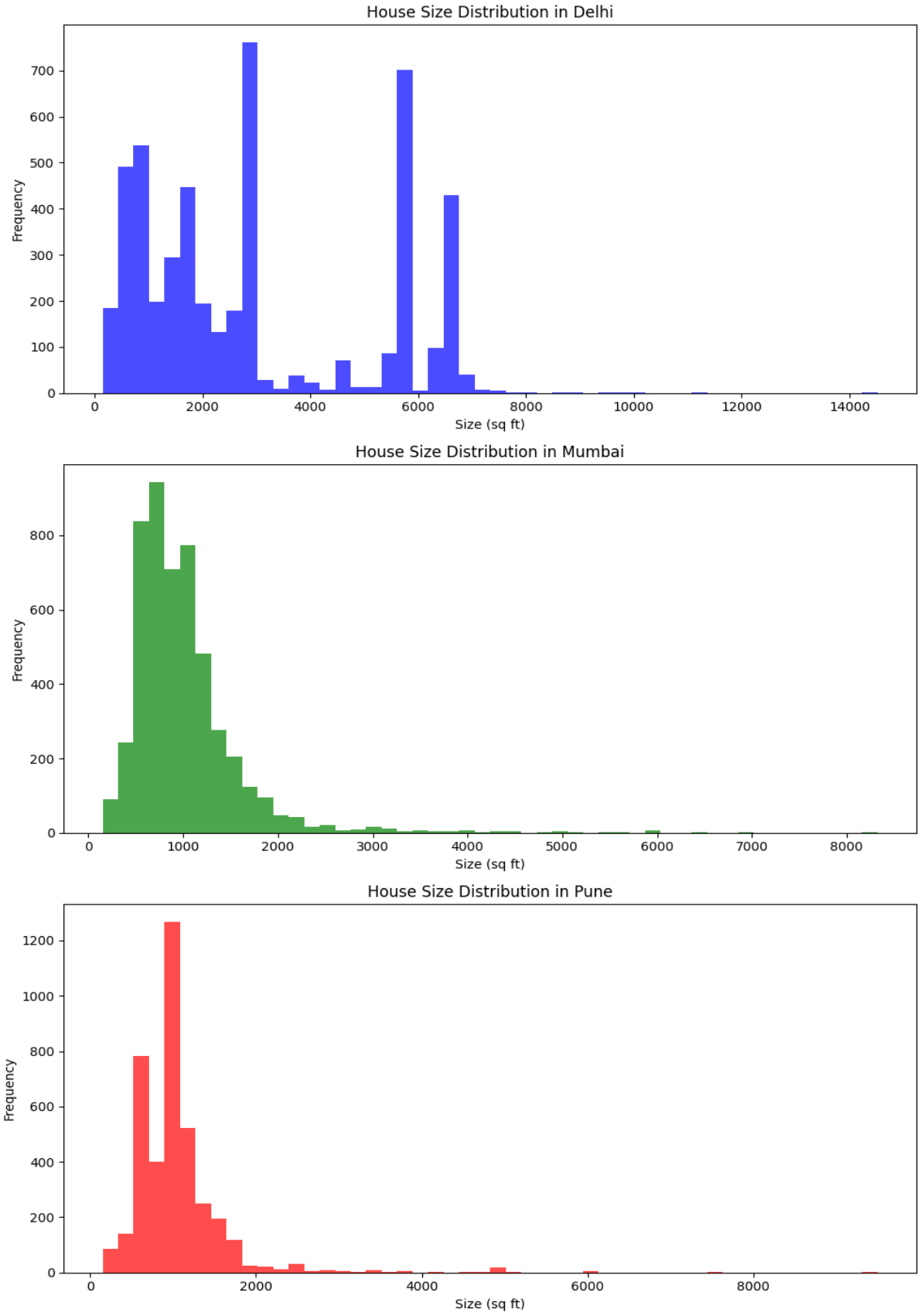

Figure 10: Histograms to display frequency distribution of House Size for the three cities

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The histograms display the distribution of house sizes in square feet for properties in Delhi, Mumbai, and Pune. Here's an analysis of the data visualized:

Delhi:

- The distribution of house sizes in Delhi appears multimodal, with peaks at around 2000, 4000, and greater than 6000 square feet.

- This suggests a significant variety in property sizes, ranging from smaller apartments to larger homes or villas.

Mumbai:

- The histogram for Mumbai shows a more left-skewed distribution, peaking at smaller sizes around 1000 square feet and then gradually tapering off.

- It reflects the city's denser living conditions and a higher prevalence of smaller apartments suitable for individuals and smaller families.

Pune:

- Pune's distribution is also left-skewed, with the majority of properties clustered around the smaller size of under 2000 square feet.

- There is a notable peak at sizes smaller than 1000 square feet, indicating that small-sized properties are particularly common.

Comparative Analysis:

- Range and Distribution: Delhi's housing market is characterized by a wider range of property sizes, whereas Mumbai and Pune are more concentrated around smaller-sized properties.

- Peaks: The multimodal peaks in Delhi's histogram indicate distinct categories of housing sizes in the market. In contrast, Mumbai and Pune show a gradual decline from the peak, indicating fewer large-size properties.

- Skewness: All cities show some degree of skewness towards smaller sizes, but Delhi has significant frequency at larger sizes as well, which might be due to the availability of more spacious housing options.

- Outliers and Extreme Values: The charts for Mumbai and Pune do not extend as far into the larger sizes as Delhi's does, suggesting that extremely large properties are less common in these cities.

These observations could be important for understanding the different housing markets. Delhi's market caters to a broad range of housing needs, from small to large properties, whereas Mumbai and Pune are more focused on smaller properties, likely due to urban space constraints and the nature of their respective real estate markets.

House Type	Delhi	Mumbai	Pune
1 BHK Apartment	189	1580	853
1 BHK Independent Floor	216	8	31
1 BHK Independent House	6	3	60

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1 BHK Villa	0	3	2
1 RK Studio Apartment	138	168	128
10 BHK Independent House	2	0	0
12 BHK Independent House	1	0	0
2 BHK Apartment	226	2150	2009
2 BHK Independent Floor	509	5	28
2 BHK Independent House	18	4	6
2 BHK Villa	0	0	23
3 BHK Apartment	322	896	619
3 BHK Independent Floor	1567	2	2
3 BHK Independent House	18	5	6
3 BHK Villa	0	3	44
4 BHK Apartment	109	133	55
4 BHK Independent Floor	783	1	2
4 BHK Independent House	117	4	7
4 BHK Villa	258	4	11
5 BHK Apartment	6	18	3
5 BHK Independent Floor	180	0	0
5 BHK Independent House	137	0	16
5 BHK Villa	181	1	3
6 BHK Apartment	0	5	1
6 BHK Independent Floor	6	0	0
6 BHK Independent House	0	0	1
6 BHK Villa	0	5	0
6 BHK penthouse	1	2	0
7 BHK Independent Floor	2	0	0
7 BHK Independent House	1	0	0
8 BHK Independent Floor	2	0	0
8 BHK Independent House	1	0	0
8 BHK Villa	1	0	0
9 BHK Independent House	3	0	0

Table 5: Frequency distribution of House Types over the 3 cities

In Delhi, the most common house type listed is a 3 BHK Independent Floor, which significantly outnumbers other types. This suggests a preference for relatively spacious accommodations with separate floors. There's also a notable presence of 4 BHK Independent Floors and a decent number of larger villas (4 and 5 BHK).

Mumbai shows a clear demand for 2 BHK Apartments, followed by 1 BHK Apartments, indicating a trend towards more compact living spaces, which is typical in cities with high population densities and premium space costs.

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Pune mirrors Mumbai's trend with 2 BHK Apartments being the most common, but with a higher frequency of 1 BHK Apartments than in Mumbai. It also shows a surprising number of 2 BHK Villas, which isn't common in the other two cities, suggesting a unique aspect of Pune's housing market.

The table also provides insights into the diversity of housing options available in each city:

- Delhi offers a wide range of housing types, from apartments to independent floors and houses, including luxury options like larger villas and penthouses.

- Mumbai has a focus on apartments, particularly smaller ones, but also includes studio apartments, which cater to single professionals and students.

- Pune has a notable variety with a mix of apartments and villas, reflecting its blend of urban and suburban characteristics.

Less common are the larger, more expansive properties such as 6 BHK or more, which are present in very low frequencies across all cities, suggesting a niche market.

In summary, this data reflects the diverse housing needs and preferences within each city and provides valuable insights for real estate developers, urban planners, and potential residents. It shows how each city's housing market caters to its population's varying lifestyles and economic capabilities.

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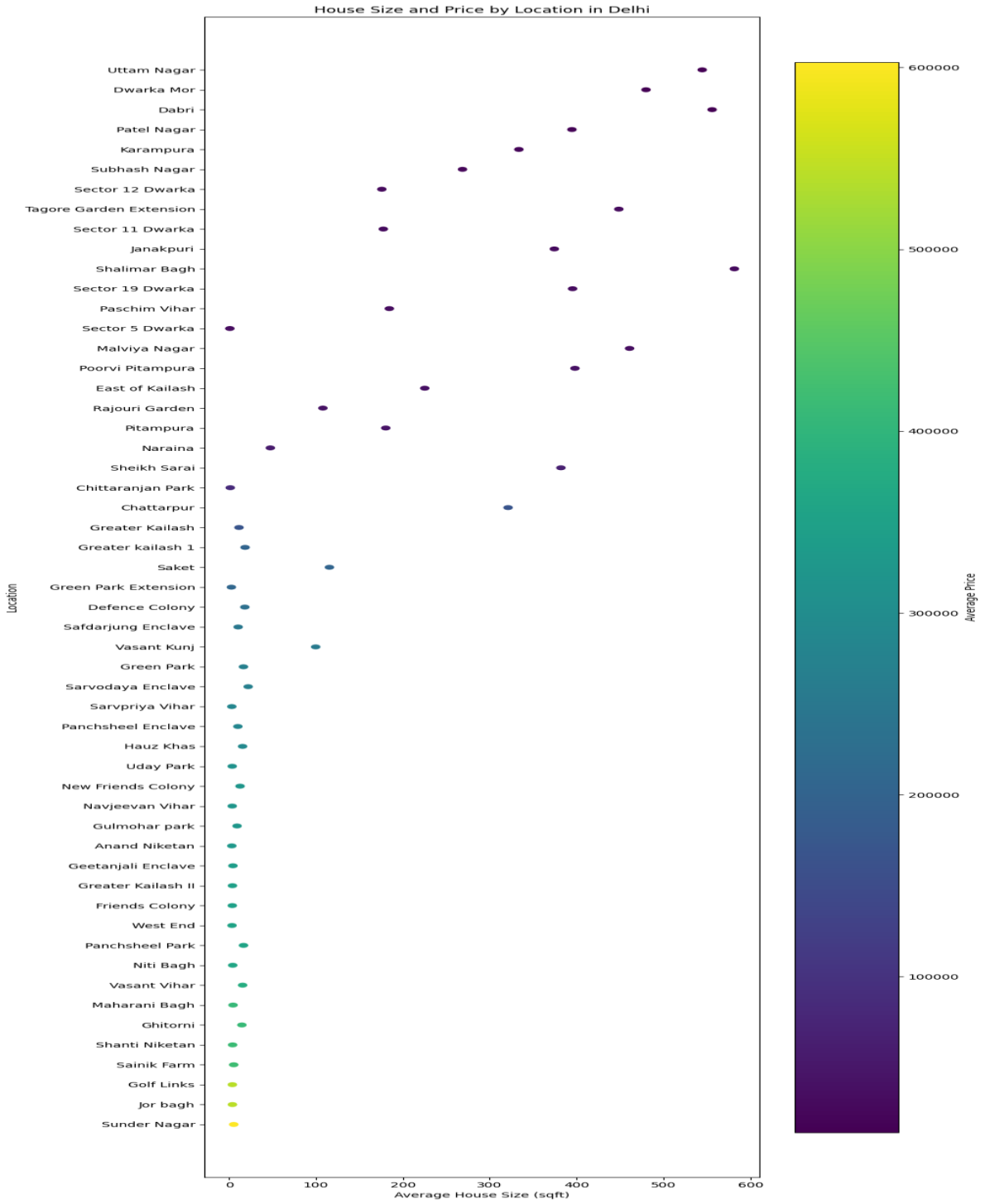

Figure 11: Distribution of House Sizes and Prices by Location in Delhi

From the chart "House Size and Price by Location in Delhi," several observations can be made:

House Size Variation: There's a wide range of house sizes, as indicated by the spread along the X-axis, which seems to go up to around 600 square feet. This suggests a diversity in the types of housing available, from smaller apartments to larger residences.

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Price Distribution: The color gradient represents the average price, and there's a spectrum from less expensive (darker color) to more expensive properties (brighter color). The color intensity appears to increase as the average house size increases, suggesting a correlation between size and price.

Concentration of Higher Prices: The top part of the chart, which likely represents central or more desirable locations, shows a cluster of locations with both larger house sizes and higher prices. This implies that these areas are more affluent, with larger and more expensive homes.

Affordable Areas: At the bottom of the chart, the cooler colors indicate locations where the average price is lower. The house sizes here vary, but it seems that there are affordable options with decent-sized housing.

Notable Anomalies: Some locations appear to have a relatively high average house size but don't correspond with an extremely high price, which could be indicative of areas that offer value for money in terms of space.

Top-tier Localities: The brightest colored points towards the bottom of the chart suggest exclusive localities where despite the average house size not being the largest, the prices are very high, potentially due to factors like prestige, proximity to amenities, or historical value.

General Trends: There seems to be a general upward trend where locations with larger average house sizes also have higher prices, which is a common trend in real estate.

This chart would be particularly useful for potential renters or buyers looking for a place in Delhi, as it highlights the trade-offs between house size, price, and location. It could also be insightful for policymakers or urban planners to understand housing dynamics in the city. To further this analysis, one might consider the impact of additional factors like local amenities, transportation links, crime rates, and the general livability of each area.

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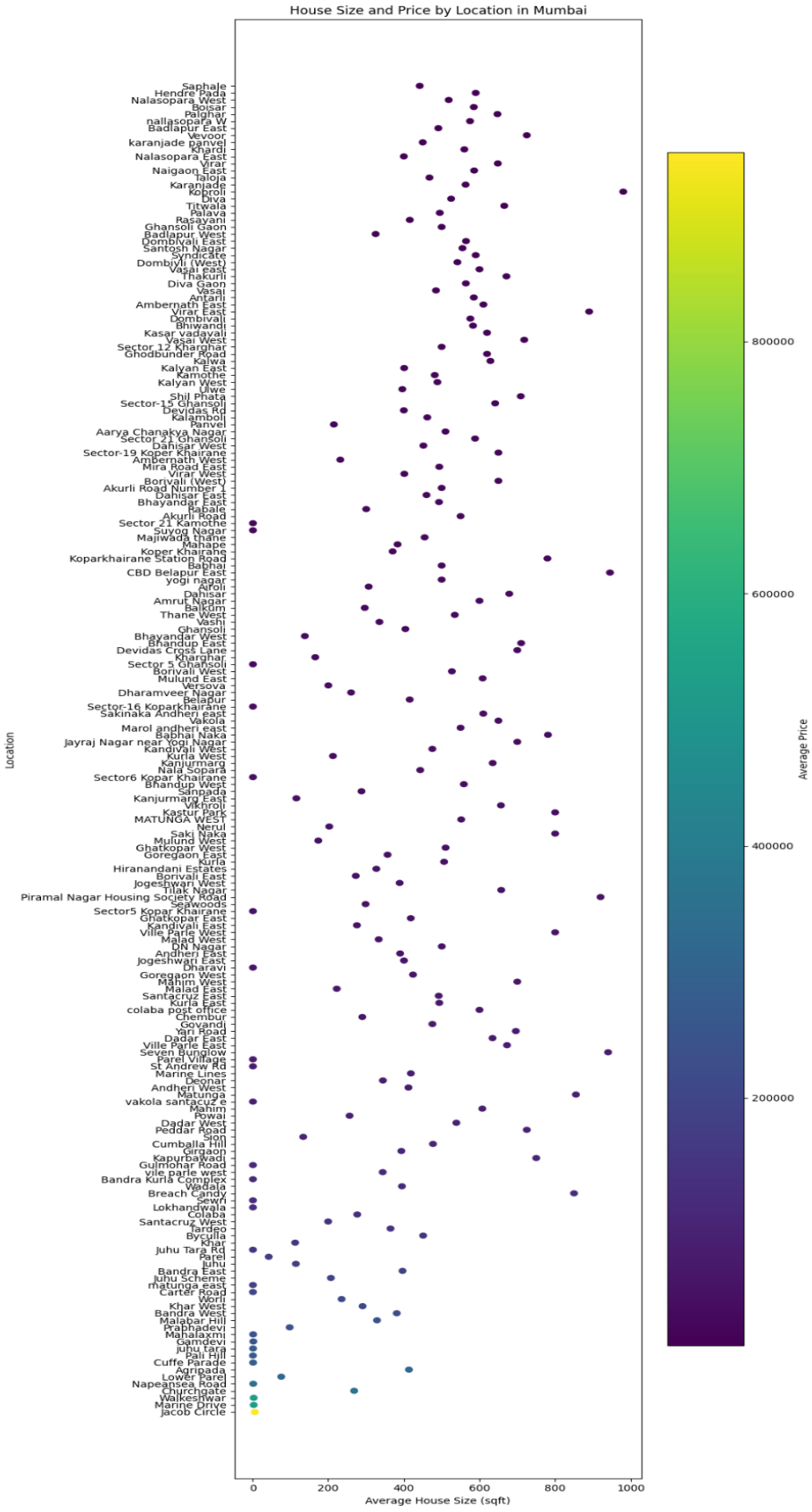

Figure 12: Distribution of House Sizes and Prices by Location in Mumbai

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The "House Size and Price by Location in Mumbai" chart showcases the following key observations:

Diversity in Housing Options: The graph indicates that Mumbai offers a range of house sizes, from small apartments to large spacious residences, with sizes extending up to 1,000 square feet. This variety caters to the different needs and preferences of the city's diverse population.

Price Points: The color gradient, representing the average price, shows a variety of price points across different locations. There seems to be a less direct correlation between house size and price in Mumbai compared to Delhi, with some smaller houses still commanding high prices.

Expensive Locales: There are certain areas, particularly those toward the bottom of the chart, that show a high average price despite not having the largest house sizes. These could be premium areas where price is driven by factors beyond size, such as the locality's prestige, proximity to key business districts, or the availability of luxury amenities.

Value for Money: Some locations provide larger houses without a proportionate increase in price. These could be areas that offer value for money, possibly due to their distance from the city center or other factors affecting real estate prices.

Affordable Housing: At the top of the chart, there's a mix of smaller and moderately sized houses with lower average prices, indicating more affordable housing options, possibly in suburban or less central areas of Mumbai.

Top-tier Localities: Just as in Delhi, the brightest points indicate where the housing prices are high regardless of size. These could be highly sought-after areas, known for their exclusivity and desirability, despite the smaller average house size.

Overall Price Trends: The wide distribution of prices across different house sizes suggests that location desirability and other non-size related factors play a significant role in pricing within the Mumbai real estate market.

In conclusion, the Mumbai housing market shows a complex interplay of house size, price, and location, where size is not the sole determinant of price. The market's dynamics appear to be influenced by a blend of factors including location desirability, local amenities, and the city's unique socio-economic landscape. Potential buyers or renters in Mumbai may need to consider these factors carefully when making housing decisions. For urban planners and policy makers, these insights can aid in understanding and addressing the challenges of housing affordability and availability in a city with such a dynamic and varied real estate landscape.

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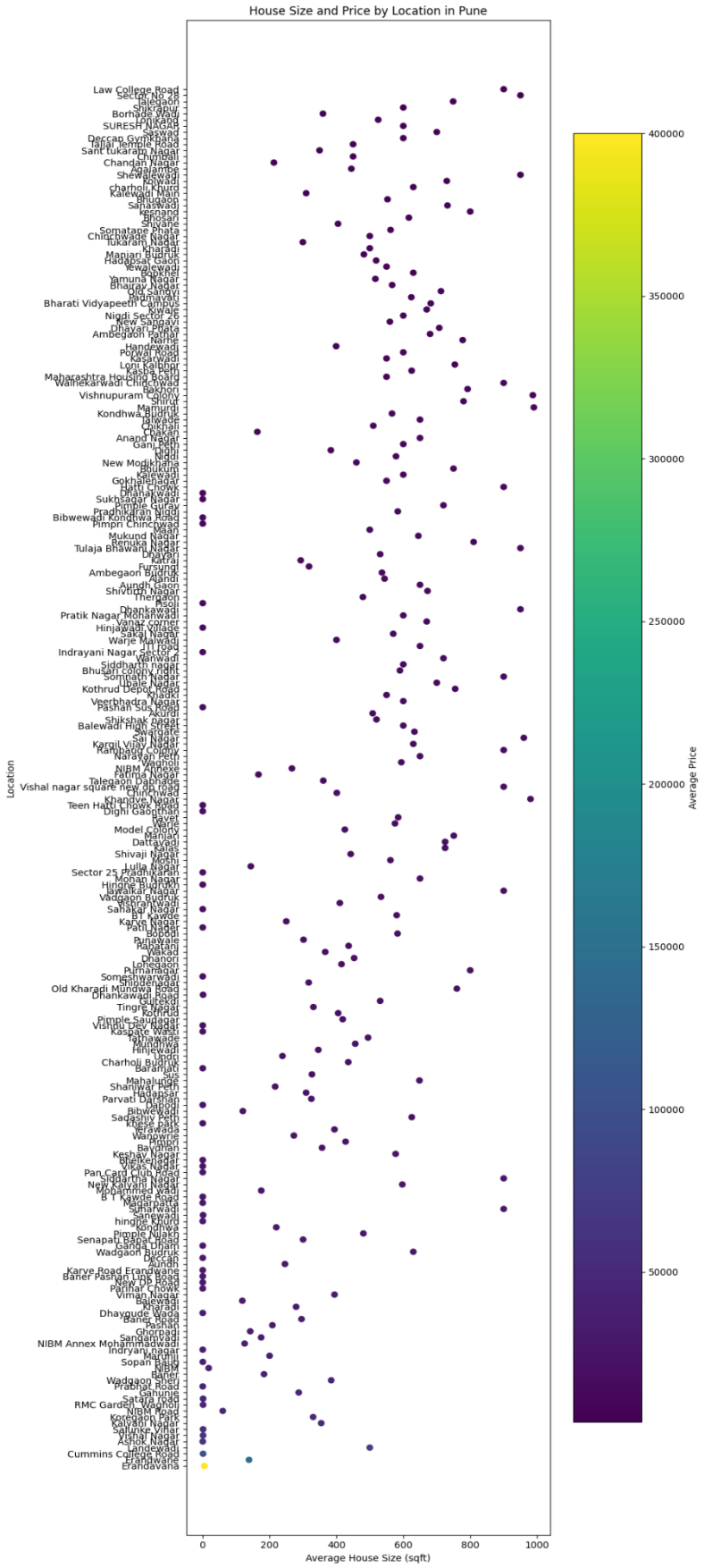

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Figure 13: Distribution of House Sizes and Prices by Location in Delhi

The "House Size and Price by Location in Pune" chart offers insights into the relationship between house sizes and prices in different locales of the city. Here are some observations:

Variety in Size and Price: The graph illustrates a diversity of house sizes across Pune, similar to Mumbai and Delhi. It indicates that Pune's housing market caters to various needs, offering both small and large homes.

Pricing Dynamics: The color gradient denotes the average price, suggesting that Pune, much like the other cities, presents a wide range of housing costs. The prices do not strictly increase with the size, pointing to other value-adding factors influencing the price.

Affordable Options: Towards the top of the graph, where the color intensity is cooler, there are several locations with smaller houses available at more affordable prices. These are likely to be in less central or upcoming areas of the city.

Premium Areas: The brightest spots on the graph, corresponding to higher prices, are not exclusively associated with larger houses. This hints at premium areas in Pune where the prices are high due to factors such as locality, amenities, or connectivity, rather than the size of the property.

Value for Money: There are locations with a good balance of size and price, possibly indicating neighborhoods that offer spacious homes without an exorbitant price tag, which may appeal to families looking for more living space.

Spatial Price Patterns: The distribution of data points indicates that in Pune, as in the other cities analyzed, there isn't a straightforward correlation between the house size and price, suggesting a nuanced real estate market where a variety of factors come into play.

In summary, the Pune real estate market displays a complex interaction between house size, price, and location. While there is a range of housing options available, the price is influenced by various factors, including the desirability of the location and the amenities offered. This emphasizes the multi-faceted nature of housing markets in Indian cities, where buyers and renters must consider several aspects when making decisions. For urban development and planning, these insights underline the importance of considering a broader range of factors beyond mere size when addressing housing affordability and availability.

Limitations:

This study, while comprehensive in its analysis of rental housing markets in Delhi, Mumbai, and Pune, encounters several limitations that must be acknowledged. First, the data derived solely from the online listings on www.makaan.com may not encompass all rental properties available in these cities, potentially excluding unlisted or informally rented accommodations that could differ significantly in terms of price and characteristics. This selection bias may influence the generalizability of the findings to the entire rental market. Additionally, the use of descriptive and geospatial analyses, though effective for identifying patterns and trends, does not allow for causal inferences about the factors influencing rental prices. The lack of qualitative data also limits the depth of understanding regarding tenant experiences and landlord behaviors which could provide richer insights into the market dynamics. Future studies might overcome these limitations by incorporating a broader dataset, employing mixed

methods to explore causality, and integrating tenant and landlord perspectives to provide a more holistic view of the rental housing landscape.

Conclusion:

This study compares rental housing markets in Delhi, Mumbai, and Pune. It uses data and geospatial analysis to identify market dynamics and socio-economic trends. The study finds significant differences in rental prices across these cities. These variations reflect unique urban challenges and opportunities in each locale.

The study shows that Delhi has a wide range of rental options, including many luxury rentals. This suggests that Delhi faces larger economic disparities. Mumbai has a compact rental price distribution, catering mostly to mid-tier economic demographics. This reflects Mumbai's dense urban environment. Pune has the most homogenous market, indicating a balanced urban growth with fewer extremes in rental costs.

Geographical factors such as proximity to city centers or key amenities significantly influence rental prices. This distribution highlights the need for urban planning that considers affordability and accessibility. This will ensure balanced urban development that caters to the diverse population.

The study provides valuable insights for urban planners, policymakers, and real estate developers. It can assist them in making informed decisions to foster the development of more inclusive urban environments. These environments should cater to the needs of a diverse urban population ranging from high-income groups to economically weaker sections.

Future research should track these trends over time, considering the impact of policy changes and economic shifts. Additionally, using more granular socioeconomic data could refine understanding of demand dynamics in these rental markets. By exploring these avenues, stakeholders can prepare for an ever-evolving urban landscape. This can promote sustainable urban development and improved quality of life for city dwellers.

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