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Data Science Lab for Smart Cities

Final Essay

Gentrification and Housing Affordability

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Abstract

As cities embrace smart technologies, gentrification and housing affordability issues become more prominent. This report examines these challenges in Milan, Italy, where urban investment has driven up property values and rents, often displacing lower-income residents. By analyzing indicators such as the Total Real Estate Accessibility Index, Housing Affordability Index, and Rent Affordability Ratio, the study reveals a significant increase in housing costs, especially in rental markets. The findings highlight a growing economic divide, stressing the need for policies that balance development with affordable housing to ensure equitable urban growth.

1 Introduction

In the era of rapid urbanization and technological progress, smart cities have emerged as a blueprint for the future of urban living, promising improved efficiency, sustainability and quality of life for their inhabitants. However, alongside the benefits of smart city initiatives, significant socio-economic challenges have also surfaced, one of the most pressing being the issue of **gentrification**.

The gentrification [1] is a process where investment in urban development leads to the displacement of lower-income residents, as property values and living costs rise. As urban areas undergo transformation through infrastructure improvements and smart technologies, they often become more attractive to higher-income groups, international investors, and tourists. This influx of wealth and demand leads to increased property prices and rents, often pushing out long-standing residents who can no longer afford to live in their neighborhoods.

Therefore, gentrification is a multifaceted phenomenon with significant implications for the social and economic environment. Due to this complexity, in this essay we choose to focus specifically on its relationship with the **housing affordability**.

Housing affordability [2], defined as the capacity of households to afford housing costs without compromising their ability to meet other essential needs, is intricately linked to gentrification. In many metropolises, the rapid increase in housing costs outpaces wage growth, leading to a widening gap between the supply of affordable housing and the demand from middle and low income residents. This creates a socio-economic division within cities, where certain neighborhoods become enclaves of affluence while others are left to struggle with inadequate housing options.

In the following sections, this essay will delve into specific indicators and datasets that can be used to measure gentrification and housing affordability, explore the ethical considerations involved, and propose strategies for mitigating the negative impacts of these phenomena in the context of city development.

2 The Problem

Housing affordability is a cornerstone of social stability and economic well-being in urban environments, yet it is increasingly under threat in many cities worldwide. As urban populations grow and cities strive to modernize, the cost of housing often escalates, outpacing wage growth and creating a significant affordability gap. When housing costs rise to levels that exceed the financial reach of average or low-income residents, a cascade of socio-economic issues emerges, with gentrification being one of the most prominent. Gentrification occurs when rising property values and living costs lead to the displacement of long-term, often lower-income residents, as wealthier individuals and investors move into previously affordable neighborhoods. This process not only transforms the economic landscape of a city but also reshapes its social fabric, often eroding the cultural diversity and sense of community that defined these neighborhoods.

The importance of addressing housing affordability and its related gentrification lies in the profound impact these issues have on the lives of city inhabitants. When residents are priced out of their homes, they are forced to relocate to less desirable areas, often with limited access to public services, employment opportunities, and social networks. This displacement disrupts community cohesion and contributes to the social exclusion of marginalized groups, exacerbating inequality within the city and leading to the homogenization of neighborhoods.

This transformation not only diminishes the cultural and social richness of urban life but also undermines the inclusivity and sustainability goals of smart city initiatives. Economically, the strain of unaffordable housing can lead to increased household debt, reduced consumer spending, and a greater reliance on social services, placing additional burdens on city infrastructure and governance. Consequently, the challenge is to balance the need for urban development and modernization with the maintenance of affordable housing and prevent the displacement of vulnerable populations.

2.1 Indicators

To effectively address the issues of housing affordability and gentrification, it is crucial to establish measurable indicators that quantify the extent and impact of these phenomena. These indicators provide data-driven insights that can guide policy decisions and urban planning efforts:

1. **Total Real Estate Accessibility Index:**

$$\text{TREAI} = 0.7 * DVP + 0.3 * DRA$$

Where

$$\text{DVP} = \left(\frac{\text{Selling Price - Market Value}}{\text{Market value}}\right) \times 100$$

$$\text{DRA} = \left(\frac{\text{Rent Price - Lease Value}}{\text{Lease value}}\right) \times 100$$

The Discrepancy in Selling Price (DVP) measures the difference between the asking sales price and the actual sales price, expressed as a percentage, while the Discrepancy in Rental Asking (DRA) measures the difference between the requested rent and the actual rental rate. The Total Real Estate Affordability Index (TREAI) is a synthetic indicator that measures the discrepancy between the prices requested for sale and rental compared to the official average market prices for a given area. It has been assigned a bigger weight on DVP over the DRA considering the amount of owned and rented properties. [3]

2. **Housing Affordability Index:**

$$\text{HAI} = \left(\frac{\text{Average Annual Income}}{\text{Income Required to Afford Average Home Price}}\right) \times 100$$

The HAI [4] measures the ability of a typical household to afford the median-priced home in a city. An HAI value above 100 suggests that a household has more than enough income to afford the average priced home, while a value below 100 indicates that the average home is unaffordable for a typical household. The income required to afford the average home price is defined as:

$$\text{R} = \left(\frac{\text{Average Home Price}}{\text{N}}\right)$$

where N is the average number of years a household is expected to pay for the home, assumed equal to 25 [5]. This indicator is critical for understanding how accessible home ownership is to average residents and how housing affordability changes over time.

3. **Rent Affordability Ratio:**

$$\text{RAR} = \left(\frac{\text{Average Monthly Rent}}{\text{Average Monthly Household Income}}\right) \times 100$$

This ratio compares average rent to average household income, expressed as a percentage. The generally accepted benchmark is that housing costs should not exceed 30% of household income [6]. A higher RAR indicates that a larger portion of income is being spent on rent, signaling affordability issues. This indicator helps assess the burden of rental costs on residents, which is particularly important in cities where renting is more common than home ownership.

4. **Displacement Index:**

$$\text{Displacement Index} = \frac{\text{Number of Evictions in a Year}}{\text{Total Number of Households}} \times 100$$

The Displacement Index measures the rate of displacement within a community, expressed per 100 households, due to rising costs. A higher index suggests more frequent displacement, indicating significant gentrification pressures. This indicator is useful for understanding the direct human impact of escalating housing costs.

5. **Gentrification Pressure Index:**

$$\text{GPI} = \frac{\text{Percentage Increase in Property Values or Rents}}{\text{Percentage Increase in average income}}$$

To calculate this index it was used the rate at which property values or rents increase compared to the growth of average income. A GPI greater than 1 suggests that housing costs are rising faster than income, a common scenario in gentrifying neighborhoods. This index highlights areas where residents are likely to be priced out due to economic pressures, providing a clear signal of gentrification. The percentage Increase in Property Values or Rents is defined as:

$$\text{R} = (\text{Percentage Increase in Rents} \times 0,3 \oplus \text{Percentage Increase in Property Values} \times 0,7)$$

3 Urban Perspectives: Milan

In this context, Milan, Italy's financial and fashion capital, is a city of striking contrasts, blending historic grandeur with cutting-edge modernity. As the second-largest city in Italy, Milan is not only a hub for commerce and design but also a cultural epicenter with world-renowned landmarks and a vibrant contemporary art scene. Its strategic location in northern Italy has made Milan a magnet for international business and tourism, contributing to its reputation as one of the most dynamic and cosmopolitan cities in Europe.

However, this growth and global prominence have come with significant challenges, particularly in the housing sector. Over the past decade, Milan has experienced a steady increase in property prices and rental costs [7], driven by a combination of factors including economic prosperity, an influx of foreign investment, and a high demand for urban living. The city's real estate market has become increasingly polarized, with luxury developments and renovated properties dominating the central and desirable neighborhoods, while affordable housing options have dwindled. This has led to a housing affordability crisis, particularly affecting middle- and low-income residents who find themselves increasingly priced out of the areas they once called home.

Gentrification has become a prominent issue in Milan [8], reshaping the city's urban landscape. Neighborhoods that were once characterized by their working-class roots and cultural diversity are now undergoing significant transformation. Areas such as Isola [9], once known for its bohemian atmosphere and vibrant arts scene, have seen a surge in high-end developments and trendy restaurants, leading to a sharp rise in property values. Similarly, the Porta Romana district, historically an industrial and lower-income area, has been revitalized with new residential complexes and upscale amenities, attracting wealthier residents and pushing out long-standing communities. The Navigli district, famous for its canals and nightlife, has also experienced gentrification, with traditional businesses being replaced by boutique shops and upscale eateries, altering the neighborhood's character and affordability.

These changes have sparked concerns about the social and cultural impact of gentrification in Milan, as the city risks losing its diverse and inclusive urban fabric. The displacement of residents from their neighborhoods not only disrupts community ties but also exacerbates social inequality, as wealthier individuals consolidate their presence in the most desirable parts of the city while others are relegated to less connected, more affordable outskirts. Despite these trends, Milan's response to gentrification has been relatively limited, with few comprehensive policies in place to protect vulnerable communities or to ensure the availability of affordable housing. As a result, the city continues to grapple with the tensions between urban development, economic growth, and social equity, making it a critical case study for understanding the complexities of gentrification in a modern European metropolis.

4 Data Analysis

4.1 Motivation and Data Sources

Milan was selected as the focal point of this study due to its prominent position in Italy's real estate market and its ongoing urban transformation. With a population of approximately 1.4 million people and as one of the top 10 cities in Italy with the most in-demand neighborhoods for home purchases [10] (Figure 1), the city represents a dynamic urban environment where the pressures of globalization, tourism, and economic growth have profoundly shaped its real estate market. As one of Italy's most populous cities, Milan also experiences significant demographic diversity, which adds complexity to the challenges of maintaining affordable housing and preserving the social fabric of its neighborhoods.

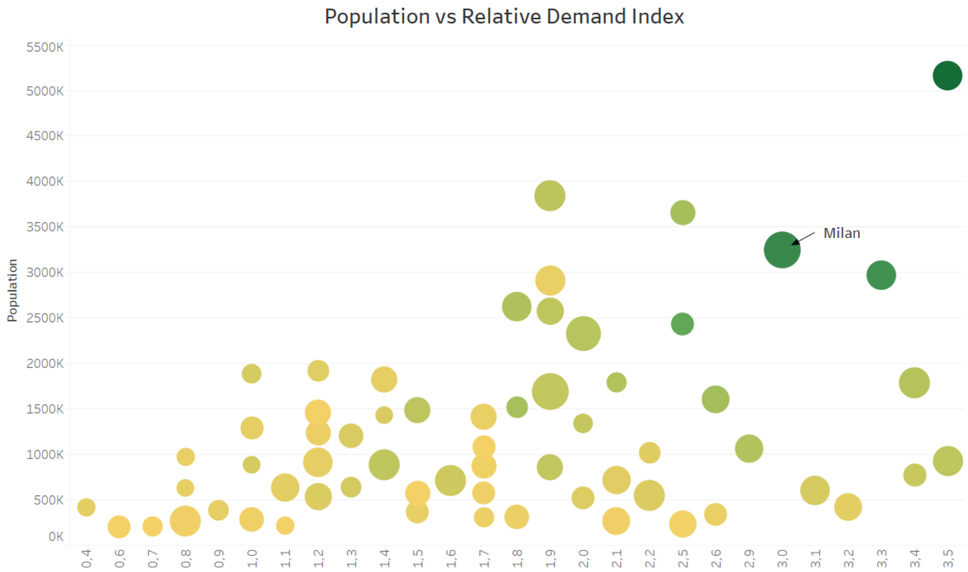


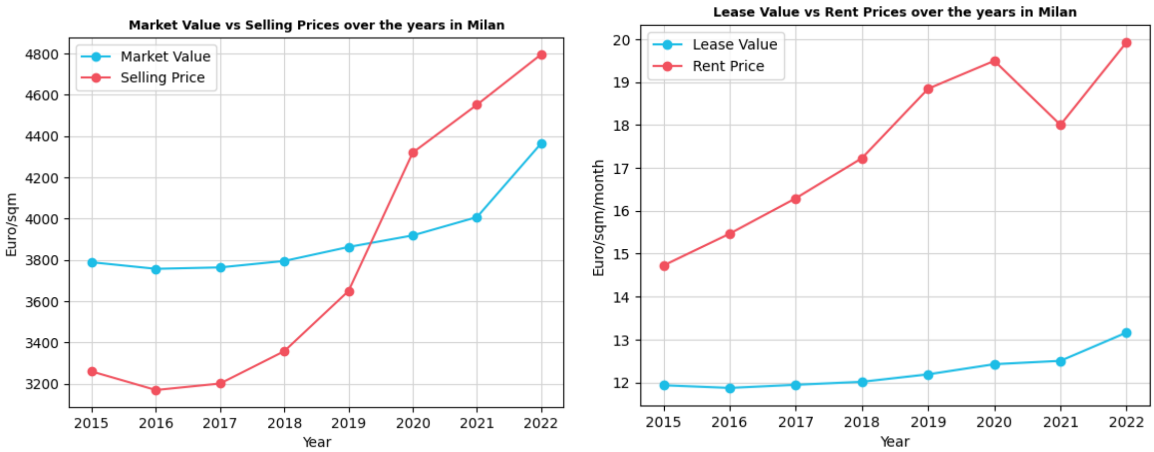
Figure 1: *Population vs Housing Demand across different cities in Italy*

In light of these factors, Milan serves as a critical example of the trends affecting European cities, where the pressures of modernization, economic development, and social inequality intersect. The city's real estate market dynamics, combined with its global prominence and local challenges, make it a compelling setting for exploring the implications of gentrification and housing affordability in the context of urbanization. A comprehensive list of the data used for the analyses includes the following websites:

- *Open street map* for Milan GeoJSON data, useful for creating maps with GeoPandas. [11]
- *Idealista* for selling and rental prices [12]
- *Open Data Milano* for the income distribution and Real Estate Quotes [13][14]
- *Agenzia Delle Entrate* for number of residential properties, categorized by type. [15]
- *Ministero dell'Interno* for number of evictions by year. [16]

4.2 Total Real Estate Accessibility Index

The objective of this index is to evaluate the overall sustainability of the real estate market, considering both purchase and rental. First we analyze the difference overtime between the market/lease values and the selling/rent prices:



(a) Market Value vs Selling Price

(b) Lease Value vs Rent Price

Over the 8-year period, the property values in Milan appears to be consistent, with a recent spike in 2022 for the market value. The difference between Market value and the selling price has narrowed slightly (from €574/m² to €431/m²), which could suggest a more balanced distribution in the owners market. On the other hand, The larger disparity between the lease value and the rent price may indicate an increasing segmentation of the rental market, amplifying concerns about affordability in this area.

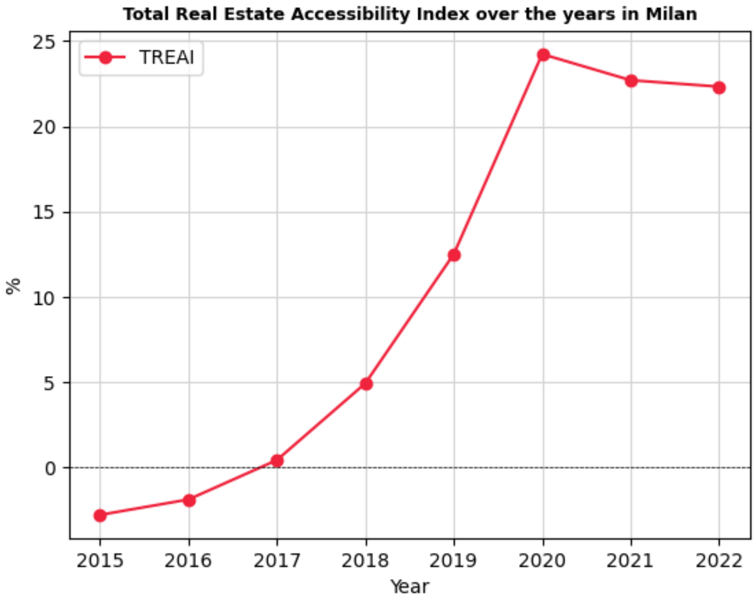


Figure 3: *Total Real Estate Accessibility Index over the years in Milan*

The overall index shows rapid growing pattern through the years, indicating that the asking prices, both for sale and for rent, exceed the average market prices. This may suggest that the city is subject to speculative pressures or that housing affordability is limited.

4.3 Housing Affordability Index and Rent Affordability Ratio

To analyze the Housing Affordability, first we show the general income trends across the various neighborhoods in Milan:

(a) Average annual income in Milan, 2015 (b) Average annual income in Milan, 2022

It's notable that there is a clear disparity in income distribution across different postal codes, despite the average income has generally increased over the years. Wealthier districts (such as Centro Storico) consistently outperform lower-income regions, indicating a significant economic inequality.

(a) Average Selling Price in Milan, 2015 (b) Average Selling Price in Milan, 2022

(c) Average Rent Price in Milan, 2015 (d) Average Rent Price in Milan, 2022

The geographical maps above showing the selling and rent prices per square meter (m^2) divided by postal code areas (CAP) from 2015 to 2022 highlight a steady increase overtime, especially for the rental market. This phenomenon might reflect inflation, increasing demand, and possibly the improvement of infrastructure or desirability in these areas.

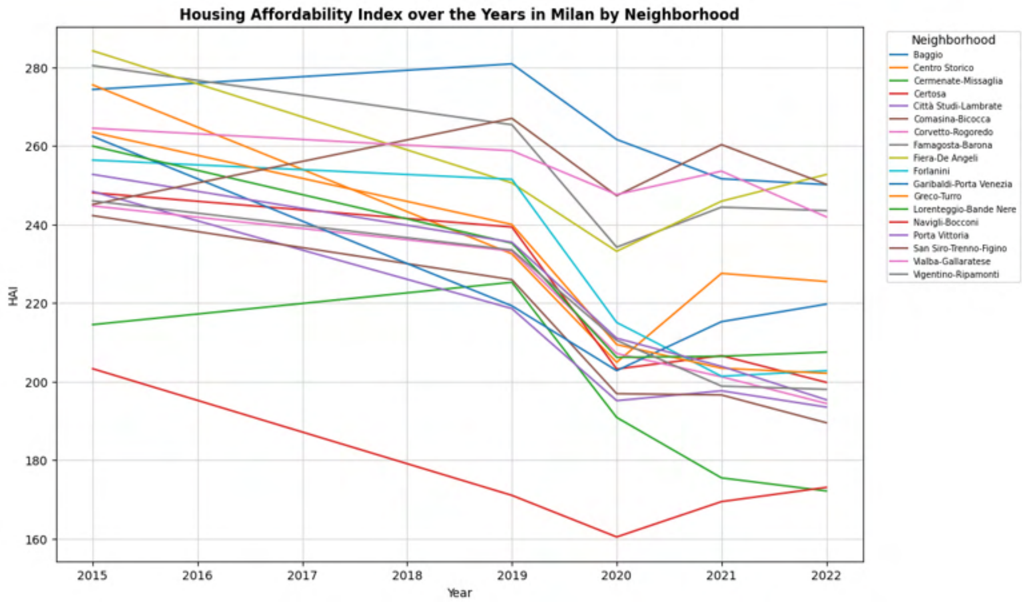


Figure 6: *Housing Affordability Index, by Neighborhood*

As introduced before, the affordability index measures the affordability of housing in a given area. Higher values indicate a greater level of affordability relative to the area's income levels. The affordability level is quite consistent, implying that housing prices relative to local income are stable and not significantly varying between different areas. The general values are over 100, which means households have enough income to afford the average priced home, but it's proximity to the threshold suggest a potential struggle for residents. Overall the most affordable market over the years seems to be in Baggio, while the least affordable is Navigli-bocconi.

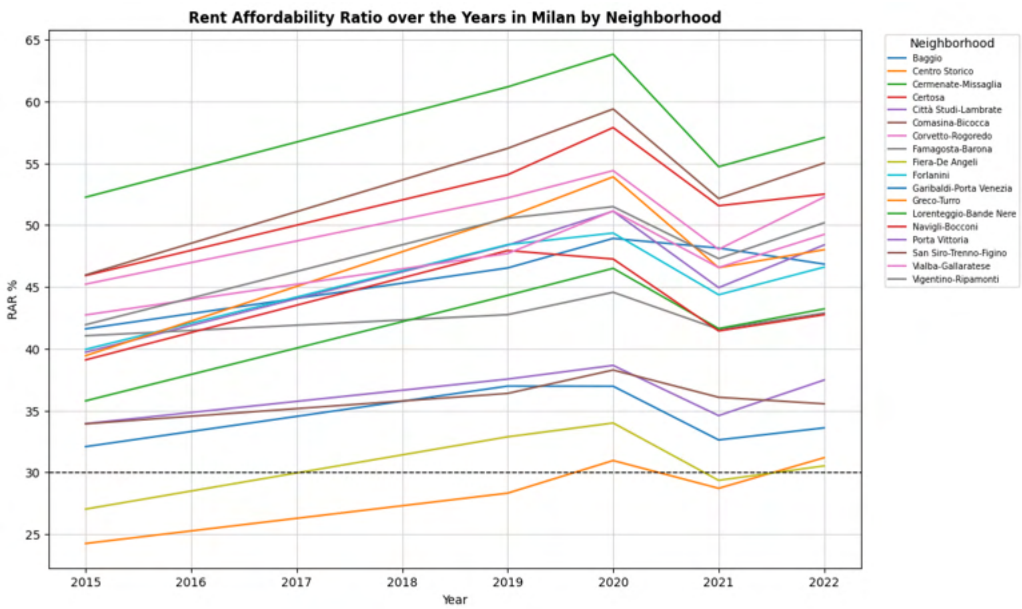


Figure 7: *Housing Affordability Index, by Neighborhood*

The increasing values of the rent affordability ratio from 2015 to 2022, with a notable peak in 2020, suggest that renting has become progressively less affordable over time. This percentage reflects growing financial pressure on renters, since spending a large portion of income on rent (more than 30%) can limit spending on other essentials and savings, affecting overall financial stability and quality of life. Across the neighborhoods, the most affordable areas for rent (in relationship with the income) are Greco-Turro and Fiera-De Angeli, while the least affordable are Comasina and Cermenate.

4.4 Displacement Index

In order to calculate the Displacement Index, it was necessary to determine the total number of residential properties in Milan. Utilizing data obtained from "Agenzia delle Entrate", an analysis of the variation in the number of properties per housing type was also conducted.

The housing types examined included: Signorile, Civile, Economico, Popolare, Ultrapopolare, Rurale, Villini, and Ville.

As we can see from the plot (Figure 8), certain neighborhoods undergo revitalization, while older, more affordable housing is often replaced or renovated to cater to a more affluent demographic. This influx of wealthier residents drives up property values, making it increasingly difficult for lower-income households to remain in these areas.

As a result, many working-class residents have been displaced from their long-time neighborhoods, leading to a decline in the number of rural, ultra-popular, and popular housing units. These residents are often forced to move to more peripheral areas or even outside the city, exacerbating socio-economic inequalities.

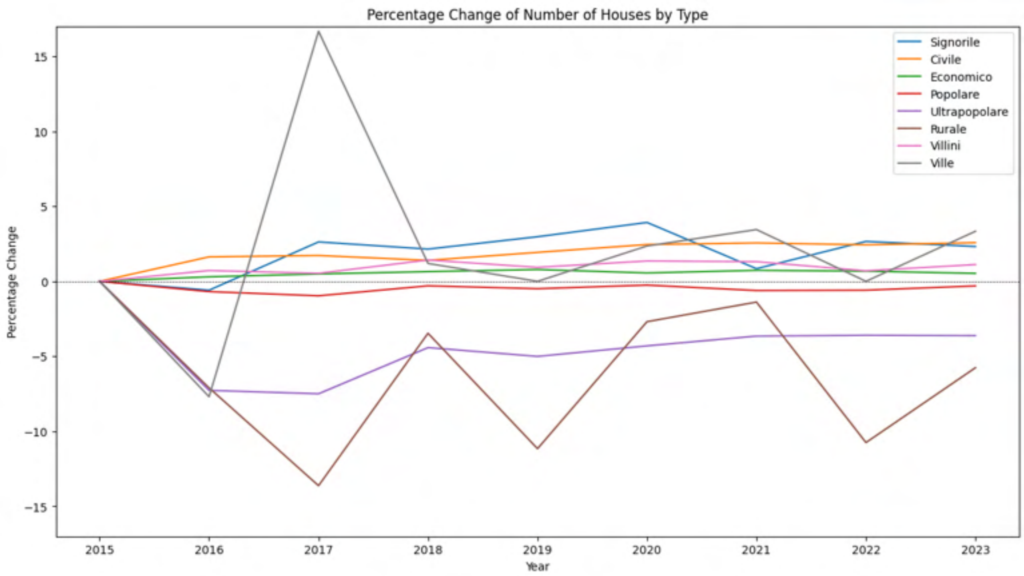


Figure 8: *Percentage Change of Number of Houses by Type in Milan*

Simultaneously, it was necessary acquire yearly eviction statistics from the "Ministero dell'Interno". The data, visualized in Figure 9, exhibits a declining trend in evictions until reaching a trough in 2020. Subsequently, the number of evictions has shown an increasing pattern.

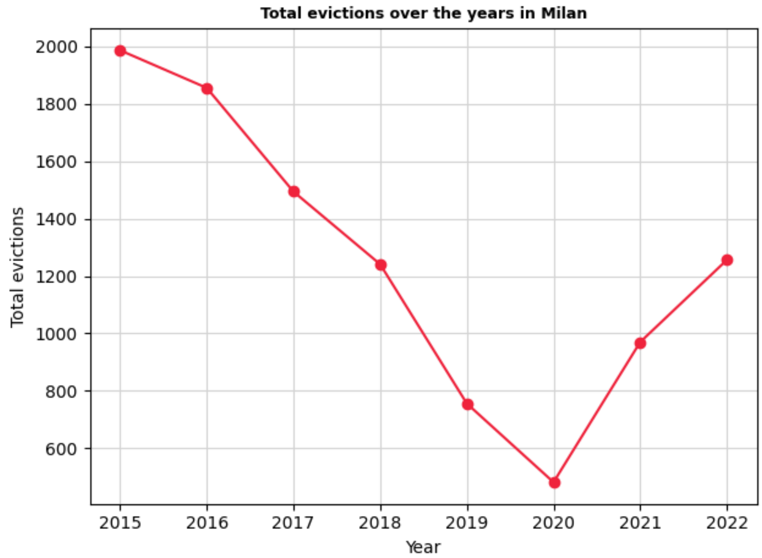


Figure 9: *Total evictions over the years in Milan*

The observed dip in the total eviction in 2020 is likely attributable to a combination of factors such as Government Interventions. Governments worldwide implemented various measures to mitigate the economic effects of the pandemic like rent assistance programs, that may have directly contributed to a reduction in displacement. It's important to note that the decrease in 2020 might be a short-term anomaly. As the pandemic's effects subside and economic conditions normalize, number of eviction may rebound as we can see from the previous plot.

In conclusion, despite a consistent increase in the overall number of residential properties between 2015 and 2022, the Displacement Index has been more influenced by the greater variability in the number of evictions as illustrated in Figure 10.

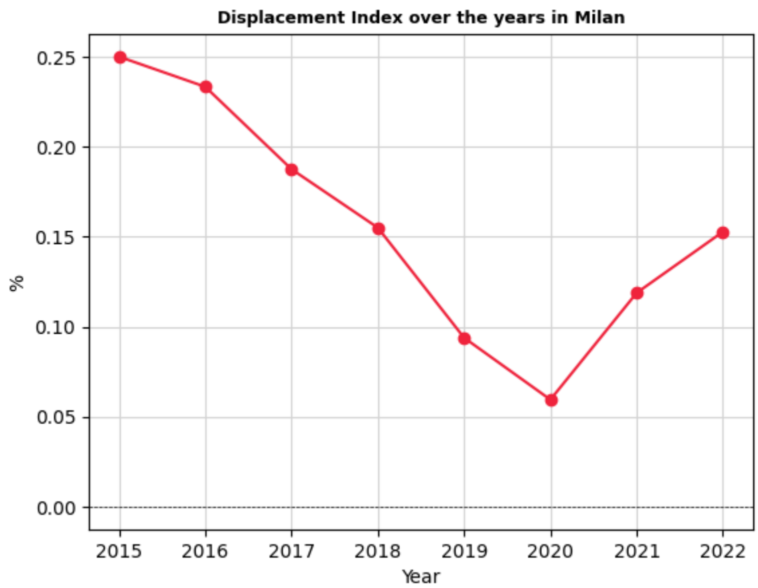


Figure 10: *Displacement Index over the years in Milan*

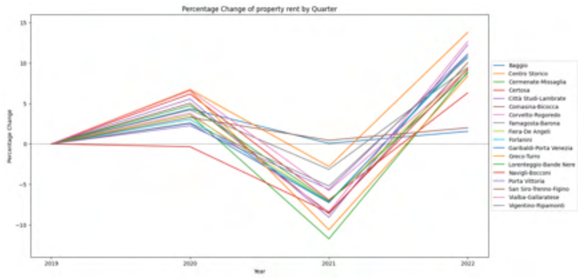
4.5 Gentrification Pressure Index

To analyze the Gentrification Pressure Index of Milan it was used the percentage changes in average rent prices and selling prices of houses across neighborhoods, along with data on the average annual income of Milan residents by neighborhood.

Before analyzing the index, it can be useful analyze the percentage changes of each metric.

As we can see from the percentage changes of property values and rents, the overall trend suggests a gradual increase in prices across most neighborhoods, specially for neighborhood "Navigli-Bocconi" and "Centro Storico".

(a) Percentage Change of property value by neighborhood



(b) Percentage Change of property rent by neighborhood

Rent values can provide insights into short-term market dynamics and not fully capture the long-term value of a property. Therefore for the compute of the Gentrification Pressure Index, a lower weight of 0.3 was assigned to rent values, while a weight of 0.7 was assigned to selling prices of houses.

Taking in consideration the percentage changes of income values by neighborhood, as we can see from figure 12, similarly with the previous graph there is an increase in income of Milan residents in most neighborhoods. This trend is particularly evident in the 'Garibaldi-Porta Venezia' neighborhood, while more peripheral areas experienced less pronounced income growth.

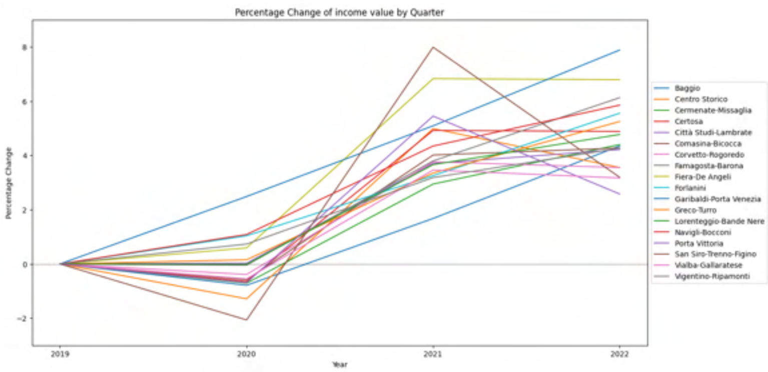


Figure 12: *Percentage Change of income value by neighborhood*

After computing the index, as can be seen in figure 13, the analysis reveals a significant increase in housing costs relative to income levels, particularly in the 'Città Studi Lambrate', 'Greco Turro', and 'Centro Storico' neighborhoods. Factors contributing to this trend include their proximity to the city center and the increasing demand for residential properties in areas with nearby universities

Anno	Baggio	Centro Storico	Cermenate-Missaglia	Certosa	Città Studi-Lambrate	Comasina-Bicocca	Corvetto-Rogoredo	Famagosta-Barona	Fiera-De Angeli	Forlanini	Garibaldi-Porta Venezia	Greco-Turro	Lorenteggio-Bande Nere	Navigli-Bocconi	Porta Vittoria	San Siro-Trenno-Figino	Vialba-Gallaratese	Vigentino-Ripamonti
2020	-7.451573	-8.119672	-18.515000	-21.406646	346.019521	-19.576524	-24.843014	-232.047300	11.434050	13.137372	3.351167	80.193579	-682.067599	4.905736	-11.965774	-2.420355	-8.588099	12.272633
2021	2.397496	-0.935282	1.650011	0.031311	-0.285119	0.082984	0.598720	-0.347263	-0.183472	1.545728	-0.565152	0.387602	0.089690	-0.779460	0.865957	0.243729	-0.292138	1.534433
2022	0.906323	2.051594	1.628534	1.597936	1.943119	2.041715	2.481962	1.207028	0.816389	1.195169	0.927930	1.269594	1.169973	0.906188	3.205491	1.798623	2.656690	1.520503

Figure 13: *Gentrification Pressure Index by neighborhood over the years*

5 Conclusion

The analysis of Milan's housing market reveals significant challenges posed by gentrification and rising property values. As the city modernizes and attracts global investment, the resulting increase in housing costs has strained affordability, particularly for lower-income residents. This growing economic divide threatens to displace long-standing communities and erode Milan's cultural and social diversity.

5.1 Policy Recommendations and Optimizations

Addressing these issues requires a multi-faceted approach. One effective strategy could be to implement inclusionary zoning policies. These policies would mandate that a percentage of new residential developments be reserved for affordable housing. By ensuring that new construction benefits a broader range of income levels, the city can help prevent the displacement of existing residents and promote more inclusive urban growth.

Introducing rent control measures is another critical step. By limiting the rate at which rents can increase annually, these measures would offer greater stability for renters and protect them from rapid rent hikes that could lead to displacement. This approach would help ensure that renting remains a viable option for many residents and reduce financial pressure on low- and middle-income households.

Supporting community land trusts represents a proactive approach to preserving affordability. These trusts allow communities to collectively own and manage land, preventing it from being sold to the highest bidder and ensuring long-term affordability. Empowering local residents with a stake in their neighborhoods can help maintain the social fabric of communities facing gentrification pressures.

Enhancing tenant protection programs is also essential. By providing legal support for renters facing eviction and ensuring that displaced residents have access to alternative housing options, these programs can mitigate the negative impacts of rising housing costs. This approach helps safeguard renters' rights and reduces the risk of homelessness.

5.2 Ethical and Social Implications

The proposed policies must be approached with careful consideration of their ethical and social implications. Inclusionary zoning aim to promote social equity, but it is crucial to design these measures in a way that avoids unintended consequences, such as the concentration of affordable housing in specific areas, which could perpetuate segregation.

Rent control and investment in affordable housing may have mixed economic effects. While these measures protect vulnerable populations, they might also impact the profitability of real estate investments. Policymakers must strike a balance to maintain a healthy housing market while addressing affordability concerns.

Finally, addressing gentrification and displacement is crucial for preserving the cultural and social fabric of neighborhoods, ensuring that development does not come at the cost of erasing the historical and cultural significance of these areas.

In conclusion, while Milan's rapid urban transformation presents significant challenges, it also offers an opportunity to discover how cities can grow in a sustainable way. By implementing inclusive policies, Milan can navigate the complexities of modernization while safeguarding the interests and well-being of all its residents.

References

[1] https://journals.sagepub.com/doi/10.1177/08854122211051603

[2] https://www.researchgate.net/publication/256033580_Housing_Affordability

[3] chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://www.sunia-milano.it/files/sunia_cgil_conf_stampa_30-09-10.pdf

[4] https://www.investopedia.com/terms/a/affordability-index.asp

[5] https://mutui.segugio.it/news-mutui/00008883-case-a-milano-tante-opportunita-per-tutte-le-fasce-di-prezzo.asp

[6] https://www.landlordstudio.com/blog/rent-to-income-ratio#:~:text=As%20a%20general%20rule%20of,three%20times%20the%20rent%20amount.

[7] https://www.ilsole24ore.com/art/milano-5-anni-rialzi-prezzi-case-oltre-40percento-AFzkKOk

[8] https://www.gromia.com/blog/news/gentrificazione-a-milano/#:~:text=La%20gentrificazione%20a%20Milano%20%C3%A8,prezzi%20immobiliari%20e%20trasformazioni%20sociali.

[9] https://www.linkiesta.it/2022/05/latronico-isola-milano/

[10] https://www.idealista.it/news/immobiliare/residenziale/2024/05/15/181017-i-quartieri-piu-richiesti-per-comprare-casa-in-italia-nel-i-trimestre-2024#:~:text=Il%20primo%20posto%20%C3%A8%20occupato,Centro%20Storico%20(917.720%20euro).

[11] https://umap.openstreetmap.fr/en/map/cap-di-milano_169260#11/45.4713/9.2489

[12] https://www.idealista.it/sala-stampa/report-prezzo-immobile/vendita/lombardia/milano-provincia/milano/

[13] https://dati.comune.milano.it/dataset/ds531_distribuzione-del-reddito-complessivo-delle-persone-fisiche-2008-avanti

[14] https://dati.comune.milano.it/dataset/ds1996-quotazioni-immobiliari-omi-compravendita-e-locazione-riepilogo

[15] https://www.agenziaentrate.gov.it/portale/web/guest/schede/fabbricatiterreni/omi/pubblicazioni/statistiche-catastali

[16] https://ucs.interno.gov.it/ucs/contenuti/Andamento_delle_procedure_di_rilascio_di_immobili_ad_uso_abitativo-168224.htm