PNAS

Gentrification and access to housing in Mexico City during 2000 to 2022

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We conducted a spatial and temporal analysis of housing patterns in Mexico City by utilizing an extensive database of 16,000 prices for flats and houses, covering the period from 2000 to 2022. Our findings reveal a striking trend: The average housing prices have quadrupled over a 20-y period, without considering inflation. In contrast, the per capita labor income of Mexican citizens has declined relative to inflation. As a result, the average family encountered four times greater challenges in accessing housing in 2015 as compared to 2005. Furthermore, our research demonstrates that areas that have undergone significant gentrification or super-gentrification contribute to a widespread increase in land value on neighboring zones, leading to the emergence of clusters of highly expensive neighborhoods.

gentrification | housing | Mexico City | segregation | inequality

In Mexico City, as in numerous urban areas in Latin America, the dominant perception concerning housing access is largely negative. This concern is particularly significant among the millennial generation, encompassing individuals born between 1980 and 2000, who encounter highly restricted housing opportunities (1). A significant contributing factor to this problem is rooted in Mexico's political landscape and land use policies, which discourage vertical construction (2). The consequences of inadequate housing access are significant, with millions of individuals forced to endure lengthy commutes of 2 h or more from their homes to their workplaces or educational institutions, followed by equally strenuous journeys back home. This not only leads to a considerable waste of time and energy but also exacerbates vehicular traffic in the city, leading to severe instances of air pollution (3).

The population of Mexico City stands at approximately 9.2 million residents (4), and an additional 1.3 million people commute from the State of Mexico, the metropolitan area of the capital city, to work or study (5). Interestingly, between 2015 and 2020, the number of people leaving Mexico City surpassed the number of new arrivals, over this period, a total of 83,000 individuals relocated from Mexico City to the State of Mexico (6). Another concerning statistic indicates that around 20,000 families are displaced each year (7). This phenomenon can be attributed to the exorbitant housing prices in Mexico City, which stem from various factors such as gentrification, political movements, and land use dynamics. To gain insights into this matter, our study conducted a comprehensive analysis of the spatio-temporal patterns of housing in Mexico City from 2000 to 2022.

This study focuses on examining the dynamics of gentrification in Mexico City, which entails the transformation of low or medium-income neighborhoods due to an influx of wealthier residents and investments. This process often results in increasing property values, cultural transformations, and the displacement of long-time residents, and it may occur over an extended period (8). We also analyzed super-gentrification, which refers to the phenomenon where an already gentrified area further intensifies its exclusivity (9). An example of this is observed in the Polanco district, originally built in the 1930s to accommodate the middle and high-income classes (10). Colonia Condesa, another example of a previously gentrified area, experienced its transformation during the 1990s (11). These areas have acted as catalysts for the gentrification of surrounding zones, a trend that has also been observed in cities like New York and London.

Method and Data

Softec Database. Our methodology relied on the housing dataset provided by the Mexican housing consulting firm, Softec. This dataset consists of information on 16,000 flat buildings from 2000 to 2022 in Mexico City, including features such as the flat size in square meters, location coordinates (x-y), neighborhood, year of sale and price in Mexican pesos.The dataset comprises new housing complexes (mainly focused

Significance

Gentrification in Mexico City is impacting housing accessibility and displacing its residents. To demonstrate this claim, we use two datasets and scraped data to observe temporal and spatial trends of housing in Mexico City. Our research reveals a general four-fold decrease in housing accessibility from 2005 to 2015, which may explain the outflow of Mexico citizens in recent years. Non-gentrified zones suffered a three-fold price increase from 2000 to 2022, whereas super-gentrified Polanco district experienced an eight-fold increment from 2000 to 2018. Gentrification primarily spread through exclusive neighborhoods along main avenues, forming a circuit of highly expensive residential areas.

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in middle and high-income groups), many of them are located at the center of Mexico City or along Insurgentes Avenue. The neighborhoods with the higher number of flats are Narvarte, Del Valle, and Polanco, respectively.

Web Scraping Algorithm. We performed web scraping to gather data on approximately 20,000 flat offers in Mexico City specifically for the year 2022. These offers included information on the flat size in square meters, prices in Mexican pesos, and the corresponding neighborhood. Web-scraped data contains flats for sale (new and old) for all the 16 Alcaldías in Mexico City. Bank auction flats were not taken into consideration as they are strongly associated with irregular sales below market prices (12). In fact, web-scraped data revealed bank auction flats that may be discounted by as much as 95% compared with regular prices in the same neighborhood. We filtered duplicated flat offers and use the Python language with the BeautifulSoup library. The neighborhood with the most flats was Polanco (1400).

CONEVAL Dataset. We used The National Council for the Evaluation of Social Development Policy (CONEVAL) dataset to access the income ranges from Mexico City citizens (13). The dataset consists of per capita labor income for Mexico City citizens from 2005 to 2022. CONEVAL also adjusted their data to the inflation effect, so a decrease with respect to the time frame indicates that inflation is growing faster than the income. For calculating the annual family income, we considered a four-person family that saves 25% of their labor income over the course of 1 y.

Derivative. We computed the derivative of the prices to obtain the year an specific neighborhood (or all neighborhoods of Mexico City) reached its highest price increment. We use the following formula:

$$\frac{dP}{dt} = P(t+1) - P(t),$$

where $P(t)$ indicates the price at year t, and $\frac{dP}{dt}$ is the derivative of the price P with respect to the time.

Results

Price and Access to Housing from 2000 to 2022. Fig. 1 showcases various aspects of housing in Mexico City. First, the upper part of the figure presents the average price per square meter (in Mexican pesos) for housing in the city. Over the period from 2000 to 2022, this value has increased sixfold. The derivative of the average price indicates that the most substantial price increments occurred during the years 2014 to 2016, coinciding with the administrations of former president Enrique Peña Nieto and former Mayor Miguel Angel Mancera.

In the middle of that same graph, the average price per square meter is adjusted for inflation. This adjusted price reflects a fourfold increase, indicating that only one-third of the housing price growth is attributable to inflation. Additionally, the figure includes data on annual family labor income obtained from the CONEVAL dataset (13). This income is also normalized for inflation. It is noteworthy that considering a family's ability to save 25% of their income for housing expenses, the annual income in 2005 would have allowed the purchase of $3\,\mathrm{m}^2$, whereas by 2015, it would not be sufficient for even $1\,\mathrm{m}^2$.

The bottom of that same figure presents the number of years required for a family to afford a 50-m^2 flat in Mexico City. In 2005, it took approximately 20 y to purchase such a flat, whereas by 2020, it would take more than 80 y, highlighting the increasing difficulty for families to achieve homeownership in the city.

It is worth mentioning that the influx of digital nomads, which significantly increased during the COVID-19 pandemic, does not appear to significantly impact the dynamics of housing access (Fig. 1, *Middle*) or the number of years needed to afford a regular
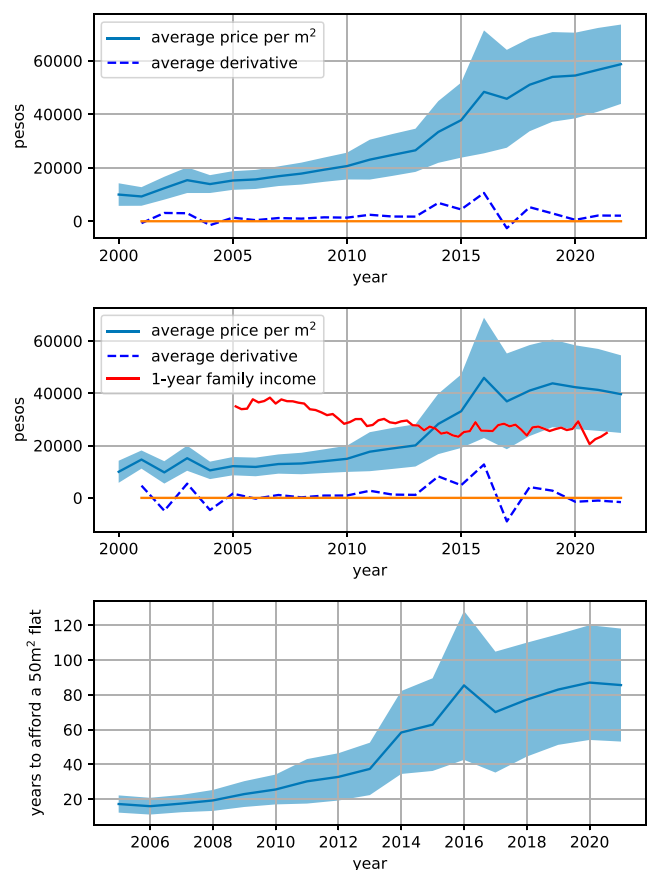

Fig. 1. Accessibility of housing in Mexico City. In the *Top* graph, the average price of housing per square meter is depicted, with the shaded area representing the SD. The *Middle* graph showcases the inflation-normalized average price of housing per square meter, along with the annual family labor income (represented by the red line) and the shaded area denoting the SD. The *Bottom* graph displays the number of years required for a family to afford a 50-m^2 flat in Mexico City.

flat (Fig. 1, *Bottom*). Additionally, it may be too early to observe the full impact of these newcomers on housing access, as of 2022, the number of foreigners living in Mexico City was reported to be 11,000 (14). This population is relatively small when compared to the annual displacement of 15,000 to 80,000 individuals. However, it is worth considering that income inequality between average citizens and digital nomads could potentially worsen the issue of housing access (15), although we believe it is not the primary cause. Based on our analysis, we infer that displacement and gentrification predominantly originate from government policies and politics.

Gentrification Dynamics in Mexico City. Fig. 2 presents the observation of trendy neighborhoods. The graph indicates the specific year that recorded the largest increment in housing prices within the 2000 to 2022 period. For instance, Condesa neighborhood (super-gentrified zone) experienced its most substantial increase in 2013, while popular neighborhoods like Doctores, Obrera, and Guerrero saw their increments in more recent years.

Polanco, a well-known upscale area, registered its highest increment in 2017. Additionally, Pensil, a neighboring zone near Polanco, exhibited an increase in 2018. Another notable case is Xoco, which is recognized as a gentrification zone resulting from the Mtikah tower, a high-profile urban development project. Xoco experienced its most significant increment in 2018, a trend
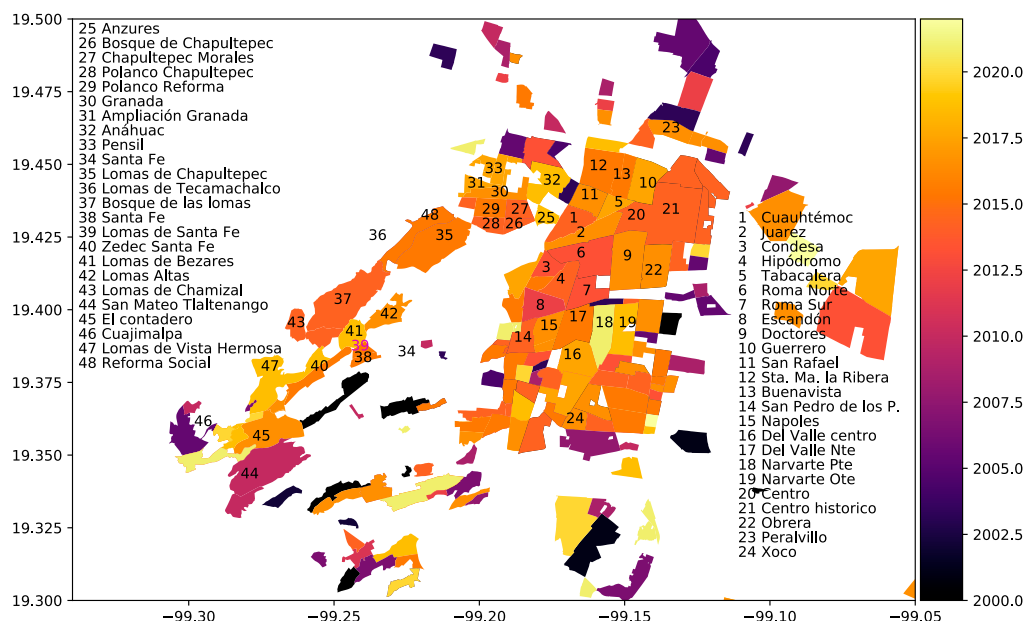
Fig. 2. Gentrification dynamics are depicted in the graph, with the color range indicating the year in which each neighborhood experienced the highest price increment. Trendy neighborhoods such as Condesa, Hipódromo, Roma Norte, and Roma Sur witnessed significant increases in prices around 2013 to 2014. These increments subsequently influenced the surrounding neighborhoods, including Juárez, Doctores, Tabacalera, Nápoles, Del Valle, Narvarte, and others, causing their costs to rise in the following years.

attributed to the construction of luxury flats and developments in the area.

Next, to determine the effect of gentrification in the growing price behavior, we show in Fig. 3 the average price in Mexican Pesos per m² for the super-gentrified Polanco, gentrified Pensil neighborhood and Iztapalapa Alcaldía. Polanco showed a rapid price increment since 2010, and reached an eight-fold increase from 2000 to 2018. After 2018, the price seems to deal with market saturation and no longer overpass inflation. Gentrified Pensil, formerly a popular neighborhood, also suffered a seven-fold increment from 2000 to 2022 mainly caused by Polanco proximity. The popular Iztapala Alcaldía, located at the east of

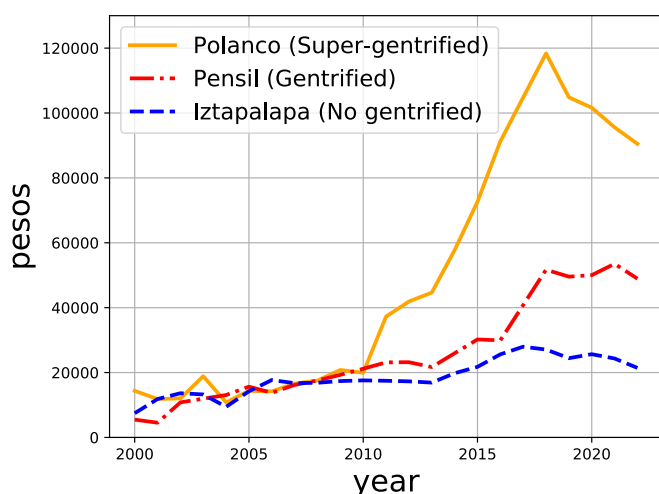Mexico City, experienced a three-fold increment from 2000 to 2022, indicating a general price trend.

The findings suggest that the increases in trendy locations and the presence of mega-developments stimulate price increments in the surrounding areas, indicating a spillover effect.

Cluster of Gentrified Neighborhoods. Regarding Fig. 4, we conducted web scraping to collect data on approximately 20,000 flat offers across all 16 alcaldías of Mexico City, specifically for the year 2022, where the highest housing costs are concentrated in the central and eastern parts of Mexico City, particularly along Insurgentes Avenue from north to south, Reforma Avenue from east to west, and Constituyentes Avenue in the eastern region. The two primary areas, or Alcaldías, associated with the highest prices are Cuauhtémoc and Miguel Hidalgo. The most expensive zones are Reforma-Polanco and Bosque de Chapultepec, followed by Cuauhtémoc and Tabacalera. Moreover, at the top of expensive neighborhoods are Granada and Ampliación Granada (also known as Nuevo Polanco), and trendy neighborhoods like Condesa and Roma. Mitikah mega-project exerts its influence as its neighborhood (Xoco) is the unique from Coyoacán alcaldía that appears in the top of expensive neighborhoods. It is worth mentioning that the empty neighborhoods and Islands that are surrounded by expensive prices at the west, most of them correspond to urban green zones with no principal avenues.

Discussion

We analyzed the dynamics of price housing and gentrification in Mexico City from 2000 to 2022. We showed that the access to housing decreased drastically for this period, and the increment of house prices may explain the outflow of Mexican citizens in recent years (4, 6). The highest housing costs are concentrated in the central and eastern parts of Mexico City. The highest price corresponds to the Chapultepec-Polanco zone, which can be attributed to better environmental conditions that attracted wealthy residents in the last century, and even the
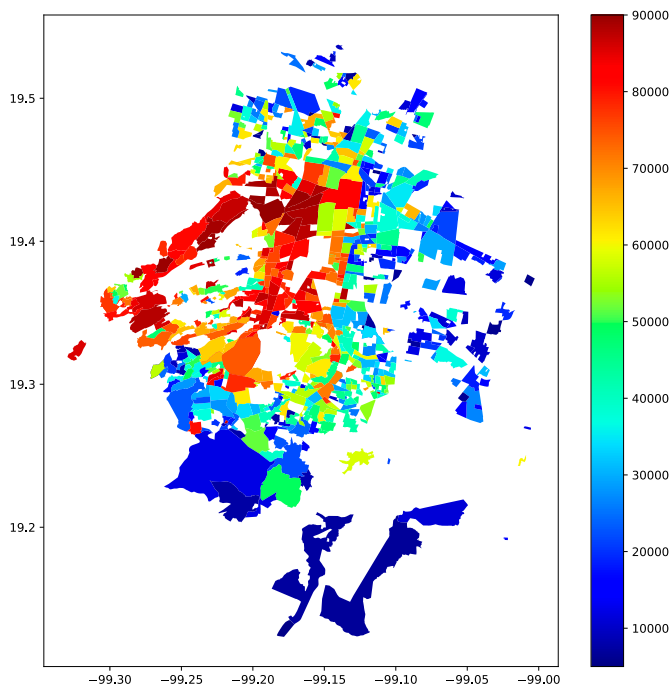

Fig. 3. Price per m² in Mexican pesos for super-gentrified, gentrified, and no gentrified zones, without considering inflation. The Polanco district suffered an eight-fold increase from 2000 to 2018, however, the price has fallen in comparison with inflation in recent years. Gentrified Pensil, which is near to Polanco (around 0.5 km far from Polanco) presents a seven-fold increase. Iztapalapa Alcaldía shows a three-fold price increment.

Fig. 4. Price per m² (in Mexican pesos) of housing in Mexico City, 2022. Average price of housing segmented by neighborhoods obtained from web-scraped data.

presidential quarters were established near Chapultepec from 1934 to 2018, intensifying the sense of exclusivity in the surrounding area even further. Moreover, housing price did not grow homogeneously, not gentrified Iztapalapa presented a three-fold increment, whereas Polanco district showed an eight-fold increment, indicating that most of its price increment is due to gentrification. Web scraping reveals that some neighborhoods (like Polanco) could be more than ten times more expensive than others (Fig. 4), significantly influencing the estimated time required to afford a flat or a house. (Fig. 1). The center-to-edge gradient of costs (Fig. 4) are well predicted by the Alonso/Muth model (16), meaning job location strongly influences house prices, as private companies and administrative buildings are located along Insurgentes and Reforma avenues.

The widespread of super-gentrification in Polanco and Condesa districts promoted the gentrification of a larger cluster in neighboring areas. The accelerated increment of housing prices was mainly driven by the principal avenues such as Insurgentes, Reforma, Constituyentes, and Periférico, creating a circuit of gentrified and super-gentrified zones. This phenomenon is quite similar to that found in New York and London cities. For instance, the super-gentrified Manhattan diffused gentrification to Brooklyn and Bronx, also known as cascading effect (9, 17). For Brooklyn, Flatbush avenue, Williamsburg bridge, and Broadway avenue were the channels to gentrify Brooklyn heights, Bedford-Stuyvesant, and Park Slope neighborhoods. On the contrary, at the center of the Mexico City gentrified circuit, composed of urban islands but no principal avenues, is not predominantly characterized by high costs. However, there is a possibility of accelerated gentrification diffusion in the upcoming years.

It is worth mentioning that there is not sufficient data to do a full hedonic price model, which involves a uniform bidding for the different sub-markets (18). For example, Iztapalapa Alcaldía (117 km²) comprised 440 offers in Softec database, whereas Polanco district (4 km²) conformed 900 offers.

Overall, this study examines gentrification in an emerging country where citizens have relatively low economic incomes, making displaced individuals more vulnerable to insecurity and limited access to essential services such as healthcare and education. Mexico City requires immediate implementation of social housing initiatives that have been neglected since the 1990s (19), which involves combating corruption and ending the exclusive benefits given to developers. Without such changes, only the affluent high-income class will be able to afford housing.

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