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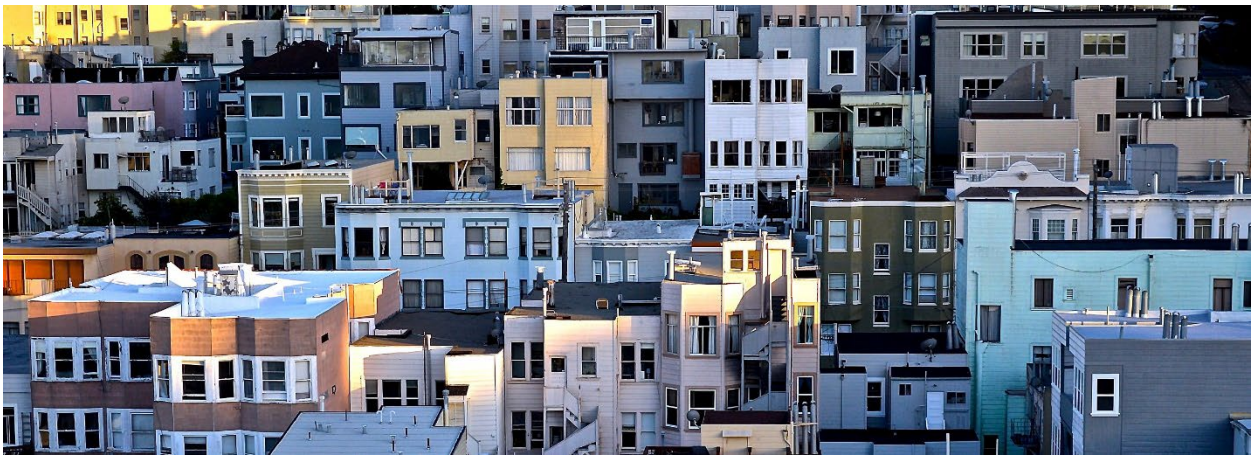

Linking Housing Costs, Land Use Regulation, and Fair Housing

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Key Takeaways

- This report develops a quality-adjusted measure of housing price increases for five large coastal cities in California: Los Angeles, Oakland, San Diego, San Francisco, and San Jose.
- In four of these cities, lower-income residents generally experience more rapid housing cost increases than higher income residents. This is a problem, because lower-income residents are also more likely to be renters. Renters are harmed by cost increases, whereas homeowners benefit. Moreover, lower-income residents are more likely to be people of color, so that the relatively high cost increases that they experience result in racial inequities.
- Increasing housing supply in lower-density, higher-income neighborhoods by facilitating the development of diverse housing types could help alleviate rapid increases in housing costs in lower-income neighborhoods.
- Local planners can use the housing price indices developed for this study to assess whether existing regulation promotes housing development in an equitable manner.

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Introduction

Westlake, located 2.5 miles from downtown Los Angeles, is home to a largely Latino population and is one of the densest neighborhoods in Los Angeles. The neighborhood has a long history of underinvestment, and members of the community face a series of problems such as inadequate trash collection and poorly maintained, overcrowded apartments.[1] Robert Rodriguez lived in an apartment in Westlake. In 2018, Rodriguez and other tenants of the building faced rent increases of more than $250.[2] "After everything I've been put through, I won't do it," Rodriguez said.[3] Tenants of the apartment complex said they were living with pest infestations, inconsistent access to hot water, and a backlog of maintenance problems.[4] But, despite the substandard living conditions, moving elsewhere in Los Angeles or nearby cities did not seem to be a viable option for Rodriguez or many other tenants in the building, due to the high rents throughout the region.

Rodriguez's experience is part of the severe housing affordability crisis in California: a shortage of affordable housing that hits lower-income households particularly hard. Lower-income households must spend a larger share of their incomes on housing, and they are more likely to be renters. Only 41% of the households earning less than $75,000 owned a home as of the 2020 American Community Survey (ACS), as compared to the statewide homeownership rate of 55%.[5] Among renter households earning less than $75,000 in 2020, 72% were rent-burdened (i.e., spending at least 30% of their incomes on rents), whereas 15% of renter households earning $75,000 or more were rent-burdened. Unlike homeowners, who typically benefit from appreciating home values, renters are harmed by rising rents. The situation is even more dire for lower income households when prices are appreciating more quickly in lower-income neighborhoods than in higher-income neighborhoods, and – as this report demonstrates – such is the case in Los Angeles.

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1 See Marisa Clifford, *Why doesn't MacArthur Park gentrify?*, CURBED LA (January 26, 2017), https://la.curbed.com/2017/1/26/14391534/macarthur-park-development-street-vending-gentrification.

2 Elijah Chiland, *More than 80 tenants launch multi-building rent strike in Westlake*, CURBED LA (April 10, 2018), https://la.curbed.com/2018/4/10/17216952/westlake-rent-strike-tenants-union-eviction-defense.

3 Christian Monterrosa, *Burlington rent strike is over, but tenants continue to organize*, CURBED LA (2018, September 21), https://la.curbed.com/2018/9/21/17887348/burlington-rent-strike-westlake-union-evictions.

4 Chiland, *supra* note 2.

5 U.S. Census Bureau, American Community Survey, 2020 5-year estimates. These estimates are based on data collected over a 60-month period, from 2016 to 2020. For census tracts, multiyear estimates are the only available demographic data, apart from the decennial census. The relevant tract-level data from the 2020 Census are not available as of the publication of this report.

Why would housing prices appreciate more quickly in lower-income neighborhoods? Economic theory suggests that demand for housing is relatively high in these neighborhoods. This demand is clearly not driven by some characteristics of these places, such as relatively high pollution burdens and relatively limited access to parks and well-resourced schools. But higher demand for housing in lower-income neighborhoods, as revealed through faster price appreciation, could occur if these neighborhoods provide something that is unavailable (or much less available) in wealthier neighborhoods. That "something" could be housing at varied price points, housing accommodating a range of sizes and tenure options (e.g., rental and ownership), or access to public transit.

Throughout the U.S., higher-income, white-majority neighborhoods offer few rental opportunities,[6] and subsidized housing units and public transit are often sited in neighborhoods where low-income and minority households are concentrated.[7] As a result, relatively low-income, low-resourced neighborhoods often absorb housing demand from both lower-income households *and* moderate- to higher-income households who cannot afford housing in wealthier, single-family neighborhoods. Higher price appreciation in lower-income neighborhoods may also stem from developers' competition for land for future development (or redevelopment). In Westlake, for example, multiple development projects including apartments, hotels, and mixed-use projects are underway.[8]

This study seeks to inform local planning practice by examining changes in neighborhood housing prices. We develop census tract-level quality-adjusted housing price indices and identify housing price hotspots in five large coastal cities: Los Angeles, Oakland, San Diego, San Francisco, and San Jose. Housing price hotspots are defined as tracts with appreciation rates above the citywide trend. We then address two research questions: (1) how do socioeconomic characteristics differ between housing price hotspots and the rest of the city; and (2) where does local planning facilitate multifamily development?

This study highlights two common patterns, focusing on the five study cities. First, in four of the five study cities, tracts with greater housing price appreciation generally have higher density, lower median incomes, and a higher concentration of renters, indicating that housing in these locations is highly sought after and that the burdens of rising costs have disproportionately fallen on lower-income and renter households. Second, in three of the five study cities, local governments were more likely to permit multifamily development in places where developers are allowed to build at a higher density. Overall, this study points to the need for increasing

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6 HARVARD JOINT CENTER FOR HOUSING STUDIES, AMERICA'S RENTAL HOUSING 2022 (2022), https://www.jchs.harvard.edu/sites/default/files/reports/files/Harvard_JCHS_Americas_Rental_Housing_2022.pdf.

7 Vincent J. Reina et al., *Are Location Affordability and Fair Housing on a Collision Course? Race, Transportation Costs, and the Siting of Subsidized Housing*, 21 CITYSCAPE 125 (2019).

8 Bianca Barragan, *Mapping the changes on Westlake's horizon*, CURBED LA (November 27, 2017), https://la.curbed.com/maps/westlake-development-hotels-mixed-use-construction.

housing supply and facilitating the development of diverse housing types in lower-density, higher-income neighborhoods.

How can neighborhood housing price changes inform local land-use planning?

We undertook this study to assess whether analyzing housing price appreciation across neighborhoods could help local governments in California meet the statutory requirement of promoting housing development in an equitable manner. California's Housing Element Law establishes processes for determining regional housing needs and allocating these housing needs to cities and counties in the form of numerical targets. Upon receiving the allocations, each local government must update the housing element of its general plan and identify sites with the capacity to accommodate the development of the allocated housing units. Local governments must promote the statutory objective of affirmatively furthering fair housing by facilitating the development of lower-income housing units outside low-resourced, high-poverty, or segregated areas.

The efficacy of the state's planning system in part depends on the ability of local governments to assess the housing needs and development potential within their jurisdiction and facilitate development opportunity in high-resourced places. Examining changes in neighborhood housing prices could potentially help local governments identify neighborhoods experiencing relatively strong demand from home-seekers and developers and shed light on the potential drivers of such demand.

Differences in neighborhood price appreciation can reveal the **housing needs** of a community. For example, if the primary driver of housing price increases in a city is the demand for amenities and resources that are mostly available in higher-income neighborhoods, we expect to see housing prices increase faster in these neighborhoods relative to other parts of the city. On the other hand, housing needs of lower- and moderate-income households may be particularly strong in a city. While neighborhoods with high-quality amenities and low crime rates would be ideal locations for many home-seekers, those with limited financial means are in dire need of lower-cost housing. Such housing is typically outside affluent single-family neighborhoods where the supply and types of housing are extremely limited. Therefore, relatively high price appreciation in lower-income neighborhoods can indicate strong demand for lower-cost housing in a city.

In addition, variation in neighborhood price appreciation can reveal **development potential under existing regulation**. Local land-use law consists of zoning – which specifies the

permitted and prohibited land uses as well as development standards – and the procedural requirements for approving a proposed development. Land-use regulation has long prevented multi-family development from occurring in single-family neighborhoods. A site with high development potential has a higher chance of being developed (or redeveloped) relative to other sites in the city. When it gets redeveloped, developers are likely to build at a higher density, if allowed to do so. Sites where only single-family homes are legally permitted will likely have low development potential under existing regulation because the potential profits from redeveloping the sites are likely to be lower compared to building higher-density housing. Tracts with relatively high price appreciation rates and high existing density will likely have relatively high development potential under existing regulation. Such tracts can enable higher returns for developers compared to other parts of the city and will more likely allow housing types other than single-family homes.

If local planning is responsive to potential residents' housing needs and preferences, larger supply and more diverse types of housing should be allowed in places where people want to live most. People will compete for housing in these locations, and developers will compete for these relatively desirable sites and supply the amount of housing in response to demand. In practice, however, land-use regulation is typically restrictive in expensive, amenity-rich neighborhoods. To the extent that this is the case, housing price appreciation rates may be higher in places with lower socioeconomic status, driven in part by residents' competition for housing types that are not (or much less) available in other parts of the city and by developers' competition for land allowing development options other than single-family homes. Local planning and land use policies allowing high-density development only in lower-socioeconomic locations will exacerbate the affordability and equity issues by perpetuating price hikes in places where lower-income and renter populations live and by limiting access to high-quality, high-resourced neighborhoods.

The key implication for local planning is that housing prices may increase faster in lower-income, lower-resourced areas *as a result* of existing development patterns and regulation. Local planning should not simply promote development in locations that have strong housing demand and high development potential as identified by comparing neighborhood price appreciation. Instead, intra-city price appreciation should first be examined to understand the housing challenges facing the community.

By examining the intra-city patterns of housing price appreciation in five large coastal California cities, we find that opening up exclusive single-family neighborhoods has at least two potential benefits in terms of addressing housing needs: (1) reduced upward price pressure in neighborhoods that are concentrated with lower-income and renter households, and (2) improved housing options that allow low- and moderate-income households to better match residential locations and dwelling unit types with their preferences. In planning for future housing needs, local governments should not neglect places with relatively low development potential

under existing regulation (e.g., relatively slow appreciating single-family neighborhoods) but take meaningful actions to promote development opportunity in high-resourced locations.

Data and Methods

Our analysis focuses on five large coastal California cities in five different counties: Los Angeles, San Diego, Oakland, San Francisco, and San Jose. We first use a hedonic imputation approach to estimate census tract-level **housing price indices (HPIs)** – a quality-adjusted measure of housing price increases – for each study city from 2012 through 2018. Higher HPIs within a city indicate places with higher price appreciation rates. We identify local **housing price hotspots** of each study city as tracts with HPIs above the citywide trend. Next, for each city, we draw on the 2014-2018 American Community Survey and compare the demographic and socioeconomic characteristics in hotspot and non-hotspot tracts. We also utilize the Comprehensive Assessment of Land Use Entitlements dataset, as described below, to examine how local planning and development decisions correlate with housing price appreciation rates. This study uses descriptive and bivariate analyses and focuses on the common patterns observed across the study cities. The simple analytical procedures allow for more straightforward interpretation of the results and can be readily applied to other local jurisdictions in practice.

CONSTRUCTING THE HOUSING PRICE INDEX

This research examines neighborhood housing price dynamics through developing census tract-level HPIs using a novel approach and proprietary data furnished by Zillow.[9] The HPI measures each tract's average change in prices over time for a bundle of predetermined home types (e.g., single-family homes and condominium units).[10] Because the constructed HPIs are adjusted for property-specific attributes,[11] the spatial variation in HPIs primarily reflects variation in housing price appreciation attributable to the market's valuation of location. High HPIs could stem from homebuyers' competition for existing housing as well as developers' competition for sites for future development. We detail the procedure of constructing HPIs in the Technical Appendix and briefly explain the novelty of our approach below.

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[9] Data provided by Zillow through the Zillow Transaction and Assessment Dataset (ZTRAX). More information on accessing the data can be found at http://www.zillow.com/ztrax. The results and opinions are those of the authors and do not reflect the position of Zillow Group.

[10] Single-family homes and condominium units are bundled by taking the geometric mean of the predicted appreciation rate of each unit for tracts with a sufficient sample size of both housing types, as detailed in Appendix 1.

[11] Changes in housing prices are also attributable to changes in the market's valuation of property-specific attributes (e.g., number of bedrooms and size of living area). To adjust for property-specific attributes, our hedonic modeling process estimates the market's valuation of property-specific attributes at different points in time.

To construct the HPIs, we use a hedonic imputation approach entailing a standard price index formula measuring the change in the price of a given basket of goods and services during a given time period.[12] This approach differs from conventional hedonic analysis, which estimates housing prices as a function of property structural attributes and location and/or time fixed effects. The hedonic imputation approach we use has several advantages. First, a hedonic imputation approach is more suitable for large cities with many neighborhoods, such as Los Angeles, because a hedonic model that contains a large number of time-location dummies may be inestimable. Second, the use of a double imputation procedure, as detailed in the Technical Appendix, mitigates potential omitted variable bias that often poses serious problems in conventional hedonic modeling.[13] Last, a hedonic imputation approach allows greater flexibility by estimating a hedonic model for each time period (e.g., each year in the study period). Like other widely-used price indices (e.g., the Consumer Price Index), if data on housing transactions in later time periods become available, HPIs estimated for the new time periods can be appended to the HPIs of the initial study period.

COMPREHENSIVE ASSESSMENT OF LAND-USE ENTITLEMENTS

Drawing on the Comprehensive Assessment of Land-Use Entitlements (CALES) dataset, we examine the relationship between the approval of multi-unit residential projects and housing price appreciation rates. The CALES data includes all residential projects of five units or more that were entitled from 2014 through 2017 in selected California jurisdictions and provides detailed histories of the entitlement processes for these projects.[14] The entitlement process is the project approval process developers must complete in order to obtain construction permits.

Under California's land use laws, a proposed project may be subject to discretionary or ministerial review. If the proposed project qualifies for ministerial review, the application must be approved if it complies with applicable objective standards. If the required review is discretionary, the application is subject to additional scrutiny from one or more government agencies even if it conforms to the objective requirements imposed by the applicable zoning ordinance. Once the project application has completed all applicable discretionary reviews, it can proceed to obtain construction permits (e.g., a building permit), which are subject to

[12] Sofie R. Waltl, *Variation Across Price Segments and Locations: A Comprehensive Quantile Regression Analysis of the Sydney Housing Market*, 47 REAL EST. ECON. 723 (2019); Robert J. Hill & Michael Scholz, *Can Geospatial Data Improve House Price Indexes? A Hedonic Imputation Approach with Splines*, 64 REV. INC. & WEALTH 737 (2018).

[13] Waltl, *supra* note 12.

[14] Moira O'Neill et al., *Final Report: Examining Entitlement in California to Inform Policy and Process: Advancing Social Equity in Housing Development Patterns; Prepared for the California Air Resources Board and the California Environmental Protection Agency* (2021), https://papers.ssrn.com/abstract=3956250.

ministerial review.[15] The number and type of discretionary approvals needed vary by project and by local jurisdiction.[16]

By relating the approval of multifamily projects to housing price increases, we examine whether local planning facilitates housing development in places where development potential is high under existing regulation and housing needs are strong in each study city. To the extent that this is the case, such planning practices should be evaluated based on the socioeconomic conditions in higher-appreciating places relative to the rest of the city. For example, the presence of generally lower-income hotspots (relative to non-hotspot tracts) may suggest that people cannot find housing that fits their needs in higher-income, non-hotspot tracts. Limiting housing development in higher-income, non-hotspot tracts will continue to limit access to high-resourced locations for lower-income people and perpetuate the affordability crisis by restricting higher-density development to lower-resourced locations.

Housing Price Trajectories, Hotspots, and Socioeconomic Conditions

We first provide the descriptive statistics of demographic and socioeconomic characteristics as well as citywide quality-adjusted housing price trends for the five study cities. We then define local housing price hotspots of each study city as tracts with housing price growth rates above the citywide trend during 2012 and 2018. As shown below, this time period was marked by rapid housing price increases in all five cities. We then compare various demographic and socioeconomic characteristics between the hotspot and non-hotspot tracts in each city. The purpose of this analysis is to examine the characteristics of locations that may have relatively high development potential under existing land use regulation and strong housing demand.

The five study studies, while varying along a range of demographic attributes (Table 1), all experienced steady housing price growth in the post-financial crisis period of 2012-2018 (Figure 1). The most striking price increase occurred in Oakland, where the citywide HPI increased by 165% from 2012 through 2018. San Diego had the lowest price appreciation rates among the five study cities, yet its citywide HPI increased by over 75% from 2012 through 2018. HPIs in San Jose, Los Angeles, and San Francisco increased by approximately 115%, 97%, and 87% during this period, respectively. Overall, the HPI trajectories show strong demand for housing in all study cities. Figure 2 shows the spatial distribution of housing price hotspots within each study city.

[15] Among the study cities, Los Angeles provides for ministerial review for residential developments that are consistent with applicable zoning requirements and do not exceed 49 units.

[16] O'Neill et al., *supra* note 14.

	Los Angeles	Oakland	San Diego	San Francisco	San Jose
Total population	3,973,278	422,575	1,414,545	874,784	1,029,409
% Hispanic/Latino	48	27	30	15	31
% non-Hispanic White	29	29	42	40	25
% Asian	12	16	17	34	37
% Black / African American	8.8	23	6.1	5.1	2.9
Land area (sq. mi.)	469	56	326	47	178
Density (people/sq. mi.)	8,463	7,555	4,341	18,647	5,775
Median household income	65,290	80,143	83,454	119,136	117,324
Total households	1,402,522	160,095	511,662	362,141	324,340
% renter households	63	59	53	62	43

Table 1. Demographics by Study City
Source. American Community Survey, 2020 5-year estimates.

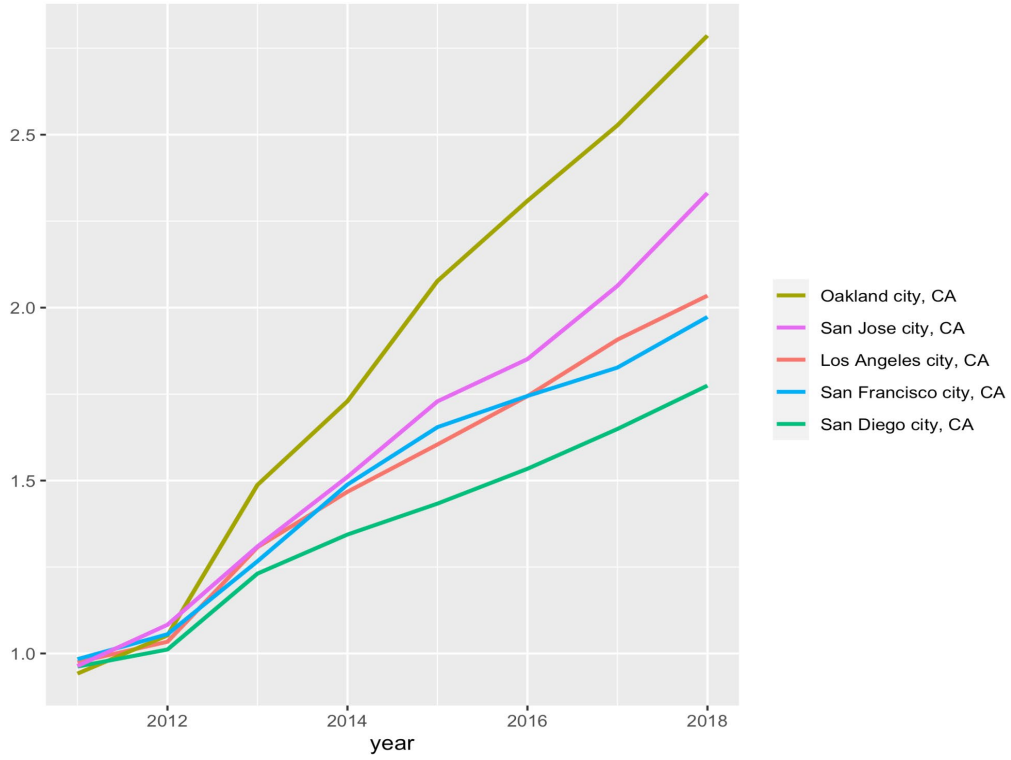
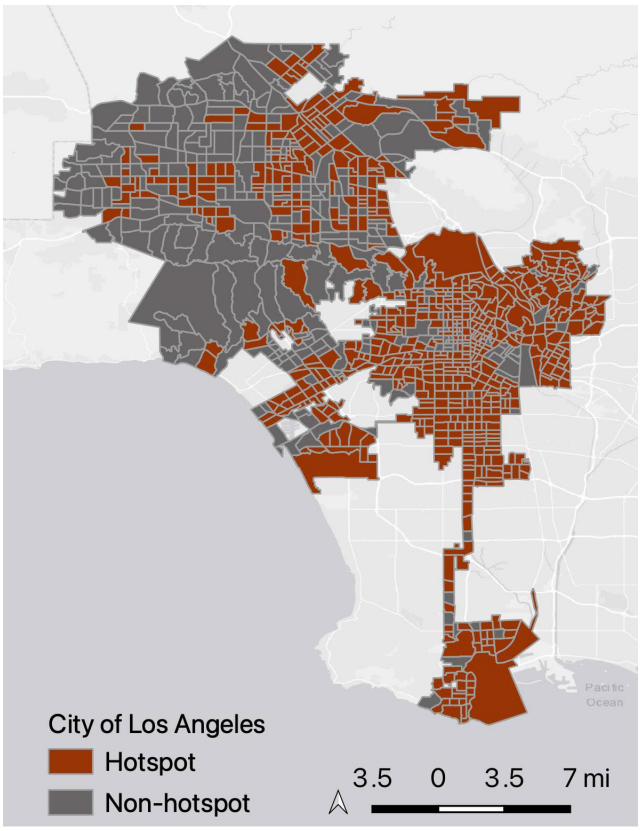


Figure 1. HPI by City, 2011-2018
Note. HPI in 2010 is normalized to 1.


City of Los Angeles
Hotspot
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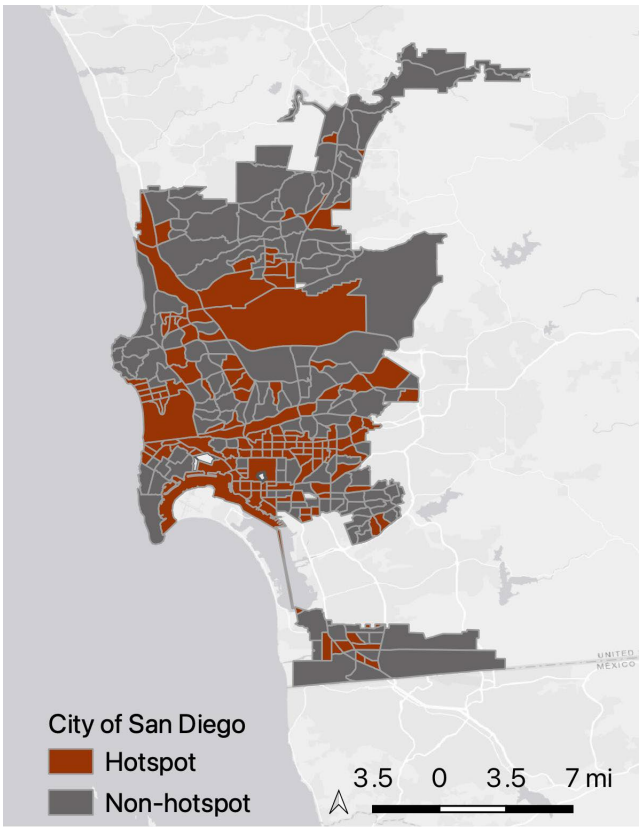
City of San Diego
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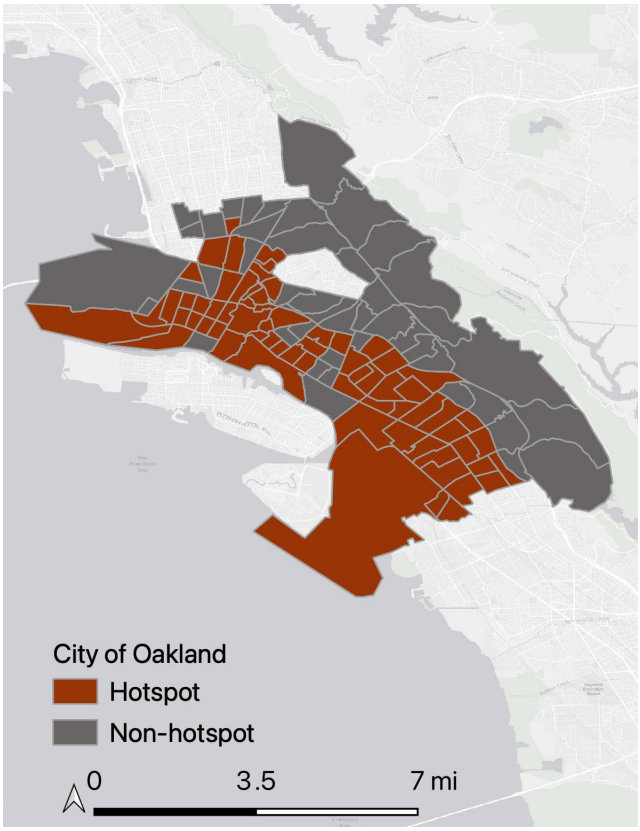
City of Oakland
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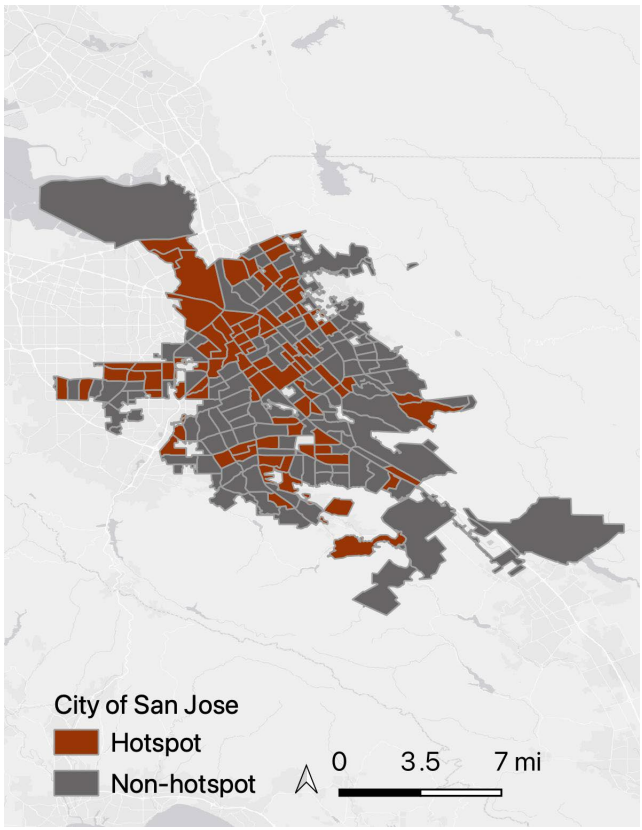
City of San Jose
Hotspot
Non-hotspot
0 3.5 7 mi

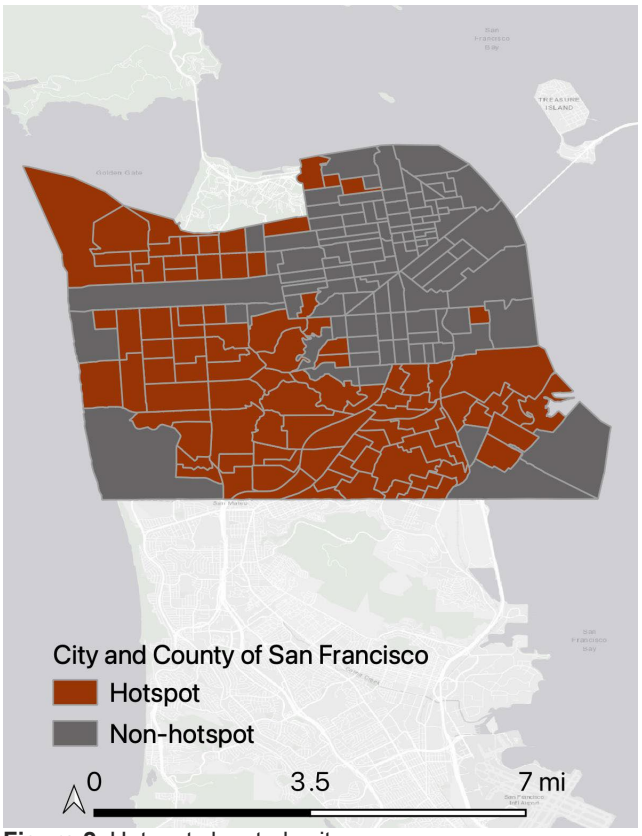

Figure 2. Hotspots by study city

Note. Housing price hotspots are defined as tracts with appreciation rates above the citywide trend from 2012 through 2018.

As discussed earlier, hotspot tracts can indicate places with relatively high development potential under existing regulation in a city. Specifically, a hotspot tract with a relatively low share of single-family housing density signals to developers two important pieces of information: (1) this location is experiencing relatively high price appreciation, and (2) existing regulation has allowed housing types other than single-family homes in this location. Developers can expect higher financial returns from development and can more likely build at a higher density in hotspots where single-family homes do not predominate. In all study cities except San Francisco, hotspot tracts are generally characterized by a lower percentage of owner-occupied detached single-family homes (Figure 3, top left). These places should have relatively high development potential under existing regulation because they can enable higher returns for developers relative to other parts of a city, and because developers are more likely to find sites where housing types other than single-family homes are legally permitted.

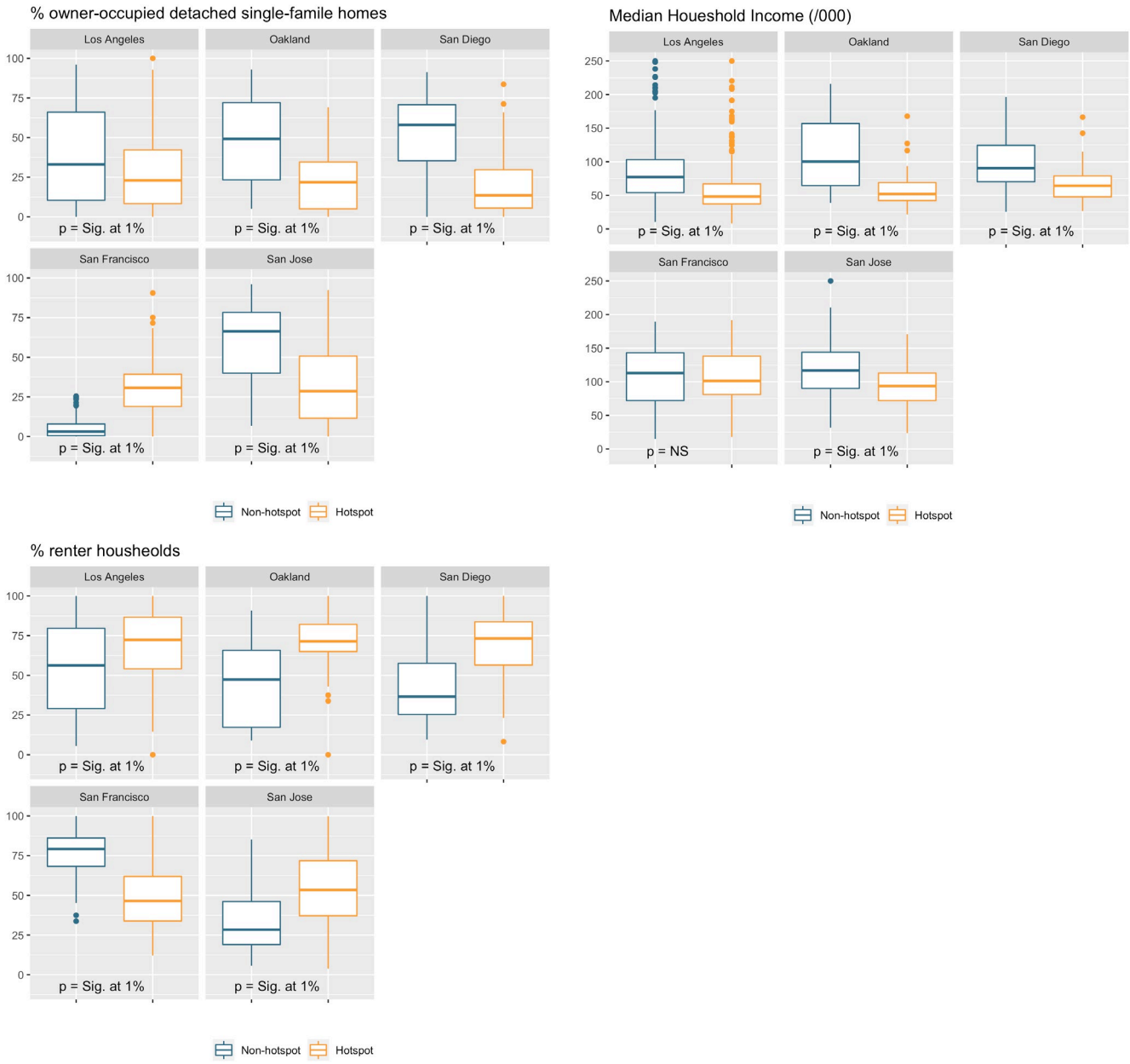

Figure 3. Tract characteristics by hotspot status.
Source. American Community Survey, 2018 5-year estimates.
Note. "NS" refers to not significant for two-sample t-tests comparing means.

In our study cities except San Francisco, hotspot tracts generally had lower socioeconomic status. Specifically, median household incomes as of the 2018 ACS were significantly lower in hotspot tracts than in non-hotspot areas.[17] The difference in income distribution was particularly evident in Oakland and San Diego. In Figure 3 (top right), the boxes for these two cities – which capture the 25th to 75th percentile of the citywide distribution of tract-level income – barely overlapped between hotspots and non-hotspots. Furthermore, the percentages of renter households were significantly higher in hotspot tracts compared to the rest of the city (Figure 3, bottom left). This is not surprising because residents of lower-income neighborhoods are typically more likely to be renters. In these four study cities, the percentages of people identifying as non-Hispanic white were also lower in hotspot tracts than in non-hotspot tracts (Figure 4).

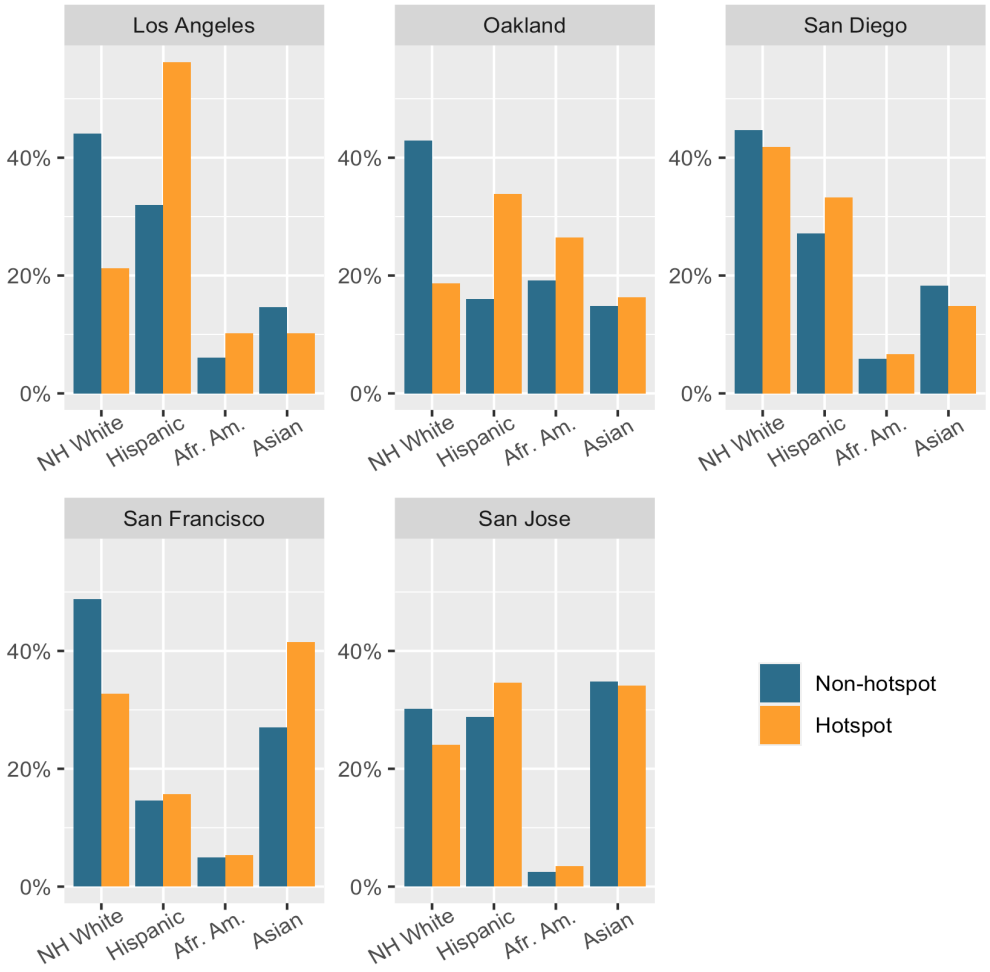

Figure 4. Racial/Ethnic composition in tracts by hotspot status.
Source. American Community Survey, 2018 5-year estimates.
Note. "NH White" refers to people identifying as non-Hispanic white. "Afr. Am." refers to people identifying as Black or African American.

[17] U.S. Census Bureau, American Community Survey, 2018 5-year estimates.

San Francisco differs from the other four study cities in that its hotspot tracts were characterized by a significantly lower percentage of renter households and a higher percentage of owner-occupied detached single-family homes. Therefore, in the case of San Francisco, intra-city appreciation rates may not be a good indicator of relative development potential. Furthermore, median household incomes were similar between the hotspot and non-hotspot tracts. In our discussion below, we focus on the implications of the observed common patterns.

Our findings raise several affordability and equity concerns. The first concern is related to the burden of rising housing costs. In four of the five study cities, lower-income and renter households as well as people of color were relatively more concentrated in hotspot tracts, suggesting that these groups are disproportionately harmed by the burdens of rising housing costs. In the case of San Francisco, the percentage of owner-occupied single-family housing was significantly higher in hotspot tracts than the rest of the city. While the existing homeowners in hotspot tracts could benefit from rapidly rising property values, these neighborhoods are increasingly out of reach for low- and moderate-income households.

Second, existing development patterns have failed to address community housing needs in an equitable manner. As previously described, housing price appreciation is in part attributable to the demand for housing types that are only available in some parts of the city but not others. In four of the five study cities (Los Angeles, Oakland, San Diego, and San Jose), local hotspots were characterized by relatively high housing density. The distribution of hotspots in these cities may be attributable to competition from home-seekers that cannot meet their housing needs in largely single-family neighborhoods, indicating strong demand for housing types that are more affordable than single-family homes. Such housing should not be only available in certain pockets of the city – especially historically segregated, high-poverty neighborhoods – leaving limited location options for lower-income households and those earning higher incomes but unable to afford single-family homes. The observed spatial patterns consistently point to the lack of housing and diverse housing types in lower-density, higher-income neighborhoods.

Furthermore, common patterns in four of the five study cities suggest that development potential under existing regulation is relatively high in hotspot tracts (as compared to other tracts in each city), but these tracts are generally characterized by relatively low neighborhood opportunity. This is because incomes were generally lower in these hotspot tracts, and household incomes capture a variety of opportunity indicators related to socioeconomic advancement.[18] Therefore, the data suggest relying on sites with high development potential under existing land use to accommodate future housing development will not adequately promote access to opportunity.

[18] Nicholas J. Marantz & Huixin Zheng, *State Affordable Housing Appeals Systems and Access to Opportunity: Evidence from the Northeastern United States*, 30 HOUSING POLICY DEBATE 370 (2020); Huixin Zheng et al., *Accessibility, Affordability, and the Allocation of Housing Targets to California's Local Governments* (University of California Institute of Transportation Studies, 2021).

Multi-Unit Residential Development Approval

The previous analysis shows that restricting housing development outside of neighborhoods with high HPIs raises equity and affordability concerns. To assess local planning and development decisions, we draw on the CALES data and examine the approval of residential development of five or more units from 2014 through 2017 (hereinafter referred to as CALES projects).

The data indicate that multifamily projects are generally less likely to be approved in single-family neighborhoods. In all five study cities, the percentages of owner-occupied single-family homes were significantly lower in tracts with CALES units approved from 2014 through 2017 than in the rest of the city (Figure 5). This is not surprising because, in practice, higher-density development projects are typically not legally permitted in single-family neighborhoods. Even when they are allowed by applicable land-use standards, such projects could face strong opposition from homeowners that are concerned about the impacts of new development on local infrastructure and property values.

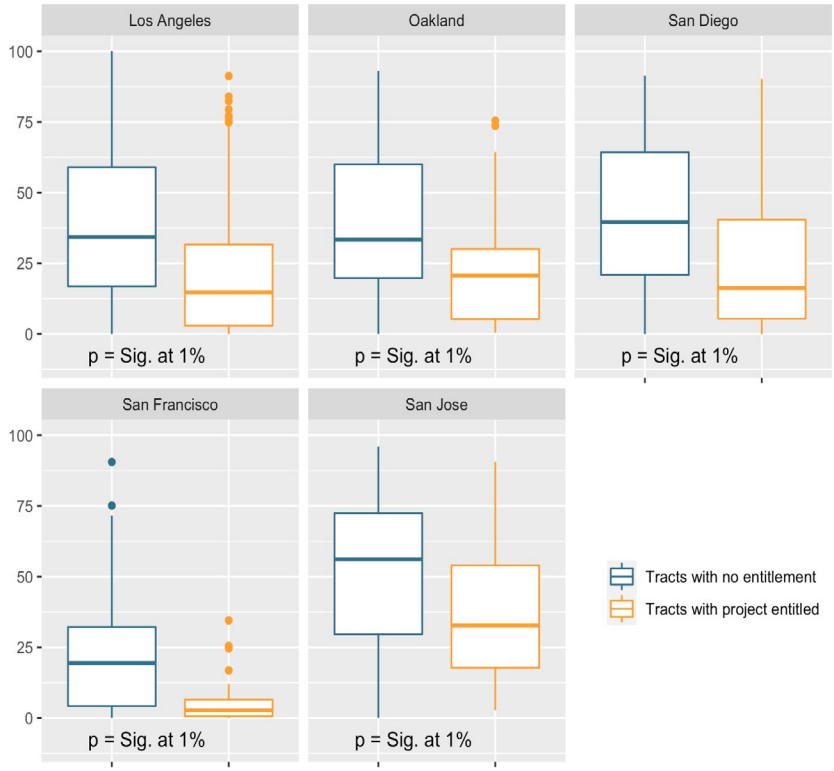

Figure 5. Percentage of owner-occupied single-family homes.
Source. American Community Survey, 2018 5-year estimates.

Our analysis of neighborhood price appreciation reveals that local governments are generally more likely to approve multifamily projects in neighborhoods where development potential is relatively high under existing land use regulation. Sites with relatively high development potential are characterized by relatively low percentages of single-family housing and relatively high price appreciation. The previous analysis shows that development potential is relatively high in hotspot tracts in our study cities except San Francisco. Figure 6 shows that in three of these cities – Oakland, San Diego, and San Jose – the number of CALES units per 1,000 people was substantially higher in the city's hotspot tracts.

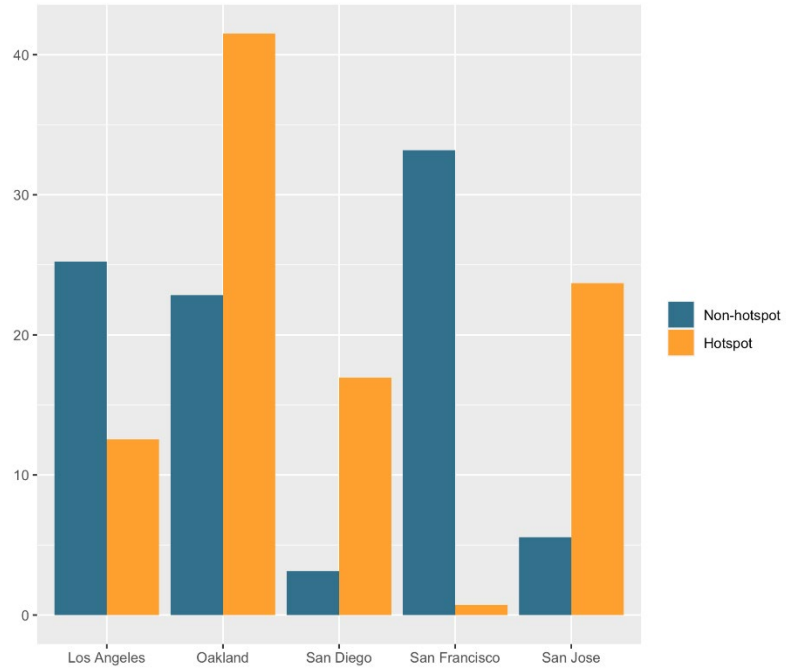

Figure 6. Total housing units in CALES projects per 1,000 people.
Note. CALES projects refer to development projects of 5 or more units entitled from 2014 through 2017.

To pursue multifamily projects in places with relatively low development potential under existing regulation, developers may need a general plan amendment or rezoning to deviate from existing land use. Indeed, in Oakland, San Diego, and San Jose, the percentage of CALES units approved with a general plan amendment and/or rezoning in non-hotspot tracts far exceeded that in hotspot tracts (Figure 7).

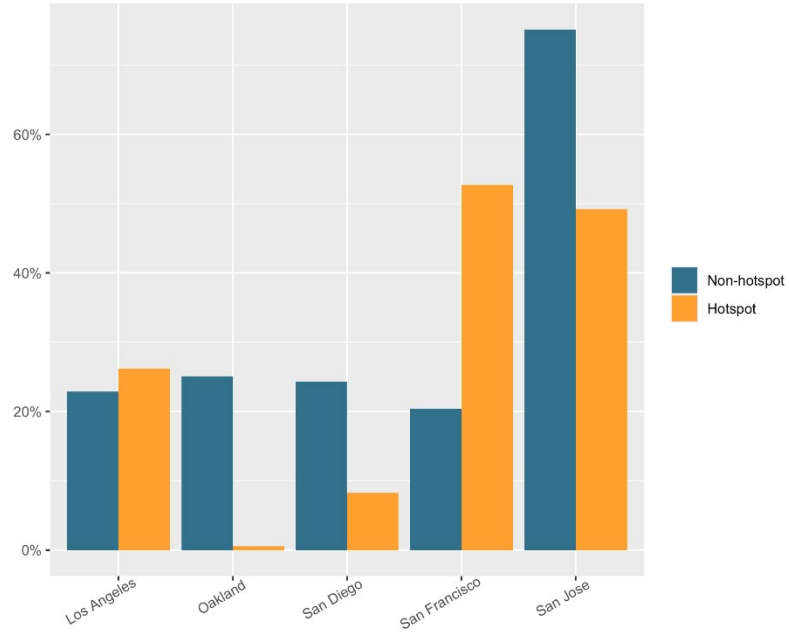

Figure 7. Percentage of CALES units approved with a general plan amendment and/or rezoning.
Note. CALES projects refer to development projects of 5 or more units entitled from 2014 through 2017.

Los Angeles presents a more nuanced case because the multifamily projects were more likely to be approved in the city's non-hotspot tracts, which should have relatively low development potential under existing land use compared to the hotspot tracts. Los Angeles approved twice as many CALES units per 1,000 people in the city's non-hotspot tracts as in the hotspot tracts. Furthermore, the rates of general plan amendments and rezonings permitting multifamily development were similar between the hotspot and non-hotspot areas of Los Angeles. The observed patterns suggest that Los Angeles may be beginning to facilitate multifamily housing development in lower-density, non-hotspot neighborhoods.

San Francisco is another outlier. The previous analysis shows that, unlike in other study cities, the hotspots of San Francisco are not characterized by lower socioeconomic status. Despite the strong demand for housing in the city's hotspot tracts, local planning of San Francisco did not seem to be facilitating housing development in these generally low-density hotspot tracts. Very few CALES units were permitted in the city's hotspots. Of the small number of CALES units approved in the hotspot tracts of San Francisco, over half of them were approved with general plan amendment and/or rezoning.

Analyzing the approval of CALES units reveals that, consistent with expectations, local governments generally direct multifamily development to neighborhoods with relatively high development potential under existing land use. This is the case in three of the study cities (Oakland, San Diego, and San Jose). In lower-density neighborhoods, developers are more likely to need approval of a general plan amendment or a rezoning in order to build at a higher

density. Such regulatory procedures could cause substantial delays in the entitlement process.[19] The data also suggest that development opportunity is relatively lacking in single-family neighborhoods in all study cities. Developers will have to pursue multi-family development outside these exclusive neighborhoods, further bidding up the prices of sites in neighborhoods that are relatively low-resourced.

Takeaways for Planning Practice

HPIs can provide information that is not available from other measures of housing demand that are widely used in scholarly research and governmental decision-making process, such as home prices and rents.[20] Housing prices and rents are often used as indicators of neighborhood quality and desirability because home-seekers are willing to pay more for desirable neighborhood attributes. Therefore, planners can use home prices and rents to identify high-demand neighborhoods where demand is driven by neighborhood quality. However, people can only bid for housing within their budget constraints. When people looking for housing in a city cannot afford relatively high-priced neighborhoods, they must compete for housing in less expensive neighborhoods or look outside the city. If planners want to identify places where people are competing most intensely for housing, neighborhood HPIs provide a useful metric.

In order for HPIs to be a useful metric for assessing housing needs, there must be a broad income range among home-seekers in a city. For example, in a particularly high-cost city, even *relatively* lower-income neighborhoods are not affordable to many lower-income people, and it is possible that only high-income households will consider moving there. This may be the case in San Francisco, which has the highest income among the study cities. As previously described, the observed HPI pattern suggests relatively strong housing needs in San Francisco's single-family neighborhoods. However, this pattern should not be interpreted as evidence that the city has adequately accommodated lower-income housing needs. In fact, the HPI pattern may be attributable to the city's extremely restrictive regulation, which has made housing production highly costly and cumbersome.[21] Additionally, this study only analyzes HPIs in strong housing markets. The use of HPIs in declining housing markets may raise different concerns.

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[19] Nicholas J. Marantz et al., *Factors Affecting Development Decisions and Construction Delay of Housing in Transit-Accessible and Jobs-Rich Areas in California* (University of California Institute of Transportation Studies, 2022).

[20] For example, a recent study by San Francisco Planning categorized neighborhoods in the city into four levels of market strength based on apartment rent data. *See* SAN FRANCISCO PLANNING, HOUSING DEVELOPMENT FEASIBILITY AND COSTS 21 (2020), https://default.sfplanning.org/plans-and-programs/housing/affordability-strategy/HAS_Feasibility_and_Dev_Costs_FInal.pdf.

[21] Moira O'Neill et al., *Developing Policy from the Ground Up: Examining Entitlement in the Bay Area to Inform California's Housing Policy Debates*, 25 HASTINGS ENVTL. L. J. 85 (2019).

Planners can assess how local planning practice responds to relative price increases and addresses the concerns raised by the HPI patterns. If price hotspots are generally lower-income and have higher density, as seen in four of the five the study cities, then local land use policy may need to promote lower-cost housing opportunity outside existing price hotspots so that lower- and moderate-income home-seekers are not limited to the housing options in certain pockets of the city. In order to understand whether this is the case, planners should compile data on local development entitlement processes and examine a range of questions. For example, has the city permitted multifamily housing more frequently in price hotspots than in non-hotspot neighborhoods? Did projects permitted in non-hotspot neighborhoods generally need longer approval timeframes and undergo more types of discretionary reviews compared to those permitted in price hotspots? Did projects approved in hotspot neighborhoods tend to be larger in scale? Using the CALES data, we were able to answer these questions. Based on our analysis, only in Los Angeles did we find preliminary evidence that local government has facilitated housing development outside the city's hotspot areas, which are generally lower-income.

Planners can use HPIs with income and tenure data to identify neighborhoods that are most vulnerable to rent increases. For example, such neighborhoods can be identified as hotspot tracts where median household incomes are in the bottom 40th percentile of the citywide income distribution and more than 60% of the households are renters. In Los Angles, for example, these neighborhoods are most concentrated in Central and South Los Angeles. To address the economic and racial inequities in cost increases, cities should assess strategies for addressing the risk of displacement in these areas.

Conclusion

This study analyzes intra-city housing price appreciation from 2012 through 2018 in five California cities. Because this study uses descriptive and bivariate analysis and cannot draw causal conclusions, we focus on the common patterns observed across the study cities. We conclude this study by highlighting some patterns in our study cities except San Francisco, which appears as an outlier throughout the analysis.

Tracts where housing prices appreciated faster are generally characterized by a lower share of single-family housing, lower median household incomes, and a larger percentage of renter households. The patterns observed suggest two potential major sources of relatively fast housing price appreciation: (1) development options other than single-family homes are only permitted under existing land use in some parts of a city, and developers will compete for these sites and bid up land prices, and (2) housing types that meet varying housing needs are only available in some parts of a city, and residents will compete for housing in these places even

though the locations may not be ideal. These two mechanisms could drive relatively high housing price increases in lower-resourced, lower-opportunity neighborhoods, as found in most of the study cities.

Limiting housing development in neighborhoods where prices increased relatively slowly raises equity and affordability concerns. This study shows that hotspot tracts are generally characterized by lower socioeconomic status. Furthermore, renters and communities of colors – which are relatively concentrated in hotspot tracts – are disproportionately harmed by rising rents. To address these concerns, local governments should facilitate the development of diverse housing types outside existing price hotspots. It is important to not just provide more housing, but to expand the location options for people in search of housing at varied price points.

Finally, our analysis of the residential projects of five units or more that were approved from 2014 through 2017 finds that multifamily projects are more likely to be permitted in neighborhoods with relatively high development potential under existing land use. Such places are identified by local hotspot tracts, which were generally less concentrated with single-family housing compared to the rest of the city. A considerable body of research has shown that land-use regulation has created inequitable, segregated residential patterns by limiting development options in single-family neighborhoods.[22] Perpetuating such development patterns will likely exacerbate the equity and affordability issues discussed above.[23] Local governments should assess strategies to remove regulatory constraints to the development of housing in places that have historically excluded lower-income households.

The simple analytical tools can be readily applied to other local jurisdictions, including those with a small number of census tracts that make statistical inference inapplicable. To facilitate this process, state and local governments could develop programs to track neighborhood housing price/rent trajectories for a selected set of housing types. As many California jurisdictions are required to rezone a large number of sites in order to accommodate the state-assigned housing targets, future research could assess the impact of parcel-level regulatory changes on neighborhood-level housing price dynamics.

[22] *See generally*, JESSICA TROUNSTINE, SEGREGATION BY DESIGN: LOCAL POLITICS AND INEQUALITY IN AMERICAN CITIES (2018).

[23] See Michael Manville et al., It's Time to End Single-Family Zoning, 86 J. Am. Plan. Ass'n 106 (2020).

Appendix 1. A Hedonic Imputation Approach to Constructing House Price Index

This study uses a hedonic imputation approach to construct quality-adjusted housing price indices (HPIs) for each year from 2011 through 2018 at the census tract level for single-family residential (SFR) and condominium transactions. The constructed HPIs, normalized to 2010, are used to measure relative housing price changes in neighborhoods in a given city.

IMPLEMENTATION PROCEDURE

A hedonic imputation approach utilizes standard price index formula that measures the change in the price of a given basket of goods and services during a given time period. The two most basic formulas are the Laspeyres index and the Paasche index. Both formulas are used in the present study. The procedure to derive HPIs for each study jurisdictions takes the following four steps.[24]

- Step 1: Estimating the hedonic price model.

The hedonic model takes the following semilog functional form:[25]

$$y = Z\beta + L\lambda + \varepsilon,$$

where y is the vector of log house prices and Z is the matrix of sale and structural characteristics (e.g., quarter when the sale occurred, number of bedrooms, building area, etc.); L is a vector of block group dummies, and ε is the error term. β represents the vector of characteristic shadow prices (i.e., estimated prices for characteristics whose prices are not independently observed) and is estimated simultaneously with location fixed effects λ. This study utilizes arm's length SFR and condominium transactions with sales prices ranging from $10,000 to $5,000,000 for each year during 2010-2018. Home sales resulting from foreclosure and outliers with extreme values are excluded – a common practice in hedonic house price

[24] See Sofie R. Waltl, Variation Across Price Segments and Locations: A Comprehensive Quantile Regression Analysis of the Sydney Housing Market, 47 Real Est. Econ. 723 (2019); Robert J. Hill & Michael Scholz, Can Geospatial Data Improve House Price Indexes? A Hedonic Imputation Approach with Splines, 64 Rev. Inc. & Wealth 737 (2018).

[25] For a discussion of the advantages of semilog specification in a hedonic context, see Stephen Malpezzi, Hedonic Pricing Models: A Selective and Applied Review, in Housing Economics & Public Policy 67 (Tony O'Sullivan & Kenneth Gibb eds., 2002).

analysis. As shown in Table A1-1, the criteria for removing outliers vary by county. This is because data availability and the distributions of the single-family homes and condominiums of different structural characteristics vary by county in the Zillow data.

Table A1-1. Criteria for Removing Outlier Transactions.

	Bedrooms	Baths	Total Rooms	Building Area (sq. ft.)	Lot Size (sq. ft.)	Building Age
Los Angeles County						
Single-family homes						
Min Allowed	1	1	Not used	300	300	0
Max Allowed	6	6	Not used	6,000	43,560	N/A
Condominiums						
Min Allowed	1	1	Not used	300	Not used	0
Max Allowed	5	5	Not used	5,000	Not used	N/A
San Diego County						
Single-family homes						
Min Allowed	1	1	Not used	300	300	0
Max Allowed	6	6	Not used	5,000	43,560	N/A
Condominiums						
Min Allowed	1	1	Not used	300	Not used	0
Max Allowed	5	5	Not used	5,000	Not used	N/A
Santa Clara County						
Single-family homes						
Min Allowed	1	Not used	1	300	300	0
Max Allowed	6	Not used	12	5,000	43,560	N/A
Condominiums						
Min Allowed	1	Not used	1	300	300	0
Max Allowed	5	Not used	10	5,000	3,500	N/A
Alameda and San Francisco Counties						
Single-family homes						
Min Allowed	1	1	Not used	300	300	0
Max Allowed	6	5	Not used	5,000	43,560	N/A
Condominiums						
Min Allowed	1	1	Not used	300	Not used	0
Max Allowed	5	5	Not used	5,000	Not used	N/A

Note. "N/A" indicates that no filtering criterion is applied. "Not used" indicates that the structural characteristic is not used in the hedonic equation due to issue with significant missing data. The minimum and maximum allowed values are not necessary the minimum and maximum values of the qualifying transactions after all filtering criteria are applied.

- Step 2: Imputing house prices.

The price p of house i sold in year t can be imputed using the equation estimated for year t:[26]

$$\widehat{p_{it}}(Z_{it}) = \exp(Z_{it}\widehat{\beta_t} + \widehat{L_t}).$$

[26] Strictly speaking, $\hat{p}$ is a biased estimate of p, but possible corrections for semilog models are typically very small and ignored in the context of generating hedonic price indices. David E. A. Giles, The Interpretation of Dummy Variables in Semilogarithmic Equations: Unbiased Estimation, 10 Econ. Letters 77 (1982); Robert J.Hill & Iqbal A.Syed, Hedonic Price–Rent Ratios, User Cost, and Departures from Equilibrium in the Housing Market, 56 Reg'l Sci. & Urb. Econ. 60 (2016).

For year s, the price p of house i sold in year t can be imputed by substituting its characteristics into the equation estimated for year s:

$$\widehat{p_{is}}(Z_{it}) = \exp(Z_{it}\widehat{\beta_s} + \widehat{L_s}).$$

- Step 3: Estimating four HPIs for each census tract.

For a given housing type H (i.e., single-family homes or condominiums), let H_{tc} denote the set of all qualified transactions of H that occurred in year $t \in \{2010, \dots, 2018\}$ within census tract C. The price index for year s normalized to year t can be calculated using the following standard price formulas:

The Laspeyres index focuses on houses observed in year t: $P_{t,s}^{L,C} = \prod_{i=1}^{H_{tc}} \left(\frac{\widehat{p_{is}}(Z_{it})}{\widehat{p_{it}}(Z_{it})}\right)^{1/H_{tc}}$,

The Paasche index focuses on houses observed in year s: $P_{t,s}^{P,C} = \prod_{i=1}^{H_{sc}} \left(\frac{\widehat{p_{is}}(Z_{is})}{\widehat{p_{it}}(Z_{is})}\right)^{1/H_{sc}}$.

Last, the Törnqvist index combines the Laspeyres and Paasche indices with equal weights:

$$P_{t,s}^{T,C} = \sqrt{P_{t,s}^{L,C} * P_{t,s}^{P,C}}$$

The double imputation approach used in the above formulas mitigates potential omitted variable bias,[27] and it can also be applied to zip code areas. Therefore, four sets of HPIs, normalized to 2010, are estimated for the present study: (1) HPIs based on SFR transactions at the census tract level, (2) HPIs based on condominium transactions at the census tract level, (3) HPIs based on SFR transactions at the zip code level, and (4) HPIs based on condominium transactions at the zip code level.

- Step 4: Estimating final tract-level HPIs.

The final tract-level HPIs draw upon one or more sets of above-described HPIs, depending on the number of housing transactions in the tract in the relevant year. Table A1-2 illustrates the decision rule for determining the HPI for a census tract in a given year.

[27] See Waltl, supra note 24.

Table A1-2. Decision Rule for Determining Tract-Level HPI.

		Did the tract have at least a total of 10 qualified SFR transactions in 2010 and in the year for which HPI is estimated?	
		YES	NO
Did the tract have at least 10 qualified condominium transactions in 2010 and in the year for which HPI is estimated?	YES	Tract HPI = geometric mean of tract-level SFR-based HPI and condominium-based HPI	Tract HPI = tract-level condominium-based HPI
	NO	Tract HPI = tract-level SFR-based HPI	Tract HPI is imputed using zip code-level HPIs

Note. For each type of HPIs (i.e., SFR or condominium), a tract is considered having a sufficient number of observations if it has at least a total of 10 qualified transactions of the relevant housing type in 2010 and in the year for which HPI is constructed. Qualified transactions are arm's length transactions excluding outliers, as detailed in Table A1-1. We count the observations in both 2010 and the year for which HPI is estimated because the HPIs are normalized to 2010.

For tracts with inadequate qualified SFR or condominium transactions, zip code-level HPIs, if available, are used to impute the tract-level values. Specifically, if tract-level HPIs are missing throughout the study period of 2010-2018, zip code-level HPIs are used for this tract. For a given tract, if at least one but not all years of the HPIs are estimated, the missing values are imputed under the assumption that housing prices at the tract and zip code levels followed the same trend in the relevant period. Whenever possible, a two-way imputation approach is used to impute and smooth the tract-level values. For example, if HPIs are estimated for 2013 and 2015 but missing for 2014, the HPI for 2014 will be imputed as follows:

$$HPI_{tract,2014} = \sqrt{\left(HPI_{tract,2013} * \frac{HPI_{zip\ code,2014}}{HPI_{zip\ code,2013}}\right) * \left(HPI_{tract,2015} / \frac{HPI_{zip\ code,2015}}{HPI_{zip\ code,2014}}\right)}$$

where the subscripts denote the year and geographic unit for which HPIs are estimated. A one-way imputation approach is used if housing price trends at the zip code level are only available in one direction. For example, if HPIs are estimated for 2011-2016 but missing for 2017 and 2018 in a tract, the HPIs for 2017 and 2018 are imputed as follows:

$$HPI_{tract,2017} = HPI_{tract,2016} * \frac{HPI_{zip\ code,2017}}{HPI_{zip\ code,2016}}$$

$$HPI_{tract,2018} = HPI_{tract,2016} * \frac{HPI_{zip\ code,2018}}{HPI_{zip\ code,2016}}$$

Last, if a tract missing HPI estimates overlaps with multiple zip code areas, the imputed HPI is equal to the geometric means of the tract-level HPIs imputed using the HPIs estimated for each overlapping zip code area, weighted by the number of housing units (as of 2010) in each overlapping portion of the tract.[28]

[28] Data come from the Geocorr 2014 geographic correspondence engine, provided by the Missouri Census Data Center, https://mcdc.missouri.edu/applications/geocorr2014.html.