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America's Housing Supply Problem: The Closing of the Suburban Frontier?

ABSTRACT   Housing prices across much of America have hit historic highs, while less housing is being built. If the US housing stock had expanded at the same rate from 2000–2020 as it did from 1980–2000, there would be 15 million more housing units. This paper analyzes the decline of America's new housing supply, focusing on large Sunbelt markets such as Atlanta, Dallas, Miami, and Phoenix that were once building superstars. New housing growth rates have decreased and converged across these and many other metro areas, and prices have risen most where new supply has fallen the most. A model illustrates that structural estimation of long-term supply elasticity is difficult because variables that make places more attractive are likely to change neighborhood composition, which itself is likely to influence permitting. Our framework also suggests that as barriers to building become more important and heterogeneous across place, the positive connection between building and home prices and the negative connection between building and density will both attenuate. We document both of these trends throughout America's housing markets. In the Sunbelt, these changes manifest as substantially less building in lower-density census tracts with higher home prices. America's suburban frontier appears to be closing.

How has housing supply in America evolved over the past fifty years? Twenty years ago, Glaeser and Gyourko (2005) noted that America could be divided into growing Sunbelt markets with elastic housing supply (e.g., Atlanta, Dallas, and Phoenix), high-cost coastal markets (e.g., Boston, New York City, Los Angeles, and San Francisco) with inelastic housing supply, and low-demand erstwhile industrial cities (e.g., Cleveland and Detroit). In this paper, we document that the Sunbelt markets are no longer so elastic. The combination of declining output and rising prices indicates that the supply of new housing has shifted downward.[1]

Real, constant-quality home prices hit historic highs in 2024, both for the nation and for many individual markets. At the start of 2025, national prices are about 15 percent above the peak reached just before the global financial crisis (GFC). Local prices have never been higher for many housing markets ranging from Los Angeles to Dallas, Miami, Tampa, and Phoenix. The combination of high prices and high interest rates has increased the costs of homeownership and public anxiety about housing affordability.[2] Of course, high homeownership costs are not identical with high costs of shelter, both because of the option to rent, and because we do not know how much today's new homeowners will benefit from future housing price appreciation.[3]

From 2000 to 2024, Miami, Tampa, and Phoenix ranked first, fifth, and ninth, in price growth across the twenty areas that make up the S&P

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1. The term "housing supply" is used in two distinct ways in the literature: (1) the relationship between the total number of homes in an area and the price of housing, which can be termed static supply; and (2) the relationship between the number of new homes in an area and the price of housing, as studied by Topel and Rosen (1988), which we refer to as dynamic supply or new housing supply. Static supply is the appropriate concept when examining a spatial equilibrium, because old houses are a close substitute for new houses (Roback 1982; Louie, Mondragon, and Wieland 2025). Dynamic supply is more relevant when focusing on changes in the ability to build (Topel and Rosen 1988 and this paper). We document that dynamic supply has declined significantly over the past fifty years, which also implies that static supply itself has become somewhat less elastic. Static supply rarely declines because housing is durable (Glaeser and Gyourko 2005).

2. One recent example is a *Wall Street Journal* article and podcast that investigated the rising cost of ownership in Chapel Hill, North Carolina, just over the last fourteen years (Dagher 2025; Aspuru, Dagher, and Walker 2025).

3. Raven Molloy, in her comments on our paper and in previous research (Molloy, Nathanson, and Paciorek 2022) correctly notes that housing services can be rented in any market, and that rents need not move commensurately with house prices. She and her coauthors document that rents often are not rising much in the most high-priced American housing markets; rather, the price-to-rent ratios in those places are rising. Our data are consistent with their argument, especially in coastal markets. Price-to-rent ratios are rising in the Sunbelt markets too, but by less. Real rents for the median tract in many Sunbelt markets have been increasing, but again, not by as much as house prices.

CoreLogic Case-Shiller 20-City Composite Home Price NSA Index. Each of these areas experienced more price growth than the New York City area, whose prices still increased by a healthy 70 percent. Between 1975 and 1999, no Sunbelt city (outside of California) was among the top twelve of the same twenty markets.[4]

We interpret these rising prices as reflecting a downward shift in supply rather than an upward shift in demand because the quantity of housing production has declined substantially over the last half century. As figure 1 in section I.B shows, the 1950s and 1960s were a golden age of building, with abundant housing production in any market with robust demand. From a base of 36 million housing units in 1950, the national stock increased by 50 million homes over the next three decades. Housing unit growth rates then dropped by more than one-third between the 1970s and the next two decades.[5] In the 1980s and 1990s, the growth rate of housing was barely half that seen in the 1950s and 1960s. The first decade of the new century saw slightly less growth followed by even lower housing unit production in the 2010s. While recent years have seen some recovery in housing production, building levels remain far below their postwar heyday. Standard economic logic suggests that the combination of rising prices and slowing production of new units means that a tepid supply side plays an important role in explaining today's high prices. Since this paper does not estimate housing demand elasticities, we will not quantify how much lower prices would be today if housing supply had grown at the same rate between 2000 and 2020 as it did between 1980 and 2000, but an extra 15 million housing units would surely make a difference.

Another key fact is that these national changes mask important changes across housing markets. As in the 1980s and 1990s, there is still little new supply today in either the previously supply-constrained coastal markets or the old industrial centers mired in economic decline. The striking change is the declining intensity of new housing production in major Sunbelt and

4. Among the seven Sunbelt markets in that index, Charlotte had the highest rank of 13 because of its quite modest 11 percent appreciation over that quarter-century time period. Phoenix was 14 at 9 percent, Miami was 16 at 5 percent, Atlanta was 17 at 4 percent, Tampa was 18 at 3 percent, Dallas was 19 at −1 percent, and Las Vegas was 20 at −4 percent. These figures pale in comparison to those that Glaeser and Gyourko (2018) identified as the supply constrained coastal markets of San Francisco (160 percent), Seattle (110 percent), Boston (96 percent), Los Angeles (87 percent), New York City (71 percent), and San Diego (69 percent).

5. The critical distinction here is between dynamic supply (the production of new homes) and static supply (the total number of homes). The quantity of new homes fell significantly; the total number of homes did not.

mountain state markets. The largest shifts in housing supply have occurred in areas that were once notable for abundant new housing production and moderate prices. Figure 2 in section I.B documents declining construction rates for six metropolitan area housing markets that will be a particular focus of this paper: Atlanta, Dallas, Detroit, Los Angeles, Miami, and Phoenix. From the immediate postwar period through the 1970s, there was enormous heterogeneity in the rates of production, especially between the then relatively less populous Sunbelt markets that faced robust demand. The 1980s saw the beginning of a convergence in these rates, and by the 2010s, each of these six markets had similarly low rates of housing supply growth. The limited data since the 2020 Census suggest this situation has not changed materially.

This combination of facts raises the possibility that once elastically supplied housing markets such as Miami, Phoenix, and Dallas are becoming more like the supply-constrained coastal markets that we identified decades ago.[6] One important change appears to be a reduction in new construction in moderate- to high-price, low-density, and typically suburban census tracts. Table 6 in section III.B shows that in the Miami metropolitan area, 44 percent of all new housing units supplied in the 1970s were in these attractive low-density, higher-price areas. However, that share had fallen to 12 percent by the 2010s. This pattern is repeated across many different markets and motivates the question posed in this paper's title.

We explore these changes more formally in the second part of our paper. There we estimate "empirical" supply curves within metropolitan areas to understand the changes, especially in the Sunbelt markets that had once been housing supply superstars. In section II, we present a simple model of housing supply and demand. One central implication of our model is that over periods of, say, ten years or more, variables that shift demand will almost invariably shift supply as well. A factor that increases demand for a

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6. In related research, an important recent paper by Baum-Snow and Han (2024) estimates highly inelastic supply sides for many very local housing markets in urban areas across the country. This clearly is consistent with a slow rate of supply increase. Orlando and Redfearn (2024) posit that the nature of supply could be changing in previously elastically supplied metropolitan areas such as Houston in ways that would lead to higher prices in equilibrium. More broadly, Baum-Snow (2023) highlights how housing supply constrains urban growth from the neighborhood level up. Baum-Snow (2023) also makes the important point that there can be benefits, not just costs, to such constraints. Gyourko and McCulloch (2024) provide a recent estimate of the benefits to incumbent residents of restricting density. We do not provide a full welfare analysis of this situation in this paper. Finally, Baum-Snow and Duranton's (2025) recent review also explores the link between changing supply conditions and housing affordability.

location may also bring in wealthier or better educated residents who may then alter the permitting environment. Two implications of our framework are that when supply limitations become more important, the positive correlation between price and construction will diminish and the negative correlation between price and density will move toward zero or flip sign.

Despite the difficulties of measuring the true underlying housing supply curve over longer time horizons, we believe that the actual empirical link between prices and construction, which we call the "empirical housing supply curve," is an inherently important object, even if we cannot be sure what parameters that curve actually represents. This schedule informs us about whether building is happening in places where there is more demand. A positive slope means that the market seems to be responding to demand signals and that space is being produced where people value it most. A flat empirical housing supply curve suggests that we should expect housing supply to remain fixed even if prices rise. The empirical housing supply curve is also relevant for telling us about the size of the social losses due to limited housing construction, since expensive areas are likely to have the biggest gap between how much consumers value housing units and how much housing costs to build.

We find that the relationship between house price and new construction across census tracts is declining in almost all of America's metropolitan areas between 1970 and 2020. In Los Angeles, the relationship between price and new construction was weak even in the 1970s. But in most of the Sunbelt, housing construction used to supply high-demand areas within metropolitan areas. That has become much less true.[7]

Where did the empirical housing supply curve flatten most sharply? Variables such as the Wharton Residential Land Use Regulatory Index (WRLURI) that measure the strictness of land use regulation reliably predict the shift. The share of educated workers in the metropolitan area, which is also thought to drive land use regulation, is also correlated with the change. We provide no further evidence that land use regulation has led to the change in housing supply, but we believe that this is the most natural explanation for the shift.

The estimated relationship between density and the growth of housing was generally negative in the 1970s, but has become closer to zero or positive over time, which is also compatible with supply conditions gaining

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7. This complements the well-documented fact that, across metropolitan areas, places that build a lot aren't expensive and places that are expensive don't build a lot (Glaeser and Gyourko 2018).

importance. While more work remains to be done on this issue, our evidence does not suggest that housing supply growth is slowing primarily because particular neighborhoods have become "built out."

There have been other changes and shocks to American housing markets. Real construction costs increased by 25 percent over the past two decades. A large fraction of the employees and establishments in the home building sector left the sector after the GFC. The COVID-19 pandemic had an impact on supply chains and the demand for larger housing units. Most recently, rising interest rates have influenced both the demand for homes and the supply of homes for listing. As we will later discuss, some of these changes are economically material, but a core argument of this paper is that the genesis of our current situation began long before the GFC. This change is most prominent in America's once expanding suburbs, where the link between new building and high house prices has been declining for decades.

The next section of this paper documents key facts about American housing markets and how they have changed over time. Section II provides a model of changes in housing supply. Section III outlines our empirical strategy and presents results for a select set of markets. The analysis is expanded to a much broader set of markets in section IV, and section V concludes.

I. The State of the American Housing Market

Economists have long identified rising prices and declining quantities of new units as evidence of an upward shift or tilt of the supply curve. In this section, we document three facts that suggest American housing supply has declined, making achieving homeownership more costly. First, we document a sharp decline in housing production over the last fifty years, as well as convergence in new supply rates over recent decades. Second, America's housing prices have continued to rise, both in absolute levels and relative to production costs and income. Third, the home building industry has changed materially in recent decades. Real construction costs have risen by about 25 percent per home since the early 2000s. In addition, the construction industry suffered a huge negative shock from the GFC. Both home building establishments and employment declined by over 50 percent between 2004–2022.

I.A. Data Sources

We use Decennial Census data from 1950–2020 and the five-year American Community Survey (ACS) sample from 2023, which were downloaded from

the IPUMS National Historical Geographic Information System (NHGIS) (Schroeder and others 2025). We also work with national aggregate data, county-level data, and census-level tract data, which enables us to observe prices, housing quantities, and demographics at different spatial levels over many decades.

Logan, Xu, and Stults's (2014) Longitudinal Tract Database (LTDB) provides one excellent panel of tracts. Unfortunately, this widely used database is problematic for measuring the correlates of housing unit growth because tracts are defined based on their population in 2010. Consider a tract that is divided between 1990 and 2010 so that the populations of the two new tracts are roughly identical. Mechanically, the new tract that began with less population will register a faster growth rate, which may lead to a spurious negative relationship between initial population (or initial population density) and subsequent growth.[8] This may not be an issue for many of the largely cross-sectional analyses using the LTDB, but it generates the scope for substantial bias in any regression involving the growth of population or households, not only when the explanatory variable is initial population or density but whenever the explanatory variables are correlated with past population levels within divided tracts.

Consequently, we construct a census tract database that harmonizes tract boundaries based on 1970 boundaries to ensure a geographically consistent measure of key economic variables across the United States over each decade from 1970 to 2020 and from 2020 to 2023. Because tract definitions can change each decade, our "reverse LTDB" aligns historical tract definitions (1970) with source-year tract geometries from subsequent decades (e.g., 1980, 1990 . . . 2020) using spatial operations and area weighting. The resulting crosswalk enables consistent comparisons of demographic and economic data over time, even when tract boundaries have changed.[9]

The reverse LTDB provides several advantages. By working forward through time, our unit of observation is not determined by an endogenous outcome. Consistent geographies over time provide more consistent

8. Consider a tract that has a high-density area with 2,000 units and a low-density area with zero units in 1990. Presume that the high-density area population doubles in twenty years and the low-density area sees its population stay the same. When the tract is split, the low-density area is grouped with half of the high-density area. The result is two tracts: One with high density that did actually grow, but the data indicate it did not; the other with lower density that did not actually grow per this example, but the data indicate that it did. This example illustrates how the data series could incorrectly assign growth to nondense areas and stagnant growth in dense areas.

9. The details of the data creation, along with a comparison with the LTDB, can be found in a separate paper of ours and is available upon request (Glaeser, Gyourko, and Neiszner 2025).

measures of density.[10] Finally, we can account for large additions or losses in units for specific tracts, which we have had trouble doing with the LTDB. Typically, the outliers in the reverse LTDB are correlated with major changes such as new infrastructure.

The reverse LTDB has two disadvantages. Starting in 1970 reduces the effective sample size because the number of tracts has increased over time, especially in low-density suburban areas. This reduces the precision of some of the regressions run in the latter part of this paper. Moreover, our 1970-based sample of tracts does not cover all of the counties that now lie within the fastest-growing metropolitan areas.[11]

I.B. *The Decline in the Intensity of Housing Production*

Figure 1 documents the change in housing supply for the United States as a whole. The bars show the total housing stock in the United States in Decennial Census years from 1950 to 2020 and for 2023. The solid line reports the average annual rate of change in the total stock over each time period. The values for the housing stock are on the left side and the values for annual percentage growth are on the right side of the figure.

The overall housing stock increased from 36 million units in 1950 to 144 million units in 2023. Somewhat amazingly, America built more than 50 million homes from 1950 to 1980.[12] In the 1950s, the housing stock grew at 4 percent per year. That rate declined every decade until the 2000s, when

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10. We compare and contrast how the tract-level distribution of density changes over time in our working paper using the Phoenix Core-Based Statistical Area (CBSA) as an example (Glaeser, Gyourko, and Neiszner 2025). Using our 1970-based tract data, we show in figure 3 that there is a significant rise in density of about 1.5 units per acre for the median tract between 1970 and 2010, but density stopped growing in the 2010s. Using the LTDB we find that measured density remains extremely low through 1980, with the median tract having close to no housing in 1970. This level and time pattern are driven by the use of 2010 tract definitions. Because Phoenix's population exploded over the last half century, many physically small tracts were created by 2010. These tiny geographies are both plentiful in number and were close to empty of housing until recent decades.

11. Our "Measuring Neighborhood Change: The Issue of Ex Post Borders" paper includes a CBSA coverage table that reports the tract count in our data and in the LTDB, as well as the share of the population covered by our tract boundaries (Glaeser, Gyourko, and Neiszner 2025). In Charlotte, North Carolina, for example, our 1970 tracts always capture at least 96 percent of the CBSA population in every decade from 1970 to 2020. In Austin, Texas, however, we sometimes only capture 55 percent of the area population. This limitation leads us not to include markets such as Austin and Nashville, Tennessee, in the analysis reported in the latter part of the paper.

12. As described in the notes to the figure, the 1950 and 1960 housing stock numbers are constructed using the count of homes built before 1950 and 1960, respectively, from 1970 Census county-level data. See online appendix discussion 1 for more on this decision.

Figure 1. The American Housing Stock and Its Growth, 1950–2023
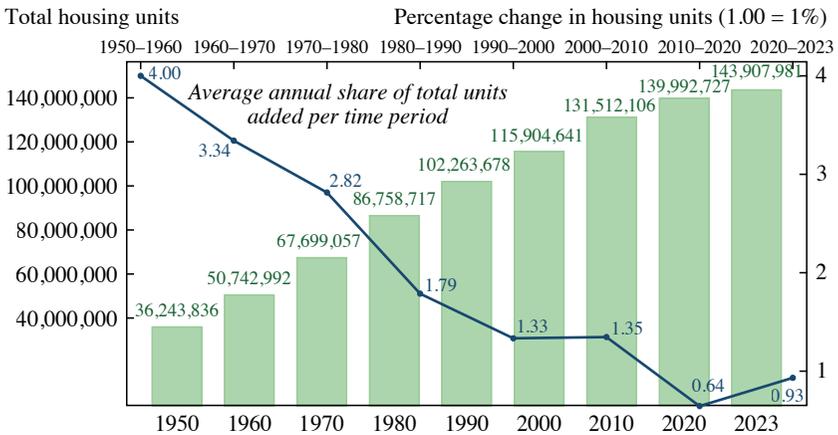
Source: Authors' calculations based on Decennial Census and ACS data downloaded from IPUMS NHGIS (Schroeder and others 2025).

Note: Housing stock numbers for 1950 and 1960 are constructed using the count of homes built before 1950 and 1960, respectively, in the 1970 Census. All others are from the Decennial Census (1970–2020) or built up from county-level data from the 2019–2023 five-year ACS estimates. See the discussion in section I.A for more on these choices. The average annual share added is calculated by dividing the percentage changes over time period. For example, the 4 percent between 1950 and 1960 is calculated by $[(50{,}742{,}992 - 36{,}243{,}836) / 36{,}243{,}836] / 10 \times 100\%$.

it flattened out at just over 1 percent per year. The construction rate then dropped again in the 2010s, when the average annual rate of growth in the stock was an anemic 0.64 percent per year.

The absolute level of production has also declined. There were almost 17 million units built in the 1960s and 19 million units in the 1970s. The era of the Nixon, Ford, and Carter administrations was the high-water mark for the home building industry. In the 2010s, we added fewer than 8.5 million units to the housing stock.[13]

Figure 2 shows the decline in building rates across our six focal markets: Atlanta, Dallas, Detroit, Los Angeles, Miami, and Phoenix. This sextet is meant to capture three different parts of America. Detroit is the quintessential rust belt metropolis, with low population growth and low prices. Los Angeles represents coastal America, with high prices and high levels of housing regulation. Atlanta, Dallas, Miami, and Phoenix are four of the highfliers

13. The flip side of this decline in production intensity is the falling depreciation rate of homes because of increasing amounts of rehab work and investment (Baum-Snow and Duranton 2025).

Figure 2. Average Annual Growth of Housing Units by Decade, Six Metropolitan Areas, 1950–2023

Percentage change (1.00 = 1%)
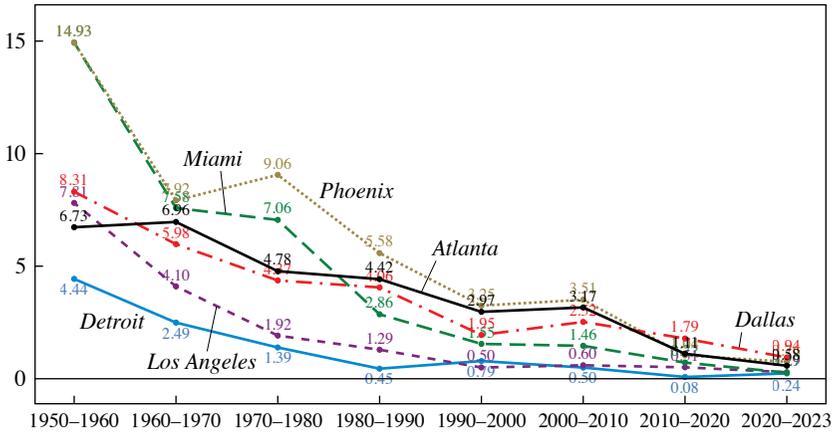
Source: Authors' calculations based on Decennial Census and ACS data downloaded from IPUMS NHGIS (Schroeder and others 2025).

Note: The value for 2020–2023 is the average percentage change over three years. For the years 1950 and 1960, we construct Core-Based Statistical Area (CBSA)–level aggregates from 1970's county-level census data on the number of homes built before 1950 and 1960. For each decade in 1970–2000, we construct CBSA-level aggregates from county-level census data from that year. In 2010, 2020, and 2023 we use 2006–2010, 2016–2020, and 2019–2023 five-year ACS county-level estimates to aggregate up to the CBSA level.

of population growth over the last fifty years. Historically, they have been affordable places where it was easy to build. We are particularly interested in whether their permissive building environment remains.

Throughout the nearly three-quarter-century time period we cover, Detroit and Los Angeles have remained at the bottom of the pack in terms of net housing unit production, but even so, their growth was impressive during the decades following World War II. In the 1950s, the housing stocks of Los Angeles and Detroit increased by over 7 percent and 4 percent per year, respectively. The city of Detroit's population crested in 1950, but the metropolitan area still experienced sizable suburban growth after that year. But since the 1960s, both areas have experienced far more modest housing growth. In three of the four decades between 1980 and 2020, Detroit's average annual growth rate has been 0.5 percent or less and Los Angeles's average annual growth rate has been 0.6 percent or less. Of course, as our data on housing prices show, Detroit's weak growth reflects limited demand, while Los Angeles's low growth reflects limited supply.

Figure 3. Percentage Change in Housing Units over Time, 2000–2020 Versus 1980–2000, Top Fifty Markets by 2020 Population

Percentage change in total housing units 2000–2020

Percentage change in total housing units 1980–2000

Source: Authors' calculations based on Decennial Census data downloaded from IPUMS NHGIS (Schroeder and others 2025).

The other four Sunbelt markets experienced extraordinary growth through the 1980s, and then lower but stable growth over the next two decades. Nevertheless, the growth of each of these areas follows a slightly different pattern. Miami and Phoenix both have extraordinary growth in the 1950s, but by the 1980s, Miami has the slowest growth of the four Sunbelt areas. Dallas begins growing more slowly than Miami and Phoenix, but ends up with the fastest growth rate of the four during the 2010s. Atlanta begins with the slowest growth of the four areas, but has the second-highest growth rate from 1980 to 2010. Despite the growth slowdown, Atlanta, Dallas, and Phoenix all managed annual growth rates over 2.5 percent from 2000 to 2010. In the 2010s, the housing stocks of Atlanta, Miami, and Phoenix each grew by less than 1.2 percent per year. Overall, there has been a great convergence in housing production across these six cities.[14]

Figure 3 confirms the slowdown is widespread with its examination of new supply growth rates over time across America's fifty largest metropolitan areas by population as of 2020. Along the horizontal axis, we show the growth rate in the number of housing units between 1980 and 2000.

14. Online appendix table 1 reports the analogous data for eighteen additional CBSAs.

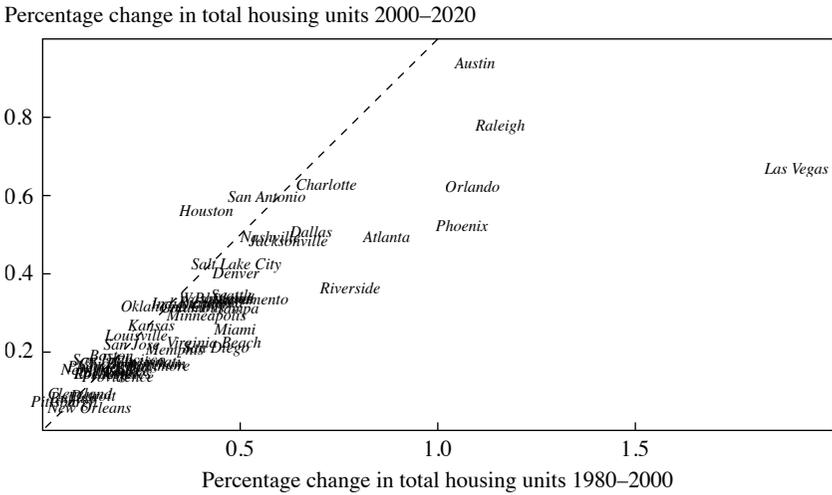**Figure 4.** The Distribution of Housing Density over Time in the Phoenix Metro Area
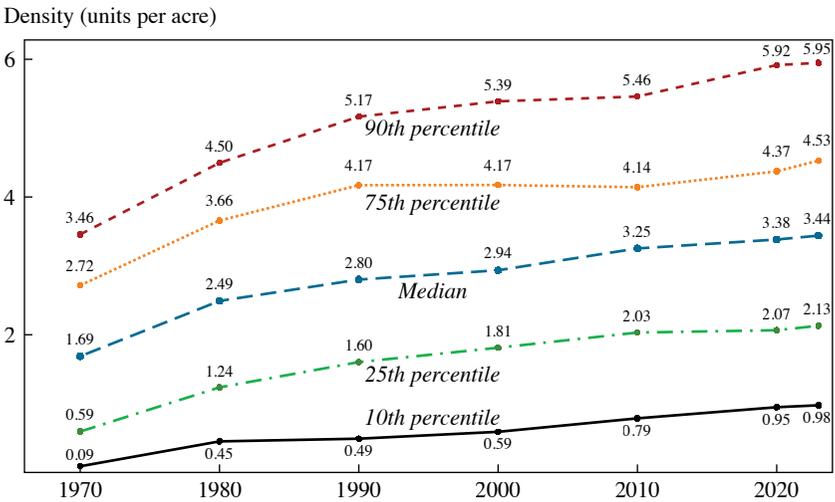
Density (units per acre)

Source: Authors' calculations based on Decennial Census and ACS data downloaded from IPUMS NHGIS (Schroeder and others 2025).

Note: Tract-level total unit density is constructed as the number of all housing units per acre in 1970-standardized tracts per discussion in section I.A. The distribution is calculated in each year based on Phoenix's 1970 CBSA boundary.

Along the vertical axis, we show the housing growth rate between 2000 and 2020, with the dashed line being at 45 degrees. The places that experienced high levels of growth from 1980 to 2000 had far lower levels of growth between 2000 and 2020, except for Houston and San Antonio. The slowdowns of Atlanta and Phoenix are remarkable, but so are the reductions in the growth rates of Las Vegas, Orlando, Raleigh, and Riverside, California.

In principle, housing growth could decline because we have stopped packing more housing into a fixed area (densification) or because we have stopped extending the edges of metropolitan areas. Figure 4 examines the densification of Phoenix, with density defined as total housing units per acre, using census data with tracts defined in 1970. The middle of the five lines shows median tract-level density, which increased by almost 0.4 units per acre per decade from 1970 to 2010, raising the number of units per acre from 1.69 to 3.25. Between 2010 and 2020, median density only rose by 0.13 units per acre. Similarly, the density of the 75th percentile tract (the second-highest line) rose dramatically from 1970 to 1990 but has remained essentially constant since that year. The 25th percentile tract

(the second-lowest line) has been steady since 2010, and while densification continues for the 10th percentile tract (bottom line), density remains quite low at this part of the distribution. Only the 90th percentile (top line) shows continued densification since 2010. Except for the densest tracts, these data are consistent with a density "wall," after which Phoenix tracts stop increasing density, either because of regulation or limited demand.[15]

Table 1 provides a more systematic look at densification by distance from the urban core for our six focal markets.[16] We show the percentage change in the number of housing units per acre by decade among tracts within five miles of the metro's center, within five to ten miles of the center, and more than ten miles out from the center.[17] In all of the markets, there has been a significant slowdown in densification in tracts more than ten miles out from the urban core. In every market except for Detroit, this has been somewhat offset by increased building in the urban core, which largely reflects multiunit housing. Construction in the middle-distance tracts is generally lower, but each city has its own pattern. In Phoenix, middle-distance growth declines in almost every decade. In Atlanta, Dallas, and Miami, middle-distance growth was significantly higher in the 1970s than in later decades, but there is little clear trend since the 1980s. There is no trend in middle-distance tracts in either Detroit or Los Angeles, as Los Angeles has experienced modest densification in almost every decade and Detroit has experienced modest declines in density in every decade.

We are building less housing as a nation, especially in the outlying areas of once rapidly expanding Sunbelt metropolises, but that need not mean that the rate of new housing production is somehow problematic. Housing is a durable good, and we have a lot of old housing, which is a substitute for new construction. Falling birth rates or lower net in-migration could have driven demand down. Only prices can help us determine whether the decline in housing production represents a shift in supply or demand. We turn to those data next.

I.C. The Rise in Housing Prices

In this section, we use the Federal Housing Finance Agency House Price Index (FHFA HPI) data on repeat sales price from the mid-1970s through 2024. The indexes are all normalized to equal one hundred in the

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15. Results for twenty-four markets are included in online appendix table 2.
16. Results for an additional eighteen markets are reported in online appendix table 3.
17. The center is defined as the tract in the LTDB that had the highest housing unit density in 1970.

Table 1. Decadal Percentage Change in Aggregate Total Units Density by Miles from City Center

CBSA	Miles from center	1970–1980	1980–1990	1990–2000	2000–2010	2010–2020
Atlanta	0–5	−0.022	−0.004	0.001	0.143	0.134
	5–10	0.240	0.139	0.101	0.141	0.110
	10 plus	0.912	0.781	0.352	0.303	0.098
Dallas	0–5	0.020	0.011	−0.010	0.062	0.155
	5–10	0.407	0.114	−0.010	0.010	0.157
	10 plus	0.711	0.438	0.275	0.309	0.196
Miami	0–5	0.181	−0.014	0.030	0.146	0.162
	5–10	0.202	−0.012	0.091	0.045	0.041
	10 plus	0.511	0.108	0.186	0.447	0.103
Phoenix	0–5	0.120	0.010	0.029	0.024	0.146
	5–10	0.922	0.234	0.108	0.125	0.066
	10 plus	1.667	1.087	0.489	0.403	0.124
Los Angeles	0–5	0.061	−0.066	−0.001	0.120	0.068
	5–10	0.062	0.030	0.045	−0.001	0.063
	10 plus	0.334	0.078	0.109	0.030	0.052
Detroit	0–5	−0.185	−0.216	−0.081	−0.120	−0.092
	5–10	−0.015	−0.058	−0.033	−0.065	−0.064
	10 plus	0.343	0.124	0.142	0.075	0.035

Source: Authors' calculations based on Decennial Census and ACS data downloaded from IPUMS NHGIS (Schroeder and others 2025).
Notes: All housing unit density in each distance-to-center ring is calculated by adding all housing units in each distance bin and dividing by the total acreage of the tracts in that distance bin. A tract is considered within a given distance-to-center bin if its centroid is in that distance bin. Using these decadal density measures, we compute the decadal percentage change for a distance-to-center bin within a given CBSA.

Figure 5. FHFA HPI Repeat Sales Price Indexes, Select Markets 1975–2024:Q4

FHFA recalibrated index
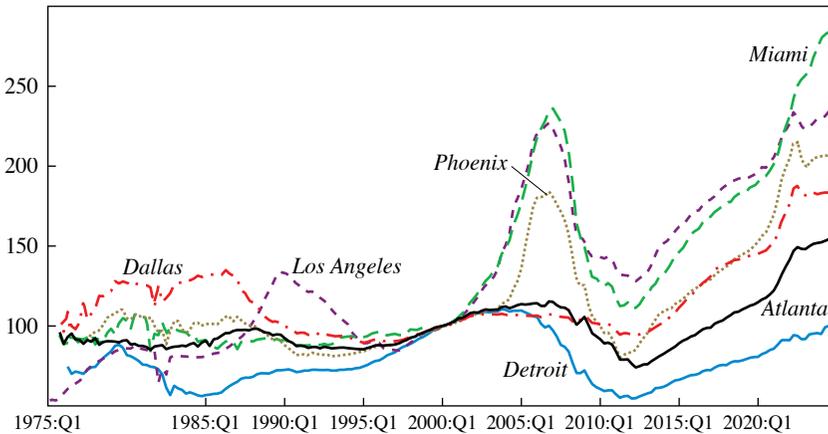
Source: FHFA HPI.
Note: 2000:Q1 = 100.

first quarter of 2000. These data are available at the national level and for many individual metropolitan areas, and the repeat sales structure hopefully controls for the quality of homes sold.

Figure 5 shows the price variation for our six focal markets.[18] Detroit's prices have mostly recovered from their post-GFC bust, but Detroit remains affordable, with prices close to those seen at the turn of the century. Los Angeles provides a canonical example of what happens when strong demand is met with limited new supply for decades. Los Angeles's prices are above their pre-GFC peak, more than double their 2000 level and more than four times their 1975 level. Among our six cities, Los Angeles experienced the highest growth over the entire 1975–2024 time span, but

18. Online appendix figure 1 plots the aggregate data for the United States. That plot documents a total of four booms and three busts. The booms and busts have grown larger over time, and both indexes show a steady rise in national prices. In aggregate, real constant-quality prices are well above their pre-GFC peaks, by over 15 percent. Both trends could reflect increasing limitations on housing supply. Our past work (Glaeser, Gyourko, and Saiz 2008; Glaeser and Gyourko 2018) documents that places facing greater housing constraints also experience more extreme housing booms and busts. In 2024, the country appears to be at the crest of the fourth boom, but while such booms have historically been followed by price drops, the decline in building means that new construction now plays less of a role in pushing prices downward.

Figure 6. Percentage Change in House Prices over Time, 2000–2020 Versus 1980–2000, Top Fifty Markets by 2020 Population

Percentage change in real median price 2000–2020

Percentage change in real median price 1980–2000

Source: Authors' calculations based on Decennial Census data downloaded from IPUMS NHGIS (Schroeder and others 2025).

Miami's prices rose more from 2000 to 2024.[19] Real home prices in Miami have risen by 155 percent since their post-GFC nadir in 2012 and now cost nearly three times their levels in 1975 and 2000. Real constant-quality prices in Phoenix have risen by 157 percent from that city's 2011 post-GFC floor and are now nearly twice their levels in both 1975 and 2000. Dallas's housing is over 50 percent more costly than in 1975 and 2000, and it has experienced a 95 percent increase from its 2012 low. Atlanta's price increase since 2000 is a more modest 32 percent. The price volatility in the four fast-growing Sunbelt markets is also dramatically higher after 2000 than it was before that year, which suggests that housing has evolved from a readily produced commodity into a scarce asset.

Figure 6 shows the real price growth rate between 1980 and 2000 along the horizontal axis and the real price growth rate between 2000 and 2020 along the vertical axis for the broader set of fifty large metropolitan areas. This graph is, in a sense, the mirror of figure 3, which shows that housing

19. The indexes start at slightly different times for individual markets. Los Angeles's series begins in 1975:Q1, with the others beginning in 1976 or 1977. This variation is a function of when the FHFA began publishing a given metropolitan area's series.

Figure 7. Price Growth Versus Quantity Growth, 2000–2020, Top Half of Quantity Growth in 1980–2000

Percentage change in real median price 2000–2020
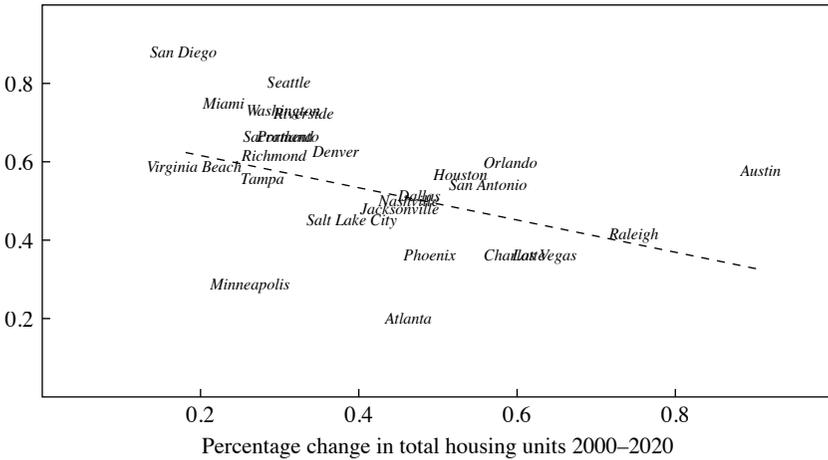
Percentage change in total housing units 2000–2020

quantity growth rates had dropped dramatically after the millennium. In this case, price growth has risen dramatically over the last twenty years. This growth is not just in places like New York and Los Angeles, but also in Dallas, Miami, and Phoenix. Figure 6 documents that our four Sunbelt cities are not all that unusual, as price growth has also been higher recently in Riverside, Houston, and Tampa.

Figure 7 looks at the connection between declining production and rising prices. In this plot, we have taken the twenty-five markets that were growing most quickly between 1980 and 2000 in figure 3. There is a negative relationship between housing unit growth between 2000 and 2020, shown on the horizontal axis, and price growth, shown on the vertical axis. There are, of course, outliers. Minneapolis experienced less housing unit growth and less price growth, and Austin's prices rose significantly despite enormous housing unit growth. Yet, the overall slope is negative and significant, as we estimate that a 10 percent increase in housing units is associated with about a 4 percent decrease in prices (t-statistic ~ −2.4).

This negative correlation and the starkly rising prices that appear in so many markets is incompatible with the view that the decline in new construction is driven by a lack of housing demand. Basic economics tells

Table 2. Price-to-Income Ratios in Phoenix and Detroit

	Phoenix			*Detroit*		
Year	*10th*	*50th*	*90th*	*10th*	*50th*	*90th*
1970	0.87	1.61	2.97	0.90	1.51	2.41
2000	1.60	2.43	4.57	0.73	2.25	4.63
2023	2.96	4.37	7.77	0.82	2.48	5.31

Source: Authors' calculations based on Decennial Census and ACS data downloaded from IPUMS NHGIS (Schroeder and others 2025).

Notes: In each decade, the price-to-income ratio is constructed at the tract level by dividing the tract-level real median house price by the relevant CBSA-wide mean real income. For Phoenix and Detroit, we report the price-to-income ratios at each percentile within the CBSA.

us that sharply rising prices and declines in supply can only indicate a shift in supply. This supply shift could reflect regulation, increased production costs in the building industry (as in Goolsbee and Syverson 2023), or an absence of developable land.

The lack of land hypothesis seems somewhat incompatible with the enormous expanses of open country that surround Atlanta, Dallas, and Phoenix, and with the fact that the median tract density in Phoenix is less than 3.5 homes per acre. One possibility is that rising prices for the metropolitan area as a whole reflect a highly constrained and desirable interior with high and increasing prices, and an unconstrained and far less attractive urban fringe with low prices that are tied closely to construction costs. To investigate this possibility, we will look at the heterogeneity in housing price growth within these areas. We will also examine the distribution of prices across tracts relative to construction costs in the market region.

Online appendix table 4 reports how price-to-income (P/I) ratios have changed across the United States and for select metropolitan areas. Price growth has outpaced income growth generally, and especially so in more expensive tracts. For the 10th percentile tract in the nation, P/I = 1.06 in 1970 and 2.08 in 2023. The nation's median tract's P/I ratio rose by 2.8 times over the same time period, from 1.77 in 1970 to 5.03 in 2023, while that for the 90th percentile increased by 3.4 times, from 3.00 to 10.08. These national changes are a mixture of markets such as Los Angeles and Phoenix. For example, the 90th percentile tract's P/I ratio in Los Angeles rose by 4.4 times, from 3.53 in 1970 to 15.37 in 2023. The analogous increase in Phoenix was only 2.62 times, from 2.97 in 1970 to 7.77 in 2023.

Another important change over time is the divergence of Sunbelt markets such as Phoenix from markets such as Detroit. In 1970, the P/I ratios look quite similar in Phoenix and Detroit. Table 2 shows this was still largely true in 2000, but by 2023, home prices in the typical tract (and more expensive

ones) had escalated far more than average incomes in the Phoenix market than in the Detroit market.

We now turn to the relationship between prices and construction costs. In our earliest work, we focused on the gap between these two numbers, which we argued could be a measure of the impact of regulation under particular circumstances (Glaeser, Gyourko, and Saks 2005). While we do not have measures of construction costs for all houses, we create a proxy for the minimum profitable production cost of a typical home.

The RSMeans (acquired by Gordian) data report the per square foot construction cost for multiple sizes and qualities of homes. We estimate the cost of a 2,000-square-foot average-quality home in each year.[20] This home represents a good- (not high-) quality unit that meets all building code regulations in a community. This reference unit is smaller than newly built homes in most markets, but it is not smaller than most existing homes, which constitute the bulk of the stock that transacts.

To obtain a Core-Based Statistical Area (CBSA)–specific estimate for a 2,000-square-foot home, we correct the national average square foot cost by the CBSA-specific market index value (divided by one hundred, given how their data are reported). This physical construction cost estimate is an input into an estimate of overall production cost, which includes the cost of land (20 percent) and a builder's profit (17 percent on land and structure).[21] We define the minimum profitable production costs (MPPC) of a home as:

$MPPC_c = A_c \times 2000 \times \left(\dfrac{1}{1 - Land\ Share} \right) \times 1.17$, where A is the square foot

cost of providing the 2,000-square-foot economy average-quality home in CBSA c, 2,000 represents the square footage to scale up the per square foot costs on our reference building, $Land\ Share$ is 20 percent, and 1.17 represents a 17 percent profit margin for developers.[22] We then estimate

20. The RSMeans data include cost estimates for four qualities of home: economy, average, custom, and luxury, going from lowest to highest quality, and they provide metropolitan area indexes, but they do not produce separate cost estimates for each quality type for each area.

21. These numbers follow Glaeser and Gyourko (2018).

22. The 20 percent *Land Share* is an assumption we (and others) have used before. It was chosen because land shares in elastically supplied housing markets typically are not more than 20 percent of total home costs. The goal is to have a cost that is associated with a relatively "free" market. Seventeen percent is a typical margin noted by home builders in a survey we conducted some years ago. It is an average over a full housing cycle. It also is consistent with the 9–11 percent internal rates of return that publicly traded home builders earn over time. The RSMeans construction costs data also include a 15 percent margin for developers. This means our estimates for MPPC are conservatively large, making our price-to-MPPC ratio (P:MPPC) an underestimate of the true value.

a price-to-MPPC ratio (P:MPPC) using tract-level median prices in the numerator and our estimates of MPPC in the denominator. Hence, all variation in this ratio within a metropolitan area is driven by differences in prices in the numerator.[23]

Table 3 reports the share of tracts in a given housing market with median house price at least 20 percent below our estimate of fundamental production costs, the share between 80 and 120 percent of production costs, and the share of tracts with median price at least 20 percent more than production costs. Prices can be significantly below construction costs either because a tract's housing has depreciated or because demand for a place has declined. Detroit, for example, never has a substantial number of tracts with median prices greater than 1.2 times MPPC, and always has a healthy majority of tracts with median prices below 0.8 times MPPC.

Los Angeles is our quintessential high-demand, low-supply coastal city and the fourth panel of table 3 documents how virtually the entire housing stock of Los Angeles became more costly than the production costs of delivering those homes. Through 1980, most tracts had median house prices below or near our estimate of MPPC, despite the fact that the share of tracts with a median price 20 percent or more above MPPC jumped from 5 percent to 25 percent during the 1970s. The change was even starker during the 1980s. By 1990, over 60 percent of tracts in the Los Angeles metropolitan area had prices more than 1.2 times our estimate of production costs. Prices fell during the 1990s relative to production costs, but that reversed after 2000, and as of 2023, 93 percent of Los Angeles's tracts had median prices that were at least 20 percent higher than MPPC.

As of 1990, prices were less than 0.8 times production costs in at least 65 percent of the tracts in all four of the Sunbelt cities, and prices were less than 1.2 times production costs in at least 82 percent of all tracts. While these metros were growing and Detroit was not, they weren't all that much less affordable than the Motor City. Atlanta and Miami diverged from the other two cities during the 1990s, and in 2000, the share of tracts with median prices above 1.2 times MPPC was over 20 percent in both areas. In Dallas and Phoenix, the share of tracts with median prices more than 1.2 times of MPPC was less than 12 percent. By 2023, the share of tracts with prices that were at least 1.2 times construction costs had risen

23. We have experimented with different costs in the denominator. The basic patterns discussed below are not much affected if modestly different housing qualities are employed. The potential biases are as follows. Quality drift up will lead to our finding higher P:MPPC ratios over time. We try to counter this by making a conservative estimate of MPPC in the denominator, as described just above.

Table 3. Share of Tracts in P:MPPC Bins—Six Focal Markets

CBSA	P:MPPC Bin	1970	1980	1990	2000	2010	2020	2023
Atlanta	P:MPPC < 0.8	0.835	0.818	0.727	0.553	0.539	0.555	0.416
	0.8 < P:MPPC < 1.2	0.097	0.140	0.135	0.193	0.233	0.202	0.267
	P:MPPC > 1.2	0.068	0.042	0.139	0.254	0.229	0.244	0.317
Dallas	P:MPPC < 0.8	0.876	0.838	0.791	0.754	0.776	0.684	0.527
	0.8 < P:MPPC < 1.2	0.099	0.092	0.115	0.131	0.121	0.146	0.230
	P:MPPC > 1.2	0.025	0.070	0.094	0.114	0.103	0.170	0.243
Detroit	P:MPPC < 0.8	0.934	0.903	0.899	0.752	0.895	0.912	0.884
	0.8 < P:MPPC < 1.2	0.049	0.072	0.065	0.165	0.079	0.067	0.087
	P:MPPC > 1.2	0.018	0.026	0.036	0.084	0.026	0.021	0.028
Los Angeles	P:MPPC < 0.8	0.856	0.383	0.085	0.149	0.015	0.019	0.011
	0.8 < P:MPPC < 1.2	0.096	0.361	0.292	0.451	0.096	0.232	0.057
	P:MPPC > 1.2	0.048	0.256	0.624	0.400	0.889	0.749	0.932
Miami	P:MPPC < 0.8	0.899	0.657	0.659	0.531	0.288	0.393	0.183
	0.8 < P:MPPC < 1.2	0.081	0.198	0.161	0.258	0.361	0.300	0.403
	P:MPPC > 1.2	0.020	0.145	0.180	0.210	0.351	0.307	0.413
Phoenix	P:MPPC < 0.8	0.955	0.839	0.825	0.683	0.535	0.588	0.346
	0.8 < P:MPPC < 1.2	0.036	0.106	0.122	0.229	0.287	0.268	0.355
	P:MPPC > 1.2	0.009	0.055	0.052	0.088	0.178	0.145	0.298

Source: Authors' calculations based on data from RSMeans.
Notes: P:MPPC is calculated for each tract in each year by taking the real median home value P and then dividing it by the CBSA-level value of MPPC. We compute the share of tracts within a CBSA in the designated bins accordingly. See online appendix table 5 for data on the broader set of twenty-four markets tracked in this paper.

to 24 percent in Dallas, 30 percent in Phoenix, 32 percent in Atlanta, and 41 percent in Miami. Unlike Los Angeles, these Sunbelt metropolitan areas all have substantial inexpensive areas, where prices are less than 80 percent of construction costs, but by 2023, they also all have significant areas in which homes are significantly more costly to buy than to build. Increasingly, larger swaths of the Sunbelt metropolises are starting to look more like Los Angeles.

I.D. The Evolution of the Residential Construction Industry

The increasing gap between how much it costs to buy a home and the physical cost of production is happening in previously high supply growth Sunbelt metropolises despite the fact that the physical costs of construction are also rising. This section also shows that those rising costs are accompanied by a sharp reduction in the overall employment and number of establishments in the construction industry.

I.E. The Changing Physical Cost of Housing Production

Figure 8 plots the per square foot construction costs across the six metropolitan areas discussed above. Costs are highest in the markets of Detroit and Los Angeles, while costs in the four Sunbelt metros are lower and similar to each other. The RSMeans data suggest the primary difference is due to labor costs, as the firm assumes that higher-cost union labor is used in both Detroit and Los Angeles. The time patterns of costs covary positively and strongly across all markets. Until the mid-2000s, costs are either flat or declining in each market, but have increased by about 25 percent since then.

That is an economically significant increase in general, and it roughly equals the real constant-quality price growth since the turn of the century discussed above in the Atlanta housing market. It dwarfs the appreciation in Detroit, which is another signal of how weak fundamentals are in that housing market. However, high production costs cannot account for the bulk of the constant-quality price growth in the Dallas, Los Angeles, Miami, or Phoenix markets.[24] At the national level, the FHFA repeat sales price index data reported in online appendix figure 1 show that constant-quality transaction values rose by 77 percent from 2000 to 2023, which suggests that perhaps one-half of the increase in housing costs can be linked to the higher cost of building per se. D'Amico and others (2024) argue that the slow

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24. The same is true for a variety of other Sunbelt markets such as Charlotte, Las Vegas, and Tampa. Price appreciation in this century also has been much higher than production cost increases in the major coastal markets.

Figure 8. Construction Costs for 2,000-Square-Foot Average-Quality Home

Real construction costs (2020 USD/sq. foot)
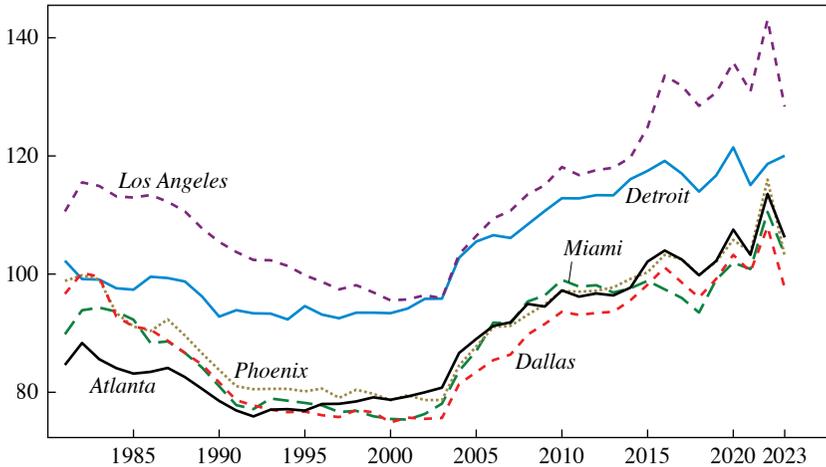
Source: Authors' calculations based on data from RSMeans.
Note: The city-level square foot costs are taken from the RSMeans Construction Cost books. We convert the costs into 2020 real USD values using the nonseasonally adjusted all-items Consumer Price Index for the nation.

productivity in the construction sector reflects the small scale of projects and businesses, which is in turn the result of either land use regulations or limited land availability. If so, then this rising cost of building is not distinct from land use regulation but another example of the consequences of that regulation.

In sum, the rise of building costs may play a significant role in driving price growth in some markets, but it is neither the exclusive or dominant factor in America's most expensive markets (e.g., Los Angeles) nor in many major markets off the coasts and in the Sunbelt.

I.F. The Decline of Construction Employment and Establishments

We now look at the pattern of employment and establishments in home building. Across the country as a whole, both series declined after the GFC and never fully recovered. Yet, in quickly growing markets such as Dallas and Houston, employment and establishments have both come back and are now above pre-GFC peak levels.

Figure 9 depicts these changes based on data from 146 major markets in home building employment and establishments between 2004 and 2022. We define home building as North American Industrial Classification System

Figure 9. Employment and Establishments in the Home Building and Remodeling Sectors, Nationally and by Select Market, 2004–2022
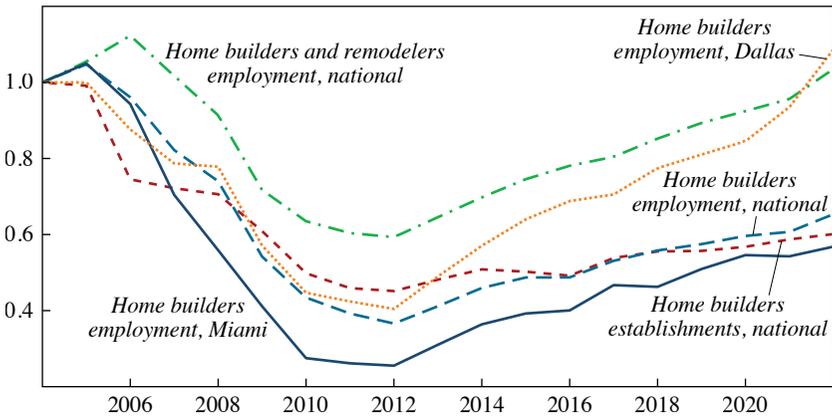
Source: Authors' calculations based on data from the US Census Bureau.

Note: We construct the home building establishments and employment counts by aggregating over three NAICS codes: 236115 (single-family housing construction), 236116 (multifamily housing construction), and 236117 (new housing for sale builders). We also use NAICS code 236118 for residential remodelers' employment. Miami's and Dallas's CBSA data originate from the County Business Patterns (CBP) data and are aggregated to the CBSA level. The national values are calculated by aggregating across all CBSA's in the data. The index plotted for each series scales all years by the 2004 value in its series. Thus, each data point is the percentage change relative to the 2004 value.

(NAICS) codes 236115 (single-family housing construction), 236116 (multi-family housing construction), and 236117 (new housing for sale builders). In this figure, each series is indexed to have a value of one in 2004, with deviations from one indicating the percentage change relative to that year.

The negative shock from the GFC to the housing construction sector is apparent from the different lines that depict the change in establishments and employment, respectively. National home builder employment had dropped by 60 percent in 2012 and establishments had decreased by over half. Neither series has since recovered to the levels seen before the GFC. Do these persistent declines reflect the long-term effects of the GFC? Perhaps the enormous magnitude of the dislocation led to permanent losses in building-related entrepreneurial skill and human capital, or perhaps there was a change in the difficulty of home building? One way to distinguish between these hypotheses is to look at those metropolitan areas where we believe that building is or was relatively unfettered.

In Dallas, home builder employment has fully recovered from its post-GFC decline; in Miami, home builder employment languishes at barely

half of its 2004 level. These data indicate that it is possible to reconstitute a large employment base, even after a large negative shock. The construction industry is dominated by tiny firms, which suggests that barriers to entry are limited. Indeed, if there is less scrutiny of smaller firms for compliance with labor regulations, it may be easier for small firms to function in this industry. Small construction firms typically open and close rapidly, too. For example, in 2022, almost one-fifth of establishments in residential building construction (NAICS 2361) were less than one year old according to the Business Dynamics Statistics database.[25] This is not unique to that year either, as 17.5 percent of all builders were born during every year since 2011.

Figure 9 also plots the total number of employees nationally in the home builder and remodeler sectors combined. In data not plotted here, there was a decline in both remodeling establishments and employment after the GFC, but the trend in both series reversed after 2010. The fact that employment in the combined sectors is back to 2004 levels indicates that remodeling employment increased sharply after the GFC. The growth in remodeling suggests both the flexibility of entry in this sector and that a significant amount of labor and entrepreneurial effort that had once been in home building is now working in the less regulated sector of remodeling.[26]

II. A Framework for Understanding Changes in Housing Supply

In this section, we consider a one-period investment model, which will relate to the housing change regressions in the next section. We label the beginning of the period zero and the end of the period one. To start with, we assume that all households and all housing are homogeneous. The flow utility from owning a home is $\alpha_t D_i^{-\gamma_i} L^\sigma$, where L refers to the amount of land associated with the house, α_i captures an exogenous amenity value,

25. US Census Bureau, "BDSNAICS Business Dynamics Statistics," https://data.census.gov/table?q=BDSTIMESERIES.BDSNAICS&n=2361.

26. It also is the case that home builders have not been earning excessively high returns during the recent boom. Online appendix figure 2 plots the returns of over one dozen publicly traded home builders who are part of the SPDR S&P Homebuilders ETF, along with those for the S&P 500 Index. Home builders certainly do better than the typical S&P 500 firm in good times, but that is to be expected. Home building is a high beta sector. However, when one looks at four-, ten-, or fifteen-year periods, builders have not enjoyed higher returns (absolutely or relative to the broader stock market) in the current boom period compared to past boom periods. Comparisons using longer ten- and fifteen-year periods reach the same conclusion.

and D_i refers to the density level of the neighborhood as a whole. We let $D_{i,0}$ refer to the density as of period zero. The parameter γ_t is time indexed to suggest that density might be considerably less desirable during some periods, such as the 2000s, than in others, such as the 1970s.

We assume that the price of a home at period one will equal $\alpha_i D_i^{-\gamma_t} L^\sigma / r$, which can be interpreted as the net present value of the infinite time horizon flow of utility from owning this housing, assuming that nothing ever changes in the future. If the equilibrium price of land equals P_L, then optimal land ownership implies $P_L = \sigma \alpha_i D_i^{-\gamma_t} L^{\sigma-1} / r$ for every household. Assuming away geographic constraints on land assembly so that each household can buy or sell land freely, then the identical homeowners assumption implies identical land ownership within the neighborhood, and then $D_i = \dfrac{1}{L}$ implies that $P_L = \sigma \alpha_i D_i^{1-\sigma-\gamma_t} / r$.

The physical cost of building a home equals C_t. Across the metropolitan area as a whole, this cost will be endogenous, but at the neighborhood level it can be treated as exogenous because we assume that each tract is an arbitrarily small part of the metropolitan region, just as each home is an arbitrarily small part of the neighborhood's housing stock. If the builder wants to acquire $1/D_i$ units of land for the home (or if the owner wants to subsequently add or subtract land), then the value of the house minus the land cost will equal $(1 - \sigma)\alpha_i D_i^{1-\sigma-\gamma_t} / r$. As in Glaeser and Gyourko (2005), new housing will not get built if $\dfrac{(1-\sigma)\alpha_i D_{i,0}^{1-\sigma-\gamma_t}}{r} < C_t$.

We assume that there is also a cost of the permitting process, which is determined by neighborhood-specific factors, density, and housing growth over the time period. We also assume that this cost is proportional to construction costs, so that total permitting costs equal $\left(\rho_i D_i^{\theta_t} \left(\dfrac{D_i}{D_{i,0}} \right)^{\mu_t} - 1 \right) C_t$, where ρ_i is a neighborhood-specific permitting cost, and θ_t and μ_t are potentially time-varying parameters. We will assume that $\rho_i D_{i,0}^{\theta_t} \geq 1$ for all neighborhoods, so that these costs are always weakly positive.

Total production costs for a house with a standard lot will therefore equal $\rho_i D_i^{\theta_t} \left(\dfrac{D_i}{D_{i,0}} \right)^{\mu_t} C_t$. In a construction market equilibrium with a positive amount of building, the cost of building (structure plus land) must equal the price of housing, which implies $\dfrac{(1-\sigma)\alpha_i D_i^{-\sigma-\gamma_t}}{r} = C_t \rho_i D_{i,0}^{\theta_t} \left(\dfrac{D_i}{D_{i,0}} \right)^{\theta_t + \mu_t}$.

This equality implies two equations that will lie at the heart of the supply curve estimation that follows:

(1) $\ln\left(\dfrac{D_i}{D_{i,0}}\right) = K_0 + \dfrac{1}{\theta_t + \mu_t}\ln(P_H) - \dfrac{\theta_t}{\theta_t + \mu_t}\ln(D_{i,0})$

$\qquad\qquad = K_I + \dfrac{\ln(\alpha_i) - \ln(\rho_i)}{\theta_t + \mu_t + \sigma + \gamma_t} - \dfrac{\sigma + \gamma_t + \theta_t}{\theta_t + \mu_t + \sigma + \gamma_t}\ln(D_{i,0}),$

and

(2) $\ln(P_H) = K_P + \dfrac{(\theta_t + \mu_t)\ln(\alpha_i) + (\sigma + \gamma_t)\ln(\rho_i)}{\theta_t + \mu_t + \sigma + \gamma_t}$

$\qquad\qquad\quad - \dfrac{\mu_t(\sigma + \gamma_t)}{\theta_t + \mu_t + \sigma + \gamma_t}\ln(D_{i,0}),$

where the K_0, K_I, and K_P terms reflect terms that are constant across neighborhoods. Amenities (α_i) positively predict prices and building. Local permitting difficulty (ρ_i) predicts higher prices and less building.

If we look across neighborhoods with a common value of $D_{i,0}$ and a positive level of construction, and if we assume that both $\ln(\alpha_i)$ and $\ln(\rho_i)$ are mean zero, then the univariate coefficient if $\ln\left(\dfrac{D_i}{D_{i,0}}\right)$ is regressed on $\ln(P_H)$ will equal:

(3) $\dfrac{\begin{array}{c}(\theta_t + \mu_t)\mathrm{Var}\big[\ln(\alpha_i)\big] - (\sigma + \gamma_t)\mathrm{Var}\big[\ln(\rho_i)\big] \\[4pt] + (\sigma + \gamma_t - \theta_t - \mu_t)\mathrm{Cov}\big[\ln(\rho_i), \ln(\alpha_i)\big]\end{array}}{\begin{array}{c}(\theta_t + \mu_t)^2\mathrm{Var}\big[\ln(\alpha_i)\big] + (\sigma + \gamma_t)^2\mathrm{Var}\big[\ln(\rho_i)\big] \\[4pt] + 2(\theta_t + \mu_t)(\sigma + \gamma_t)\mathrm{Cov}\big[\ln(\alpha_i), \ln(\rho_i)\big]\end{array}}.$

This will only recover the "true" housing supply elasticity $\dfrac{1}{\theta_t + \mu_t}$ when the variance of $\ln(\rho_i) = 0$. If the two local shocks are orthogonal to one

another (which seems unlikely to us), then the coefficient will be positive if and only if $\text{Var}[\ln(\alpha_i)] > \dfrac{\sigma + \gamma_t}{\theta_t + \mu_t}\text{Var}[\ln(\rho_i)]$ or the variation in amenities is larger than the variance in the difficulty of getting approvals. If opposition to building has risen in some areas more than others, then $\text{Var}[\ln(\rho_i)]$ will have increased, which implies that the estimated coefficient when building is regressed on price should decline.

Similarly, the univariate coefficient if growth in density is regressed on initial density levels will be estimated by:

$$(4) \quad \frac{1}{\theta_t + \mu_t + \sigma + \gamma_t}\left(\frac{\text{Cov}\left[\ln\left(\alpha_i\right), \ln\left(D_{i,0}\right)\right]}{\text{Var}\left[\ln\left(D_{i,0}\right)\right]} - \frac{\text{Cov}\left[\ln\left(\rho_i\right), \ln\left(D_{i,0}\right)\right]}{\text{Var}\left[\ln\left(D_{i,0}\right)\right]}\right) - \left(\sigma + \gamma_t + \theta_t\right).$$

The $\sigma + \gamma_t + \theta_t$ are the "structural" terms linking density and new construction, which sums together a preference term for density (γ_t), a preference term for land (σ), and the adverse impact of density on permitting (θ_t). The $\text{Cov}[\ln(\alpha_i), \ln(D_{i,0})]$ term can be positive, if there was more historic building in nicer places, or negative if older dense areas are located near current or past polluting industries or if they have just become run down.

We are particularly interested in $\text{Cov}[\ln(\rho_i), \ln(D_{i,0})]$, which captures the link between density and the permitting environment. If places with less opposition to growth acquire more density over time, then this term will be negative and increase the estimated coefficient of growth on density. If the variance of $\ln(\rho_i)$ increases over time, then we expect to see that the coefficient between initial density and growth will either get closer to zero or become positive because the positive correlation between density and the ease of building will become more important.[27]

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27. Glaeser and Ward (2009) report a strong positive correlation between building and initial density levels across towns in Greater Boston, which is compatible with the view that higher-density areas have lower values of $\ln(\rho_i)$.

II.A. Instrumental Variables

In the analysis that follows, we typically instrument for current prices with either lagged prices or geographic variation (such as distance to the central business district) or both. We do not know of any cross-sectional instrument that is correlated with α_i and not ρ_i, or correlated with ρ_i and not α_i, partially because amenities will shape the demographic composition of a neighborhood and the demographic composition of the neighborhood will determine the difficulty of permitting. The fact that both variables enter both equations makes the estimation of housing supply curves inherently challenging. Baum-Snow and Han (2024) solve this by focusing on a relatively short horizon (such as 2000 to 2006) and assume that shocks to labor demand will increase the demand for housing over the period without having a material impact on the supply of housing.

To see this, we sketch a version of the model with two groups of people, which we label H-types and L-types, which have different marginal utilities of cash and reservation locations. The L-types have a marginal utility of income equal to one, while H-types have a marginal utility of income equal to $\frac{1}{\theta} < 1$. The reservation community for the L-types costs nothing and provides no housing-related welfare, hence they are willing to pay $\frac{\alpha_i D_i^{-\sigma-\gamma_t}}{r}$ to live in neighborhood i. The reservation community for the H-types costs P_H and provides housing-related welfare of H_H, and hence the willingness to pay for any other community satisfies $\frac{\alpha_i D_i^{-\sigma-\gamma_t}}{r} - \frac{P_i}{\theta} = H_H - \frac{P_H}{\theta}$, so $P_i = P_H + \theta\left(\frac{\alpha_i D_i^{-\sigma-\gamma_t}}{r} - H_H\right)$. Moreover, we assume that ρ_i gets multiplied by $\theta > 1$ if the community is occupied entirely by H-types rather than L-types, which will lead to flatter supply curves in H-type neighborhoods. This assumption reflects the possibility that more skilled individuals are also more effective in using political and legal processes to block construction near them. The H-types could also dislike density more, which is suggested by Gyourko and McCulloch (2024).

At a point in time, when density is fixed, there will be a marginal community that satisfies $\alpha_i D_i^{-\sigma-\gamma_t} = \frac{r\left(P_H - \theta H_H\right)}{\left(1 - \theta\right)}$, at which H-types and L-types are willing to pay the same amount, and H-types will live in

communities for which $\alpha_i D_i^{-\sigma-\gamma_i} > \dfrac{r\left(P_H - \theta H_H\right)}{\left(1-\theta\right)}$ and L-types will live in

communities in which $\alpha_i D_i^{-\sigma-\gamma_i} < \dfrac{r\left(P_H - \theta H_H\right)}{\left(1-\theta\right)}$. Demand-related instru-

mental variables typically purport to be shocks to α_i, and a shock to α_i could convert the neighborhood from being an L-type neighborhood to being an H-type neighborhood. This shock will then shift the supply curve as well. Assuming that demand for the city is growing everywhere, the growth in housing in the shocked community can be lower than in those communities, which were not shocked because the increase in demand is also associated with a downward shift in the supply elasticity.

Neighborhood change doesn't happen instantaneously and even after an area gentrifies, it can take time for the permitting culture to change. Consequently, there can be short-run (e.g., under ten years) shocks to either demand or supply that can essentially satisfy the exclusion restriction, but we are skeptical about any longer-term shocks.[28] Moreover, it is hard to think of any permanent attribute, whether distance to the central business district or elevation, that will serve as a valid instrument for either demand or supply. An amenity that has an impact on the difficulty of building (as in Saiz 2010), is likely to attract people who like less density. These people may oppose new development, thereby leading ρ_i to rise. Moreover, their presence may lead to endogenous local amenities, causing α_i to rise, perhaps by attracting more prosperous people who find it easier to stop new projects.

In the work that follows, we will look at decadal shifts in the housing stock, between 1970 and 2020. We focus on the coefficients on both price and density and their shifts over time. We will refer to the estimated object as the "empirical housing supply." The model suggests that interpreting both coefficients is fraught, but a downward shift in the link between price and construction is likely to mean that the variance of $\ln(\rho_i)$ has increased relative to the variance of $\ln(\alpha_i)$. A decline in the measured price elasticity can also occur if the parameters θ_t and μ_i increase. We will not try to estimate

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28. Consider a longer-term version of the Baum-Snow and Han (2024) instrument, which focuses on hyper-local labor demand. A formerly working-class neighborhood is near an office complex specializing in a particular type of business services. Nationwide employment in this type of business service soars, and demand for the neighborhood grows from knowledge workers. These knowledge workers move in and also start attending community meetings to oppose new projects. Over five years, only the α_i changes, but over longer periods both the α_i and the ρ_i go up.

those parameters separately, but we will refer to those equations when we interpret the empirical results that follow.

The density coefficient is also difficult to interpret because density can be correlated with either amenities or permissiveness of the permitting environment. Nonetheless, if the relationship between density and construction, holding price constant, gets less negative or positive, then we will interpret this as evidence supporting the increased importance of supply conditions, as suggested by equation (4).

III. Changes in the Empirical Housing Supply Curve in Six Metropolitan Areas

We now turn to our estimation of the empirical housing supply curve in six metropolitan areas. We first discuss our methodology and then turn to the results.

III.A. Estimating the Empirical Housing Supply Curve

For all six cities (and for all other markets used in analysis reported later in the paper), we use our 1970-based tract-level data. We use density levels as reflected in total housing units per acre and median housing value in the tract. We look at the five decades for which we have our 1970-based tract-level data: 1970–1980, 1980–1990, 1990–2000, 2000–2010 and 2010–2020.

Our first specification uses naive ordinary least squares (OLS), which is estimated for each metropolitan area:

$$(5) \qquad \Delta \log\left(density_{i,t+1}\right) = \alpha + \beta_1^t \log\left(price_{i,t+1}\right)$$

$$+ \beta_2^t \log\left(density_{i,t}\right) + \epsilon_{i,t},$$

where i indexes the individual census tracts and t denotes the starting decade. Thus, if $t = 1970$, then $t + 1 = 1980$, so that $\Delta\log(density_{i,t+1}) = \log(density_{i,1980}) - \log(density_{i,1970})$, with each subsequent decade defined analogously. This specification exactly follows the first part of the equality in equation (1). If we thought we had instruments that correlated with demand (but not supply) in 1990 or 2000, then we would actually be able to interpret β_1^{1970} as $\dfrac{1}{\theta_t + \mu_t}$.

We utilize an instrumental variable strategy that will reduce some of the issues with equation (5), but still fail to identify the core theoretical supply

elasticity, which is why we refer to them as empirical housing supply elasticities. Our instrumental variables equations have the following second stage where future price is instrumented with different variables:

$$(6) \qquad \Delta \log\left(density_{i,t+1}\right) = \alpha + \lambda_1' \log\left(\widehat{price}_{i,t+1}\right)$$

$$+ \lambda_2' \log\left(density_{i,t}\right) + \epsilon_{i,t},$$

and where $\log\left(\widehat{price}_{i,t+1}\right)$ indicates that the coefficient on the logarithm of price at the end of the period is estimated using instrumental variables. In tables 4 and 5, we report results with the following first stage:

$$(7) \qquad \log\left(price_{i,t+1}\right) = \alpha + \delta_1 distance_i + \delta_2 distance_i^2$$

$$+ \sum_{q=i}^{8} \delta_q I_q^{Loc} + \delta_4' \log\left(price_{i,t}\right) + u_{i,t}.$$

In this specification, the distance terms refer to the distance from the centroid of the metropolitan area's central tract. We have supplemented distance by subdividing the metropolitan area into eight octants, by drawing circles around the central tracts. The terms I_q^{Loc} are indicator values that take on a value of one if the tract is in a particular octant.[29] This approach relies on the fact that distance to the central business district can be an amenity. Particular geographic parts of the city may also have different amenity levels. Of course, particular parts of the city may also have more difficult building conditions, perhaps because they have higher amenity levels. Finally, we also use the initial period price as an instrument for price at the end of the period.

This is our primary specification, which reduces the downward bias in the supply curve elasticity that comes from the negative impact of new supply on price. But instrumenting for current price with lagged price is essentially equivalent to regressing housing supply growth on the initial period price, and this still will not recover $\dfrac{1}{\theta_t + \mu_t}$ unless there is no variation

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29. If zero degrees is a line due east from the centroid, then the octants include tracts that are between −22.5 degrees and 22.5 degrees, 22.5 degrees and 67.5 degrees, and so forth. See online appendix figure 3 for an example using the Atlanta metropolitan area.

across census tracts in the difficulty of building. The goal is to create a better first-stage fit and to reduce the direct impact of building on price. We now turn to our results for the six metropolitan areas.

III.B. Empirical Housing Supply Curves Across Six Metropolitan Areas

Tables 4 and 5 report our results across our six primary markets. Table 4 shows results for tracts that are within ten miles of the metropolitan area, and table 5 shows results that are farther out. We think of the inner sample as capturing central city or urban tracts and the outer sample capturing suburban areas. Both tables show results from equation (6) with the first stage from equation (7), which uses both location controls and lagged price as instruments. Results for the naive OLS and the two other IVs that used only price or location controls as instruments are available in online appendix tables 6A and 6B. We discuss the price coefficients in both tables first and then conclude with an interpretation of the density coefficients.

The price coefficient declines over time for almost all cities in both time periods in both samples, and online appendix tables 6A and 6B document that this pattern also holds for three other specifications: OLS, IV just using lagged price, and IV just using geographic information. The only exceptions are the close-in tracts in Atlanta and Detroit. Infill development appears to be particularly important in Atlanta. Detroit is losing housing within its urban core, and unsurprisingly, it is losing more housing where prices are lowest.

The change in new housing supply is most visible in the changing relationship between price and building among the suburban tracts. There used to be substantial building in high-priced tracts more than ten miles out during the 1970s, especially in Dallas and Phoenix, where our estimated price elasticities are 0.72 and 0.65, respectively. By the 2010s, that phenomenon had largely disappeared, and table 5 reports price elasticities below 0.1 for all of the metropolitan areas. We estimated smaller elasticities in the 1970s for Atlanta and Miami (0.3 and 0.25, respectively), but in the 2010s, the estimated elasticities for both areas are not statistically distinct from zero. Online appendix table 6B shows that in the three other specifications across all four cities, the supply response to density in the 2010s is always much lower than the response in the 1970s.

Figure 10 plots the shifting empirical supply curves over time for the four Sunbelt metros based on the regression results reported in tables 4 and 5. The plotted lines depict the predicted housing supply as a function of price.

Table 4. Regression Tables of Delta Log All Unit Density on Initial Period Log Price for Six CBSAs (Within Ten miles)

Coefficient	CBSA	1970	1980	1990	2000	2010
Log price	Atlanta	0.089	0.178	0.127	0.112	0.146
Log price SE		(0.055)	(0.038)	(0.035)	(0.048)	(0.030)
Density		−0.210	−0.024	−0.135	−0.115	0.005
Density SE		(0.043)	(0.041)	(0.077)	(0.056)	(0.029)
R^2/Wald F		81.879	168.049	118.739	64.308	72.521
# Obs		167	167	164	160	146
Log price	Dallas	*0.232*	*0.059*	*0.081*	*0.006*	*0.017*
Log price SE		(0.067)	(0.025)	(0.033)	(0.021)	(0.015)
Density		*−0.243*	*−0.054*	*−0.149*	*−0.125*	*−0.005*
Density SE		(0.070)	(0.032)	(0.043)	(0.044)	(0.033)
R^2/Wald F		157.176	311.531	216.836	222.305	296.882
# Obs		*200*	*197*	*194*	*192*	*181*
Log price	Miami	0.147	0.106	0.048	0.076	−0.034
Log price SE		*(0.043)*	*(0.045)*	*(0.022)*	*(0.048)*	*(0.024)*
Density		−0.015	−0.188	0.008	−0.012	−0.001
Density SE		(0.023)	(0.081)	(0.023)	(0.026)	(0.028)
R^2/Wald F		*134.651*	*1418.405*	*684.530*	*230.400*	*373.123*
# Obs		108	107	106	104	99
Log price	Phoenix	*0.363*	*0.137*	*0.052*	*0.102*	*0.035*
Log price SE		(0.073)	(0.067)	(0.023)	(0.091)	(0.022)
Density		−0.325	−0.058	−0.067	−0.118	0.022
Density SE		*(0.048)*	*(0.051)*	*(0.045)*	*(0.070)*	*(0.033)*
R^2/Wald F		130.835	89.320	166.686	97.381	117.984
# Obs		*158*	*156*	*154*	*154*	*148*
Log price	Los Angeles	0.100	0.019	−0.007	0.037	−0.006
Log price SE		(0.015)	(0.017)	(0.010)	(0.022)	(0.008)
Density		*−0.015*	*−0.005*	*−0.003*	*−0.094*	*−0.007*
Density SE		(0.015)	(0.019)	(0.008)	(0.032)	(0.006)
R^2/Wald F		*252.782*	*476.234*	*177.365*	*232.059*	*255.320*
# Obs		636	630	618	608	583
Log price	Detroit	0.142	0.233	0.158	0.203	0.170
Log price SE		(0.051)	(0.037)	(0.015)	(0.031)	(0.020)
Density		−0.217	−0.097	0.006	−0.118	−0.030
Density SE		(0.044)	(0.042)	(0.015)	(0.046)	(0.027)
R^2/Wald F		68.943	5845.502	242.008	114.861	101.992
# Obs		491	486	477	469	440

Source: Authors' calculations.

Note: The results reported are from estimation of equation (6) with the first stage from equation (7), which uses both location controls and lagged price as instruments. For each CBSA, the final row in the subpanel corresponds to the Kleibergen-Paap rk Wald F statistic for the first-stage regression.

Table 5. Regression Tables of Delta Log All Unit Density on Initial Period Log Price for Six CBSAs (Outside Ten Miles)

Coefficient	CBSA	1970	1980	1990	2000	2010
Log price		0.298	0.325	0.183	0.053	0.021
Log price SE		(0.155)	(0.111)	(0.076)	(0.040)	(0.017)
Density	Atlanta	−0.140	−0.151	−0.172	−0.192	−0.026
Density SE		(0.032)	(0.023)	(0.026)	(0.028)	(0.010)
R^2/Wald F		24.122	24.561	167.542	109.818	173.212
# Obs		80	80	80	80	73
Log price		0.723	0.447	0.219	0.148	0.071
Log price SE		(0.069)	(0.059)	(0.030)	(0.047)	(0.023)
Density	Dallas	−0.151	−0.096	−0.067	−0.095	−0.044
Density SE		(0.014)	(0.010)	(0.006)	(0.012)	(0.007)
R^2/Wald F		83.086	248.971	325.151	96.469	218.719
# Obs		337	336	335	331	291
Log price		0.248	0.186	0.069	0.077	−0.000
Log price SE		(0.076)	(0.041)	(0.028)	(0.051)	(0.015)
Density	Miami	−0.314	−0.150	−0.059	−0.069	−0.011
Density SE		(0.037)	(0.027)	(0.016)	(0.023)	(0.011)
R^2/Wald F		102.356	82.662	218.729	92.932	224.072
# Obs		310	309	307	306	277
Log price		0.645	0.434	0.263	−0.233	0.098
Log price SE		(0.227)	(0.130)	(0.088)	(0.155)	(0.046)
Density	Phoenix	−0.194	−0.038	−0.057	−0.130	−0.034
Density SE		(0.055)	(0.019)	(0.016)	(0.043)	(0.013)
R^2/Wald F		20849.441	3689.113	2280.118	1916.108	161.486
# Obs		74	72	72	72	62
Log price		0.169	0.012	0.008	−0.029	−0.030
Log price SE		(0.030)	(0.019)	(0.010)	(0.014)	(0.009)
Density	Los Angeles	−0.144	−0.081	−0.030	−0.045	−0.019
Density SE		(0.017)	(0.014)	(0.006)	(0.013)	(0.007)
R^2/Wald F		249.445	267.250	277.753	327.195	263.673
# Obs		1245	1241	1236	1229	1188
Log price		0.201	0.102	0.055	0.088	0.041
Log price SE		(0.044)	(0.025)	(0.027)	(0.035)	(0.011)
Density	Detroit	−0.148	−0.060	−0.100	−0.051	−0.014
Density SE		(0.014)	(0.007)	(0.015)	(0.006)	(0.006)
R^2/Wald F		128.880	996.375	516.773	162.663	335.172
# Obs		572	569	564	562	553

Source: Authors' calculations.

Note: The results reported are from estimation of equation (6) with first stage from equation (7), which uses both location controls and lagged price as instruments. For each CBSA, the final row in the subpanel corresponds to the Kleibergen-Paap rk Wald F statistic for the first-stage regression.

Figure 10. Empirical Housing Supply Curves for Four Sunbelt Markets

Atlanta

Predicted delta log density

Log (price/median CBSA price)

Dallas

Predicted delta log density

Log (price/median CBSA price)

- - - 2010–2020 (Within 10 miles)   —— 2010–2020 (Outside 10 miles)
······· 1990–2000 (Within 10 miles)   —— 1990–2000 (Outside 10 miles)
– – 1970–1980 (Within 10 miles)   —— 1970–1980 (Outside 10 miles)
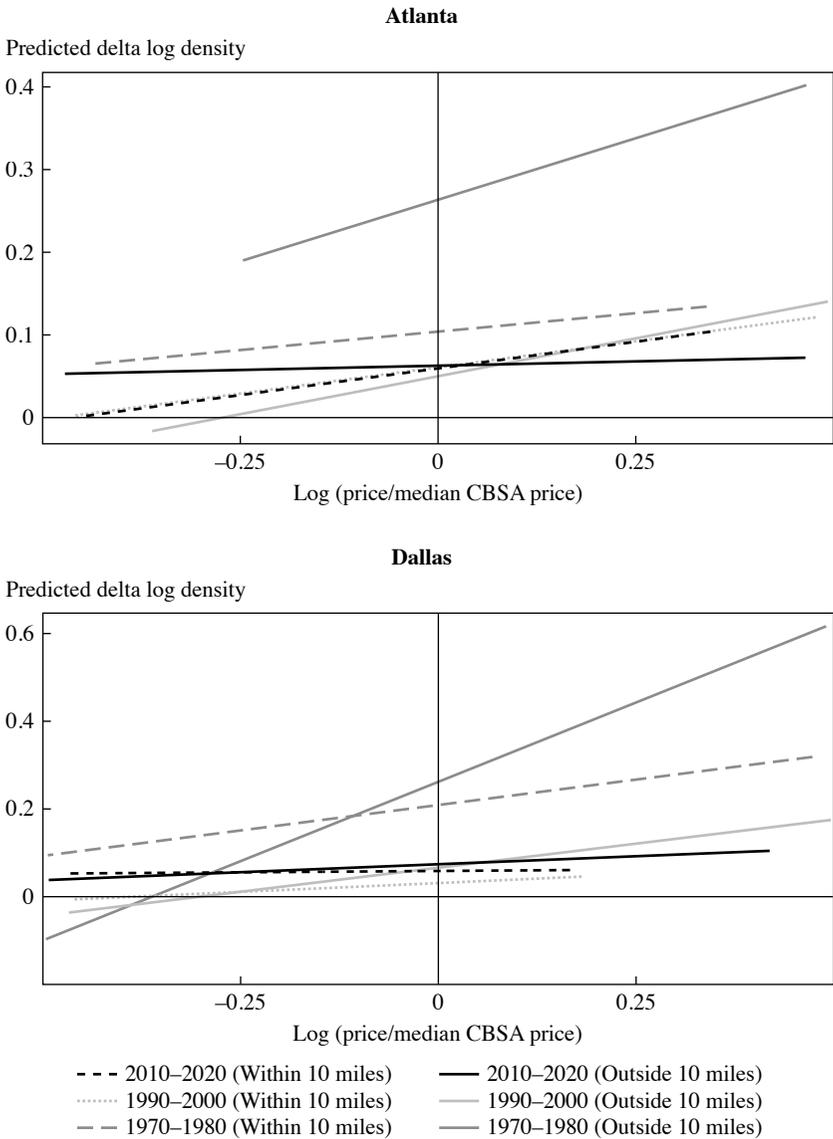
Figure 10. Empirical Housing Supply Curves for Four Sunbelt Markets (*Continued*)

Miami

Predicted delta log density

Log (price/median CBSA price)

Phoenix

Predicted delta log density

Log (price/median CBSA price)

- - - 2010–2020 (Within 10 miles) —— 2010–2020 (Outside 10 miles)
········ 1990–2000 (Within 10 miles) —— 1990–2000 (Outside 10 miles)
– – 1970–1980 (Within 10 miles) —— 1970–1980 (Outside 10 miles)
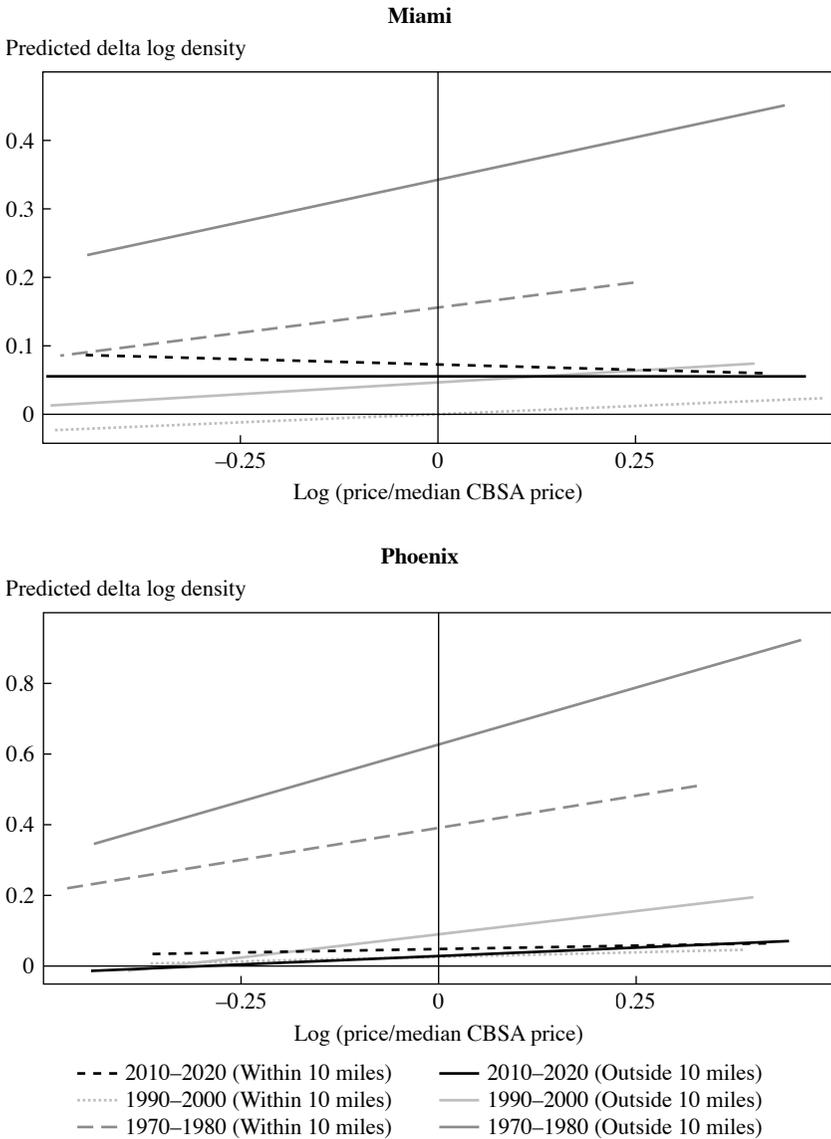
Since these supply curves also depend on tract-level density, we fix the density for each metropolitan area at the median tract level in that year. To make units comparable, the *x*-axis shows the log of price relative to the median price across the metropolitan area. Subtracting the area median is just adjusting the constant. We report predicted supply for (log) price-to-median tract price ratios that run from −0.5 to +0.5. Across each decade starting with the 1970s, there always are many cases within that domain range. The solid lines reflect the results for distant tracts and the dotted lines reflect the more central tracts. We report results for three decades: the 1970s, the 1990s, and the 2010s.

The pattern of results is quite similar across the four Sunbelt markets. The empirical supply curve among suburban tracts in the 1970s always is steeper than the supply curve for more central tracts. Except for Dallas, the suburban line always is above the city line throughout our domain. In addition, the 1970s lines always are above those for the 1990s and 2010s. By the end of our data in the 2010s, the schedules have shifted down and flattened considerably, which is compatible with the decline in home building discussed above. The lines for the 1990s show that this change began before the 2010s. High prices in the suburban parts of these metro areas no longer stimulate much new building, possibly because the residents of these areas have made it difficult to permit new projects.

Figure 11 reports the analogous results for Los Angeles and Detroit. The pattern for Los Angeles is similar to that for the Sunbelt markets, but there is much less building, which is reflected in the narrow range of the *y*-axis and the supply function. Detroit does have a positive slope in more recent decades, but this represents not growth but decline, as shown by the negative values predicted for the 1990s and 2010s. The least valuable properties are abandoned first.

We now turn to the coefficients on density, which generally rise over time. In table 4, the density coefficients among closer-in tracts are almost always negative and generally statistically significant in the 1970s and 1980s. In almost every case, the coefficients get closer to zero over time. Online appendix table 6A shows the same pattern for our three other specifications. Table 5 and online appendix table 6B show that the same basic pattern is true in more distant tracts. The coefficients are almost always negative and decline in magnitude over time.

The negative coefficients indicate that higher density does limit building, consistent with a "density wall" hypothesis, which posits that the supply slump reflects the fact that America's suburbs are just running out of land. However, these coefficients are small and getting smaller. A coefficient

Figure 11. Empirical Housing Supply Curves for Los Angeles and Detroit

Los Angeles

Predicted delta log density

Log (price/median CBSA price)

Detroit

Predicted delta log density

Log (price/median CBSA price)

- - - 2010–2020 (Within 10 miles)   ——— 2010–2020 (Outside 10 miles)
········ 1990–2000 (Within 10 miles)   ——— 1990–2000 (Outside 10 miles)
— — 1970–1980 (Within 10 miles)   ——— 1970–1980 (Outside 10 miles)
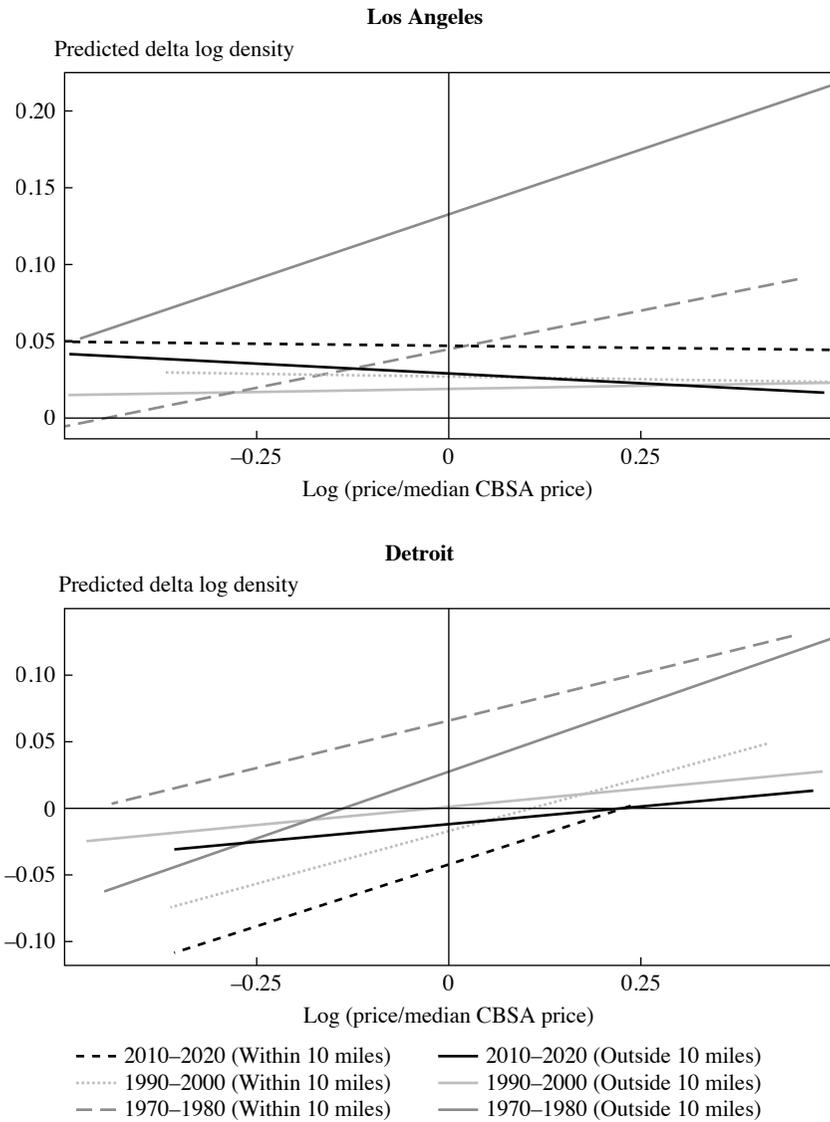
Source: Authors' calculations using the regression results from tables 4 and 5.

Note: When computing predicted values, log all housing unit density is held constant at the CBSA-level median.

of −0.25 (which is larger than all but two density coefficients reported in tables 4 and 5) means that an enormous 50 percent increase in density is only associated with about a 12.5 percent reduction in the production of single-unit housing.

A coefficient of −0.05 (which is larger than any coefficient estimated for the 2010s) means that a 50 percent density increase would reduce construction by only 2.5 percent. While density does matter for construction, American housing supply is not declining primarily because we are hitting a density wall.

While these linear specifications yield important insights, we are also interested in potential interaction effects. To gain insight into their possible role, we turn from regression specifications to manipulation of tract-level density and price data. Initially, we assigned each tract into one of three price categories as well as one of four density categories.

The price bins are based on the tract's price-to-minimum profitable production costs (P:MPPC) ratio defined above. We classify tracts as cheap (median price is less than 80 percent of MPPC), moderate (price is between 80 and 120 percent of MPPC), and expensive (price is at least 20 percent higher than MPPC). We also grouped tracts into four density bins: less than 0.5 housing units per acre, from 0.5 to 1.5 housing units per acre, from 1.5 to 2.5 housing units per acre, and tracts with more than 2.5 units per acre. There are twelve possible cells, and cross-tabulation tables were created across all possible price-density categories for each decade from the 1970s through the 2010s for each metropolitan area.

For presentation purposes, we group the moderate and expensive tracts together and call them "high price." We also group the density bins together if they have below 1.5 units per acre or above 1.5 units per acre. Combining these two density and two price categories, we show the changes in building activity in low-density/low-price tracts, low-density/high-price tracts, high-density/low-price tracts, and high-density/high-price tracts over time in table 6.

Increases in the share of housing units built in low-density/low-price tracts tend to be modest. This number has not risen substantially over time except in the Atlanta market, and we see this as reflecting limited demand for frequently quite far-off tracts.[30] Relatively low numbers of housing units

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30. It is also the case that there was a relatively high share of production in these types of tracts in the 1970s (and only in the 1970s) in the Miami and Phoenix markets. The analogous share in the Dallas metro has hovered around 11–13 percent from the 1970s through the 2010s.

Table 6. New Housing Shares over Time by Price and Density for Six CBSAs

CBSA	Year	Total change in units	Low-density/ low-price	Low-density/ high-price	High-density/ low-price	High-density/ high-price
Atlanta	1970s	231,118	0.059	0.901	−0.004	0.044
	1980s	297,572	0.045	0.884	0.019	0.052
	1990s	258,881	0.046	0.860	0.001	0.093
	2000s	331,861	0.320	0.508	0.051	0.121
	2010s	164,869	0.204	0.395	0.053	0.347
Dallas	1970s	347,958	0.136	0.694	0.005	0.165
	1980s	389,433	0.126	0.674	0.020	0.180
	1990s	338,408	0.110	0.753	−0.002	0.139
	2000s	497,227	0.138	0.722	0.023	0.118
	2010s	444,406	0.136	0.570	0.041	0.252
Detroit	1970s	258,898	0.039	0.828	−0.005	0.138
	1980s	115,810	0.016	1.001	−0.247	0.229
	1990s	145,227	0.003	1.001	−0.171	0.167
	2000s	75,078	0.021	1.161	−0.397	0.215
	2010s	36,451	0.052	1.121	−0.696	0.523
Los Angeles	1970s	577,763	0.049	0.412	0.039	0.500
	1980s	453,678	0.082	0.359	0.166	0.394
	1990s	211,335	0.074	0.433	0.167	0.326
	2000s	188,100	0.145	0.413	0.186	0.256
	2010s	231,359	0.057	0.196	0.278	0.470
Miami	1970s	595,427	0.238	0.444	0.083	0.236
	1980s	416,262	0.039	0.654	0.055	0.252
	1990s	299,419	0.051	0.596	0.099	0.253
	2000s	275,001	0.091	0.267	0.170	0.472
	2010s	179,585	0.064	0.121	0.262	0.552
Phoenix	1970s	286,947	0.178	0.627	0.046	0.149
	1980s	292,202	0.060	0.637	0.044	0.259
	1990s	300,577	0.014	0.817	0.011	0.159
	2000s	378,479	0.075	0.775	0.030	0.119
	2010s	177,490	0.027	0.696	0.063	0.214

Source: Authors' calculations are described in the text.
Note: Low-density tracts are defined as those with less than 1.5 units per acre, while high-density tracts have more than 1.5 units per acre. Low-price tracts are defined as those whose median price is less than 80 percent of the CBSA-level median house price. High-price tracts are those whose median price is 80 percent or more of the CBSA median. See online appendix table 7 for results on the other eighteen markets we track throughout the paper.

are built in high-density/low-price tracts, too, but these shares have typically risen over time, especially in the Los Angeles and Miami markets. In those cities, where demand is robust almost everywhere, it can be easier to add multifamily units in already dense, if not high-value, tracts. This process is often associated with gentrification.

There is near universal decline in the amount of growth in high-price, low-density areas, both in absolute levels and as a share of total construction. It has become harder over time to build in low-density, higher-price areas in major markets such as Atlanta (50 percentage point decline in share and 69 percent decline in units built from the 1970s to the 2010s), Los Angeles (20 percentage point decline in share and 81 percent decline in units built), and Miami (32 percentage point decline in share and 92 percent decline in total units). The one major exception is Dallas, which is also unusual in building more during the 2010s than it did in the 1980s. In the Phoenix market, the share of homes built in low-density, high-price areas has not declined, but the actual number of units built in these areas was 30 percent lower in the 2010s than in the 1970s.[31] Detroit's growth was anemic in the 2010s, but what little there was occurred in high-density, low-cost areas.

Building in high-cost, high-density areas has increased as a share of total production in every city except for Los Angeles. Atlanta and Dallas are actually building more in the high-density, high-cost areas now than in the past, but in Atlanta's case, the new units are nowhere near enough to offset the reduced production in lower-density areas. In Detroit, Miami, Phoenix, and Los Angeles, production in high-density, high-cost areas is lower in absolute terms in the 2010s than the 1970s, even though such building is a larger share of production. We interpret these results as suggesting that building everywhere has become more difficult, but the change is most dramatic in the pricier suburbs.

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31. We suspect absence of a decline in share reflects a cost of using our 1970-based tract boundaries. In Phoenix, what are now outlying suburbs were very large census tracts with low populations in 1970. They have seen much growth, especially in more recent decades. However, the acreage of these 1970-defined tracts is so large that they still are defined as low-density by our metric. One possible implication is that any growing metro area that sees its share of building in low-density, higher-price tracts not falling likely has physical capacity to continue growing its suburbs.

Figure 12. Changes in Price Coefficients over Time, All Housing Unit Sample, Tracts Within Ten Miles of the Metro Center

Source: Authors' calculations are described in text.

IV. Changes in the Empirical Housing Supply Curve Across the United States

We now turn to our results for a broader set of forty-four large metropolitan areas listed in online appendix table 8. This sample again begins with the fifty largest metropolitan areas, but also requires at least 70 percent of the area's population to be covered in each decade by 1970-defined tract areas, and for the area to have at least fifty tracts both within and beyond ten miles of the urban core for us to credibly use both location controls and lagged price as instruments.

Figures 12 and 13 each present four plots of the price elasticity coefficients from metropolitan areas, with each plot comparing the coefficients

Figure 13. Changes in Price Coefficients over Time, All Housing Unit Sample, Tracts Greater Than Ten Miles from the Metro Center

1980–1990 vs. 1970–1980

1980–1990 price coefficient

```
1.00
0.75
0.50
0.25
   0
        0   0.25  0.50  0.75  1.00
           1970–1980 price coefficient
```

1990–2000 vs. 1970–1980

1990–2000 price coefficient

```
1.00
0.75
0.50
0.25
   0
        0   0.25  0.50  0.75  1.00
           1970–1980 price coefficient
```

2000–2010 vs. 1970–1980

2000–2010 price coefficient

```
1.00
0.75
0.50
0.25
   0
        0   0.25  0.50  0.75  1.00
           1970–1980 price coefficient
```

2010–2020 vs. 1970–1980

2010–2020 price coefficient

```
1.00
0.75
0.50
0.25
   0
        0   0.25  0.50  0.75  1.00
           1970–1980 price coefficient
```
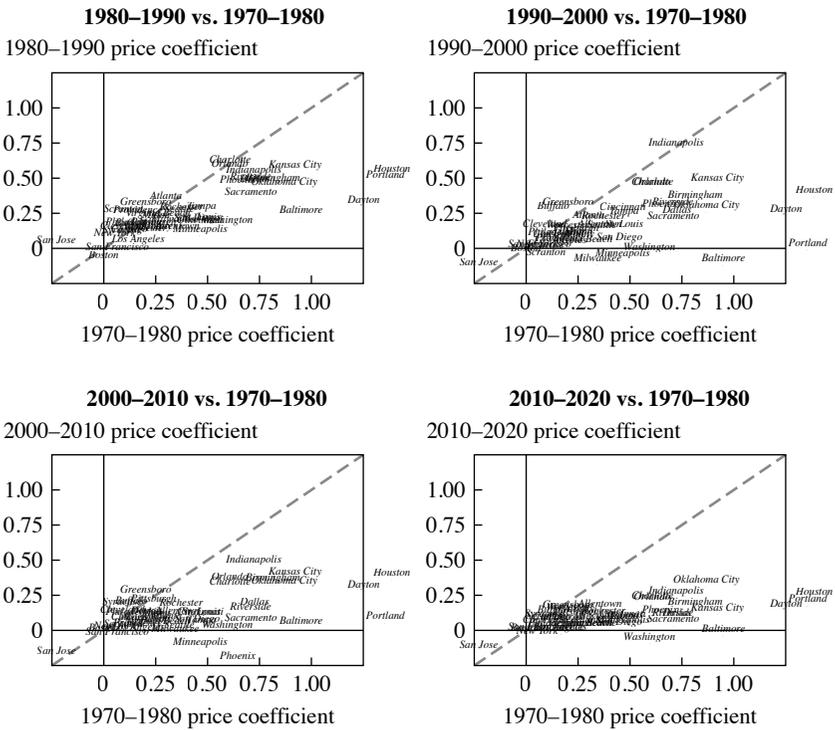
Source: Authors' calculations are described in text.

from the 1970s decadal estimations to those from the 1980s, 1990s, 2000s, and 2010s. Each comparison uses IV results using both lagged price and geographic variables as instruments as described above. The 1970–1980 estimated coefficient always is reported on the horizontal axis, with the other decade's coefficient on the vertical axis. The dotted lines represent the 45-degree line (not fitted values), so a market above that line had a higher estimated price coefficient for a later decade than it did in the 1970s.

The vast majority of markets are below the 45-degree line, especially among the tracts more than ten miles out (figure 13). For the tracts within ten miles of the urban core depicted in figure 12, only thirteen markets are above the 45-degree line in the 1980s, eight in the 1990s, twelve in the 2000s, and nine in the 2010s. Among the tracts farther out (more than ten miles beyond the core), there never are more than eight metros above

Figure 14. Changes in Density Coefficients over Time, All Housing Unit Sample,
Tracts Within Ten Miles of the Metro Center

Source: Authors' calculations are described in text.

the 45-degree line in any of the plots. The major difference between the inner
and outer areas is that the supply elasticities were much higher in the 1970s
in the outer areas, which provided much more room to go down. Price
elasticities fell over time in most American housing markets, especially in
outlying census tracts far from the urban core, not just in the six focal areas
tracked throughout our paper.

Figures 14 and 15 report the analogous plots using the density coeffi-
cients. As with our six focal markets, density coefficients for this broader
sample of metro areas almost always are negative. Most markets are above
the 45-degree line, indicating that the density coefficients generally rose
(i.e., became less negative) over time. For tracts within ten miles of the metro
core, twelve markets are below the 45-degree line in the 1980s, eight in the
1990s, ten in the 2000s comparison, and none in the 2010s versus 1970s

Figure 15. Changes in Density Coefficients over Time, All Housing Unit Sample, Tracts Greater Than Ten Miles from the Metro Center

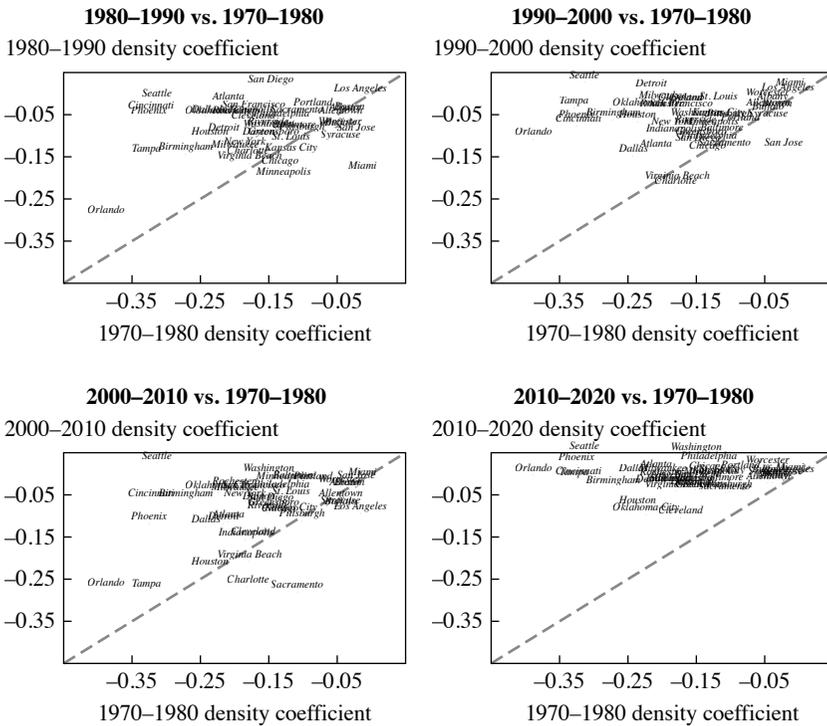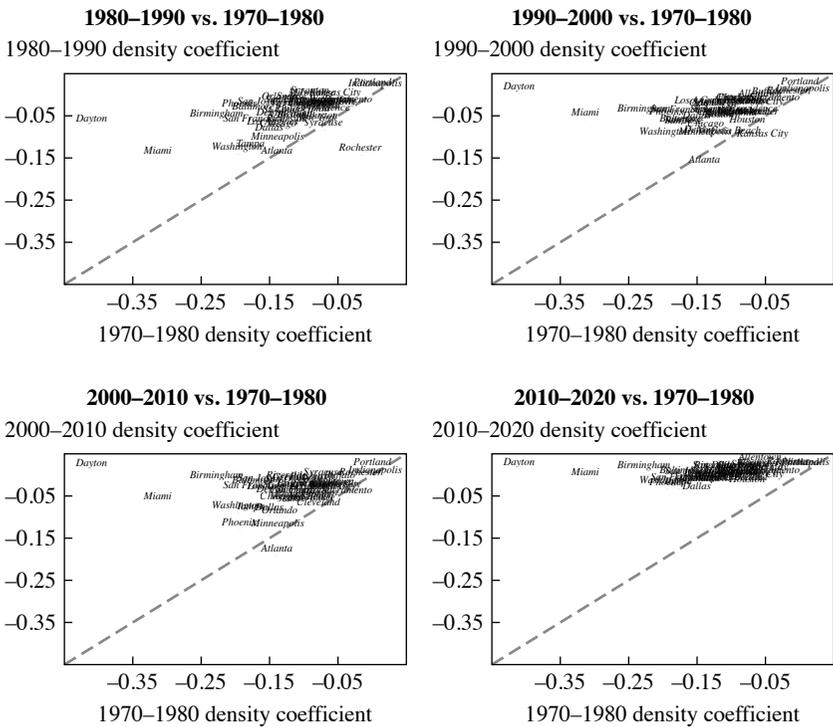Source: Authors' calculations are described in text.

comparison. Among tracts more than ten miles out, there never are more than four markets below the 45-degree lines in any cross-decade comparison. The negative correlation between density and growth has diminished or reversed across America, not just in our six focal markets. These facts are compatible with the view that unobserved heterogeneity in supply conditions increasingly determines where America builds.

Our last empirical exercise is to regress the current decade's price elasticity on the previous decade's price coefficient using our primary IV specification's coefficient estimates from each decadal period on the previous decades' price coefficient and three other variables: the Wharton Residential Land Use Regulatory Index (WRLURI), the share with a college degree at the start of the previous decade, and the average change in density

Table 7. Regressing Decadal Price Elasticity on Previous Decade Price Elasticity and Covariates, All Units

Coefficients	Decadal specifications			
	1980 on 1970	*1990 on 1980*	*2000 on 1990*	*2010 on 2000*
(a) WRLURI				
$\psi_{1,c}^{t}$	0.279	0.394	0.459	0.147
	(0.042)	(0.070)	(0.088)	(0.094)
WRLURI	−0.047	−0.067	−0.045	−0.058
	(0.026)	(0.021)	(0.020)	(0.020)
(b) Share educated				
$\psi_{1,c}^{t}$	0.301	0.419	0.509	0.234
	(0.041)	(0.072)	(0.086)	(0.093)
$\overline{share\ educated_{t,c}}$	−0.741	−0.464	−0.235	−0.222
	(0.257)	(0.216)	(0.202)	(0.200)
(c) Lagged density				
$\psi_{1,c}^{t}$	0.289	0.485	0.544	0.298
	(0.050)	(0.074)	(0.082)	(0.089)
$\overline{\Delta \log\left(density_{t+1}\right)_{c}}$	−0.003	−0.219	−0.168	0.292
	(0.093)	(0.112)	(0.142)	(0.129)

Source: Authors' calculations.

Note: The reported results are taken from estimations of equations (8a), (8b), and (8c) as described in the text.

in the CBSA over the decadal period.[32] For this final exercise, we run these specifications at the CBSA level, where c denotes a CBSA, and t denotes the decade in the equations below.[33]

Table 7 reports the results from estimating the following equations:

$$(8a) \qquad \lambda_{1,c}^{\widehat{t+1}} = \alpha + \psi_{1,c}^{t}\left(\widehat{\lambda_{1,c}^{t}}\right) + WRLURI_c + u_c,$$

$$(8b) \qquad \lambda_{1,c}^{\widehat{t+1}} = \alpha + \psi_{1,c}^{t}\left(\widehat{\lambda_{1,c}^{t}}\right) + \overline{share\ educated_{t,c}} + u_c, \text{ and}$$

$$(8c) \qquad \lambda_{1,c}^{\widehat{t+1}} = \alpha + \psi_{1,c}^{t}\left(\widehat{\lambda_{1,c}^{t}}\right) + \overline{\Delta \log\left(density_{t+1}\right)_{c}} + u_c.$$

32. For example, we regress ($\lambda_{1,c}^{\overline{1980}}$) on ($\lambda_{1,c}^{\overline{1970}}$) from equation (6). Then, we roll through the decadal pairs regressing ($\lambda_{1,c}^{\overline{1990}}$) on ($\lambda_{1,c}^{\overline{1980}}$), ($\lambda_{1,c}^{\overline{2000}}$) on ($\lambda_{1,c}^{\overline{1990}}$), and finally ($\lambda_{1,c}^{\overline{2010}}$) on ($\lambda_{1,c}^{\overline{2000}}$). These are the columns of table 7.

33. That is, we do not disaggregate tracts within a CBSA into those within and beyond ten miles of the metro center. This allows us to use more markets in the regression analysis (eighty-two instead of forty-four). Standard errors are in parentheses.

As expected, the estimated ψ's are positive. These coefficients are lowest in the last column that regresses the 2010s on the 2000s, which is consistent with the general decline in building intensity after the GFC. The estimated coefficient on the Wharton index is always negative and at least weakly significant. This is not always the case for the other two variables, but the coefficients on education are always negative. The coefficients on density are generally insignificant and switch signs.

V. Conclusion

The supply curve for new housing in America has shifted dramatically over the last fifty years. Real, constant-quality prices are at historically high levels in many major markets, most notably in Sunbelt areas, such as Miami, Tampa–St. Petersburg, Phoenix, and Atlanta. Building levels have declined dramatically, especially in higher-price, lower-density areas. The positive correlation between price and construction and the negative correlation between density and construction have both attenuated in recent decades. These facts are compatible with the view that local barriers to construction increasingly determine where America grows.

While some short-term factors surely contributed to today's high housing costs, including the COVID-19 pandemic's impact on supply chains and increasing interest rates, which lowered the supply of older homes because of the mortgage lock-in effect, this paper argues that the genesis of today's high housing prices lies further back in time. Real construction costs have risen by about one-quarter since the turn of the century, which is important but can explain only a fraction of today's prices in many markets. The GFC damaged the construction sector, but supply started to shift downward before 2006.

We have not estimated the demand elasticities that would be necessary to know what prices would be if construction rose to 1970s levels, but if the housing stock had grown by the same rate between 2000 and 2020 as it did between 1980 and 2000, then America would have 15 million more housing units. The key driver appears to be that the intensity of housing production has dropped substantially over time, especially in many expanding Sunbelt markets that were once housing production superstars. More generally, there is a marked convergence in the pace of housing unit production across markets throughout the country: Miami has become far more like Los Angeles.

There has been a significant flattening of the empirical housing supply curve in these places. Our inelastic coastal markets already experienced this

by 1990, because in these places, supply conditions have long driven new construction more than demand. Within metropolitan areas, we now build less in the highest-demand neighborhoods, just as we have long built less in the highest-demand metropolitan areas. There is dramatically less building, especially in low-density, higher-price census tracts. The suburban frontier seems to be closing in some of our largest, and previously fastest-growing markets. The negative relationship between density and the construction of housing has also attenuated or reversed, which is also compatible with the increasing importance of supply conditions.

To us, this suggests that American housing markets increasingly follow the model put forth by Olsen (1982). In his view, insiders increasingly use regulations to protect their own rents and keep outsiders out. If existing homeowners in high-price areas have become better at controlling land use regulations and stopping new construction, then we should expect to see a decreasing link between high prices and new construction, which is exactly what the data show.

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Comments and Discussion

COMMENT BY
NATHANIEL BAUM-SNOW   In their insightful paper, Glaeser and
Gyourko bring forth compelling evidence that US housing supply and
affordability challenges have become increasingly serious in each of the past
few decades. Their paper convincingly demonstrates both large reductions
in the rates of new construction and commensurately large declines in afford-
ability for homebuyers. Since the global financial crisis (GFC), declining
housing unit production is concentrated in Sunbelt markets, which had been
the only ones left providing much new housing supply. The era of the devel-
opment of suburban and exurban land for new large-tract single-family
housing is coming to an end in the United States.

A review of potential mechanisms explaining this construction decline
settles on endogenous land use regulation as the central force. Indeed,
the authors provide evidence that increased market power by builders and
reduced construction capacity are not important explanatory factors. Their
model formalizes the following mechanism, one that has not been artic-
ulated carefully in the literature before. Neighborhoods are initially built
to densities justified by demand conditions at the time of development.
Initial neighborhood residents tend to be higher income with a distaste for
densification (Gyourko and McCulloch 2024), leading them to enact land
use restrictions in response to local housing demand growth, which lock in
these initial densities. These "zoning straitjackets" (Ellickson 2022) make
it impossible to build more housing in these neighborhoods as demand for
living in them rises, thereby pushing new housing development into other
areas that still have land available for development. The result is low housing
supply elasticities in built-up areas, reflecting this endogenous regulation

response. Positive housing demand shocks beget negative housing supply shocks and less elastic local housing supply functions.

In this comment, I develop these ideas a bit further and consider their implications for the potential efficacy of new strategies to expand housing supply going forward. First, I discuss the history of land development and suburbanization in the United States. Just like with agricultural land, the "best" highest-demand urban land gets developed first, with subsequent development moving down the quality distribution. The post–World War II construction of limited-access highways dilated the location quality distribution for a time, opening up more peripheral areas for development. But this process has now largely come to an end with few new intra-urban highways being built. As such, through a land depletion effect, the opportunities to develop new single-family homes in high-demand locations have largely been exhausted.

Instead, the new focus has to shift toward one on effective land redevelopment and densification. Prices have risen enough to justify much denser development than exists on the ground in many areas built up in the first wave of suburbanization. Such redevelopment can occur by right in only a small number of neighborhoods these days, especially in highly regulated suburban areas. Redevelopment frictions have precipitated a host of policies put forth by states and cities nationwide to make development easier. While these policies have had mixed success, it is clear in the data that the types of locations that have most successfully promoted new housing development are the large, high-demand superstar cities. And this new development has increasingly come in the form of multifamily housing. Glaeser and Gyourko's evidence of the closing off of the suburban frontier contrasts with a reopening of urban possibility.

I finish by considering the implications of analyzing housing affordability in an environment in which housing units are heterogeneous. With an ever greater fraction of new construction being large single-family suburban homes for high-income buyers, what are the prospects for improving affordability for low- and middle-income homebuyers? With low rates of housing construction now reaching the increasingly remote urban fringes, ever greater opportunities exist for urban revival. Large US cities have the infrastructure and land use planning regimes to support much higher densities and populations. Indeed, they have already done so in the past in the pre-suburbanization era. The challenge is how to make these central locations more livable, with improved local public services and higher quality of life.

HISTORICAL NARRATIVE During the 1950 to 1980 period, the golden age of American suburbanization, a number of factors combined to contribute to

massive amounts of suburban home building, reduced residential crowding, and increases in homeownership rates.

One centrally important factor was the construction of the interstate highway system. New highways opened up huge tracts of land for development outside of America's largest, most productive cities. As these areas were mostly unincorporated, few constraints on large-tract residential development existed, and suburban areas could be developed at scale. Suburbs like Levittown, Pennsylvania, were built up virtually overnight, as developers quickly learned how to build a large number of single-family homes at scale (D'Amico and others 2024). The new highways essentially delivered land supply shocks to metropolitan areas. Locations at urban peripheries experienced large positive housing demand shocks, to which developers responded with a large amount of new housing development. Ultimately, the spatial distribution of the population shifted toward the suburbs, with each radial highway emanating from a central city promoting a 14–16 percent decline in central city population (Baum-Snow 2007, 2020).

With suburbanization came both changes in municipal structure and tighter zoning rules. In areas that were already incorporated into municipalities, as in New England, once rural towns became suburbs. For them, local government structure already existed to enact land use restrictions that would limit new development. These development restrictions came quite quickly after local housing demand growth, with large lots that remain to this day in the wealthier areas of suburban Boston, New York, San Francisco, and Los Angeles, despite the very high land values that persist in these superstar cities (Gyourko, Mayer, and Sinai 2013). Unincorporated suburban areas, which disproportionately surround Sunbelt cities, including Atlanta, Dallas, Houston, and Phoenix, were built up a few years later but just as quickly. These areas were slower to enact land use restrictions and so experienced less rapidly declining rates of housing development. But municipal annexations and more active county-level governments led to increasingly restrictive regulatory environments for construction over time, limiting further densification. The existence of suburban density ceilings is where we stand today. There is very little land left in "good," high-demand locations available for development by right. The natural result is the marked slowdown in rates of new construction documented by Glaeser and Gyourko.

While supply-side forces, including land use and zoning restrictions, are clearly the most important drivers of declining construction, demand factors also have some influence. Slowing rates of population growth have reduced demand growth while declining household sizes have increased demand growth. In rural, suburban, and urban markets alike, the 2000–2020 rate of

housing unit growth exceeded population growth (Baum-Snow and Duranton 2025), though by much higher rates in rural areas, where supply growth is relatively unconstrained.

As supply constraints begin to bind, and new construction becomes more costly, the market responds in new ways. For 1980–2000, annualized housing unit teardown rates were similar at 0.5–0.7 percent in rural and suburban areas. Similar teardown rates persisted to 2020 in rural areas, where land available for development is abundant. After the GFC, however, teardown rates fell to near zero in suburban areas (Baum-Snow and Duranton 2025).

Glaeser and Gyourko's analysis indicates that this likely reflects the importance of increasingly binding land use constraints. The lack of teardowns became an important new source of housing supply in suburban areas relative to rural areas. Evidence on supply elasticities for the 2000–2010 period corroborates this descriptive observation (Baum-Snow and Han 2024).

A look at the experience of superstar cities, which have consistently had both high levels of housing demand and tight supply constraints, is consistent with this explanation.[1] Since 1990, these cities have experienced very low rates of teardowns, at less than 0.2 percent annually, much like suburban areas in recent years only (Baum-Snow and Duranton 2025, fig. 3). This is in contrast to increasing rates of new construction in these cities, a topic to which I return below. Other central cities have had a similar profile of teardowns to suburban areas.

Suburbs have hit up against housing unit density ceilings of their own making. At all distances from central business districts, suburban housing densities increased in each decade from 1980 to 2000 (Baum-Snow and Duranton 2025, fig. 5). After 2000 these increases almost stopped, with average densities stuck at about 1,000 housing units per square kilometer in typical suburbs and 2,000 units per square kilometer in suburbs of superstar cities. The most common regulatory vehicles for restricting density are single-family and minimum lot size (MLS) zoning. In the United States, 86 percent of municipalities have single-family zoning, most with MLS restrictions as well (Bartik, Gupta, and Milo 2024; Song 2025). MLS zoning is widely regarded as exclusionary, in the sense that it keeps out lower-income households by requiring them to purchase more housing services than they are willing to buy in order to gain access to the community. For this reason, MLS zoning is often appropriately derided as reducing housing affordability.

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1. Following Duranton and Puga (2023), New York, San Francisco, Washington, Boston, Seattle, and San Diego are the superstar cities.

However, land use restrictions do not necessarily reduce welfare. Glaeser and Gyourko's model justifies land use density restrictions through residents' explicit distaste for density (Gyourko and McCulloch 2024). While this direct preference-based explanation for zoning is an appropriate reduced form, it is worth considering some likely additional underlying motivations. First, MLS zoning also limits negative fiscal externalities. Hamilton (1975) and Fischel (2001) conceptually articulate zoning's role in replicating head taxes to be used to fund the provision of local public goods, an idea originally attributed to Oates (1972); see also the comprehensive discussion of these issues in Trounstine (2018). Second, there is extensive evidence of homophilic preferences, with Couture and others (2025) providing a recent example. Finally, there is evidence of preferences for higher-income and more educated neighbors (Bayer, Ferreira, and McMillan 2007; Macek 2024). Denser neighborhoods tend to be lower-income, less educated, and provide lower-quality local public goods.

Whatever the motivation for expanded land use restrictions, Glaeser and Gyourko show convincingly that they tend to be positively correlated with the strength of housing demand. Areas with stronger housing demand tend to enact tighter land use regulations, which leads to more inelastic housing supply and even higher prices. Similar evidence is found in Baum-Snow and Han's (2024) analysis estimating local housing supply elasticities. Ordinary least squares (OLS) relationships between housing quantities and prices tend to be weaker than relationships that are pinned down only through variation in demand, thereby tracing out housing supply functions.

As buildable land with demand sufficient to cover construction costs gets depleted, a greater fraction of new housing supply must come from infill construction, redevelopment, and the longer maintenance of existing structures. Indeed, Glaeser and Gyourko present compelling evidence that in recent decades new housing construction has increasingly shifted away from urban fringes to be more evenly distributed across space as a function of distance from central business districts. Central cities have not had the same restrictive density ceilings seen in suburban areas and have experienced commensurate densification. Indeed, Bartik, Gupta, and Milo (2024) demonstrate that density regulations are much less binding in central cities. These are areas with higher fractions of renters and more underutilized industrial land available for conversion, and where the electorate is less concerned about protecting the quality of local public services through inhibiting in-migration. Instead, a key challenge facing many central cities is that existing quality of life in many of their neighborhoods makes housing demand too weak to justify new construction.

POLICY RESPONSES The lack of denser housing development has now become widely recognized as an impediment to affordability. This recognition has led a number of states and cities to enact laws making the construction of new housing development easier. These initiatives have had mixed success.

One common upzoning policy in North America requires local authorities to allow the construction of accessory dwelling units (ADUs) with minimal permitting requirements. An ADU is an additional small housing unit added to an existing tax parcel, be it freestanding, attached to the main house, or attached to the garage. The State of California and many larger cities in North America have passed such laws. Allowing this type of small-scale densification is not as controversial as the permitting of large-scale multiunit construction, perhaps explaining the relative lack of political opposition to ADUs. However, there is little evidence that allowing ADUs has resulted in many new housing units or increases in affordability. In the context of Vancouver's 2009 ADU law, Davidoff, Pavlov, and Somerville (2022) provide evidence that the construction cost of laneway homes is about the same as the present value of their net operating income. These units are so small that the fixed costs of development apparently make them poor investments, even with expedited permitting. The difficulty of large fixed costs of developing bespoke new construction housing units is a theme to which I return below.

Massachusetts's 2021 MBTA Communities Law is another initiative aimed at limited densification. This law compels municipalities that have not done so to establish zoning districts with multifamily housing development allowed as of right with densities of at least fifteen units per acre within 0.5 miles of a transit station. Commuter rail stations are included in the transit station designation, meaning many high-income, low-density suburban communities are affected by this law. Municipalities that do not comply lose state infrastructure funding. Nonetheless, the high-income communities of Milton and Needham have voted to reject rezoning proposals that meet this upzoning requirement.[2] Local resistance to densification can be fierce enough to defy state law and lose a large amount of state funding as a result.

Several cities around the world have enacted large-scale upzoning with some success for expanding housing supply and affordability. The 2016 upzoning of three-quarters of the residential land in Auckland, New Zealand,

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2. Commonwealth of Massachusetts, "MBTA Communities Law Q&A," https://www.mass.gov/info-details/mbta-communities-law-qa.

has been found to result in more construction and lower prices (Greenaway-McGrevy and Phillips 2023). The number of new building permits requested as a result of the upzoning represented 4 percent of the aggregate stock of housing units. This study follows evidence in Greenaway-McGrevy, Pacheco, and Sorensen (2021) that upzoning primarily increased the values of underdeveloped properties, for which the option value of redevelopment increased the most. Anagol, Ferreira, and Rexer (2021) find that the 2016 zoning reform in São Paolo, Brazil, which raised density limits in some areas of the city, promoted more tall building construction and lower housing costs. Since 2009, the city of Minneapolis has undertaken several large-scale upzoning initiatives, including allowing densification of single-family house neighborhoods and eliminating minimum parking requirements. While identification is more difficult in the Minneapolis case, evidence suggests large housing development responses, less rapid rent growth, and more rapid price growth for single-family homes, especially in lower-income neighborhoods (Kuhlmann 2021; Liang, Staveski, and Horowitz 2024).

It is revealing that the most successful examples of large-scale upzoning either occur in large central cities or by edict from a higher level of government. Consistent with Glaeser and Gyourko's analysis, this observation suggests that local interests are more likely to oppose upzoning, even in the face of wide recognition of its broad affordability benefits. This is a coordination problem. Small municipalities have no interest in upzoning alone, as doing so would come with all of the negative consequences amid little change to housing costs. Mast's (2024) evidence that city council members representing at-large districts are more development friendly than those representing specific wards is causal evidence of this phenomenon. A regional- or national-level mechanism for coordinating the expansion of housing supply is more likely to be successful.

Further evidence for this observation can be seen in the Canadian province of Ontario. Ontario is one of the few jurisdictions in North America in which a high level of government can rule on specific development applications. The Ontario Land Tribunal and its predecessors, whose members are appointed by the provincial government, have overruled many local planning decisions, even for proposed developments that violate municipal zoning codes. This has contributed to the city of Toronto's 4.9 percent annualized growth rate in dwellings in multifamily buildings over 2001–2021, far outpacing corresponding rates for large US cities (ab Iorwerth, Baum-Snow, and Macek 2025). The housing start-to-population ratio has been 0.8 percent in Toronto in recent years, mostly in large condominium towers, according to the Canada Mortgage and Housing Corporation Starts and Completions

Survey. The option to appeal to provincial review has facilitated the city of Toronto's transition from one of single-family houses to one of multiunit condominium towers.

Such transitions are not feasible in all cities, as infrastructure can be an impediment to densification. Many Chinese cities have famously built out their subway systems incredibly rapidly over the past twenty years (Gonzalez-Navarro and Turner 2018), facilitating their rapid population growth and densification. Even Dubai, a city famously built up around the automobile, has recently developed a heavily used subway system. Water, sewer, and electricity infrastructure must also be upgraded to handle higher densities. Such infrastructure development is akin to the suburban highway construction in the United States in the 1960s and 1970s, though the associated newly supported housing has to be built up rather than out.

There are also demand-side impediments to urban densification. Many US cities face quality-of-life challenges that limit housing demand. Despite being located with the best accessibility to jobs and economic activity, central areas of central cities have been depopulating even in the face of national population growth. For example, despite high levels of transit connectivity, large areas of the South and West Sides of Chicago have lost more than half of their population over the past thirty years, in part because of quality-of-life challenges (Scarborough, Lewis, and Arenas 2022). New York City's improvements in quality of life in the 1990s prompted a huge population gain of nearly 700,000 in this decade, or about 10 percent of the city's 1990 population. In Washington, DC, quality-of-life gains after 2010 contributed to driving the city's 15 percent population growth, or about 90,000 new residents, between 2010 and 2020.[3] Such large increases are possible in locations like New York and Washington given that appropriate infrastructure and land use planning regimes are in place to support them.

SOME EMPIRICAL OBSERVATIONS Below I present some evidence on the location and composition of new construction. This evidence complements Glaeser and Gyourko's findings by differentiating between types of housing units. A look at the composition of new construction over time and space confirms elements of my narrative above.

Panel A of figure 1 plots the number of housing units built nationwide in the ten years prior to each year indicated on the horizontal axis by the indicated number of bedrooms. Evident in this figure is the fact that declines in new construction started among medium- and then small-sized homes of three and then two bedrooms in the 1980s and 1990s. From 1990 till 2005,

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3. US Census Bureau, "Explore Census Data," https://data.census.gov/.

Figure 1. The Composition of New Construction Units (Less Than Ten Years Old)

Panel A: Nationwide	Panel B: Glaeser and Gyourko's cities
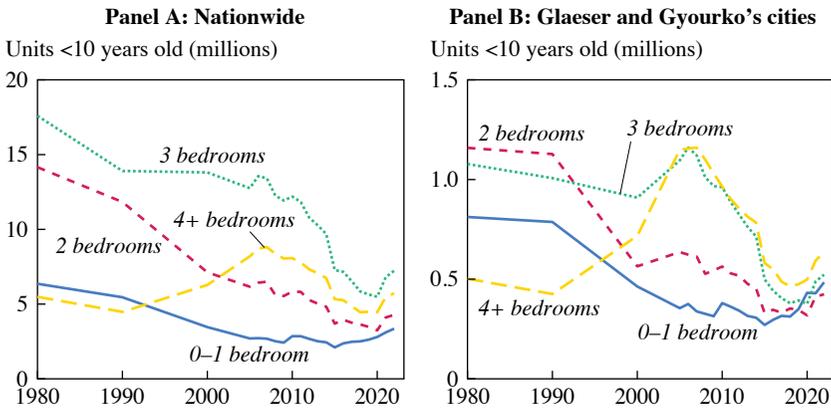
Source: Ruggles and others (2025).

Note: Underlying data are from 5 percent samples of the 1980, 1990, and 2000 Censuses of Housing and 1 percent sample of the American Community Survey (ACS) for 2005–2022. The 2005–2014 ACS only reports whether each sampled housing unit was built after 1999, and the 2021–2022 ACS only reports whether the housing unit was built after 2009. For these years, I assume a constant construction rate since the indicated base year and rescale to a ten-year basis. Glaeser and Gyourko's cities include urban and suburban areas of the Atlanta, Dallas, Detroit, Los Angeles, Miami, and Phoenix 2020 definition Core-Based Statistical Areas.

the number of new construction, four-plus-bedroom homes increased, before experiencing similar declines as for smaller homes. The GFC hit the construction of midsize three-bedroom homes the hardest. That is, for several decades the only type of new home with increasing construction was quite large and likely built to serve the top end of the housing market. Panel B of figure 1 shows the analogous picture for the six focal metropolitan areas studied by Glaeser and Gyourko (Atlanta, Dallas, Detroit, Los Angeles, Miami, and Phoenix). These cities are fairly representative of large cities around the country, including Sunbelt, superstar, and rust belt cities. Patterns for them are similar, though new construction homes are smaller in this more urban sample. These cities experienced a greater increase in construction of large four-plus-bedroom homes. Striking are the large drops in new construction of one- and two-bedroom homes in the 1990s such that the majority of new construction has been three-plus-bedroom homes after 2000, even though this construction rate drops precipitously after the GFC.

Figure 2 repeats the same analysis as in figure 1 but for two polar opposite types of locations. Panel A shows patterns of construction in counties covering metropolitan areas with a central city of under 100,000 population in 2000 and rural counties. Panel B shows construction patterns in

Figure 2. The Composition of New Construction Units (Less Than Ten Years Old): Specific Markets

Panel A: Small-rural

Units <10 years old (millions)

Panel B: Superstar central cities

Units <10 years old (millions)
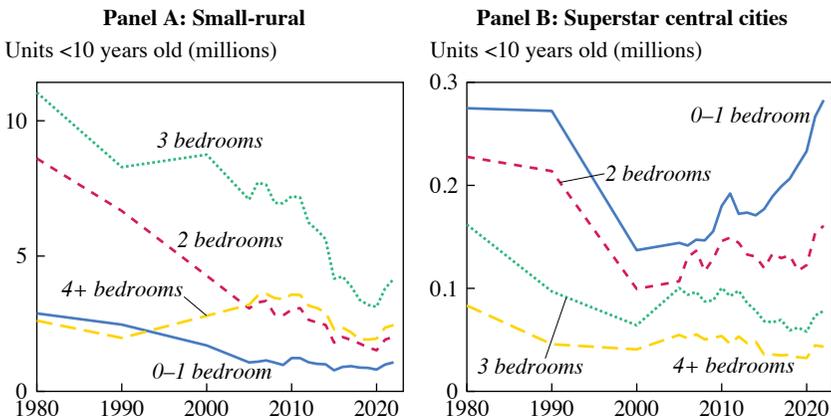
Source: Ruggles and others (2025).

Note: See notes of figure 1 for details about the data. The subsample used to generate panel A includes all counties outside of a 2020 definition Core-Based Statistical Area (2000 population: 18 million) and all counties inside the 846 Core-Based Statistical Areas in which the main central city had a population of less than 100,000 in 2000 (2000 population: 89 million). The superstar central cities used in panel B are New York, San Francisco, Washington, Boston, Seattle, and San Diego (2000 population: 15 million).

the high-demand and supply-constrained superstar cities of New York, Los Angeles, San Francisco, Washington, Boston, Seattle, and San Diego.[4]

Construction in rural counties looks similar to that for the entire country in figure 1. Even in areas where land is abundantly available for development, we see a big decline in construction after the GFC that is almost entirely accounted for by reductions in new midsize single-family houses of three bedrooms. Given the large lot sizes found on urban fringes, Glaeser and Gyourko interpret this type of decline seen in their data as reflecting a rise in land use regulation, like half-acre MLS zoning, rather than reductions in land available for development. It seems logical that both margins must matter. Large tracts of undeveloped land get zoned for very low (essentially rural) densities, leaving little unzoned land left that is available for development.

Panel B of figure 2 shows something quite different for superstar central cities. After experiencing a marked decline in new construction in the 1990s,

4. See Baum-Snow and Duranton (2025) for more details on these geographic units.

especially for zero- to two-bedroom houses and apartments, these cities have managed increased construction rates in almost every year since 2000. This notably bucks declining construction rates in all other types of locations and matches evidence in Glaeser and Gyourko's table 1. Not discussed in their paper, this increase is driven by small housing units of zero and one bedrooms. Particularly notable is the 65 percent increase in the number of studio and one-bedroom units less than ten years old between 2014 and 2022. It is clear that these large supply-constrained and high-demand cities are beginning to figure out how to facilitate the development of large-scale multiunit buildings. However, the number of new housing units contributed to the nationwide stock remains small, at 565,000 units under ten years old in these seven cities in 2022, relative to 20.6 million units nationwide.

CONSIDERING HOUSING UNIT HETEROGENEITY The fact that central cities are providing an increasing share of new housing units is a reason for optimism. While most are probably built for upper-income buyers, these smaller domiciles have the profile of housing units that could plausibly filter down the income distribution to provide affordable housing for middle- and lower-income buyers in decades to come. Indeed, co-op and condominium buildings that were built for luxury buyers decades ago are now mostly inhabited by middle-income households.

In contrast, the profile of most new housing units constructed in recent decades seems less likely to eventually serve middle-income buyers. Large exurban houses of at least four bedrooms have primarily been built for the top of the market and seem likely to remain there. There is a danger that these types of homes become "stranded assets" in the sense that, once they depreciate to some degree, they are too large to be appropriate for other income levels. Indeed, many luxury homes in poor locations outside of large metropolitan areas experienced this fate in the aftermath of the GFC. With declining household sizes, the demand for luxury homes may soften some, heightening this risk.

The broad point is that many recent newly constructed housing units may not make sense for most segments of the market. The classical filtering model (Sweeney 1974) predicts that new homes will be built for the top end of the market and over time will filter down throughout the income distribution, such that new units supply lower-income households over time. Assignment models that describe the equilibrium allocation of heterogeneous homes to heterogeneous households in a commodity hierarchy predict that demand shocks far down in the distribution of housing quality can generate price growth much further up the distribution (Landvoigt, Piazzesi, and

Schneider 2015). This class of model also predicts the "filtering up" of housing units when new housing is built for the highest-income households. The view, thus, is that any new construction is good for affordability for all households that are farther down in the commodity hierarchy. As a result, the more luxury the construction, the greater the positive affordability impact.

The extent to which such filtering up happens in practice remains an open empirical question.[5] Maintenance costs, poor location matches, and the limited feasibility of subdividing large houses (either logistically or because of zoning restrictions) represent potentially insurmountable frictions to such a process. Indeed, land use restrictions may play a central role. Single-family zoning makes it impossible to subdivide these large houses into smaller apartments, as has happened in many formerly high-income neighborhoods of central cities that have experienced shifts in the composition of demand toward lower-income households. Given that most new construction is still of single-family houses on large lots in suburban areas, these homes may never be affordable for middle- and lower-income households. Assignment can mean very low supply elasticities for "middle"-type housing units that fall between subsidized housing (including low-income tax credit–supported construction) and luxury housing.

It is worth reprising one central way in which regulatory burdens may shape the composition of the newly built housing units. Zoning and land use regulation increase developers' fixed costs, which requires strong demand conditions to overcome. One source of strong demand is high-income households looking to buy bespoke homes. Another is the aggregate demand for condominiums or apartments in multiunit buildings. Only a few cities have allowed for the construction of many large multiunit structures in the past few decades. To overcome fixed costs of navigating the approval process, these structures have typically been quite large, containing many housing units. In the past, when large tracts of undeveloped land in good locations existed, the fixed costs could be spread across multiple single-family houses intended for middle-income households built at scale. The lack of such land availability, perhaps combined with low-density zoning, makes this no longer possible.

CONCLUSIONS We have reached the end of the era of large-scale single-family home construction in suburbs and exurbs of large cities. Maintaining

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5. The small body of literature on vacancy chain draws mixed conclusions, which appear to depend somewhat on the profile of new construction housing studied (Mast 2023; French and Gilbert 2024; Mense 2025).

the current status quo of density restrictions will mean much less construction and ever higher prices for all types of homes going forward. Suburban and exurban density restrictions have proved very difficult to overcome. However, there are glimmers of hope coming out of large central cities. In the past decade large cities have facilitated the construction of historically large amounts of multifamily housing.

There is a clear new path forward. It is to facilitate easier construction of multifamily homes in denser neighborhoods. This is the way people in cities around most of the world live. The United States will have to transition in this direction as well. Canada, where even in small cities and rural regions the majority of new construction units are in multifamily buildings, has already begun such a transition. Urban opposition to densification has been on the decline, with various examples around the United States of cities upzoning and making it easier for developers to build multifamily housing. One thing holding some cities back is their weak demand, at least in some neighborhoods, considering quality-of-life issues. Additionally, there is the political challenge of convincing existing urban residents that new construction and densification can be good for everyone in cities. Such arguments are more difficult to make to suburban homeowners who face more potential downsides from nearby housing densification.

Finally, I note another piece of relatively good news. Since 2010, there has been very little deterioration of rental affordability despite the large declines in affordability for home buyers. In her comment, Raven Molloy considers some potential explanations and lessons from this observation. I note that rental units are more likely to be in denser urban areas, and an active market for conversion of owner-occupied to rental single-family homes has sprung up only in the last ten years or so. The market has been finding ways to respond to rising rental demand while maintaining affordability. As prices reflect longer-run outlooks, it appears the market expects high capital gains and binding supply constraints to continue into the future, especially at the top end of the housing market. The time must be now to find ways to start alleviating the associated supply pressures.

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COMMENT BY
RAVEN MOLLOY[1] The original title of this paper was "America's Housing Affordability Crisis and the Decline of Housing Supply." The term "housing affordability" is commonly used in academic and policy circles, usually referring to the idea that some aspect of housing has become more expensive. However, the term is not well defined, and different people often use it to mean different things: house prices, rents, housing-related expenditures, price-to-income ratios, and so on. Glaeser and Gyourko show large increases in house prices over the past several decades and link high house prices to public anxiety about housing affordability. House prices reflect the cost of purchasing a home. I am sympathetic to the idea that we should care about the affordability of homeownership. Homeownership provides access to wealth building because the returns to housing have been quite high over the past fifty years (on average) and housing is the primary form of wealth for many households. It also provides a sense of stability because, unlike renters, owner-occupants do not have to worry about a landlord deciding not to renew their lease and forcing them to move. Homeownership can also provide access to neighborhoods with desirable amenities because some of these neighborhoods have a limited amount of rental housing.

Despite the advantages of homeownership, I would argue that an even more important aspect of housing affordability is the price of shelter. Shelter is a basic human necessity—it is required for survival. And shelter is a large fraction of the family budget, so changes in the price of shelter can have material effects on the amount of money that people have left over to spend on other goods and services. Moreover, macroeconomists should care about the price of shelter because it is the housing component of inflation in the United States. House prices are irrelevant for measuring inflation in the United States. For these reasons, I will focus my comments on the question of whether America is facing a crisis of shelter affordability.

THE PRICE OF SHELTER FOR RENTERS The price of shelter is commonly measured with rents because rent reflects the cost of occupying a home. Figure 1 shows the long-run trends in the real constant-quality house prices and rents from 1950 to 2024. The data through 2006 are from Lyons and others (2024), referred to henceforth as the LSGA House Price Index (HPI)

Figure 1. Real Constant-Quality House Price and Rent

1950 = 1
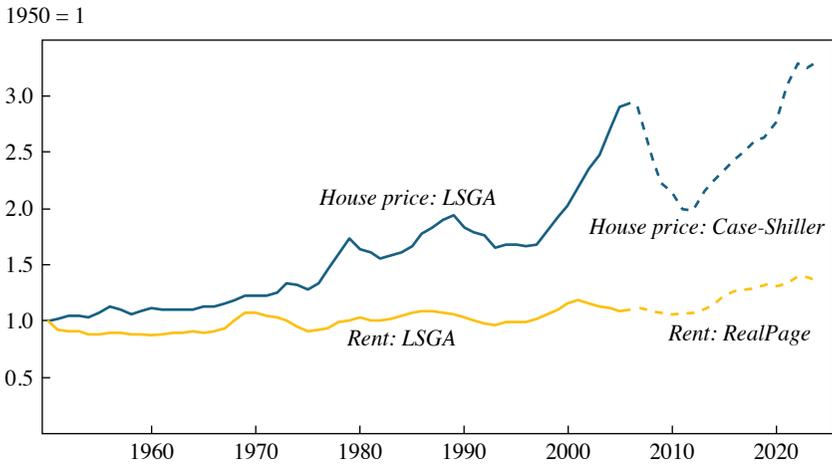
Source: Federal Reserve Bank of Philadelphia Historical Housing Prices Project (Lyons and others 2024); Case-Shiller Repeat Sales Price Index; and RealPage.

and LSGA Rent Index (RI).[2] I extend the LSGA HPI with the Case-Shiller National House Price Index and the LSGA RI with average asking rent per square foot of professionally managed multifamily apartments from RealPage.[3] It is clear that rents have increased by much less than house prices over the long run. Whereas house prices have increased by more than a factor of three since 1950, rents have increased by less than 40 percent. Acknowledging that rents were at a cyclical peak in 1950, we might instead want to compare rents to the relatively stable level seen from the mid-1950s to the mid-1960s. In this case, we would say that rents have increased by about 55 percent.

Is an increase in rent of 55 percent over six decades large enough to say that we are experiencing a crisis of shelter affordability? Often when people use the term "affordability" they mean the price of something relative to the amount of money that people have to spend. In policy circles, a common measure of housing affordability is the ratio of rent to income. For example, the 2024 *Economic Report of the President* shows the fraction of

2. Data available at Federal Reserve Bank of Philadelphia, "Historical Housing Prices Project," https://www.philadelphiafed.org/surveys-and-data/regional-economic-analysis/historical-housing-prices.

3. The rent series looks similar if I use an index of single-family rents from Cotality.

Table 1. Rent-to-Income Ratios

Year	Median rent-to-income ratio	Fraction of renters spending > 30% of income on rent
1950	0.17	0.20
1960	0.15	0.19
1970	0.15	0.21
1980	0.20	0.28
1990	0.21	0.31
2000	0.21	0.32
2010	0.25	0.41
2023	0.26	0.42

Source: Decennial Census and American Community Survey, accessed through IPUMS USA (Ruggles and others 2025); and 1950 Census of Housing report.

renter households with a rent-to-income ratio greater than 30 percent, 40 percent, and 50 percent (White House 2024). Table 1 shows the median rent-to-income ratio across all renter households in the United States and the fraction of renters who spend more than 30 percent of their income on rent, using data from the Census and American Community Survey.[4] Whereas the median renter in 1960 and 1970 spent only one-sixth of their income on rent, the median renter in 2023 spent one-quarter of their income on rent. Meanwhile, the fraction of renters spending more than 30 percent of their income on rent doubled from 20 percent in 1960 to 40 percent in 2023. These measures suggest that housing affordability has deteriorated considerably.

One big difference between the rent data shown in figure 1 and the measures shown in table 1 is that the latter do not control for changes in the quality of the housing stock. And it turns out that the quality of rental homes has increased substantially over time. Table 2 shows evidence from the American Housing Survey. Rental housing was much more likely to have two or more bathrooms in 2023 than it did in 1985. It was also much more likely to have a variety of interior amenities like a dishwasher, laundry, and air-conditioning. The structure quality of rental homes has also probably improved in many ways not captured by the survey data shown here, such

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4. The data from 1960 to 2023 are household-level Census and American Community Survey data made available through IPUMS (Ruggles and others 2025). The 1950 Census of Housing data were never digitized. I report data from volume 2 of the published Census of Housing report, which covers nonfarm housing; table A-9 shows that the median rent-to-income ratio is between 15 and 19 percent; table 1 reports the midpoint of this range. See US Census Bureau, "1950 Census of Housing: Volume 2. Nonfarm Housing Characteristics," https://www.census.gov/library/publications/1953/dec/housing-vol-02.html.

Table 2. Characteristics of Rental Units

Fraction	1985	2023
Two or more bathrooms	0.11	0.33
With:		
Dishwasher	0.28	0.61
Washing machine	0.38	0.66
Dryer	0.28	0.65
Air-conditioning	0.27	0.64
Single-family	0.30	0.34
Greater than 1,500 sq. ft.	0.18	0.18
Three or more bedrooms	0.22	0.30

Source: American Housing Survey.

Table 3. Actual and Predicted Rent-to-Income Ratios

Year	(1) Actual median rent-to-income ratio	(2) Predicted using average rent growth and average family income of renters	(3) Predicted using constant-quality rent growth and average family income of renters	(4) Predicted using constant-quality rent growth and median individual income
1980	0.20	0.20	0.20	0.31
1990	0.21	0.22	0.18	0.28
2000	0.21	0.21	0.17	0.26
2010	0.25	0.26	0.20	0.31
2023	0.26	0.26	0.19	0.31

Source: Decennial Census and American Community Survey, accessed through IPUMS USA (Ruggles and others 2025); and Bureau of Labor Statistics CPI for rent of primary residence.

as having more energy-efficient windows and higher-quality interior finishes. Notably, although rental housing has become nicer, it has not become larger. Table 2 shows that the fraction of rental units that are single-family dwellings and the distributions of square footage and number of bedrooms have not changed much since 1985.

Table 3 illustrates how much of the increase in the rent-to-income ratio can be explained by changes in structure quality. The first column of the table repeats the median price-to-income ratio from table 2. In the second column, I start with the median rent-to-income ratio in 1980 and grow out the numerator with average rent growth, and I grow out the denominator with average family income of renters (average rent and income are both from the Census and American Community Survey).[5] This calculation mimics

5. To obtain a separate numerator and denominator, I take the medians from the separate distributions of rent and income among renters with a rent-to-income ratio within a 0.01 band around 0.20 (the median ratio in 1980).

the actual median ratio quite well, illustrating that this approach provides a reasonable method for approximating the median rent-to-income ratio. In the third column, I grow out the numerator with the growth rate of the index for rent of primary residence from the Consumer Price Index (CPI), which measures the rent for a constant-quality rental unit. I use this index rather than the index shown in figure 1 because the data in figure 1 reflect the average asking rent of units for rent, whereas the rent component of the CPI reflects the average rent paid among all occupied rental units. The latter concept is more similar to the measure of rents used in the Census and American Community Survey, which reflects the rent paid by all renters. The denominator in column 3 is the same as that used in column 2. The constant-quality rent-to-income ratio in 2023 is no higher than it was in 1980, illustrating that all of the increase in the median rent-to-income ratio can be explained by increases in the quality of the rental stock, not by increases in the constant-quality price of shelter.

The rent-to-income measure shown in the third column of table 3 might be a misleading measure of shelter affordability because the incomes of renter households are influenced by housing costs. For example, high housing costs can encourage adults to live with others rather than living alone, which would increase the average household income of renters, all else equal. Therefore, in the last column of table 3, I replace the denominator of the rent-to-income ratio with the median income of all individuals age 18 to 64 who are not in school. One can interpret this measure as the cost of a constant-quality rental home relative to the income of a typical working-age adult. Obviously, the level of this ratio is higher than in column 2 because many people do live with at least one other working adult. But this ratio is no higher in 2023 than in 1980, illustrating that the affordability of a constant-quality home for the median adult has not increased much over time.

THE PRICE OF SHELTER FOR OWNER-OCCUPANTS Owner-occupants have made up more than 60 percent of US households since 1960, so it is important to consider the price of shelter for this group.[6] Of course, this task is much more difficult than measuring the price of shelter for renters because the price of shelter for owner-occupants is fundamentally unobservable. One common method of estimating the price of shelter for owner-occupants is to impute rent to owner-occupied units based on nearby rental units with similar characteristics. This approach is used by the Bureau of Labor

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6. US Census Bureau, "Housing Vacancies and Homeownership," https://www.census.gov/housing/hvs/index.html.

Figure 2. Owners' Equivalent Rent and Tenants' Rent

1983 = 1
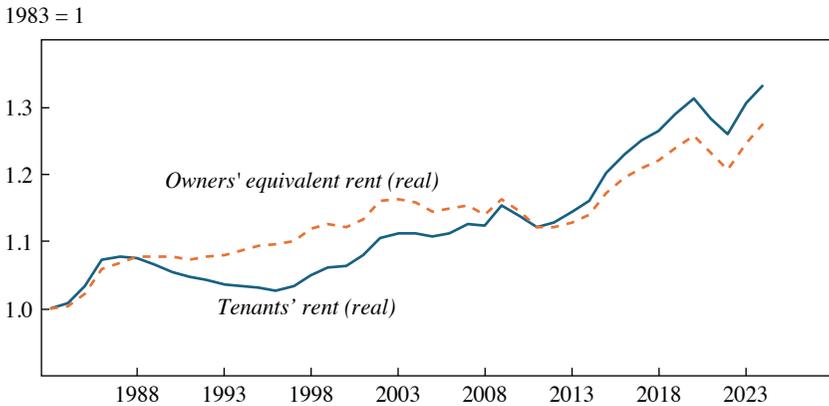
Source: Bureau of Labor Statistics.
Note: Both series are deflated by the aggregate CPI-U.

Statistics (BLS) to calculate the owners' equivalent rent component of the CPI. Figure 2 shows that owners' equivalent rent has risen by somewhat less than the price of shelter for tenants, on net, since the BLS first started using this approach in the early 1980s. Therefore, using this approach, one would conclude that if the affordability of a constant-quality rental unit has not deteriorated, then the affordability of a constant-quality owner-occupied unit has not deteriorated either.

One concern with imputing rents to owner-occupied homes is that many owner-occupied homes do not have comparable rental units nearby, so imputing rents to those homes might not be very accurate. Another approach is to estimate the costs that owners face to occupy their property: mortgage interest, property taxes, homeowners insurance, and maintenance. In figure 3 I use fairly common assumptions for each of these costs to calculate owner costs relative to median family income. Specifically, I assume that the mortgage is 80 percent of home value and that property taxes and maintenance are each 1 percent of home value.[7] I assume that homeowners insurance was not used prior to 1970, that it was 1 percent of home value from 1970 to 2010, and that it was 2 percent of home value in 2023.[8]

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7. I use the mortgage rate from Freddie Mac's Primary Mortgage Market Survey for 1980–2023. For earlier years I use the mortgage rate from Drehmann, Juselius, and Quincy (2024).

8. Sastry and others (2025) show that homeowners' insurance premiums increased substantially from 2019 to 2023.

Figure 3. Owner Costs Relative to Median Family Income

Owner cost/median family income
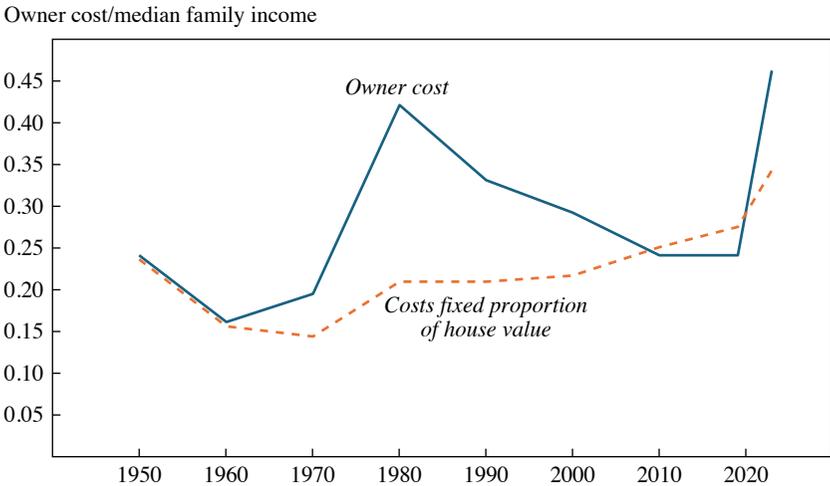
Source: Decennial Census and American Community Survey, accessed through IPUMS (Ruggles and others 2025); 1950 Census of Housing report; Federal Reserve Bank of Philadelphia Historical Housing Prices Project (Lyons and others 2024); Freddie Mac Primary Mortgage Market Survey; and Drehmann, Juselius, and Quincy (2024).

Figure 3 shows the ownership costs of a constant-quality home relative to median family income, where I have estimated the value of a constant-quality home by growing out average house value in 1950 with the constant-quality house price data shown in figure 1.[9] Relative to family income, the ownership costs of a constant-quality home in 2023 were much higher than in many previous decades, and about the same as they were in 1980, when mortgage rates were near 14 percent. From 1980 to 2019 this measure gradually declined as decreases in mortgage rates reduced the cost of

9. I use the average house value because the LSGA HPI reflects changes in the average house price. It would be nice to create a measure of constant-quality median home value because the distribution of house values is so skewed. However, I am not aware of any measures that estimate the price of a constant-quality median home for this entire time period. The Zillow Home Value Index (ZHVI) estimates the increase in value for the 35th to 65th percentile of the house value distribution. This index increased by somewhat less than the LSGA HPI: by a factor of 3.4 from 1996 (first available year) to 2024, while the LSGI HPI rose by a factor of 4.0. Of course, other methodological differences might also have caused these two measures to differ. It might be an overestimate to assume that maintenance costs are proportional to the price of a constant-quality home since increases in a constant-quality price index mostly reflect increases in the price of land. Results are similar if I assume instead that maintenance costs are constant in real terms (not shown).

ownership by more than the boost from rising house prices relative to income. The ratio of owner costs to median income nearly doubled from 2019 to 2023 due to the combination of a jump in mortgage rates, an increase in homeowners' insurance premiums, and continued house price increases. The dashed line in the figure isolates the portion of owner costs that is purely related to changes in constant-quality house prices relative to income by holding all of the costs at a constant fraction of house value. This measure increased gradually from 1970 to 2019 and then stepped up notably from 2019 to 2023. Therefore, the costs associated with living in an owner-occupied home have risen, in part, because house prices have risen faster than incomes and many of these costs are proportional to the price of the home.

Overall, figure 3 suggests that the costs associated with occupying an owner-occupied home have increased substantially relative to median family income and are high relative to historical standards. This result is consistent with the rising price-to-income ratios that Glaeser and Gyourko show in their table 2. That said, one should be cautious about interpreting this measure as an estimate of the price of shelter because it does not incorporate all of the costs and benefits of property ownership. Housing market equilibrium entails that the price of shelter should equal a complete user cost of owning that includes factors like the opportunity cost of the cash used for the down payment, the tax advantages of homeownership, and the capital gain expected by the owner (Poterba 1984; Himmelberg, Mayer, and Sinai 2005). These factors are too complex to be considered in this short discussion.

SUMMARY In conclusion, it is clear that the price of shelter has increased by much less than the price of purchasing a home. For people concerned about the affordability of shelter, it is important to understand that increases in rental expenditures relative to income have been driven by changes in the quality of the housing stock, not by changes in the constant-quality price of shelter. That said, one should not necessarily conclude that shelter affordability is not a problem in the United States. It is possible that some families live in larger, nicer homes than they would prefer because smaller, lower-quality housing is not available. For example, the increases in construction costs and changes in the regulatory environment that Glaeser and Gyourko describe in their paper may have caused a shift in the types of homes being produced toward larger, higher-quality homes. For people concerned about the affordability of purchasing a home, prices have indeed risen considerably relative to incomes, even for a constant-quality home. In that sense, the case for a housing affordability crisis is stronger for purchasing a home than for purchasing shelter. However, as Glaeser and Gyourko stated

nicely, it is difficult to know the extent to which today's new homeowners will benefit from future house price appreciation.

This discussion has highlighted a number of important questions for future research. One pertains to the reasons underlying the rise in structure quality. Surely improvements in structure quality must be partly due to rising household incomes. But they could also be partly due to supply constraints in new construction or to changes in the filtering process of higher-quality homes transitioning to lower-quality as they age. Indeed, Baum-Snow and Duranton (2025) show that the rate of housing depreciation in high-demand metro areas has slowed since 2000, which could reflect a change in this filtering process. Future research should also examine the effect on the price of shelter of the dramatic decline in the housing supply documented so convincingly by Glaeser and Gyourko. The LSGA RI only increased by 0.8 percent per year (in real terms) from 1990 to 2024 after having increased by 0.6 percent per year from 1960 to 1990. It is puzzling why the considerable decline in the supply of homes since 1990 has not resulted in a larger step-up in shelter inflation. And finally, future research should also address why house prices have risen by so much more than rents over the past seventy-five years.

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GENERAL DISCUSSION   Gerald Cohen was not convinced Texas's return of its home construction industry to pre–global financial crisis (GFC) levels was sufficient evidence to state that present housing supply growth trends are not at least partially explained by persistent GFC effects. Edward Glaeser explained that when considering individual housing markets rather than the overall trends across the United States, trends are long-term ones dating back farther than the GFC. In Dallas and Miami, for example, these trends started fifty years ago. He noted that in the 1970s there was a strong, positive relationship between prices and quantities that has since largely disappeared; and that there used to be a strong negative relationship between housing supply growth and density, but this has gone away or even reversed. Heterogeneity of supply conditions, he posited, is currently driving housing supply growth.

Joseph Gyourko commented that remodeling has increased drastically while new construction has not, speculating that since the GFC, many construction companies have rebranded themselves as remodelers. He suggested a growing number of small-scale renovations of already built developments are behind this trend and that high demand for housing with little change in new housing growth prompted many to save existing stock. Gyourko remarked that if they were to add up remodelers and new home builders, the home building sector is very likely back to pre-GFC levels in most places.

Elaine Buckberg expressed surprise when learning that construction labor markets have not recovered to pre-GFC levels. She reflected on how economists often believe higher wages would increase the quantity of construction labor, but seeing the construction workforce still has issues recruiting, she was curious about what sort of other supply constraints there may be on expanding the home construction workforce. She suggested considering local constraints on occupational licensing, limits on apprenticeships, or simply a change in taste for jobs in younger generations. Gyourko recalled a conversation he had with a senior executive of a large construction company. The company found it very difficult to find younger plumbers for their projects, which Gyourko interpreted as evidence of a growing constraint to expanding the home construction workforce.

Janice Eberly noticed, when looking at discussant Nathaniel Baum-Snow's charts on what types of homes were being built, that one- to three-bedroom homes were most likely to be built in superstar cities. She wondered if, alongside demand for affordable homes, there might be a coincident demand from retiring baby boomers wanting to move into smaller homes. As evidence for this theory, Eberly pointed out that smaller homes have exhibited the largest price increases and the lowest drop in quality-adjusted price, which would suggest a more resilient demand in contrast to other home categories. Glaeser provided a counterpoint to Eberly's comment, noting that the literature on retirement and demand for urban space has previously shown that this segment of the market has not been a particularly strong force on overall housing demand, but he conceded that newer data may provide a different story.

Fabrizio Perri asked for clarification on whether housing prices in the paper reflected true price increases in some areas, or if they were all increases in the quality of the housing stock. John Haltiwanger emphasized the importance of understanding the nature of supply depreciation and how housing stock quality looks for cities in decline. Is there spatial variation in the quality of housing and how does it contribute to this trend? In response, Glaeser highlighted that the price discussions in the paper are all quality-adjusted, using the Federal Housing Finance Agency House Price Index (FHFA HPI). Once controlling for quality, the authors found that market prices have risen substantially, and indeed, risen faster than income. Glaeser noted that subcity-level repeat pricing indexes that could measure local quality variation are too sparse for them to say anything about quality adjustments at the hyper-local level.

Adele Morris made the point that some luxury amenities are now better described as necessities; for example, air-conditioning in places such as Miami or Houston. Morris further noted that a higher demand for washers and dryers may reflect a change in household dynamics through increased participation of women in the labor force, contributing to the observed shifts in housing quality.

Douglas Elmendorf was reminded that pre-GFC, economists at the Federal Reserve were paying close attention to the price-to-rent ratio. He noted that discussant Raven Molloy's figures highlighted a sharp increase in price-to-rent ratio across the United States, but that there may be a similar increase in the price-to-earnings ratio on equities, perhaps reflecting a change in the overall discount rate that cuts across different asset markets.

James Stock was surprised that rental prices and housing prices did not appear to be more closely linked. Glaeser replied that while housing

prices have increased substantially more than income, this has not been true of rents to the same extent in the authors' selected markets—at least not everywhere.

On housing prices, Gyourko added that the authors show in the paper that the price-to-income ratio in Los Angeles increased from 4.03 to 7.83 between 2000 and 2023. Admittedly, not all places showed the same trend: Detroit and Phoenix had comparable price-to-income ratios (2.25 and 2.43) in 2000, but by 2023 the price increase was only evident in Phoenix, having reached 4.37. Nonetheless, he argued that growing price-to-income ratios support the overall conclusion that median housing prices have been rising. Referring to Molloy's presentation, Gyourko acknowledged her point about the difference between renting and owning, and the ambiguous definition of housing affordability.

Glaeser brought up Charles Himmelberg, Christopher Mayer, and Todd Sinai's 2005 paper on housing prices and how their predictions didn't turn out to be as accurate in the wake of the GFC.[1] He also mentioned his own work with Joshua Gottlieb and Gyourko on the GFC, whose results suggested that interest rates could not explain the difference between rents and housing prices.[2] He explained that owners do not necessarily discount by their market rent or their market interest rate, because they are not constrained by these factors. Mortgage prepayment ability creates a disconnect between housing prices and current and expected future interest rates. Furthermore, even when Glaeser and Gyourko analyzed the elasticity of mortgage rate to changes in interest rate, they found a small effect when looking at recent increases in mortgage rate; these did not translate into a decline in housing prices. In sum, this suggests that current housing affordability questions cannot be explained by interest rate.

Referring to Baum-Snow's presentation, Jón Steinsson asked if we know how to increase housing supply and what the obstacles are, if any. Glaeser pointed out that if more land were made available, housing supply would increase. Gyourko added that housing stock issue is mainly the result of political constraints, for example, local control in the form of development restrictions in neighborhoods. He pointed out that the general absence of higher arbitrators or mechanisms to move authority to higher locus of control

1. Charles Himmelberg, Christopher Mayer, and Todd Sinai, "Assessing High House Prices: Bubbles, Fundamentals and Misperceptions," *Journal of Economic Perspectives* 19, no. 4 (2005): 67–92.

2. Edward L. Glaeser, Joshua D. Gottlieb, and Joseph Gyourko. "Can Cheap Credit Explain the Housing Boom?" In *Housing and the Financial Crisis*, edited by Edward L. Glaeser and Todd Sinai (Chicago: University of Chicago Press, 2013).

(which has been done successfully in Baum-Snow's example of Ontario), means that developable land will continue to remain scarce.

Buckberg asked about permittable land and what generalizable truth there is to anecdotes of developers finding profits only from high-quality land for luxury homes, which in turn prevents more affordable starter units from being built. Gyourko emphasized that it is not really the case that land itself is scarce; the scarcity instead arises from a shortage of available land with a permit to build on it. In the most highly distorted markets, the first developer to build a new building on land that requires a new permit pays a high cost and only breaks even if constructing high-quality units that can be sold at a high price. Glaeser argued that one strategy to construct cheap housing is to build high-density small homes, all in the same place.

Eberly questioned if the shift from large- to smaller-scale construction described in the paper contributed to the decline in productivity and the higher costs for new construction. Frederic Mishkin suggested that given the productivity decline was accompanied by a simultaneous increase in the cost of building, challenges likely extended beyond political issues. In response, Glaeser referenced his own research on the declining productivity in the construction sector.[3] He and his coauthors found that zoning regulations made projects smaller, which in turn made firms smaller and hindered progress in construction technology and innovation. This is shown not least by the trend of patents in the construction sector, which used to follow the same trend as manufacturing patents until the 1940s then started declining and fell dramatically in the 1970s, while manufacturing patents continued to grow.

3. Leonardo D'Amico, Edward L. Glaeser, Joseph Gyourko, William Kerr, and Giacomo A. M. Ponzetto, "Why Has Construction Productivity Stagnated? The Role of Land-Use Regulation," working paper 33188 (Cambridge, Mass.: National Bureau of Economic Research, 2024).

I.   Appendix Tables

Appendix Table 1: CBSA-Level Annualized Share of Total Housing Stock Added Over Time

CBSA	1950-1960	1960-1970	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020	2020-2023
Atlanta	6.73	6.96	4.78	4.42	2.97	3.17	1.11	0.58
Austin	5.78	6.37	7.46	5.65	3.39	4.24	3.40	1.92
Boston	2.07	2.30	1.61	1.13	0.59	0.75	0.79	0.23
Charlotte	6.01	5.25	3.47	3.08	3.14	3.50	1.83	0.96
Chicago	3.42	2.72	1.57	0.56	1.00	0.97	0.39	0.13
Cleveland	3.89	2.53	1.02	0.35	0.61	0.49	0.13	0.08
Dallas	8.31	5.98	4.37	4.06	1.95	2.52	1.79	0.94
Denver	7.53	4.85	5.71	2.42	2.01	1.97	1.47	0.69
Detroit	4.44	2.49	1.39	0.45	0.79	0.50	0.08	0.24
Houston	8.63	5.93	6.97	2.26	1.56	2.83	1.93	1.04
Las Vegas	22.85	14.63	10.49	6.64	7.65	5.01	0.92	0.66
Los Angeles	7.81	4.10	1.92	1.29	0.50	0.60	0.51	0.29
Miami	14.93	7.58	7.06	2.86	1.55	1.46	0.72	0.27
Nashville	5.59	5.36	3.85	2.71	2.42	2.29	1.91	1.33
New York	2.90	2.36	0.74	0.56	0.68	0.62	0.60	0.21
Orlando	12.70	6.61	7.72	6.02	3.04	3.79	1.55	1.00
Philadelphia	3.41	2.43	1.54	0.91	0.69	0.67	0.63	0.27
Phoenix	14.93	7.92	9.06	5.58	3.25	3.51	1.04	0.76
Raleigh	4.82	5.45	5.18	4.84	4.56	4.14	2.36	1.44
Salt Lake City	5.42	3.84	5.38	2.14	2.31	1.98	1.63	0.95
San Antonio	6.12	4.21	4.00	3.28	1.84	2.92	2.12	0.71
San Diego	10.53	5.90	5.98	3.14	0.99	1.20	0.55	0.33
San Francisco	4.28	3.29	1.85	1.20	0.71	0.84	0.60	0.34
Seattle	4.48	5.10	3.06	2.56	1.84	1.66	1.28	0.64
Tampa-St.	11.68	6.81	7.37	3.42	1.16	1.83	0.83	0.62
Washington	6.00	5.87	2.60	2.52	1.57	1.71	1.16	0.34

Appendix Table 2: Total Units Density (Units/Acre)

CBSA	1970	1980	1990	2000	2010	2020	2023
Atlanta	0.305	0.445	0.650	0.815	1.027	1.132	1.146
Boston	0.894	1.045	1.143	1.187	1.252	1.344	1.360
Charlotte	0.136	0.186	0.243	0.321	0.432	0.512	0.528
Chicago	0.736	0.978	0.970	1.059	1.139	1.180	1.184
Cleveland	0.579	0.657	0.665	0.703	0.726	0.733	0.732
Dallas	0.158	0.251	0.315	0.377	0.468	0.551	0.566
Denver	0.193	0.302	0.373	0.426	0.491	0.561	0.565
Detroit	0.540	0.633	0.654	0.702	0.727	0.731	0.736
Houston	0.151	0.261	0.304	0.351	0.447	0.537	0.553
Las Vegas	0.021	0.045	0.061	0.108	0.161	0.176	0.179
Los Angeles	0.979	1.239	1.295	1.412	1.448	1.524	1.536
Miami	0.386	0.519	0.536	0.620	0.888	0.980	0.987
New York	1.259	1.742	1.808	1.812	1.981	2.038	2.022
Orlando	0.072	0.123	0.204	0.266	0.364	0.421	0.433
Philadelphia	0.568	0.653	0.713	0.765	0.786	0.837	0.843
Phoenix	0.061	0.104	0.161	0.212	0.275	0.305	0.311
Raleigh	0.129	0.205	0.322	0.470	0.671	0.835	0.870
Salt Lake City	0.267	0.396	0.496	0.602	0.690	0.814	0.838
San Antonio	0.216	0.307	0.392	0.452	0.578	0.697	0.693
San Diego	0.174	0.285	0.350	0.383	0.422	0.462	0.467
San Francisco	0.670	0.865	0.931	0.994	1.047	1.103	1.114
Seattle	0.178	0.229	0.277	0.325	0.384	0.432	0.440
Tampa	0.458	0.735	0.951	1.046	1.172	1.263	1.282
Washington	0.477	0.616	0.749	0.853	0.991	1.106	1.099

Appendix Table 3: Decadal Percentage Change in Aggregate Total Units Density by Miles from City Center

CBSA	Miles from Center	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020
Atlanta	0-5	-0.022	-0.004	0.001	0.143	0.134
	5-10	0.240	0.139	0.101	0.141	0.110
	10 Plus	0.912	0.781	0.352	0.303	0.098
Boston	0-5	0.083	0.043	0.004	0.087	0.137
	5-10	0.091	0.063	0.032	0.028	0.062
	10 Plus	0.209	0.132	0.074	0.057	0.069
Charlotte	0-5	0.069	0.053	0.037	0.137	0.254
	5-10	0.535	0.450	0.351	0.338	0.157
	10 Plus	0.358	0.428	0.386	0.396	0.183
Chicago	0-5	-0.062	-0.034	0.104	-0.023	0.129
	5-10	0.003	-0.064	0.005	-0.029	0.032
	10 Plus	0.357	0.054	0.134	0.093	0.026
Cleveland	0-5	-0.086	-0.097	-0.015	-0.107	-0.018
	5-10	0.029	0.011	-0.001	-0.026	-0.026
	10 Plus	0.329	0.086	0.141	0.097	0.041
Dallas	0-5	0.020	0.011	-0.010	0.062	0.155
	5-10	0.407	0.114	-0.010	0.010	0.157
	10 Plus	0.711	0.438	0.275	0.309	0.196
Denver	0-5	0.036	0.011	0.020	0.082	0.195
	5-10	0.793	0.148	0.071	0.008	0.112
	10 Plus	2.216	0.694	0.369	0.326	0.152
Detroit	0-5	-0.185	-0.216	-0.081	-0.120	-0.092
	5-10	-0.015	-0.058	-0.033	-0.065	-0.064
	10 Plus	0.343	0.124	0.142	0.075	0.035
Houston	0-5	-0.034	-0.119	-0.001	0.151	0.176
	5-10	0.393	-0.010	0.015	0.068	0.086
	10 Plus	1.286	0.363	0.222	0.341	0.226
Las Vegas	0-5	0.833	0.238	0.100	0.034	-0.010
	5-10	2.421	1.370	1.174	0.532	0.071
	10 Plus	0.108	2.283	2.031	1.028	0.195

Appendix Table 3 Continued:

CBSA	Miles from Center	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020
Los Angeles	0-5	0.061	-0.066	-0.001	0.120	0.068
	5-10	0.062	0.030	0.045	-0.001	0.063
	10 Plus	0.334	0.078	0.109	0.030	0.052
Miami	0-5	0.181	-0.014	0.030	0.146	0.162
	5-10	0.202	-0.012	0.091	0.045	0.041
	10 Plus	0.511	0.108	0.186	0.447	0.103
New York	0-5	0.825	-0.029	-0.036	0.084	0.153
	5-10	0.253	-0.064	0.112	-0.019	0.099
	10 Plus	0.154	0.070	0.064	0.036	0.033
Orlando	0-5	0.286	0.119	0.060	0.146	0.084
	5-10	0.973	0.656	0.216	0.144	0.045
	10 Plus	0.991	0.922	0.432	0.525	0.204
Philadelphia	0-5	-0.082	-0.103	0.133	-0.156	0.211
	5-10	0.048	0.001	0.045	-0.049	0.044
	10 Plus	0.303	0.188	0.133	0.075	0.062
Phoenix	0-5	0.120	0.010	0.029	0.024	0.146
	5-10	0.922	0.234	0.108	0.125	0.066
	10 Plus	1.667	1.087	0.489	0.403	0.124
Raleigh	0-5	0.357	0.117	0.090	0.119	0.198
	5-10	1.742	0.793	0.473	0.389	0.144
	10 Plus	0.497	0.672	1.067	0.762	0.393
Salt Lake City	0-5	0.115	-0.057	0.135	-0.065	0.207
	5-10	0.538	0.210	0.138	0.036	0.090
	10 Plus	1.407	0.513	0.385	0.306	0.236
San Antonio	0-5	-0.022	-0.018	-0.011	0.000	0.062
	5-10	0.416	0.228	0.056	0.181	0.150
	10 Plus	1.710	0.964	0.392	0.519	0.311
San Diego	0-5	0.124	0.125	0.057	0.037	0.045
	5-10	0.185	0.232	0.030	-0.110	0.141
	10 Plus	1.198	0.445	0.149	0.147	0.104
San Francisco	0-5	0.005	-0.092	0.122	0.033	0.173
	5-10	0.195	-0.142	0.040	0.039	0.045
	10 Plus	0.296	0.162	0.087	0.049	0.056

Appendix Table 3 Continued:

CBSA	Miles from Center	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020
Seattle	0-5	0.070	0.063	0.061	0.163	0.249
	5-10	0.258	0.125	0.091	0.087	0.096
	10 Plus	0.423	0.303	0.232	0.191	0.112
Tampa	0-5	0.167	0.016	-0.034	-0.025	0.039
	5-10	0.664	0.402	0.048	0.001	0.044
	10 Plus	0.736	0.362	0.135	0.165	0.088
Washington	0-5	-0.009	-0.053	0.046	0.133	0.170
	5-10	0.151	0.063	0.035	0.031	0.084
	10 Plus	0.714	0.520	0.263	0.245	0.115

Appendix Table 4: CBSA-Level Distribution of Price-to-Income Ratios

CBSA	Year	10th	25th	50th	75th	90th
Atlanta	1970	1.05	1.29	1.52	2.11	2.81
	1980	1.09	1.43	2.34	3.36	4.58
	1990	1.34	1.70	2.45	3.43	5.43
	2000	1.51	1.88	2.65	4.35	7.40
	2010	2.22	2.72	3.61	5.18	7.71
	2020	1.58	2.22	3.25	5.34	8.03
	2023	2.23	2.80	3.89	5.85	7.91
Charlotte	1970	0.92	1.18	1.18	1.71	2.36
	1980	1.30	1.62	2.30	2.70	3.79
	1990	1.42	1.67	2.26	2.78	3.51
	2000	1.48	1.78	2.45	3.18	4.82
	2010	1.71	2.20	2.85	4.04	6.36
	2020	1.63	2.04	2.90	4.61	5.95
	2023	2.05	2.65	3.47	5.46	7.33
Dallas	1970	0.83	0.83	1.30	1.77	2.83
	1980	0.98	1.34	2.03	3.11	4.68
	1990	1.18	1.53	2.09	2.91	4.47
	2000	0.86	1.19	1.78	2.58	4.39
	2010	1.20	1.58	2.21	3.29	5.52
	2020	1.24	1.62	2.44	4.20	6.56
	2023	1.73	2.27	3.14	4.79	6.98
Houston	1970	0.87	1.12	1.37	1.87	2.24
	1980	1.24	1.56	2.12	3.10	4.10
	1990	1.08	1.35	1.75	2.40	3.38
	2000	0.96	1.27	1.75	2.39	3.49
	2010	1.29	1.57	2.05	3.06	4.35
	2020	1.25	1.67	2.39	3.63	5.82
	2023	1.53	2.10	2.91	4.03	5.97
Las Vegas	1970	1.52	1.76	2.11	2.81	2.81
	1980	2.62	2.79	3.62	4.05	5.00
	1990	1.94	2.26	2.81	3.51	4.68
	2000	2.15	2.31	2.92	3.57	4.96
	2010	2.60	3.10	4.44	5.66	7.25
	2020	2.93	3.35	4.34	6.01	7.86
	2023	3.71	4.15	4.98	6.81	8.21
Miami	1970	1.37	1.37	1.87	2.25	4.25
	1980	1.93	2.47	3.23	4.42	6.17
	1990	1.77	2.19	2.83	4.06	6.53
	2000	1.76	2.07	2.87	4.04	7.21
	2010	3.14	3.92	5.06	6.89	9.65
	2020	2.61	3.35	4.49	6.25	8.52
	2023	3.31	4.04	5.09	6.99	9.48

Appendix Table 4 Continued:

CBSA	Year	10th	25th	50th	75th	90th
Orlando	1970	1.03	1.32	1.62	1.91	2.65
	1980	1.74	2.29	2.74	3.51	4.62
	1990	1.86	2.19	2.65	3.07	4.17
	2000	1.76	2.06	2.57	3.10	4.07
	2010	2.48	3.29	4.06	5.29	6.76
	2020	2.05	2.79	3.74	4.71	6.33
	2023	2.69	3.31	4.22	4.87	6.89
Phoenix	1970	0.87	1.36	1.61	2.23	2.97
	1980	1.40	2.28	3.02	3.76	5.03
	1990	1.55	2.01	2.49	3.16	4.01
	2000	1.60	1.94	2.43	3.32	4.57
	2010	2.45	3.15	4.00	5.39	7.87
	2020	2.25	2.73	3.68	5.13	7.25
	2023	2.96	3.36	4.37	6.02	7.77
Raleigh	1970	1.15	1.15	1.66	2.30	3.07
	1980	1.63	1.99	2.64	3.69	4.23
	1990	1.79	2.19	2.72	3.51	4.24
	2000	1.82	2.29	3.35	4.18	5.81
	2010	2.35	2.67	4.05	5.67	7.93
	2020	2.06	2.75	4.27	5.30	7.02
	2023	2.69	3.60	4.72	6.21	8.03
San Antonio	1970	0.74	1.04	1.34	1.93	2.67
	1980	1.09	1.26	1.70	2.84	4.64
	1990	1.23	1.46	1.81	2.81	4.21
	2000	1.01	1.17	1.49	2.50	3.54
	2010	1.39	1.57	1.92	3.02	5.19
	2020	1.37	1.63	2.25	3.79	6.30
	2023	1.67	1.94	2.82	4.49	7.01
Tampa	1970	1.10	1.10	1.42	2.05	2.37
	1980	1.55	1.96	2.54	3.54	4.65
	1990	1.57	1.98	2.51	3.36	4.55
	2000	1.56	1.84	2.23	3.07	4.44
	2010	2.64	3.17	3.77	4.94	7.40
	2020	2.07	2.74	3.58	4.73	6.85
	2023	2.76	3.20	4.15	5.44	8.20
Boston	1970	1.16	1.37	1.90	1.90	2.54
	1980	1.41	1.98	2.62	3.33	4.44
	1990	3.08	3.67	4.23	5.17	7.43
	2000	2.22	2.87	3.70	5.06	7.59
	2010	3.80	4.58	5.34	6.84	9.08
	2020	3.02	3.85	4.97	6.88	9.06
	2023	3.50	4.28	5.31	7.18	9.31

Appendix Table 4 Continued:

CBSA	Year	10th	25th	50th	75th	90th
Los Angeles	1970	1.35	1.56	1.87	2.49	3.53
	1980	2.67	3.33	4.26	5.78	7.83
	1990	3.28	4.21	5.46	7.55	10.79
	2000	2.90	3.31	4.03	5.83	8.84
	2010	5.39	6.27	7.64	10.07	13.50
	2020	5.04	5.82	7.32	9.76	14.24
	2023	5.61	6.36	7.83	10.48	15.37
New York	1970	1.28	1.77	1.77	2.35	3.34
	1980	1.48	2.08	2.74	3.51	4.83
	1990	2.86	3.78	4.62	5.75	7.76
	2000	2.49	3.10	3.80	5.01	7.14
	2010	4.40	5.48	6.78	8.75	10.80
	2020	3.22	4.23	5.79	8.07	11.08
	2023	3.43	4.46	5.96	8.08	10.66
San Diego	1970	1.54	1.78	2.14	2.85	2.85
	1980	3.59	3.94	4.73	6.22	7.85
	1990	3.29	3.96	4.91	6.62	9.03
	2000	2.95	3.49	4.31	6.10	8.38
	2010	5.16	6.00	7.20	9.69	13.65
	2020	4.72	5.34	6.72	8.66	12.14
	2023	5.31	5.92	7.19	9.11	13.38
San Francisco	1970	1.48	1.77	2.36	2.36	3.35
	1980	2.49	3.58	4.65	6.47	8.58
	1990	3.10	4.39	6.14	8.36	11.13
	2000	2.51	3.62	5.44	7.96	10.90
	2010	4.85	5.92	8.12	10.81	12.58
	2020	4.32	5.42	7.72	10.44	14.10
	2023	4.50	5.92	8.11	11.01	13.97
Seattle	1970	1.18	1.39	1.60	1.92	2.56
	1980	2.25	2.84	3.33	3.78	4.77
	1990	2.09	2.60	3.49	4.45	5.63
	2000	2.55	3.10	3.88	5.16	6.78
	2010	3.58	4.31	5.43	7.01	8.90
	2020	3.11	3.82	5.27	7.41	9.32
	2023	3.60	4.32	5.70	7.76	9.76
Washington	1970	1.15	1.59	2.12	2.12	3.00
	1980	1.96	2.51	2.98	3.96	5.39
	1990	1.87	2.41	3.42	4.73	6.71
	2000	1.75	2.10	2.76	3.88	5.60
	2010	3.00	3.75	4.78	6.41	8.39
	2020	2.41	3.02	4.22	5.88	7.79
	2023	2.62	3.26	4.56	6.12	7.92

Appendix Table 4 Continued:

CBSA	Year	10th	25th	50th	75th	90th
Denver	1970	0.95	1.16	1.59	1.90	2.54
	1980	2.39	2.91	3.37	4.13	5.47
	1990	1.82	2.11	2.63	3.25	4.11
	2000	2.45	2.85	3.51	4.58	5.64
	2010	2.90	3.24	4.32	5.69	7.23
	2020	3.34	3.96	5.10	6.47	7.62
	2023	3.77	4.42	5.55	6.88	8.29
Salt Lake City	1970	1.11	1.36	1.60	2.22	2.96
	1980	2.22	2.53	3.44	4.21	4.98
	1990	1.60	1.73	2.43	3.15	4.17
	2000	2.44	2.66	3.55	4.45	6.02
	2010	2.80	3.32	4.43	5.90	7.55
	2020	2.86	3.41	4.57	5.90	7.48
	2023	3.57	4.30	5.24	6.90	8.29
Chicago	1970	1.12	1.32	1.52	2.44	2.44
	1980	1.25	1.63	2.50	3.54	4.89
	1990	1.31	1.72	2.52	3.86	6.01
	2000	1.57	2.04	3.01	4.40	7.37
	2010	2.36	3.16	4.44	6.23	8.54
	2020	1.55	2.23	3.25	4.93	7.32
	2023	1.71	2.41	3.35	4.87	7.13
Cleveland	1970	0.99	1.21	1.66	1.99	2.65
	1980	0.85	1.32	2.59	3.40	4.10
	1990	0.81	1.22	2.15	2.83	3.85
	2000	1.26	1.65	2.51	3.36	4.51
	2010	1.51	1.89	2.76	3.80	5.17
	2020	0.89	1.26	2.15	3.30	4.91
	2023	0.85	1.39	2.41	3.65	5.12
Detroit	1970	0.90	1.10	1.51	1.81	2.41
	1980	0.69	0.95	1.74	2.60	3.50
	1990	0.49	0.74	1.56	2.54	3.57
	2000	0.73	1.29	2.25	3.29	4.63
	2010	1.20	1.66	2.50	3.51	4.90
	2020	0.62	0.98	2.02	3.33	5.03
	2023	0.82	1.19	2.48	3.75	5.31
Philadelphia	1970	0.75	0.97	1.40	1.93	2.58
	1980	0.82	1.55	2.28	3.17	3.87
	1990	0.86	1.84	2.71	3.86	5.00
	2000	0.83	1.52	2.32	3.25	4.24
	2010	1.37	2.45	3.67	5.04	6.44
	2020	1.22	2.03	3.00	4.34	5.86
	2023	1.40	2.25	3.19	4.49	5.95

Notes: In each decade, the price-to-income ratio is constructed at the tract level by dividing the tract-level real median house price by the relevant CBSA-wide mean real income.

Appendix Table 5: Share of Tracts in P:MPPC Bins

CBSA	P:MPPC Bin	1970	1980	1990	2000	2010	2020	2023
Atlanta	P:MPPC < 0.8	0.835	0.818	0.727	0.553	0.539	0.555	0.416
	0.8 < P:MPPC < 1.2	0.097	0.140	0.135	0.193	0.233	0.202	0.267
	P:MPPC > 1.2	0.068	0.042	0.139	0.254	0.229	0.244	0.317
Charlotte	P:MPPC < 0.8	0.928	0.869	0.773	0.490	0.649	0.649	0.516
	0.8 < P:MPPC < 1.2	0.052	0.103	0.149	0.333	0.182	0.205	0.229
	P:MPPC > 1.2	0.020	0.028	0.078	0.176	0.169	0.146	0.255
Dallas	P:MPPC < 0.8	0.876	0.838	0.791	0.754	0.776	0.684	0.527
	0.8 < P:MPPC < 1.2	0.099	0.092	0.115	0.131	0.121	0.146	0.230
	P:MPPC > 1.2	0.025	0.070	0.094	0.114	0.103	0.170	0.243
Houston	P:MPPC < 0.8	0.908	0.813	0.892	0.824	0.796	0.720	0.643
	0.8 < P:MPPC < 1.2	0.082	0.147	0.071	0.101	0.131	0.163	0.215
	P:MPPC > 1.2	0.011	0.039	0.038	0.076	0.073	0.117	0.142
Las Vegas	P:MPPC < 0.8	0.938	0.815	0.800	0.783	0.743	0.757	0.671
	0.8 < P:MPPC < 1.2	0.047	0.123	0.143	0.174	0.214	0.186	0.243
	P:MPPC > 1.2	0.016	0.062	0.057	0.043	0.043	0.057	0.086
Miami	P:MPPC < 0.8	0.899	0.657	0.659	0.531	0.288	0.393	0.183
	0.8 < P:MPPC < 1.2	0.081	0.198	0.161	0.258	0.361	0.300	0.403
	P:MPPC > 1.2	0.020	0.145	0.180	0.210	0.351	0.307	0.413
Orlando	P:MPPC < 0.8	0.958	0.847	0.825	0.658	0.358	0.500	0.316
	0.8 < P:MPPC < 1.2	0.042	0.153	0.117	0.250	0.483	0.342	0.470
	P:MPPC > 1.2	.	.	0.058	0.092	0.158	0.158	0.214
Phoenix	P:MPPC < 0.8	0.955	0.839	0.825	0.683	0.535	0.588	0.346
	0.8 < P:MPPC < 1.2	0.036	0.106	0.122	0.229	0.287	0.268	0.355
	P:MPPC > 1.2	0.009	0.055	0.052	0.088	0.178	0.145	0.298
Raleigh	P:MPPC < 0.8	0.815	0.720	0.473	0.200	0.345	0.273	0.109
	0.8 < P:MPPC < 1.2	0.148	0.240	0.418	0.273	0.200	0.255	0.255
	P:MPPC > 1.2	0.037	0.040	0.109	0.527	0.455	0.473	0.636
San Antonio	P:MPPC < 0.8	0.915	0.867	0.895	0.883	0.883	0.846	0.747
	0.8 < P:MPPC < 1.2	0.079	0.114	0.064	0.064	0.070	0.083	0.141
	P:MPPC > 1.2	0.006	0.018	0.041	0.053	0.047	0.071	0.112
Tampa	P:MPPC < 0.8	0.964	0.927	0.828	0.765	0.653	0.591	0.407
	0.8 < P:MPPC < 1.2	0.036	0.068	0.115	0.146	0.227	0.262	0.367
	P:MPPC > 1.2	.	0.005	0.057	0.088	0.120	0.147	0.226

Appendix Table 5 Continued:

CBSA	P:MPPC Bin	1970	1980	1990	2000	2010	2020	2023
Boston	P:MPPC < 0.8	0.929	0.844	0.138	0.219	0.069	0.127	0.042
	0.8 < P:MPPC < 1.2	0.043	0.119	0.562	0.405	0.432	0.348	0.251
	P:MPPC > 1.2	0.027	0.038	0.300	0.375	0.499	0.526	0.707
Los Angeles	P:MPPC < 0.8	0.856	0.383	0.085	0.149	0.015	0.019	0.011
	0.8 < P:MPPC < 1.2	0.096	0.361	0.292	0.451	0.096	0.232	0.057
	P:MPPC > 1.2	0.048	0.256	0.624	0.400	0.889	0.749	0.932
New York	P:MPPC < 0.8	0.856	0.839	0.210	0.387	0.088	0.235	0.158
	0.8 < P:MPPC < 1.2	0.105	0.107	0.458	0.397	0.321	0.320	0.315
	P:MPPC > 1.2	0.038	0.054	0.332	0.215	0.592	0.445	0.527
San Diego	P:MPPC < 0.8	0.932	0.399	0.153	0.152	0.016	0.043	0.013
	0.8 < P:MPPC < 1.2	0.054	0.393	0.433	0.421	0.136	0.287	0.072
	P:MPPC > 1.2	0.014	0.208	0.414	0.427	0.847	0.670	0.914
San Francisco	P:MPPC < 0.8	0.815	0.382	0.120	0.116	0.007	0.018	0.003
	0.8 < P:MPPC < 1.2	0.135	0.331	0.206	0.172	0.113	0.111	0.058
	P:MPPC > 1.2	0.050	0.287	0.674	0.712	0.880	0.871	0.939
Seattle	P:MPPC < 0.8	0.975	0.786	0.472	0.152	0.086	0.117	0.010
	0.8 < P:MPPC < 1.2	0.019	0.184	0.370	0.415	0.354	0.316	0.204
	P:MPPC > 1.2	0.005	0.030	0.157	0.434	0.560	0.567	0.786
Washington	P:MPPC < 0.8	0.470	0.389	0.193	0.208	0.011	0.090	0.058
	0.8 < P:MPPC < 1.2	0.487	0.379	0.285	0.386	0.224	0.301	0.286
	P:MPPC > 1.2	0.043	0.232	0.522	0.405	0.765	0.610	0.657
Denver	P:MPPC < 0.8	0.752	0.578	0.767	0.210	0.353	0.093	0.022
	0.8 < P:MPPC < 1.2	0.236	0.314	0.185	0.476	0.387	0.363	0.230
	P:MPPC > 1.2	0.012	0.109	0.048	0.315	0.260	0.544	0.748
Salt Lake City	P:MPPC < 0.8	0.852	0.667	0.822	0.270	0.300	0.236	0.034
	0.8 < P:MPPC < 1.2	0.136	0.262	0.111	0.404	0.344	0.348	0.348
	P:MPPC > 1.2	0.011	0.071	0.067	0.326	0.356	0.416	0.618
Chicago	P:MPPC < 0.8	0.914	0.803	0.714	0.564	0.528	0.734	0.722
	0.8 < P:MPPC < 1.2	0.064	0.136	0.162	0.233	0.287	0.161	0.160
	P:MPPC > 1.2	0.022	0.061	0.124	0.203	0.184	0.104	0.118
Cleveland	P:MPPC < 0.8	0.948	0.847	0.891	0.768	0.878	0.900	0.874
	0.8 < P:MPPC < 1.2	0.038	0.131	0.082	0.164	0.101	0.090	0.110
	P:MPPC > 1.2	0.014	0.022	0.027	0.068	0.021	0.010	0.016

Appendix Table 5 Continued:

CBSA	P:MPPC Bin	1970	1980	1990	2000	2010	2020	2023
Detroit	P:MPPC < 0.8	0.934	0.903	0.899	0.752	0.895	0.912	0.884
	0.8 < P:MPPC < 1.2	0.049	0.072	0.065	0.165	0.079	0.067	0.087
	P:MPPC > 1.2	0.018	0.026	0.036	0.084	0.026	0.021	0.028
Philadelphia	P:MPPC < 0.8	0.953	0.834	0.598	0.715	0.599	0.730	0.670
	0.8 < P:MPPC < 1.2	0.035	0.137	0.274	0.209	0.273	0.205	0.233
	P:MPPC > 1.2	0.011	0.029	0.128	0.076	0.128	0.065	0.098

Note: P:MPPC is calculated for each tract in each year by taking the real median home value (P), and dividing it by the CBSA-level value of MPPC. We compute the share of tracts in a CBSA in the designated bins accordingly.

Appendix Table 6A: Regression Tables of Delta Log All Unit Density on Initial Period Log Price for 6 CBSAs Outside 10 Miles from CBSA Center, 3 Specifications

Coefficient	CBSA	(1) Naive OLS					(2) Log Price IV					(3) Distance and Octant IV				
		1970	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*
Log Price	Atlanta	0.207	0.338	0.202	0.067	0.022	0.333	0.178	0.166	0.043	0.031	0.295	0.345	0.170	0.017	0.022
Log Price SE	Atlanta	*(0.095)*	*(0.083)*	*(0.063)*	*(0.040)*	*(0.019)*	*(0.171)*	*(0.181)*	*(0.075)*	*(0.039)*	*(0.021)*	*(0.163)*	*(0.117)*	*(0.086)*	*(0.038)*	*(0.020)*
Density	Atlanta	-0.137	-0.151	-0.173	-0.193	-0.026	-0.141	-0.148	-0.171	-0.192	-0.027	-0.140	-0.151	-0.172	-0.191	-0.026
Density SE	Atlanta	*(0.031)*	*(0.023)*	*(0.021)*	*(0.018)*	*(0.011)*	*(0.032)*	*(0.024)*	*(0.027)*	*(0.028)*	*(0.010)*	*(0.031)*	*(0.023)*	*(0.027)*	*(0.028)*	*(0.009)*
R2/Wald F	Atlanta	0.224	0.431	0.481	0.597	0.079	113.248	6.433	1228.889	316.454	205.674	16.013	19.586	29.291	29.573	40.829
Log Price	Dallas	0.638	0.391	0.251	0.166	0.084	0.719	0.444	0.213	0.137	0.062	0.964	0.655	0.365	0.206	0.198
Log Price SE	Dallas	*(0.050)*	*(0.041)*	*(0.021)*	*(0.028)*	*(0.019)*	*(0.071)*	*(0.058)*	*(0.030)*	*(0.048)*	*(0.023)*	*(0.110)*	*(0.126)*	*(0.057)*	*(0.060)*	*(0.058)*
Density	Dallas	-0.156	-0.098	-0.066	-0.094	-0.044	-0.151	-0.096	-0.068	-0.095	-0.045	-0.137	-0.090	-0.059	-0.093	-0.044
Density SE	Dallas	*(0.014)*	*(0.011)*	*(0.007)*	*(0.010)*	*(0.008)*	*(0.014)*	*(0.010)*	*(0.006)*	*(0.012)*	*(0.007)*	*(0.015)*	*(0.011)*	*(0.006)*	*(0.012)*	*(0.007)*
R2/Wald F	Dallas	0.525	0.356	0.443	0.296	0.159	533.708	1675.992	2180.918	466.027	1627.643	15.024	10.773	13.889	12.073	9.079
Log Price	Miami	0.208	0.138	0.071	0.021	0.008	0.239	0.191	0.074	0.079	0.001	0.638	-0.110	-0.045	0.101	0.033
Log Price SE	Miami	*(0.061)*	*(0.031)*	*(0.020)*	*(0.026)*	*(0.012)*	*(0.076)*	*(0.042)*	*(0.029)*	*(0.059)*	*(0.015)*	*(0.303)*	*(0.167)*	*(0.075)*	*(0.101)*	*(0.044)*
Density	Miami	-0.316	-0.152	-0.059	-0.071	-0.011	-0.315	-0.150	-0.059	-0.069	-0.011	-0.295	-0.162	-0.061	-0.068	-0.010
Density SE	Miami	*(0.017)*	*(0.013)*	*(0.011)*	*(0.013)*	*(0.008)*	*(0.037)*	*(0.027)*	*(0.016)*	*(0.024)*	*(0.011)*	*(0.038)*	*(0.031)*	*(0.017)*	*(0.023)*	*(0.010)*
R2/Wald F	Miami	0.569	0.343	0.128	0.099	0.009	512.362	177.036	1064.188	402.948	1242.684	4.534	4.790	7.561	7.156	6.421
Log Price	Phoenix	0.442	0.433	0.240	-0.037	0.108	0.646	0.372	0.252	-0.207	0.091	0.729	0.623	0.250	-0.253	0.053
Log Price SE	Phoenix	*(0.198)*	*(0.112)*	*(0.072)*	*(0.085)*	*(0.025)*	*(0.248)*	*(0.134)*	*(0.087)*	*(0.145)*	*(0.046)*	*(0.281)*	*(0.141)*	*(0.105)*	*(0.199)*	*(0.054)*
Density	Phoenix	-0.198	-0.038	-0.058	-0.120	-0.033	-0.194	-0.040	-0.058	-0.128	-0.034	-0.192	-0.030	-0.058	-0.131	-0.035
Density SE	Phoenix	*(0.040)*	*(0.022)*	*(0.015)*	*(0.021)*	*(0.008)*	*(0.054)*	*(0.020)*	*(0.016)*	*(0.042)*	*(0.013)*	*(0.057)*	*(0.018)*	*(0.018)*	*(0.044)*	*(0.014)*
R2/Wald F	Phoenix	0.314	0.235	0.352	0.331	0.429	60.770	213.140	264.694	95.563	608.168	6432.976	1183.849	278.109	692.420	1.847
Log Price	Los Angeles	0.181	0.033	0.001	-0.026	-0.026	0.149	0.022	0.009	-0.029	-0.031	0.282	0.081	0.010	0.035	-0.003
Log Price SE	Los Angeles	*(0.022)*	*(0.014)*	*(0.006)*	*(0.011)*	*(0.007)*	*(0.033)*	*(0.020)*	*(0.009)*	*(0.014)*	*(0.010)*	*(0.042)*	*(0.032)*	*(0.017)*	*(0.024)*	*(0.010)*
Density	Los Angeles	-0.143	-0.081	-0.031	-0.045	-0.019	-0.145	-0.081	-0.030	-0.045	-0.019	-0.137	-0.081	-0.030	-0.044	-0.019
Density SE	Los Angeles	*(0.007)*	*(0.005)*	*(0.003)*	*(0.004)*	*(0.003)*	*(0.017)*	*(0.014)*	*(0.007)*	*(0.013)*	*(0.007)*	*(0.016)*	*(0.013)*	*(0.006)*	*(0.013)*	*(0.007)*
R2/Wald F	Los Angeles	0.315	0.158	0.087	0.094	0.037	1236.038	423.129	789.576	2275.965	1082.763	61.914	78.194	48.816	71.518	59.599
Log Price	Detroit	0.206	0.097	0.051	0.051	0.053	0.201	0.105	0.062	0.090	0.040	0.487	0.216	0.141	0.059	0.068
Log Price SE	Detroit	*(0.034)*	*(0.020)*	*(0.022)*	*(0.014)*	*(0.007)*	*(0.044)*	*(0.025)*	*(0.027)*	*(0.035)*	*(0.011)*	*(0.087)*	*(0.039)*	*(0.043)*	*(0.041)*	*(0.016)*
Density	Detroit	-0.147	-0.061	-0.100	-0.057	-0.011	-0.148	-0.060	-0.098	-0.051	-0.014	-0.117	-0.045	-0.087	-0.055	-0.008
Density SE	Detroit	*(0.010)*	*(0.008)*	*(0.008)*	*(0.005)*	*(0.004)*	*(0.014)*	*(0.007)*	*(0.014)*	*(0.006)*	*(0.006)*	*(0.011)*	*(0.007)*	*(0.011)*	*(0.006)*	*(0.003)*
R2/Wald F	Detroit	0.385	0.170	0.263	0.255	0.157	587.756	5669.334	2540.396	924.120	1752.011	27.491	24.799	25.738	22.694	22.645

Appendix Table 6B: Regression Tables of Delta Log All Unit Density on Initial Period Log Price for 6 CBSAs Within 10 Miles from CBSA Center, 3 Specifications

Coefficient	CBSA	(1) Naive OLS					(2) Log Price IV					(3) Distance and Octant IV				
		1970	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*
Log Price	Atlanta	0.089	0.160	0.139	0.092	0.121	0.094	0.164	0.109	0.074	0.143	0.090	0.198	0.121	0.231	0.159
Log Price SE	Atlanta	*(0.035)*	*(0.032)*	*(0.032)*	*(0.043)*	*(0.024)*	*(0.067)*	*(0.038)*	*(0.043)*	*(0.048)*	*(0.031)*	*(0.042)*	*(0.047)*	*(0.036)*	*(0.068)*	*(0.033)*
Density	Atlanta	-0.210	-0.026	-0.136	-0.112	0.012	-0.209	-0.026	-0.134	-0.110	0.005	-0.210	-0.022	-0.135	-0.129	0.001
Density SE	Atlanta	*(0.025)*	*(0.029)*	*(0.031)*	*(0.036)*	*(0.025)*	*(0.045)*	*(0.041)*	*(0.077)*	*(0.055)*	*(0.029)*	*(0.040)*	*(0.041)*	*(0.078)*	*(0.058)*	*(0.027)*
R2/Wald F	Atlanta	0.388	0.144	0.184	0.074	0.171	374.502	612.622	230.174	259.428	382.068	39.141	36.271	29.587	20.528	17.825
Log Price	Dallas	0.182	0.053	0.108	0.027	0.011	0.252	0.096	0.074	-0.012	0.012	0.187	0.042	0.095	0.032	0.026
Log Price SE	Dallas	*(0.046)*	*(0.030)*	*(0.026)*	*(0.022)*	*(0.019)*	*(0.078)*	*(0.031)*	*(0.034)*	*(0.023)*	*(0.017)*	*(0.066)*	*(0.026)*	*(0.028)*	*(0.024)*	*(0.019)*
Density	Dallas	-0.246	-0.053	-0.151	-0.128	-0.004	-0.242	-0.057	-0.148	-0.123	-0.004	-0.246	-0.053	-0.150	-0.129	-0.007
Density SE	Dallas	*(0.036)*	*(0.025)*	*(0.025)*	*(0.023)*	*(0.023)*	*(0.070)*	*(0.032)*	*(0.043)*	*(0.044)*	*(0.032)*	*(0.070)*	*(0.032)*	*(0.043)*	*(0.046)*	*(0.035)*
R2/Wald F	Dallas	0.258	0.036	0.205	0.140	0.002	775.409	1020.936	706.185	1254.275	1699.970	33.077	26.717	31.451	31.108	40.250
Log Price	Miami	0.195	0.092	0.048	0.052	-0.016	0.148	0.100	0.054	0.055	-0.052	0.135	0.071	0.021	0.131	0.008
Log Price SE	Miami	*(0.043)*	*(0.045)*	*(0.017)*	*(0.039)*	*(0.024)*	*(0.041)*	*(0.045)*	*(0.021)*	*(0.044)*	*(0.025)*	*(0.061)*	*(0.054)*	*(0.026)*	*(0.070)*	*(0.035)*
Density	Miami	-0.011	-0.189	0.008	-0.014	0.001	-0.015	-0.188	0.008	-0.014	-0.002	-0.015	-0.189	0.008	-0.009	0.003
Density SE	Miami	*(0.023)*	*(0.028)*	*(0.017)*	*(0.030)*	*(0.025)*	*(0.023)*	*(0.081)*	*(0.023)*	*(0.027)*	*(0.028)*	*(0.022)*	*(0.081)*	*(0.023)*	*(0.026)*	*(0.029)*
R2/Wald F	Miami	0.170	0.326	0.072	0.020	0.005	219.844	925.937	937.050	114.447	466.877	22.781	87.063	75.936	87.928	92.727
Log Price	Phoenix	0.370	0.077	0.040	0.065	0.025	0.356	0.173	0.051	0.111	0.028	0.450	0.249	0.108	0.005	0.054
Log Price SE	Phoenix	*(0.057)*	*(0.054)*	*(0.024)*	*(0.043)*	*(0.021)*	*(0.076)*	*(0.078)*	*(0.024)*	*(0.097)*	*(0.022)*	*(0.080)*	*(0.080)*	*(0.030)*	*(0.053)*	*(0.031)*
Density	Phoenix	-0.325	-0.057	-0.068	-0.119	0.022	-0.325	-0.059	-0.067	-0.118	0.022	-0.321	-0.061	-0.066	-0.120	0.024
Density SE	Phoenix	*(0.030)*	*(0.033)*	*(0.016)*	*(0.030)*	*(0.018)*	*(0.048)*	*(0.051)*	*(0.045)*	*(0.069)*	*(0.033)*	*(0.048)*	*(0.053)*	*(0.045)*	*(0.072)*	*(0.032)*
R2/Wald F	Phoenix	0.533	0.032	0.127	0.107	0.019	452.775	398.589	1154.424	422.068	799.112	18.907	11.715	10.088	9.731	11.836
Log Price	Los Angeles	0.075	0.014	0.004	0.000	-0.008	0.093	0.018	-0.008	0.031	-0.011	0.111	0.017	-0.009	0.035	0.005
Log Price SE	Los Angeles	*(0.014)*	*(0.016)*	*(0.010)*	*(0.023)*	*(0.008)*	*(0.019)*	*(0.021)*	*(0.013)*	*(0.025)*	*(0.009)*	*(0.017)*	*(0.015)*	*(0.009)*	*(0.023)*	*(0.009)*
Density	Los Angeles	-0.018	-0.005	-0.002	-0.097	-0.007	-0.016	-0.005	-0.003	-0.095	-0.008	-0.014	-0.005	-0.003	-0.094	-0.006
Density SE	Los Angeles	*(0.010)*	*(0.012)*	*(0.007)*	*(0.012)*	*(0.005)*	*(0.015)*	*(0.019)*	*(0.008)*	*(0.032)*	*(0.006)*	*(0.016)*	*(0.019)*	*(0.008)*	*(0.031)*	*(0.007)*
R2/Wald F	Los Angeles	0.051	0.002	0.000	0.107	0.004	533.422	856.636	158.387	1275.024	1596.436	104.425	187.629	89.202	132.332	140.606
Log Price	Detroit	0.126	0.208	0.154	0.185	0.145	0.167	0.263	0.156	0.214	0.188	0.190	0.235	0.161	0.251	0.240
Log Price SE	Detroit	*(0.029)*	*(0.027)*	*(0.012)*	*(0.022)*	*(0.017)*	*(0.061)*	*(0.041)*	*(0.016)*	*(0.035)*	*(0.023)*	*(0.054)*	*(0.038)*	*(0.016)*	*(0.042)*	*(0.036)*
Density	Detroit	-0.222	-0.105	0.006	-0.117	-0.032	-0.211	-0.088	0.006	-0.119	-0.029	-0.205	-0.097	0.006	-0.121	-0.025
Density SE	Detroit	*(0.022)*	*(0.027)*	*(0.014)*	*(0.019)*	*(0.020)*	*(0.046)*	*(0.043)*	*(0.015)*	*(0.046)*	*(0.027)*	*(0.045)*	*(0.043)*	*(0.015)*	*(0.046)*	*(0.029)*
R2/Wald F	Detroit	0.269	0.178	0.252	0.181	0.148	56.946	844.668	856.171	485.058	524.662	32.286	1122.746	37.223	28.736	20.649

Appendix Table 7: Percentage Changes in Housing Production, Price vs Density by Decade, 24 CBSAs

CBSA	Year	Total change in units	Low Density/Low Price	Low Density/Moderate-to-High Price	High Density/Low Price	High Density/Moderate-to-High Price
Atlanta	1970s	231,118	0.059	0.901	-0.004	0.044
	1980s	297,572	0.045	0.884	0.019	0.052
	1990s	258,881	0.046	0.860	0.001	0.093
	2000s	331,861	0.320	0.508	0.051	0.121
	2010s	164,869	0.204	0.395	0.053	0.347
Charlotte	1970s	82,315	0.338	0.644	-0.010	0.027
	1980s	90,483	0.077	0.841	0.000	0.083
	1990s	130,171	0.029	0.912	-0.003	0.062
	2000s	188,666	0.080	0.857	0.014	0.050
	2010s	135,852	0.085	0.686	0.034	0.195
Dallas	1970s	347,958	0.136	0.694	0.005	0.165
	1980s	389,433	0.126	0.674	0.020	0.180
	1990s	338,408	0.110	0.753	-0.002	0.139
	2000s	497,227	0.138	0.722	0.023	0.118
	2010s	444,406	0.136	0.570	0.041	0.252
Houston	1970s	501,757	0.161	0.626	0.028	0.185
	1980s	300,195	0.066	0.762	0.002	0.171
	1990s	266,766	0.097	0.734	0.001	0.168
	2000s	497,157	0.119	0.707	0.026	0.148
	2010s	450,950	0.148	0.602	0.056	0.194
Las Vegas	1970s	87,645	0.070	0.775	0.065	0.091
	1980s	104,140	0.030	0.683	0.036	0.251
	1990s	244,370	0.018	0.810	0.039	0.133
	2000s	277,571	-0.001	0.542	0.008	0.451
	2010s	80,348	0.000	0.502	0.016	0.482
Miami	1970s	595,427	0.238	0.444	0.083	0.236
	1980s	416,262	0.039	0.654	0.055	0.252
	1990s	299,419	0.051	0.596	0.099	0.253
	2000s	275,001	0.091	0.267	0.170	0.472
	2010s	179,585	0.064	0.121	0.262	0.552
Orlando	1970s	143,446	0.369	0.575	-0.002	0.058
	1980s	183,976	0.205	0.752	0.002	0.041
	1990s	159,473	0.078	0.791	0.031	0.100
	2000s	254,531	0.072	0.795	0.093	0.041
	2010s	146,772	0.073	0.734	0.065	0.129
Phoenix	1970s	286,947	0.178	0.627	0.046	0.149
	1980s	292,202	0.060	0.637	0.044	0.259
	1990s	300,577	0.014	0.817	0.011	0.159
	2000s	378,479	0.075	0.775	0.030	0.119
	2010s	177,490	0.027	0.696	0.063	0.214

Appendix Table 7 Continued:

CBSA	Year	Total change in units	Low Density/Low Price	Low Density/Moderate-to-High Price	High Density/Low Price	High Density/Moderate-to-High Price
Raleigh	1970s	42,775	0.143	0.839	0.010	0.008
	1980s	60,844	0.067	0.872	0.024	0.037
	1990s	81,941	0.035	0.963	-0.003	0.005
	2000s	112,276	0.270	0.705	0.008	0.017
	2010s	90,053	0.222	0.530	0.031	0.216
San Antonio	1970s	104,922	0.079	0.843	-0.002	0.081
	1980s	118,320	0.159	0.698	-0.006	0.149
	1990s	75,788	0.063	0.799	-0.025	0.163
	2000s	152,965	0.061	0.732	0.025	0.182
	2010s	143,790	0.086	0.612	0.039	0.263
Tampa	1970s	245,312	0.069	0.699	0.014	0.217
	1980s	184,074	0.019	0.701	0.009	0.271
	1990s	86,748	0.016	0.744	-0.026	0.266
	2000s	121,485	0.030	0.708	0.045	0.217
	2010s	81,557	0.107	0.534	0.073	0.286
Boston	1970s	152,718	0.064	0.597	0.032	0.307
	1980s	114,802	0.030	0.585	0.133	0.252
	1990s	75,407	0.150	0.564	0.030	0.256
	2000s	65,070	0.199	0.455	0.241	0.105
	2010s	118,236	0.077	0.264	0.224	0.435
Los Angeles	1970s	577,763	0.049	0.412	0.039	0.500
	1980s	453,678	0.082	0.359	0.166	0.394
	1990s	211,335	0.074	0.433	0.167	0.326
	2000s	188,100	0.145	0.413	0.186	0.256
	2010s	231,359	0.057	0.196	0.278	0.470
New York	1970s	451,598	0.070	0.484	0.058	0.389
	1980s	330,989	0.065	0.562	0.061	0.311
	1990s	432,481	0.063	0.272	0.256	0.409
	2000s	195,056	0.237	0.370	0.247	0.146
	2010s	419,158	0.042	0.095	0.303	0.561
San Diego	1970s	258,396	0.018	0.669	0.043	0.270
	1980s	207,288	0.054	0.638	0.139	0.170
	1990s	93,689	0.070	0.649	0.081	0.200
	2000s	103,943	0.108	0.604	0.068	0.220
	2010s	64,619	0.073	0.180	0.145	0.602
San Francisco	1970s	220,410	0.193	0.459	0.156	0.193
	1980s	146,540	0.127	0.407	0.194	0.271
	1990s	114,608	0.165	0.402	0.156	0.277
	2000s	80,411	0.252	0.444	0.221	0.083
	2010s	106,133	0.101	0.235	0.220	0.444
Seattle	1970s	199,102	0.075	0.749	0.041	0.134
	1980s	206,438	0.053	0.656	0.032	0.259
	1990s	197,972	0.223	0.455	0.095	0.227
	2000s	184,163	0.208	0.417	0.119	0.256
	2010s	184,081	0.132	0.244	0.139	0.484

Appendix Table 7 Continued:

CBSA	Year	Total change in units	Low Density/Low Price	Low Density/Moderate-to-High Price	High Density/Low Price	High Density/Moderate-to-High Price
Washington	1970s	251,831	0.151	0.629	0.066	0.154
	1980s	284,964	0.151	0.619	0.036	0.194
	1990s	221,132	0.244	0.513	0.061	0.182
	2000s	247,493	0.206	0.432	0.099	0.264
	2010s	228,625	0.083	0.305	0.238	0.374
Denver	1970s	191,374	0.105	0.745	0.034	0.116
	1980s	120,569	0.084	0.518	0.029	0.369
	1990s	99,918	0.037	0.674	0.056	0.234
	2000s	121,201	0.107	0.569	0.076	0.247
	2010s	128,889	0.076	0.337	0.116	0.472
Salt Lake City	1970s	74,747	0.102	0.707	0.058	0.133
	1980s	40,244	0.102	0.661	0.024	0.213
	1990s	53,487	0.100	0.605	0.063	0.232
	2000s	45,692	0.306	0.578	0.058	0.059
	2010s	63,373	0.101	0.472	0.199	0.228
Chicago	1970s	452,907	0.050	0.773	-0.009	0.186
	1980s	183,950	0.059	0.863	-0.161	0.239
	1990s	324,451	0.101	0.677	0.032	0.191
	2000s	262,746	0.142	0.678	-0.015	0.195
	2010s	147,127	0.109	0.276	0.064	0.552
Cleveland	1970s	100,412	0.078	0.783	-0.049	0.188
	1980s	40,206	-0.016	1.108	-0.271	0.179
	1990s	56,651	-0.005	0.982	-0.124	0.147
	2000s	43,233	0.083	1.145	-0.235	0.007
	2010s	28,666	0.018	0.844	-0.249	0.387
Detroit	1970s	258,898	0.039	0.828	-0.005	0.138
	1980s	115,810	0.016	1.001	-0.247	0.229
	1990s	145,227	0.003	1.001	-0.171	0.167
	2000s	75,078	0.021	1.161	-0.397	0.215
	2010s	36,451	0.052	1.121	-0.696	0.523
Philadelphia	1970s	281,105	0.124	0.654	0.054	0.167
	1980s	198,526	0.011	0.863	-0.046	0.172
	1990s	166,499	0.016	0.913	-0.010	0.081
	2000s	110,567	0.055	1.121	-0.183	0.007
	2010s	147,523	0.024	0.453	0.200	0.324

Appendix Table 8: 44 CBSA Satisfying Requirement for the Regression

| 44 CBSAs		
Albany	Houston	Riverside
Allentown	Indianapolis	Rochester
Atlanta	Kansas City	Sacramento
Baltimore	Los Angeles	St. Louis
Birmingham	Miami	San Diego
Boston	Milwaukee	San Francisco
Buffalo	Minneapolis	San Jose
Charlotte	New York	Scranton
Chicago	Oklahoma City	Seattle
Cincinnati	Orlando	Syracuse
Cleveland	Philadelphia	Tampa
Dallas	Phoenix	Virginia Beach
Dayton	Pittsburgh	Washington
Detroit	Portland	Worcester
Greensboro	Providence	

Note: Scranton, PA and Providence, RI are not included in the 'outside' of 10 miles sample.
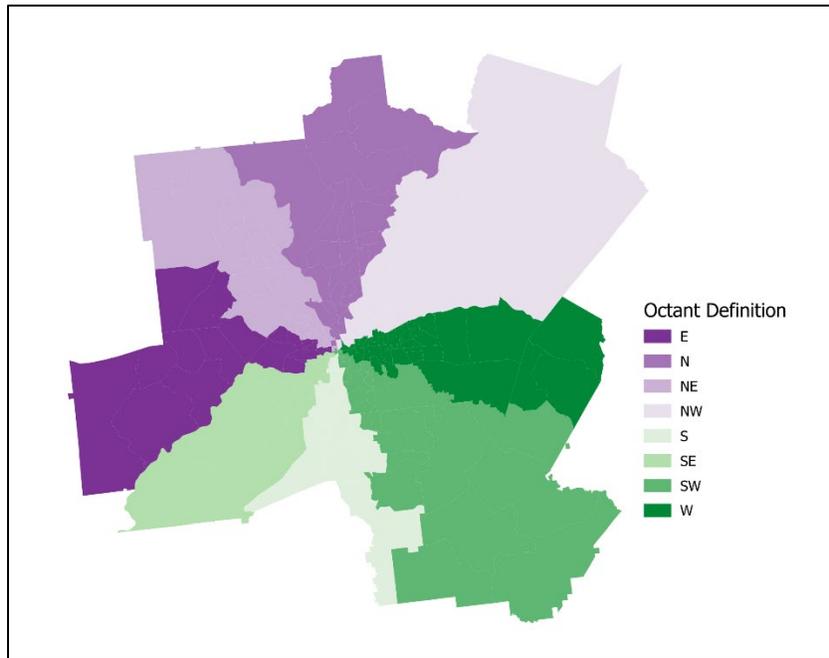
II.   Appendix Figures

Appendix Figure 1: Real Case-Shiller and FHFA National Indices.

Case-Shiller through 2024q3, FHFA through 2024q3. 1975q1 = 100.
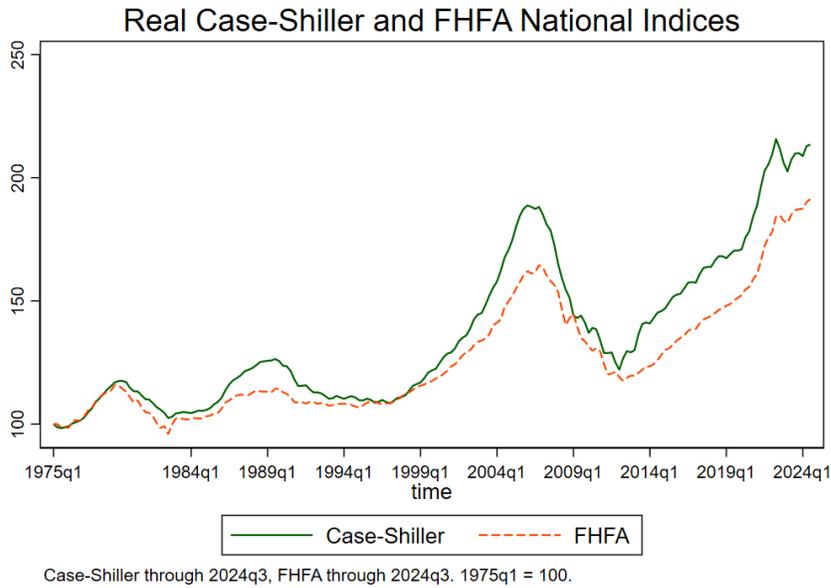
Appendix Figure 2: Annual Value-Weighted Returns, Homebuilders and the S&P500
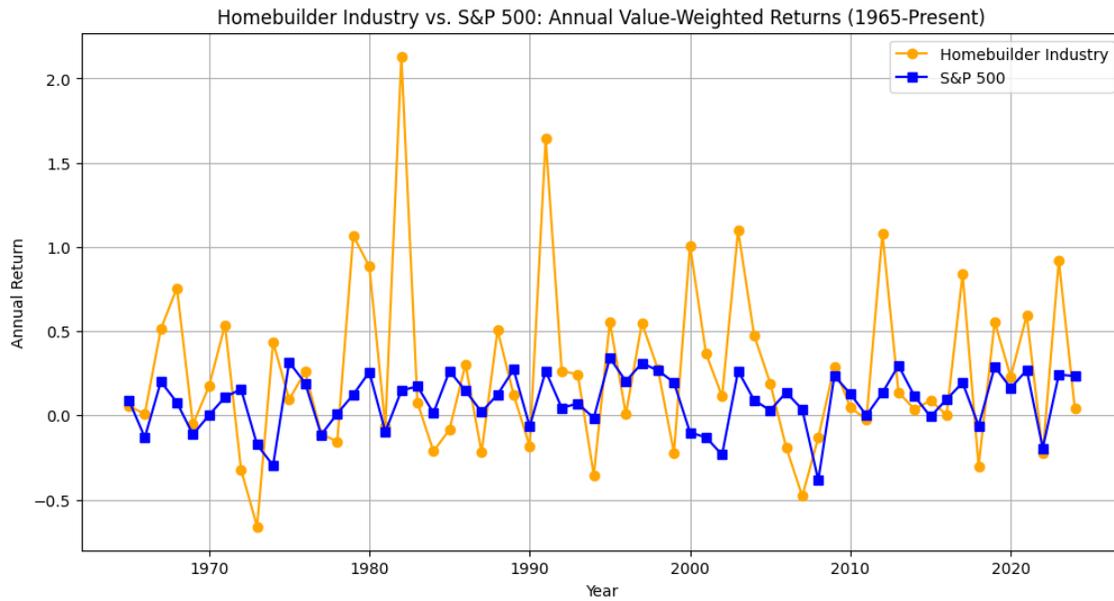
Appendix Figure 3: Atlanta CBSA Octant Definition

Appendix Discussion 1: County-Level Year-Built Data for CBSA Aggregates in 1950-1960

In Figure 1, we aggregate to the CBSA level in 1950 and 1960 using county-level estimates of the stock by the year the homes were built in. For 1950, we use the stock of homes for each county (observed in 1970) that were built before 1950. We do the same for 1960. We do this for three reasons. First, most metropolitan areas were not close to having their current number of tracts by 1950 or 1960. Thus, when we aggregate to the CBSA level using tract data, we undercount the number of homes in 1950 and 1960, resulting in a potentially large overestimate in the units added from 1960-1970 especially. Secondly, many of the markets we are interested in, such as Tampa and Phoenix have no tract-level data in 1950. Finally, we have access to county data from 1970 onwards that has full coverage for the entire country, allowing us to consistently construct a market's housing stock. Thus, to match our 1970-onwards sample of counties, and to alleviate the other two shortcomings of aggregating tract data, we use the 'year-built' variable in the 1970 county-level census to identify the stock of homes built before 1950 and 1960 to construct county-level estimates for the entire country. From this, we aggregate to

the CBSA level, and obtain market-level housing stocks consistently measured over time. That said, there is a downside to this decision—namely, some homes built before 1950 or 1960 may have been removed from the housing stock before the 1970 census. If we believe that homes roughly depreciate at the same rate across the country, our method consistently undercounts the 1950 and 1960 stock. However, we believe that the added benefit of full coverage, and consistent spatial measurement of a market's stock by using the county-level data is worth this cost. In addition, we conclude that this error is relatively small and can be signed. See our Reverse Technical Documentation Memo those details.