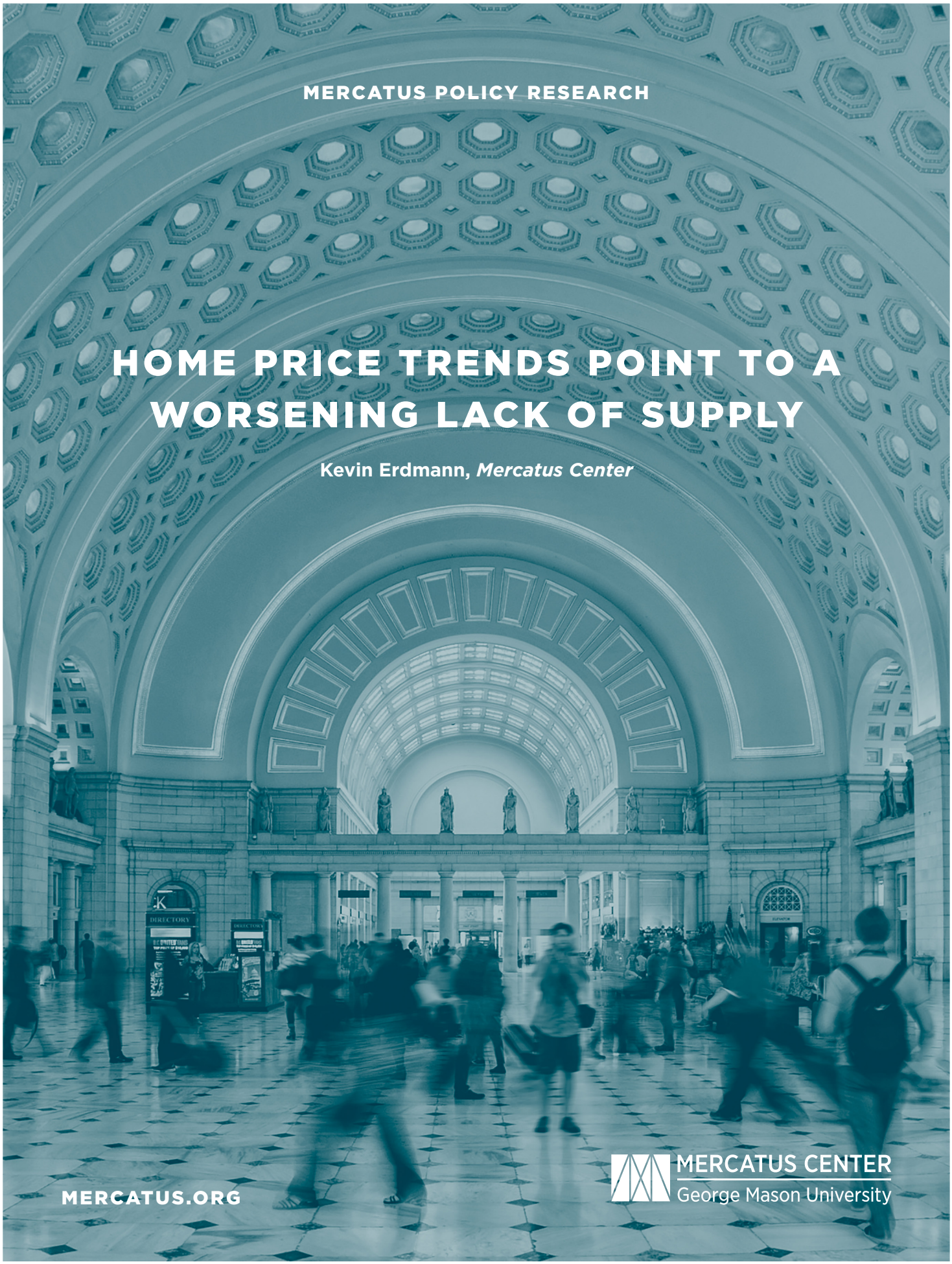

MERCATUS POLICY RESEARCH

HOME PRICE TRENDS POINT TO A WORSENING LACK OF SUPPLY

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ABSTRACT

Traditionally, metropolitan areas with strong economic prospects attracted immigrants and grew in size. Constraints on housing construction block that process so that economic growth instead leads to rising housing costs rather than population growth. The costs of inadequate housing fall most sharply on families with lower incomes as do the pressures to move away from cities with economic opportunity. New housing in a handful of metropolitan areas—Los Angeles, New York City, San Francisco, and Boston—has become so obstructed that their population growth has become countercyclical, sometimes even declining during recent periods of economic expansion. This is mostly due to outmigration of their poorest residents as housing costs rise.

After the Great Recession, all metropolitan areas have started to become more like this. Cities that had previously grown at high rates are now growing more slowly, and housing costs in the poorest neighborhoods are increasing. Mortgage access tightened during the Great Recession and has remained tight since. Peculiar correlations between rents, prices, and local incomes since the Great Recession, and the universality of the new trends, suggest that tighter mortgage access has slowed the construction of new homes. This especially has been the case in cities where average household incomes are lower and homebuyers are more sensitive to credit conditions. The end result of tightened credit access has been that home prices are at least as high as they were before the Great Recession, and rents are much higher, especially in neighborhoods with lower incomes.

JEL codes: R310, G510

Keywords: housing, housing price determination, housing prices, housing supply, regional housing market, residential real estate, mortgage lending

After bottoming out in 2012, aggregate home prices persistently increased over the following decade, returning by many measures to levels similar to the 2006 highs. This recent price appreciation was associated with lower rates of new construction in most cities and high rates of rent inflation. High home prices before the Great Recession were triggered by inelastic housing supply in a handful of metropolitan areas, but the more recent bout of high prices reflects supply conditions that have become less elastic across the country.

In this paper, I review various common explanations for the recent rise in home prices and argue that the peculiar trends of the past decade point to mortgage regulation as a key factor limiting housing production. Mortgage access increases potential demand for homeownership, but perhaps it also increases supply by allowing potential homeowners to finance the construction of new homes. Price/rent ratios declined when mortgage access was tightened after the Great Recession, but both rents and prices have subsequently risen as the construction of new entry-level homes has remained very low. The price and production trends I highlight here suggest that the supply effect may have been more important than the demand effect.

Restoring or encouraging new supply through easier mortgage access, expanding build-to-rent neighborhoods, and easing local restrictions on apartment and metropolitan infill development will be more effective solutions to rising housing costs than continued attempts to reduce buyer demand, such as strictly regulated mortgage access, attempts to raise mortgage interest rates, limits on institutional buyers of new or existing homes, and regulations against certain uses like short-term rentals.

Very inelastic housing supply—meaning that housing supply is politically obstructed so that it is not responsive to increased demand—affects the cost of housing for families with lower incomes more than for families with higher incomes. It also creates population flows to where homes can more easily be built. The first section describes this cost pattern. The following section details

how population flows and rising costs were localized and related to regional differences in housing supply before the 2008 financial crisis. The next section details how rising costs were more broad, reflecting increasingly inelastic supply conditions across the county, after 2008. And the final section reviews the possible reasons for this, highlighting the potential role tightened mortgage lending had in cutting off financing for new homes.

A BRIEF REVIEW OF THE PRICE/INCOME SLOPE AND THE EFFECTS OF INELASTIC HOUSING SUPPLY

Much of the persistent rise in US home prices since the late 20th century has been the result of binding political obstructions to new housing in key urban regions. In metropolitan areas (or MSAs—metropolitan statistical areas) that have become exceptionally expensive, home prices have risen the most in ZIP codes with lower incomes. These very expensive MSAs also routinely have both some of the lowest rates of new housing permits per capita among the largest metropolitan areas and the most negative rates of net domestic migration. Those migration patterns are largely related to rising housing costs. Where there is a lack of adequate housing, moderate population growth leads to a process of "musical chairs" in which some families must be displaced from the area. That choice—whether to stay or leave—is moderated through the financial burden of increasing housing costs, which naturally falls more heavily on households with fewer financial resources. This leads to a self-selection of households out of the expensive metropolitan areas based on how much they are willing to choose excessive housing costs over displacement.

In cities with ample housing supply, home prices in any given ZIP code typically fall within a range of three to four times the average ZIP code income (i.e., price/income ratio of 3 or 4), and the price/income ratio[1] in ZIP codes with low incomes is not substantially higher than it is in ZIP codes with high incomes (relatively flat price/income slope). In metropolitan areas with very constrained housing supply and highly negative rates of net domestic migration, price/income ratios can rise to well over 10 in ZIP codes with low incomes, and price/

1. The estimate used for the price/income ratio in any given ZIP code is the typical home value (including all types of homes, whether owned or rented) as reported by Zillow.com divided by the average adjusted gross income of each tax return as reported by the IRS. See the appendix for more details about data sources.

income ratios have a negative correlation with incomes across the metropolitan area; in other words, these MSAs have steep negative price/income slopes.[2]

An important source of affordable housing over time in a given metropolitan area is the gradual downward filtering of the aging existing housing stock of homes to residents with lower incomes. When the lack of new construction interrupts and reverses that filtering process, the steeply negatively sloped price/income line reflects the rising costs that drive the upward filtering of homes and the economically motivated outmigration of households.

In "Price Is the Medium through Which Housing Filters Up or Down: A Proposal for Price/Income as an Indicator of Housing Supply Elasticity," I concluded that the slope of that line—the sensitivity of price/income ratios to incomes across a metropolitan area—can be a useful proxy for estimating the condition of the supply elasticity in that metropolitan area. In analysis of the 2002–2006 housing boom before the Great Recession and financial crisis, I have used a taxonomy that identifies the severely supply-constrained metropolitan areas as "Closed Access" cities. These include New York City, Los Angeles, San Francisco, Boston, and San Diego. I refer to cities that experience local population booms associated with the excess migration flow out of the Closed Access cities as "Contagion" cities. Before the Great Recession, Contagion cities were generally located in Florida, Arizona, Nevada, and inland California.[3]

In "Rising Home Prices Are Mostly from Rising Rents," I presented evidence that rising home prices across almost all MSAs since about 2015 have been driven largely by rising rents and that the inflation of both rents and prices has been particularly strong in ZIP codes with low rents and incomes.[4] These recent price trends, viewed through the lens of the price/income framework, suggest that the high costs are due to inelastic supply. Before 2008, inelastic supply as a driver of housing costs was limited mostly to a few key metropolitan areas, but now it is increasingly important in all major MSAs.

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2. Kevin Erdmann, "Price Is the Medium through Which Housing Filters Up or Down: A Proposal for Price/Income as an Indicator of Housing Supply Elasticity" (Mercatus Applied Research, Mercatus Center at George Mason University, Arlington, VA, November 2022). The relationship is log-linear; in other words, the price/income ratio in a given metropolitan area will tend to decline at a constant rate for each percentage increase in a given ZIP code's income.

3. As can be seen in figures 5 and 23, the Closed Access cities routinely have the lowest rate of housing construction of the major metropolitan areas. They also have the most negative net domestic migration rates among the major metropolitan areas. For more details about the various characteristics that make these cities outliers, see Kevin Erdmann, *Shut Out: How a Housing Shortage Caused the Great Recession and Crippled Our Economy* (Lanham, MD: Rowman & Littlefield, 2018).

4. Kevin Erdmann, "Rising Home Prices Are Mostly from Rising Rents" (Mercatus Special Study, Mercatus Center at George Mason University, Arlington, VA, August 2022).

Ample intra-MSA substitutions in housing consumption transmit the effects of housing supply throughout the submarkets of an MSA. The literature documenting the filtering of existing housing up or down to new residents with higher or lower incomes, and the chain of transactions that follow the addition of new units, describes that process.[5] Observable price patterns confirm that inelastic housing supply forces marginal demand for housing down into more affordable portions of the existing stock. The lower the incomes of a given ZIP code, the more prices are pushed up. Where housing supply is more constrained, the systematic negative relationship between price/income ratios and local incomes strengthens and steepens. In short, stresses, including those that are sometimes identified as gentrification, are frequently created by inelastic supply. Inadequate supply of new housing causes the existing stock of housing to filter up to new owners with higher incomes, and this plays out in a quantifiable way throughout the housing market of each metropolitan area.[6]

Within each MSA, the price/income level of the average home in each ZIP code is systematically related to the price/income levels of homes in other ZIP codes in that MSA. Figure 1 compares the average price/income ratios of ZIP codes across the Atlanta and Los Angeles metropolitan areas. At very high income levels, the price/income ratio is similar in Atlanta and Los Angeles. But since housing supply is more inelastic in Los Angeles, and since inelastic supply pushes up low-tier prices more than high-tier prices, home prices in ZIP codes with lower incomes are much higher in Los Angeles than they are in Atlanta.

This systematic price pattern within each MSA tends to be relatively linear against log incomes. The difference in price/income slopes between MSAs leads to diverging price/income ratios in ZIP codes with lower incomes.[7] So in Atlanta, the average price/income ratio for homes in ZIP codes with log income of 11 (about $60,000) is about 4.1, and the average price/income ratio for homes in ZIP codes with log income of 12 (about $163,000) is about 2.9. In Los Angeles, the price/income ratios in ZIP codes with those log incomes are about 11.7 and 6.6, respectively.

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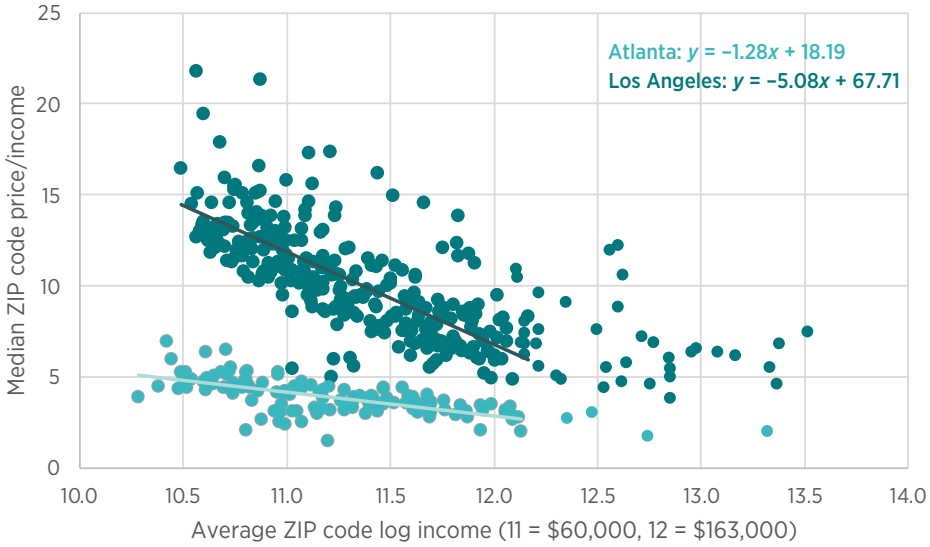
5. Quentin Brummet and Davin Reed, "The Effects of Gentrification on the Well-Being and Opportunity of Original Resident Adults and Children," FRB of Philadelphia Working Paper No. 19-30, July 16, 2019, https://ssrn.com/abstract=3421581; Liyi Liu, Douglas A. McManus, and Elias Yannopoulos, "Geographic and Temporal Variation in Housing Filtering Rates," November 16, 2021, https://ssrn.com/abstract =3527800; Evan Mast, "JUE Insight: The Effect of New Market-Rate Housing Construction on the Low-Income Housing Market," *Journal of Urban Economics* 133 (2023): 103383; Shane Phillips, Michael Manville, and Michael Lens, *Research Roundup: The Effect of Market-Rate Development on Neighborhood Rents* (Los Angeles: UCLA Lewis Center for Regional Policy Studies Report, 2021).
6. See footnote 2.
7. In figure 1, there is some nonlinearity due to the zero lower bound in the price/income ratio at very high incomes.

FIGURE 1. PRICE/INCOME RATIOS VS. INCOME BY ZIP CODE, ATLANTA AND LOS ANGELES, 2021



The price/income ratio in each metropolitan area has a unique sensitivity to income at any given point in time. As shown in figure 1, in 2021, the slope of the line estimating the price/income ratio as a function of ZIP code log income was −5.05 in Los Angeles and −1.25 in Atlanta. This slope (sensitivity) is a meaningful proxy for the relative supply elasticity of housing within each MSA at a given point in time.[8] This can be useful in analysis of housing markets. For instance, if, in 2021, there was a uniform shift in demand for housing—say, a cultural change in the average number of persons per household—we should expect that shift to have a larger effect in both metropolitan areas on home prices in ZIP codes with average income of $60,000 than on prices in ZIP codes with average income of

8. The price/income ratio has a dependably linear relationship with ZIP code incomes in most metropolitan areas. However, in ZIP codes with very high incomes, the ratio becomes asymptotic because of its natural minimum at some level above zero. Where a linear slope is estimated, I have truncated the regression to exclude ZIP codes with log income above 12 in 2018, as seen in figure 1. In most MSAs, this involves only a handful of ZIP codes, with Atlanta providing a typical example in figure 1. Since Los Angeles is an especially large MSA with substantial variance in ZIP code incomes, this truncation removes 37 ZIP codes out of 316, which is just under 12 percent. As I discussed in "Price Is the Medium," the slope of the price/income line conveys information about an MSA's housing market that is distinct from the price/income level that serves as an asymptote for ZIP codes with very high incomes. Since the slope applies to the vast majority of ZIP codes, and since the high-end price/income asymptote acts essentially as a zero bound for outlier ZIP codes in most MSAs, it is more appropriate to truncate these data than to complicate the model by trying to expand the statistical explanations to the small number of ZIP codes affected.

$163,000. And we should expect the effect on home prices to be much greater in Los Angeles than in Atlanta (a slope of −5.05 is much steeper than −1.25). New supply will reverse those price increases; generally the relative sensitivity of home prices in Atlanta to changing demand is lower than it is in Los Angeles because new supply can be added more easily in Atlanta.

In "Reassessing the Role of Supply and Demand on Housing Bubble Prices," I argued that this pattern was important during the 2002–2006 housing boom.[9] During that period, in the most expensive metropolitan areas, home prices increased the most in ZIP codes with low incomes. Since those ZIP codes naturally face the most credit constraints, loose credit markets were widely blamed for those rising prices. However, the patterns in price appreciation were more strongly correlated with pre-existing supply elasticity conditions than with credit conditions. Where home prices were becoming extremely high relative to local incomes, it was due more to an acceleration of the endemic process of existing homes filtering up to households with higher incomes than to the availability of novel credit products for new owner-occupiers with lower incomes. Where prices increased the most relative to local incomes, locals with low incomes and new mortgages weren't suddenly driving up prices in their neighborhoods; outsiders with higher incomes were driving up prices in the same systematic way that they had been for some time, because of the stresses created by housing scarcity.

Home prices were buoyant during and after the COVID-19 recession, from 2020 through the first half of 2022. If inelastic housing supply is responsible for the especial appreciation of home prices in the ZIP codes with the lowest incomes, then trends in recent years point to a broad national shift to less-elastic housing supply in most major metropolitan areas. A comparison of the housing boom periods before and after the Great Recession, using the price/income slope as an analytical tool, may help to illuminate the various causes of rising housing costs.

PRE–FINANCIAL CRISIS FACTORS IN PRICE/INCOME SLOPES: LAND USE SUPPLY CONSTRAINTS IN SELECT METROPOLITAN AREAS

There are some similarities and some differences between the pre–financial crisis housing boom and the post-crisis housing boom. Comparison of the two booms can help to clarify the role of inadequate housing supply in relative price

9. Kevin Erdmann, "Reassessing the Role of Supply and Demand on Housing Bubble Prices" (Mercatus Special Study, Mercatus Center at George Mason University, Arlington, VA, December 2022).

changes. Housing supply and demand exhibited different patterns during each period and in each metropolitan area.

Differentiating between Demand from Population Growth and Cyclical Demand

To see how different local supply conditions are related to cyclical differences in home prices, migration flows, and population growth, it is helpful to think of housing demand as the combination of two factors: population growth and cyclical demand. One way of estimating this is looking at how many people need shelter and how many homes per capita they demand.

Figure 2 shows the annual number of housing units per capita permitted in the United States since 1995 (in dark blue) as well as my estimated number of units required to meet the demands of population growth (in light blue).[10] The remaining number of units (in medium blue) reflects cyclical or permanent changes in housing demand above or below that baseline, either for vacant units, for second homes, or due to changes in household size.[11]

Another way to visualize these data is to plot the number of homes permitted per capita on the x-axis and population growth for the following year on the y-axis, as shown in figure 3. Until recently, there has been little variation in population growth from year to year, so most changes in the national housing market are due to cyclical, demographic, and cultural changes. In figure 3, the dashed green lines indicate the population-related housing production, At household

10. The measures in figure 2 include only permitted, site-constructed units and assume a 2.6-person household size plus annual replacement of 0.2 percent of the existing stock of homes. During the period reviewed, household size remained relatively stable, so the fixed size assumption is reasonable. Figure 22 in the appendix is a similar graph that estimates cyclical and population factors in new home production for the period from 1966 to 2021. In earlier years, manufactured homes were more common and household size was more variable, so figure 22 accounts for those changes. I discuss the stabilization of US household size in recent decades in "Build More Houses: How an Incorrect Perception of Housing Supply Fueled the Great Recession and Slowed Recovery" (Mercatus Applied Research, Mercatus Center at George Mason University, Arlington, VA, May 2021).

11. In this analysis, by "cyclical" I mean any changes in housing consumption that are not directly related to changing population at a stable number of residents per household. Some of those changes, such as replacement of obsolescent units or permanent changes in household size, may not be cyclical in the strict sense of the word, but their variations over time are the factors that induce changes in construction activity that appear as cyclical changes.

This cyclical demand doesn't necessarily need to average out to zero over time. In fact, before the 1990s, it was regularly positive and much more volatile than it has been since 1995; figure 22 in the appendix shows the cyclical demand over a longer period. Also see Kevin Erdmann, "U.S. Data on Housing Starts Can Be Misleading," Expert Commentary, May 12, 2021, https://www.mercatus.org/economic-insights/expert-commentary/us-data-housing-starts-can-be-misleading.

FIGURE 2. HOUSING PERMITS FOR POPULATION GROWTH VS. CYCLICAL CHANGES, 1995–2018

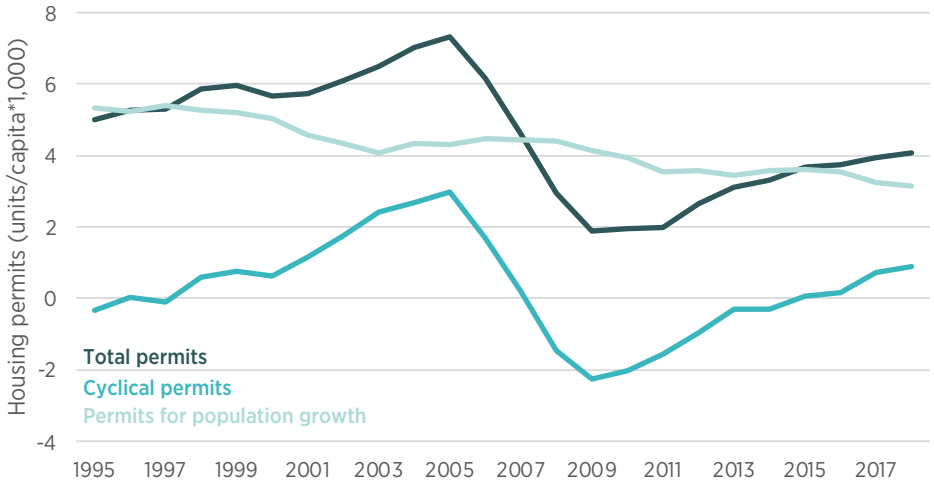
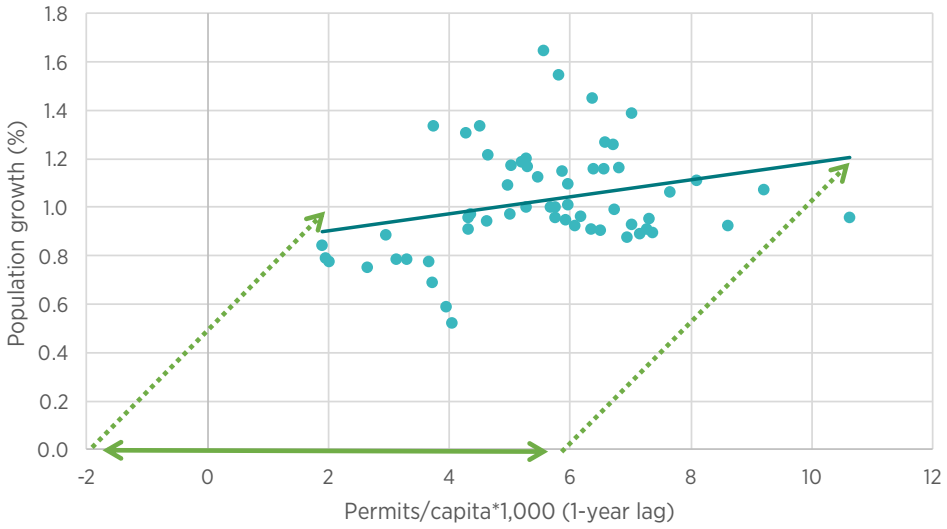


FIGURE 3. US HOUSING PERMITS AND POPULATION GROWTH, 1961–2019



Note: Solid green line is the cyclical/cultural demand; dashed green lines are population demand. Solid dark blue line is the correlation between population growth and housing permits over time.

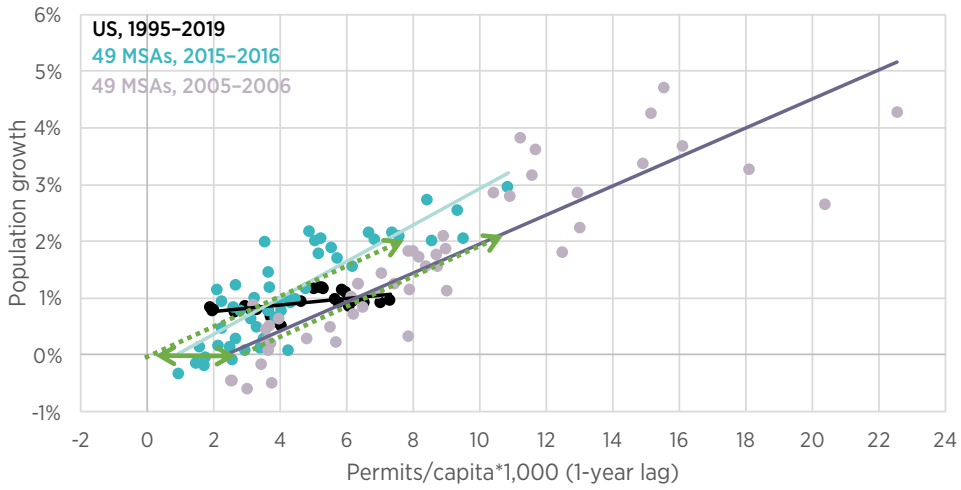
sizes typical of the last few decades, roughly 4 homes per 1,000 residents are required to accommodate 1 percent population growth. The points where the lines cross the x-axis reflect cyclical or other permanent changes in housing demand. Think of housing production in any given year as cyclical or other activity moving left or right on the x-axis, plus the number of homes required for population growth, represented by the dashed green lines.

Since 1961, about 4 to 6 units per 1,000 residents were required annually to keep up with population growth, with little variation, while cyclical changes accounted for a range from about −2 to briefly as high as 6 units per 1,000 residents. In figure 3, the regression line for the rate of population growth on the y-axis to the number of housing permits issued on the x-axis is relatively flat. In other words, changes in construction activity appear to be largely unrelated to changes in population growth.[12] This leads to a tendency to view national housing market trends almost entirely as a cyclical phenomenon.

The same dichotomy of housing trends (population versus cyclical) applies to individual metropolitan areas. Over time, the relationship between housing permits and population growth within most MSAs looks similar to the national relationship shown in figure 3. But, at any given time, cross-sectionally, cities with higher rates of housing permits have higher population growth. In fact, based on annual figures of permits for the years 1994 to 2018 and population growth the following year, a cross-sectional regression in any given year of the permits and subsequent annual population growth of the 49 largest metropolitan areas has an average correlation of about 68 percent. Figure 4 shows cross-sectional regressions of the permits and subsequent annual population growth of the 49 MSAs in 2005–2006 and in 2015–2016, as well as of the permits and subsequent annual national population growth from 1995 to 2019, as in figure 3. The dashed green lines indicate the population-related housing production and cyclical demand for the years 2005 and 2015 based on national construction activity and the subsequent year's population growth. The slope of the lines reflects the typical number of residents per unit, and the points where the lines cross the x-axis reflect cyclical housing demand, as in figure 3. The regression line for housing permits and population growth in the 49 largest MSAs for any given year generally crosses the x-axis near the point that corresponds with national cyclical demand trends and rises with a slope associated with the rate of population

12. There are a few outlier years with population growth above or below 1 percent, but for most of the last 60 years, population growth has been remarkably stable at around 1 percent in most years. Yet, housing production has fluctuated between a wide range over that time.

FIGURE 4. HOUSING PERMITS AND POPULATION GROWTH, US 1995–2019 VS. CROSS-SECTIONAL MSAs IN 2006 AND 2016



Note: Solid green line is the cyclical/cultural demand; dashed green lines are population demand.

growth in each metropolitan area. (In other words, the cross-sectional regression tends to follow the slope of the dashed green lines from figure 3.)

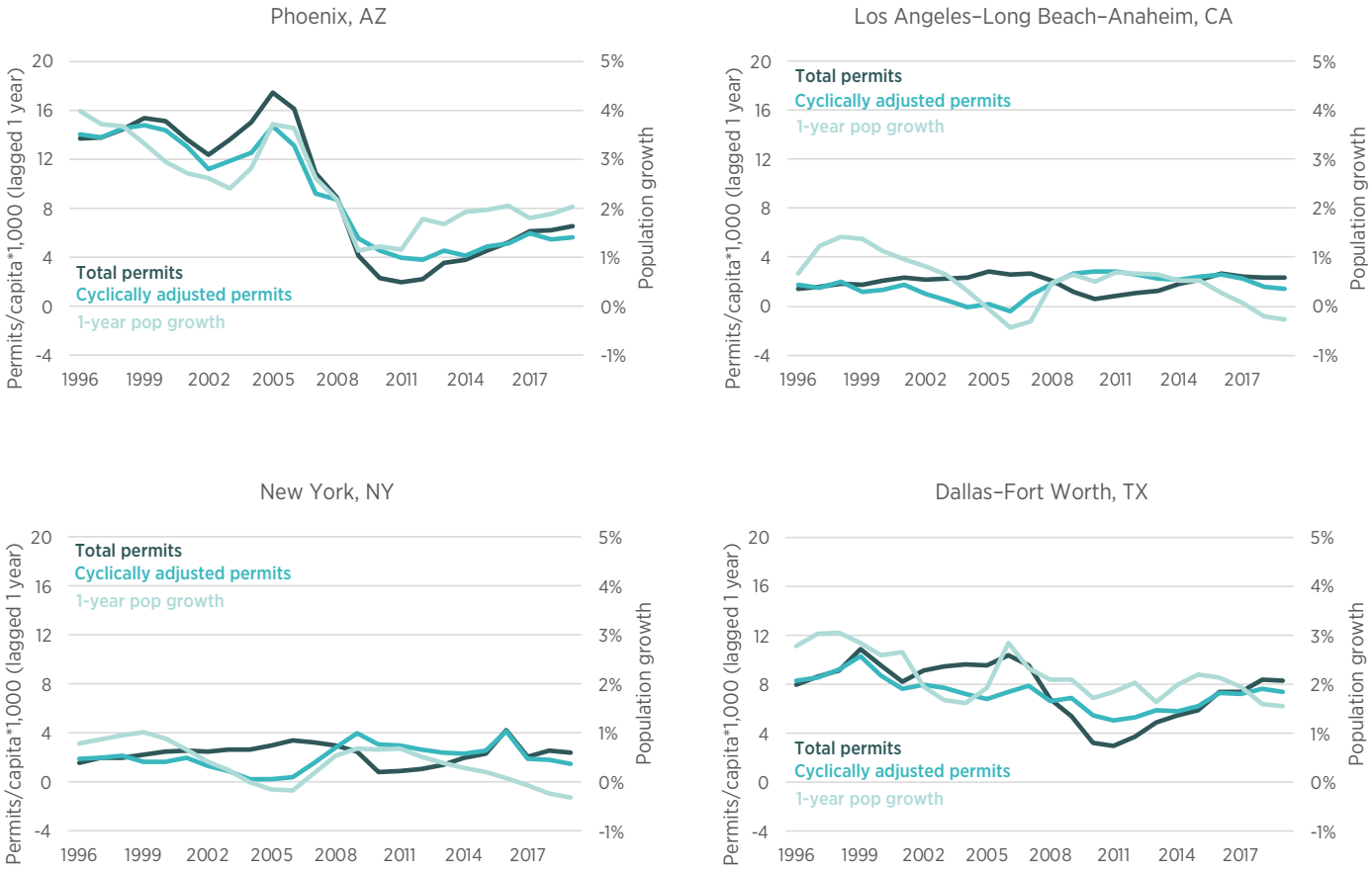
Figures 3 and 4 show that most temporary changes in housing demand are shared across metropolitan areas, and differences in construction activity between MSAs are mostly related to different population trends.

Cyclically Adjusted Housing Permits across Metropolitan Areas

To create a cyclically adjusted estimate of housing permits in each metropolitan area, I assume that the cyclical effects (the horizontal distance between the green dashed lines in figure 3 and between the purple and light blue lines in figure 4) are uniform across all cities due to a generalized increase in incomes, access to credit, changing cultural household norms, and so on. I subtract the estimated cyclical rate of permits from each metropolitan area's total permits for a given year. The remaining number of units permitted is the number of units available for population growth after accounting for the national cyclical trend; this remaining number of permits determines the cyclically adjusted permitting rate for the metropolitan area.

The national building numbers obscure a tremendous amount of variation between MSAs, and that variation plays an important role in the housing booms and busts. Figure 5 compares housing permits and population growth

FIGURE 5. TOTAL PERMITS, CYCLICALLY ADJUSTED PERMITS, AND POPULATION GROWTH IN SELECTED MSAs



for Phoenix, Los Angeles, New York City, and Dallas. The cyclically adjusted permits per capita measure (medium blue line) shown in figure 5 subtracts the cyclical permits per capita (medium blue line) shown in figure 2 from each MSA's total permits per capita (dark blue line) to estimate the number of permits per capita that should correlate with population growth in that MSA.[13] The cyclically adjusted permit measure follows each MSAs population growth trends more closely than the unadjusted measure does.

13. This assumes that cyclical housing demand (which can broadly be described as a change in the number of persons per housing unit) is uniform across MSAs.

The cyclical change in housing demand doesn't have much of an effect on markets like Phoenix and Dallas. In an MSA approving 10 or 15 new units per 1,000 residents, cyclical demand that requires 2 additional units is insignificant (although in Phoenix, the 2004–2005 price bubble suggests that limited new permits became a binding constraint at 16 permitted units per 1,000 residents). However, in Los Angeles and New York City, where permitting rates never exceed 4 units per 1,000 residents, cyclical demand for an additional 2 or 3 units per 1,000 residents becomes the dominant marginal claimant on new units. These are Closed Access cities.[14]

Los Angeles and New York City increased housing production from 2001 to 2007, but from a very low base rate. In absolute numbers, it didn't amount to enough. As shown in figure 5, Los Angeles and New York City approve an exceptionally small number of new homes per capita each year.[15] So when cyclical demand for housing increased from 2000 to 2005 (see the medium blue line in figure 2), it claimed almost all the new supply of housing, leaving no capacity for population growth. As a result, over the past 20 years, population growth in those MSAs has become negative when housing construction booms.[16] In a city that allows very limited new housing production, an increase in housing demand per capita necessarily means there is room for fewer residents. The cyclical increase in housing demand in the 2000s was quite moderate compared to trends in housing demand in earlier decades, but even that moderate increase in demand created downward population pressure in the Closed Access cities because of their very low levels of housing production.[17]

In fast-growing MSAs like Phoenix and Dallas, shown in figure 5, and cities like Riverside, Las Vegas, and Orlando,[18] most new building is related to the influx of new residents. Thus, in growing cities, as shown in figure 5, changes in cyclical demand don't have as much capacity to change the relative quantity of new homes available for growth.

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14. See figure 23 for graphs of selected other MSAs.
15. To invite comparison, the scale is the same for each MSA in figure 5. Also, the y-axis for population growth (5 pecent on the right axis) is scaled to roughly match the scale of housing permits required for population growth (20 units on the left axis) at a typical household size of roughly 2.5 persons (20 permits per 1,000 persons × 2.5 persons per household = 5 percent growth in homes).
16. The Los Angeles, New York City, San Francisco, and Boston metropolitan areas all had at least one year of negative population growth during the housing boom, according to the US Department of Commerce's Bureau of Economic Analysis. But even if their population growth had never turned negative, a negative correlation between population growth and either economic growth or housing production is peculiar—a sign of something amiss.
17. See figure 22 for long-term housing permits per capita trends.
18. These MSAs are shown in figure 23.

A Negative Correlation between Population Growth and Housing Construction

An increasing body of work is finding that the lack of housing in the Closed Access cities is leading American households to segregate by income. This is because the cost of housing is the key factor determining which households can live in these cities. The resulting housing-motivated migration is responsible for much of the divergence of average incomes among major American metropolitan areas in recent decades. As Card, Rothstein, and Yi found, much of that variance is compositional. In other words, the high incomes of the Closed Access cities are as much a function of who moves away (and who doesn't move in) as they are of the productive advantages of the cities themselves.[19]

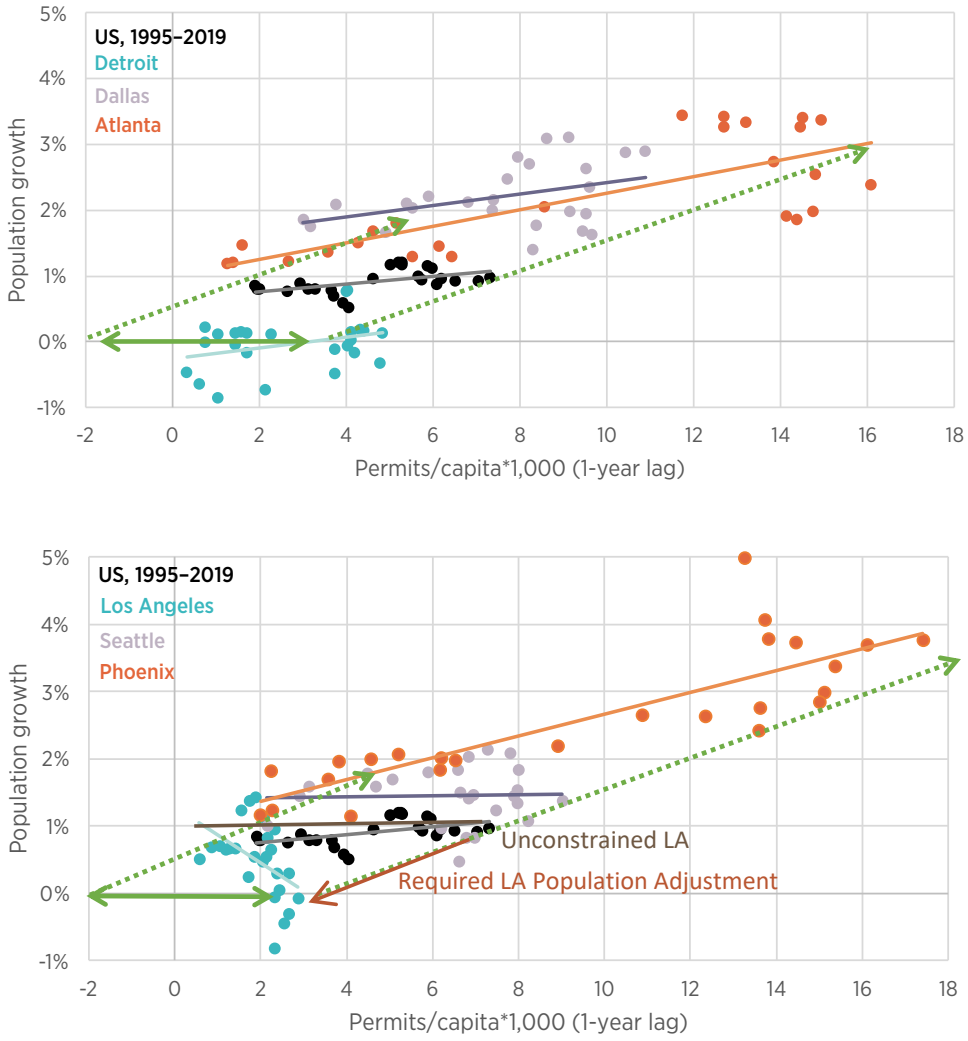
This segregation has become a prominent component of the American business cycle. When incomes are growing, housing demand tends to grow with them. As described above, rising housing demand must lead to a decline in population growth where housing supply is inelastic. Limits on population growth are mediated through rising housing costs in ZIP codes with lower incomes, which induces migration of households with low incomes away from housing-constrained cities.[20]

This has created a peculiar cyclical economic pattern: cities with inelastic housing supply (and higher incomes) have population growth rates that are *negatively correlated* with rates of housing construction. To illustrate how this happens, figure 6 compares the national correlation of population growth and housing permits per capita from 1995 to 2019, as shown in figure 4, with the same correlations for six metropolitan areas. If there were no housing-related migration, the correlations for the individual metropolitan areas would be similar to the national correlation—essentially flat. Think of it this way: Most of the difference in MSA growth rates is from domestic migration. When the national population grows by 1 percent, a city that is growing by 5 percent is mostly growing because people are moving there. If there was no inter-MSA migration, every MSA would look like the United States does in figure 2—typical population growth of 1 percent and large fluctuations in housing permits.

Even if some cities were growing faster than other cities, in general, the relationship would still be flat, but one city might have population growth at

19. David Card, Jesse Rothstein, and Moises Yi, "Location, Location, Location" (CES Working Paper 21-32, Center for Economic Studies, US Census Bureau, Washington, DC, October 2021).
20. Philip Hoxie, Daniel Shoag, and Stan Veuger, "Moving to Density: Half a Century of Housing Costs and Wage Premia from Queens to King Salmon" (AEI Economics Working Paper, American Enterprise Institute, Washington, DC, April 2022).

FIGURE 6. HOUSING PERMITS AND POPULATION GROWTH IN US AND SELECTED MSAS, 1995–2019



Note: Solid green line is the cyclical/cultural demand; dashed green lines are population demand.

0 percent while another averaged 1.5 or 2 percent. This describes the difference between Detroit, with population growth lower than the national average, and Seattle, with population growth above the national average (see figure 6). If national population growth is not correlated with housing production, then arithmetically the population growth of the average MSA cannot be correlated with housing production.

The housing constraints described above create a correlation where the regression lines for individual MSAs with inelastic supply slope downward.

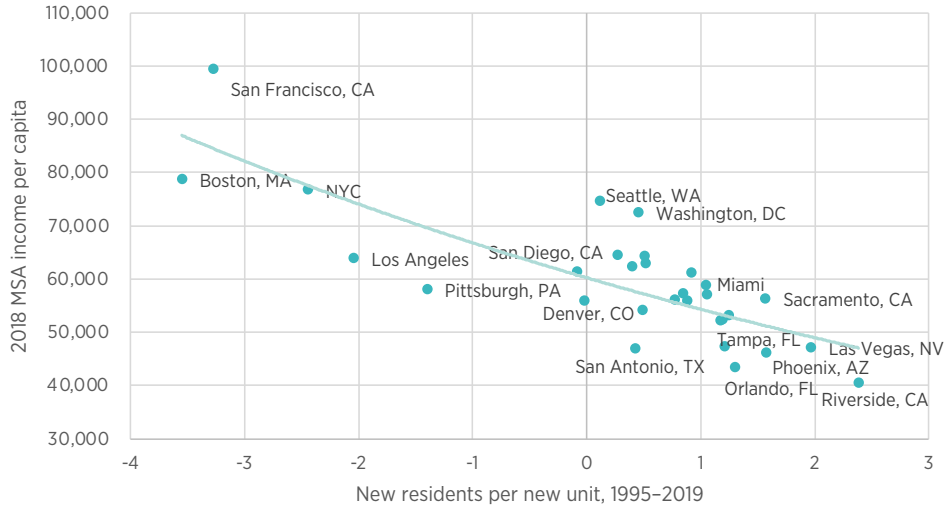
There are two bounds that act upon any metropolitan area's housing supply. Every metropolitan area has a lower bound. Because homes are relatively permanent, if demand for homes declines, cities are left with a surplus. This was the case for Detroit, shown in the top panel of figure 6. During the depths of the post-2008 housing bust, low population growth combined with declining housing demand in Detroit led to a large number of vacant and unmaintained homes. Each metropolitan area also has an upper bound on housing supply, defined by local land use policies that control housing permits. Los Angeles, in the bottom panel of figure 6, provides an example of this upper bound on housing production and demonstrates how it creates a negative correlation between housing permits and population.

When housing demand was cyclically low, as shown in figure 6, population in Los Angeles tended to grow by about 1 percent annually. In order for the city to continue to grow at that rate when cyclical housing demand was at its highest, new homes would have needed to be permitted at a rate of about 7 units per 1,000 residents. In other words, if housing supply in Los Angeles were elastic, the scatterplot and regression line for Los Angeles (shown in brown in figure 6) would look similar to the scatterplot and regression line for the United States, which also tended to have 1 percent annual population growth. However, as shown by the blue scatterplot in the bottom panel of figure 6, the Los Angeles region appears to have an upper bound on housing permits of about 3 units per 1,000 residents.

Therefore, when there is a general increase in demand for housing, prices in Los Angeles must rise until housing-motivated migration frees up existing units to accommodate the demand. Local population must decline until the number of units demanded is below the metropolitan area's maximum willingness to permit new units (shown in red in figure 6). In other words, outmigration motivated by housing costs must march Los Angeles down the dotted green line to the point where the dotted green line hits 3 units per 1,000 residents. Cyclical demand for housing is what determines Los Angeles's rate of population growth in any given year, because higher demand requires an equal and opposite reaction of outmigration. This leads to the odd result that Los Angeles's population is negatively correlated with housing production. A metropolitan area with completely inelastic supply conditions, such that construction activity was completely insensitive to changing demand, would have a vertical pattern of plots in figure 6.

This pattern of outmigration from Los Angeles during housing booms causes the correlation in Phoenix to be positive, because when demand for housing increases, the outmigration from Los Angeles creates more population

FIGURE 7. NEW RESIDENTS PER NEW HOUSING UNIT



growth in Phoenix. So housing permits and population growth in Phoenix have an unusually positive correlation. In Phoenix, when per capita housing demand increases, it tends to be paired with an additional increase in population growth because of migration from Los Angeles.

Figure 7 shows 2018 income per capita plotted against the correlation between population growth and new housing permits (the slope of the lines in figure 6) for 30 major metropolitan areas from 1995 to 2019. The most supply-constrained MSAs—Boston, San Francisco, New York City, and Los Angeles—are to the left of the origin in figure 7, meaning that their rate of population growth was *negatively* correlated with the rate of housing starts between 1995 and 2019. When Americans demand more housing, those Closed Access cities build a little bit more, but not enough, so some of the new cyclical demand for housing must claim units from the existing stock of homes. Thus, ironically, rising construction, which is sensitive to changing demand for housing but not nearly sensitive enough in those MSAs, is associated with declining MSA population. Fast-growing MSAs that have taken on housing-related migration from the Closed Access cities are to the right in figure 7.

One way to describe the distribution of MSAs in figure 7 is that the MSAs at the top left are MSAs where relatively fixed housing supply means that rising housing demand drives negative population growth, and the MSAs at the bottom right are MSAs where population growth drives housing supply. The outliers on both the left and the right of figure 7 are a result of the income-sensitive migra-

tion within and between MSAs, which is driven by the lack of adequate supply in the MSAs on the left. That migration makes both the sources and the destinations of those migrants outliers in average income (on the y-axis). If migration weren't driven by housing constraints, it would be a historical peculiarity for population growth and housing construction to be negatively correlated with incomes.

Consider the supply and demand for residency in a metropolitan area, which is closely related to supply and demand for housing. Rising cyclical demand for housing per capita in a location reduces the supply of residency.[21] Where the supply curve for housing in a metropolitan area is already very inelastic, an increase in per capita demand for housing can actually mean that the city has room for fewer residents. There are four major metropolitan areas that, since 1995, have never permitted housing at a higher rate than 4 new units per 1,000 residents and that have experienced at least one year of declining population during that time—New York City, Los Angeles, Boston, and San Francisco.[22] In every case, the decline in population coincided with the city's highest rates of permitting. That declining supply of Closed Access residency was a key factor influencing housing markets from 2001 to 2007.

Price/Income Slope Changes Over Time

Where cyclical changes in housing demand were large relative to local rates of housing production, the rise in housing demand created great pressure on home prices. As I described above and in my paper "Price Is the Medium through Which Housing Filters Up or Down," when housing production is not adequate for population growth trends, a series of intra- and intermetropolitan area migrations is set into motion.[23] Housing costs rise systematically in ZIP codes with lower incomes in metropolitan areas that lack housing. Effectively, new supply that is not created through construction is created by families moving away. Their motivation to move is rising costs, which rise most for families with lower

21. Where housing supply is constrained enough to create this negative correlation between housing production and residency, it is perhaps understandable that local activists and policymakers mistakenly conclude that new construction does not make residency more accessible. This leads to limits on various forms of housing demand, such as short-term rentals, corporate investors, or foreign ownership. These limits, of course, are proverbial thumbs in the dike, which are unlikely to be effective triggers of sustained affordability.
22. New York City did have one outlier year in 2015 where housing permits were issued at a rate slightly higher than 4 per 1,000 residents. See figure 5.
23. Erdmann, "Price Is the Medium," 10–17.

incomes, causing a steep negative slope in the price/income line, as in Los Angeles in figure 1.

During the 2002–2006 housing boom, changes in the slope of the price/income line were generally proportional to the slope of each MSA's line before the housing boom. In other words, a general increase in housing demand across the country led to price appreciation that varied across MSAs according to their local supply conditions.[24] As demand increased during the housing boom, price/income slopes steepened somewhat in general. Figure 8 shows the annual estimate of the slope of the price/income line (which was shown for Atlanta and Los Angeles for 2021 in figure 1) in 30 major metropolitan areas from 2001 to 2021. In the metropolitan areas with very inelastic supply (labeled Closed Access in figure 8), the price/income slopes were already steep in 2002 and became much steeper during the boom. Some cities (labeled Contagion in figure 8) experienced an unusual shift upward in housing demand because of the high number of households moving to them from the Closed Access cities. The increase and subsequent decrease in intermetropolitan migration caused the value of the price/income slopes to grow more negative and then reverse toward less negative territory from 2002 to about 2010 in those MSAs.

The changing price/income slopes from 2001 to 2007 in figure 8 reflect the localized effects of the cyclical rise in housing demand during that time. The MSAs with the lowest levels of maximum permitting, which were already supply constrained, with negatively sloping price/income lines reflecting that condition, became relatively much more constrained as a result of the moderate general boom in housing demand. That led their price/income slopes to steepen more than those in most other MSAs.

Figure 8 shows that price/income slopes have been steepening relatively uniformly in the more recent housing boom, but that before 2008, changes in the slope of the price/income line (i.e., changes in the relative prices of homes in ZIP codes with lower incomes) were of a much larger scale in some cities.

Changes in Population Growth and National Housing Production Since 1998

Inter-MSA population shifts related to the negative correlation between Closed Access MSA population growth and housing demand have yielded the outcomes shown in table 1. Table 1 shows that average population growth in the 30 largest

24. See Erdmann, "Reassessing the Role."

FIGURE 8. PRICE/INCOME SLOPES OVER TIME, SELECTED MSAs

TABLE 1. TRENDS IN POPULATION GROWTH AND HOUSING PRODUCTION, 1998–2019

	Four-Year Population Growth in 30 Largest MSAs		
	1998–2002	2003–2007	2015–2019
Average	5.6%	4.6%	3.4%
Standard deviation	4.3%	6.0%	3.1%
	Four-Year Permits/Capita × 1,000 in 30 Largest MSAs		
	1998–2002	2003–2007	2015–2019
Average	30.7	32.6	18.4
Standard deviation	18.0	18.4	10.2

MSAs was lower from 2003 to 2007 than that from 1998 to 2002, but there was more variance between MSAs; at the same time, there was a slight rise in average housing production with little change in variance between MSAs. The migration of former Closed Access MSA residents during the 2003–2007 period led to a relative increase in population in places like Arizona, Florida, Nevada, and inland California. Broadly, the declining medium blue line for Los Angeles in figure 5 from 2002 to 2006 caused the rising light blue line in Phoenix during the same period.[25] As a result, pressures on home prices were largely regional. High prices were associated with low population growth in the Closed Access MSAs that maintain very low rates of housing production and with high population growth in MSAs where Closed Access outmigrants land.

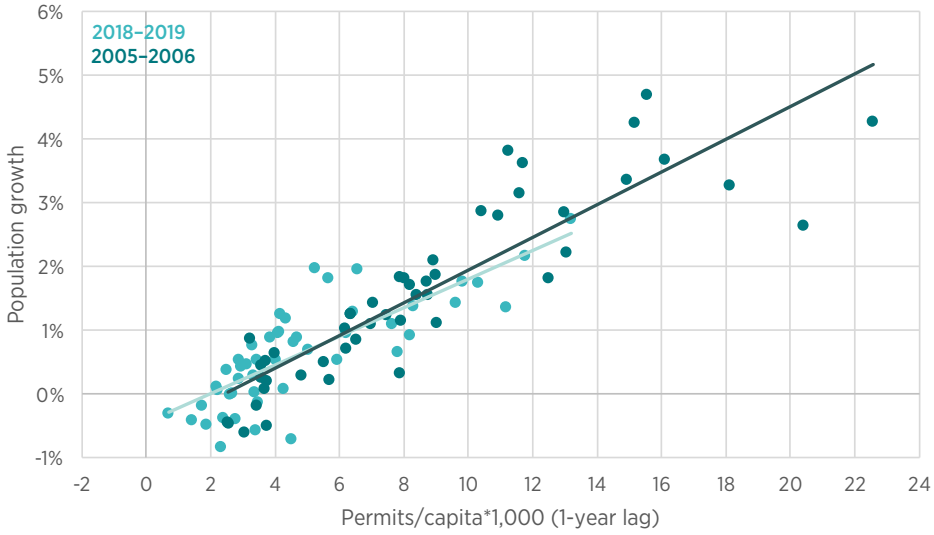
POST–FINANCIAL CRISIS FACTORS IN PRICE/INCOME SLOPES: UNIVERSAL, INCOME-SENSITIVE SUPPLY CONSTRAINTS

Housing markets have again exhibited significant price appreciation, especially after the COVID-19 outbreak, inviting comparisons to the 2002–2006 market. However, as is clear in figure 8, the pattern of price changes is not the same as in 2002–2006. In recent years, the steepening of the price/income slope (toward the negative) has been more universal in major metropolitan areas rather than being especially sharp in the Closed Access and Contagion MSAs.[26] And the

25. For an extensive analysis of migration and the cyclical relationships of housing markets in different metropolitan areas, see Gregor Schubert, "House Price Contagion and US City Migration Networks" (Meyer Fellowship Paper, Joint Center for Housing Studies, Harvard University, Cambridge, MA, March 2021).

26. The measures in figure 8 are the annual estimates of the slopes of the price/income lines for each MSA, as shown in figure 1, truncated at ZIP code log income of 12 as they were in figure 1. In most MSAs, the relationship is dependably linear. In Detroit, Philadelphia, and St. Louis, the relationship

FIGURE 9. HOUSING PERMITS AND POPULATION GROWTH IN 49 METRO AREAS, 2005–2006 VS. 2018–2019



steepening of price/income slopes in all major metropolitan areas has coincided with declining trends in all measures shown in table 1: average population growth, variance in population growth, rates of housing permit issuance, and variance in housing permits. These recent trends in price/income slopes suggest that housing supply has become less elastic in every MSA. Universal trends point to universal causes, which means that changes in local land use regulations are unlikely to be the primary cause of the recent universal steepening of price/income slopes.

Returning to the framework used in figure 3, 4, and 6, we can see the difference between the two periods of price appreciation. Figure 9 compares the cross-sectional correlation of building permits and subsequent population growth for 49 metropolitan areas in 2018–2019 to that in 2005–2006. Both periods exhibit a similar shared cyclical demand for housing and almost exactly the same relationship between permits and population growth. But the population growth rates of the fastest-growing cities are much lower in 2018–2019 than they were in 2005–2006.

is not linear because some ZIP codes with very low incomes have very low median home prices, presumably because of declining local population and related localized negative externalities. I have included the regression coefficients for them in figure 8 because changes over time still convey some information. In cities with those conditions, the price/income ratio tends to be relatively flat across incomes.

Population growth has turned negative again in the Closed Access cities like Los Angeles and New York City as a result of the higher cyclical demand, just as it did in the earlier period.[27] Migration patterns related to COVID-19 have obscured this because the decline in population has been blamed on the pandemic. However, the recent trend back to depopulation for the Closed Access cities began before COVID-19 arrived. The pandemic added a short-term deviation to the more fundamental shift, which will continue after COVID-19 migration has subsided.

As described above, a hard de facto cap on new housing production in the Closed Access cities was a key driver of housing and population trends before the Great Recession. The proportional decline in housing production across cities is emblematic of steeper supply curves rather than local maximums where supply curves are relatively vertical; Aastveit, Albuquerque, and Anundsen measured a shift to less-elastic supply across the United States after the Great Recession in all major metropolitan areas.[28]

It has been rather odd that a price spike has spread across the nation with the permitting rates shown in figure 9. Relative to all post–World War II experience, none of the years since the Great Recession have been a housing boom in terms of total units constructed. Yet as shown in figure 9, the shared systematic cyclical housing demand is positive. The regression line crosses the x-axis at nearly the same number of permits as it did in 2005.

The explanation for this shift in supply elasticity must be universal. And lower population growth rates among formerly fast-growing cities suggests that limits to building are related to slower rates of migration. The peculiarities of the evidence, which I will highlight below, point to the regulatory burdens that greatly limited mortgage access after 2007. Mortgage access can affect supply of housing as well as demand for it. A major source of customers for new home builders, after all, has historically been owner-occupiers with mortgages. The experience of the past decade suggests that limiting mortgage access has reduced housing supply more than demand. Generous financing of owner-occupied housing may have been a key element in aspirational household migration to growing, affordable cities. This has been curtailed.

This is a peculiar assertion. Could curtailed capital really lead to higher prices? Housing is peculiar because it is commonly domestically produced

27. See figure 5.

28. Knut Are Aastveit, Bruno Albuquerque, and André K. Anundsen, "Changing Supply Elasticities and Regional Housing Booms" (Bank of England Working Paper No. 844, Bank of England, London, January 2020), https://ssrn.com/abstract=3520650.

(owner-occupiers are effectively the producers of the shelter they consume), which makes it difficult to distinguish the ownership of the capital from the service it provides. When contemplating the trends in the housing market over the past decade, consider that it would be easy to understand that restricting capital for buying farmland could lead to higher food prices or that restricting the funding and ownership of metal-stamping equipment could lead to higher automobile prices and even to higher share prices for the automobile producers.

Trends in post-crisis housing markets and population growth are even more peculiar than they were before the crisis. Peculiar evidence calls for peculiar conclusions.

The Effect of Supply Elasticity on Rents and Prices

Housing can be viewed as a traditional form of income-producing capital. A home can be modeled as a financial perpetuity—an asset that returns income indefinitely into the future. The equation for the value of a perpetuity is simple. For a home, it could be stated like this:

$$\text{Home price} = \frac{\text{Rent} - \text{Expenses}}{\text{Discount rate} - \text{Rent growth rate}} \qquad (1)$$

The income that a house earns for homeowners or a landlord is its rental value after basic maintenance and upkeep costs. Discount rate can be related to mortgage rate, access to capital, risk aversion of investors, and so on. For a bond, the interest rate that the bond pays is the discount rate, because the face value of the bond when it matures is fixed. So, if an individual owns a bond that pays 6 percent interest for one year, the marginal bond owner values $106 in a year the same as they value $100 today. Since the future rental value and price of a home is not fixed, we can only guess at the discount rate homeowners demand. Expected rent growth rate can be related to local housing supply conditions, local income and employment trends, changing values of local amenities, and so on. Local conditions or cyclical trends may change the discount rate and growth rate expectations so that prices rise or decline somewhat compared to rents from place to place or over time.

According to this model, the level of construction activity at any given time is the result of a simple question: Is the market price of a typical home higher than the cost to build a new home? If the answer is yes, new homes will be constructed until rents decline. If the answer is no, then construction will slow until rents rise enough to push prices above the cost of construction.

FIGURE 10. EFFECTS OF DEMAND ON PRICE AND RENT UNDER DIFFERENT SUPPLY CONDITIONS

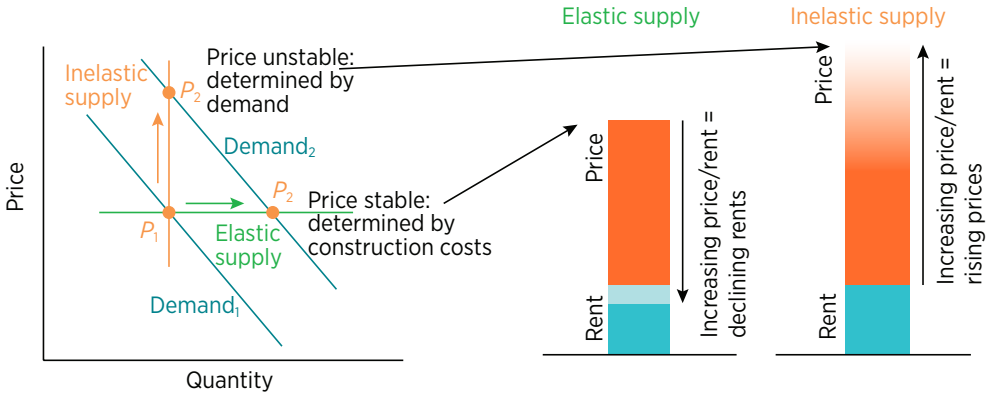


Figure 10 illustrates two extreme contexts: perfectly elastic supply where new homes can be constructed immediately and indefinitely at a cost determined by materials and labor, and perfectly inelastic supply where the quantity of homes is fixed. The Closed Access cities generally have inelastic housing supply due to local land use regulations; inelastic supply led to the pattern in price/income levels in Los Angeles shown in figure 1 and was the primary cause of the cyclical price volatility of the Closed Access cities shown in figure 8. It also led to the countercyclical population changes illustrated in figure 7. When cyclical demand for housing increases against inelastic supply, prices rise.

However, in other cities that have more-elastic housing supply, the price of homes is moderated by the cost of construction. Prices cannot easily move much higher than the cost of construction because new units are constructed until rents decline. According to the simple perpetuity model of equation 1, things like generous credit access, speculative investment, and low mortgage rates raise home prices by lowering the discount rate. And the way the market reaches equilibrium is that new homes are constructed until rents decline far enough to keep the price of homes near the cost of construction.

In markets with inelastic supply, it doesn't matter whether there is a fundamental increase in housing demand associated with rising rental expenditures, a decline in discount rates, or an increase in expected rent inflation (all variables in equation 1). In any of these cases, prices will rise. In markets with elastic supply, rent inflation expectations remain moderate. Increased expenditures on rent will lead to new construction until rents and prices reflect the cost of construction. Declining discount rates will lead to new construction until rents decline enough for prices to reflect the cost of construction.

During and after the Great Recession, prices of homes fell dramatically: according to the S&P/Case-Shiller U.S. National Home Price Index, from the first quarter of 2007 to the first quarter of 2012, the real price of the average US home declined by more than 30 percent. According to the Bureau of Labor Statistics, real rents were roughly level over that same period.[29] Therefore, using equation 1, the decrease in prices after 2007 can be attributed to an increase in the discount rate on American housing, which occurred when credit access was limited and home buyers and lenders became risk averse. In other words, price/rent ratios declined. This sharp decline in price/rent ratios after 2007 happened in spite of a significant decline in mortgage interest rates; that means that other factors had a much larger positive effect on discount rates than the negative effect of lower mortgage rates.

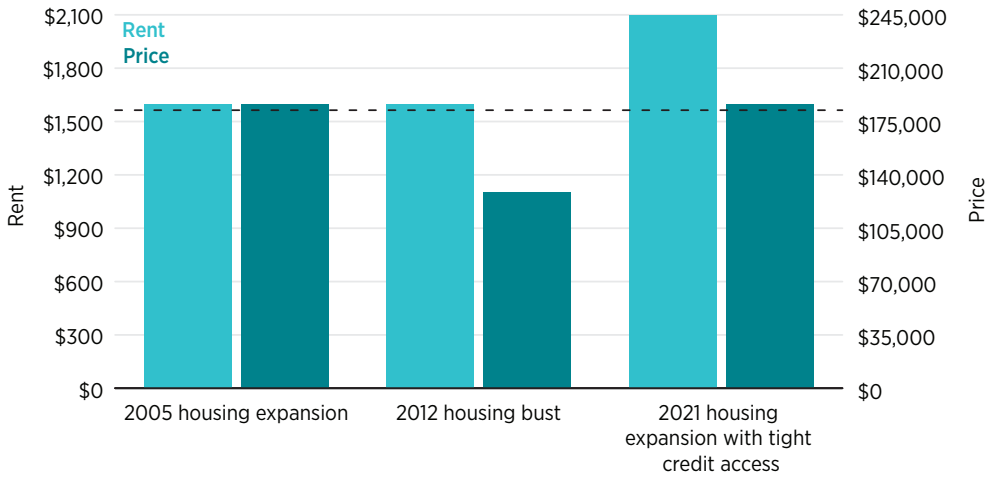
In cities that already had inelastic supply before 2007, this decline in price/rent ratios simply reversed previous price appreciation, with little long-term effect on local housing production. In the Closed Access cities where supply is inelastic enough to create a negative correlation between population growth and housing production, permits for new homes top out at fewer than four units per 1,000 residents annually. By 2015, they were all back to the top of their ranges while permits in the rest of the country remained at about half of the pre-recession levels. In most cities, where supply had been relatively elastic before 2007, deeply lower price/income ratios pushed the prices of many homes below the cost of construction. In that condition, rents must rise enough to push prices back above the cost of construction before new housing will be constructed. To state this in terms of supply elasticity, a decline in purchase demand causes the supply of homes to become inelastic because the existing stock of homes doesn't shrink when declining demand for buying homes pushes prices lower; supply is fixed until prices rise above the cost of construction again.

Declining Rents Lead to Declining Prices, but Declining Prices Lead to Rising Rents

Figure 11 is a simple visualization of this series of developments from 2005 to 2021 for a hypothetical marginal house where local supply conditions are other-

29. Estimates of home prices, rents, and inflation adjustments are from S&P Dow Jones Indices, "S&P/Case-Shiller U.S. National Home Price Index" (dataset), https://fred.stlouisfed.org/series/CSUSHPISA; US Bureau of Labor Statistics, "Consumer Price Index for All Urban Consumers: Rent of Primary Residence in U.S. City Average" (dataset), https://fred.stlouisfed.org/series/CUUR0000SEHA; and US Bureau of Labor Statistics, "Consumer Price Index for All Urban Consumers: All Items in U.S. City Average" (dataset), https://fred.stlouisfed.org/series/CPIAUCSL. All accessed April 10, 2023.

FIGURE 11. THREE PHASES OF RENT AND PRICE REACTIONS TO TIGHTENED LENDING



Note: Prices above dashed line induce new building—natural replacement cost.

wise elastic. The market began near a stable equilibrium, where rents and prices were near the levels required to induce new construction under current conditions (leftmost bars in figure 11).

In the wake of the housing boom, regulations on mortgage lending were tightened, and tighter lending standards brought down home prices. For my purposes here, the observation that lending standards were tightened and that tightened lending was expected to and did cause prices to decline comports with all historical accounts of the period.[30] As a result, by 2012, the price of that hypothetical marginal house had shifted to levels shown by the center bars in figure 11. This was the condition that arose after 2007 in many cities where supply had been elastic before: construction activity, rents, and prices followed patterns suggested by this simple model. If discount rates permanently increase (which means that price/rent ratios decrease) because of changes such as buyer risk aversion or limited access to mortgage financing, the new equilibrium level will eventually settle at the initial price but at higher rents.[31] The rent has to rise until the price is high enough to induce new construction, and the higher discount

30. For a discussion of policy changes and their consequences during the 2000s, see Kevin Erdmann, *Building from the Ground Up: Reclaiming the American Housing Boom* (Brentwood, TN: Post Hill Press, 2022).
31. This assumes, of course, that other factors such as the cost of construction remain stable.

rate from equation 1 means that rents must rise in order to return to the original price level. This is shown in the rightmost pair of bars in figure 11.

Steeply higher discount rates on American homes since 2007 put many cities into a condition of inelastic supply. Ironically, post-2007 changes, such as tightening mortgage access, which were intended to lower the prices of homes, may mainly have raised their rental values, and therefore, eventually, their prices. The process I have described above—a decline in home prices, followed by a drop in construction activity, followed by an increase in rents and prices—describes much of the American housing market since 2007. This includes recent steepening of price/income slopes across metropolitan areas (shown in figure 8), which is a signal of the upward filtering of the existing housing stock that is set in motion by inelastic supply.

The following sections detail the three steps of the process shown in figure 11 that has left the US housing market with high rents and insufficient housing construction.

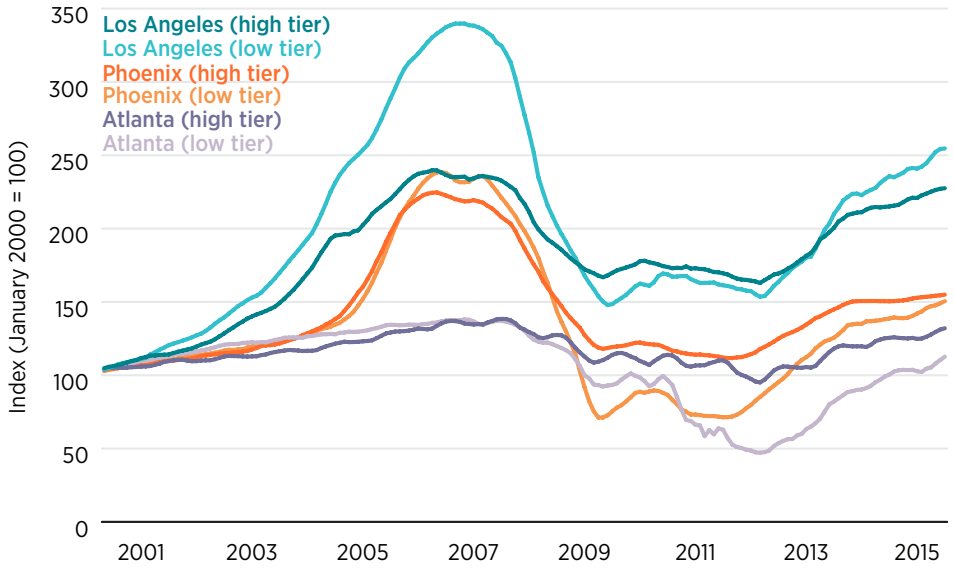
Step 1: Post-crisis declines in prices in ZIP codes with lower incomes. The first change suggested by figure 11 is a decline in prices. As I discussed in "Reassessing the Role of Supply and Demand on Housing Bubble Prices," home price appreciation from 2002 to 2006 was reversed in many ways from 2006 to 2010.[32] But there were important ways in which 2006 to 2010 was not a mirror of 2002 to 2006. Most importantly, the pattern of price appreciation and reversal was not symmetrical.

From 2002 to 2006, prices in most MSAs appreciated relatively uniformly across the metropolitan area; excess price appreciation in ZIP codes with lower incomes was largely limited to the most supply-constrained, expensive metropolitan areas. This pattern I found using Zillow price estimates is confirmed by S&P/Case-Shiller home price indices for "high tier" and "low tier" homes for some metropolitan areas. The low tier indices track prices in parts of the metropolitan area where incomes, rents, and home prices tend to be lower. High tier indices track the more expensive homes with higher rental values and tenants with higher incomes.

In "Reassessing the Role of Supply and Demand on Housing Bubble Prices," I found that some price trends did reverse from the bubble, some only partially reversed, and some didn't reverse at all. Figure 12 shows these asymmetries in relative price appreciation for Los Angeles and Atlanta, the two metropolitan areas

32. Erdmann, "Reassessing the Role," 25–37.

FIGURE 12. HIGH- AND LOW-TIER PRICE TRENDS IN SELECTED MSAS, 2000–2015



Source: S&P Dow Jones Indices, LLC. Data captured from FRED graph, accessed April 10, 2023, https://fred.stlouisfed.org/graph/?g=YCx4.

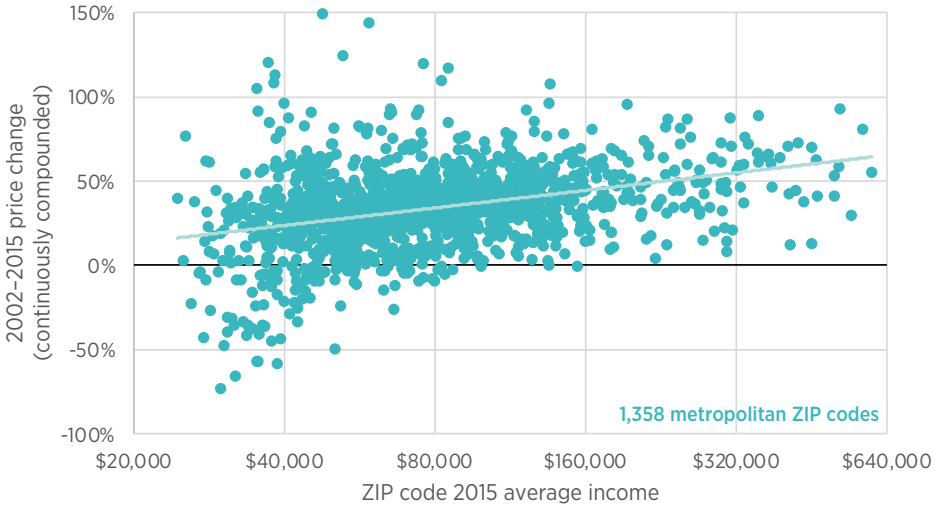
compared in figure 1. Los Angeles is emblematic of the most supply-constrained, Closed Access cities, and Atlanta is similar to most cities in the country's interior.[33] Phoenix is also included in figure 12 as an example of a Contagion city.

There were individual metropolitan areas, like Phoenix in figure 12, where both high-tier and low-tier prices appreciated significantly during the boom and then reversed completely. And then there were places like Los Angeles, where from 2002 to 2006 low-tier home prices appreciated much more than high-tier home prices did. In other words, rising prices were largely related to the steepening price/income slope, shown in figure 1. In Los Angeles, low-tier and high-tier prices then reconverged during the post-2008 housing bust. In Atlanta, changes were relatively small before 2008, so there weren't any significant trends to reverse.

After 2008, there was a new divergence in prices unrelated to earlier trends. From 2006 to 2010, low-tier prices dropped much more than high-tier prices in

33. I have referenced Case-Shiller data here because the high tier and low tier indices help to highlight this point and to show that these patterns are not limited to the Zillow datasets that I use throughout the rest of this paper.

FIGURE 13. LOWER PRICES WHERE INCOMES ARE LOWER, 2002–2015

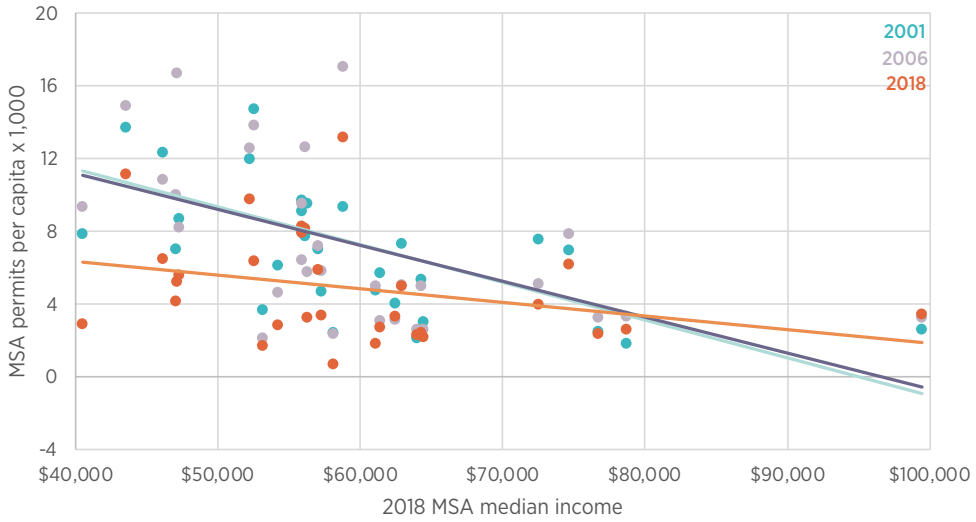


virtually all cities. Figure 13, which takes the entire boom and bust period into account by showing cumulative price changes from 2002 to 2015, demonstrates that home prices in ZIP codes with lower incomes increased much less than home prices in ZIP codes with higher incomes. This was effectively a leveling of the price/income slope in every major metropolitan area. As described above, I attribute cross-sectional differences in the price/income slope to differences in metropolitan area supply elasticities. However, there are several reasons to doubt that lower prices in ZIP codes with lower incomes during the housing bust period were caused by more-elastic supply.

The decline in prices after 2006 coincided with a decline in construction activity. It is true that home sales also declined, which could be associated with demand moving downward on a convex supply curve to a more elastic part of the curve;[34] to some extent, that was surely a factor, at least temporarily. However, there was not a steep permanent decline in rents after 2006,[35] so the demand for purchasing homes declined much more than the demand for shelter. In "Reassessing the Role of Supply and Demand on Housing Bubble Prices," I pointed to

34. Erdmann, "Price Is the Medium," figure 7.
35. Based on end-of-year estimates, inflation for consumer price index rent of primary residence was positive but below 1 percent in 2009 and 2010 before moving persistently back above 2 percent in 2011 and after. US Bureau of Labor Statistics, "Consumer Price Index for All Urban Consumers."

FIGURE 14. DECLINING PERMITS WHERE INCOMES ARE LOWER, 30 LARGEST MSAS



evidence of extreme shifts in mortgage underwriting standards as the source of those shifts in purchasing demand.[36] Reducing access to capital for credit-constrained borrowers, who tend to live in ZIP codes with lower incomes, pushed the housing markets in those ZIP codes into the middle scenario in figure 11: price/rent ratios were squeezed so that rents remained relatively level, but prices ceased to be high enough to induce new construction.

Step 2: Post-crisis declines in construction in MSAs with lower incomes. As shown in Table 1, population growth, variance of population growth across MSAs, building rates, and variance of building rates have all declined since 1998. Population growth and construction activity have declined the most in MSAs with lower incomes, which had previously maintained elastic housing supply as an outlet for population to flow out of the housing-constrained cities. Since the Great Recession, the growth rates of MSAs with lower incomes have declined so that they are nearer to the growth rates and construction activity of the Closed Access cities. Figure 14 shows the correlation of the rate of housing permits issued in the largest 30 MSAs with their per capita income level for the years 2001, 2006, and 2018. Both lower relative prices (figure 13) and declining construction activity (figure 14) are correlated with lower incomes. These are the

36. Erdmann, "Reassessing the Role," 35–37.

patterns that would likely arise if tightened lending standards systematically pushed some markets into the middle scenario of figure 11. Income and capital access have become more important factors limiting the ability of families to buy homes, so where incomes are lower, prices and construction activity are lower.

The transition of many metropolitan areas to the middle scenario of figure 11 during the housing bust meant that fewer new homes were built, and so homes stopped filtering down. This trend shift has been showing up in research on home filtering: Liu, McManus, and Yannopoulos found evidence of "a potential structural change, in that older properties are not filtering downward as fast" since the financial crisis.[37] Myers and Park found that filtering in existing apartment buildings has abruptly reversed since 2011 from at least 30-year trends.[38] For decades, as apartments aged, their new tenants tended to be tenants with lower incomes than the previous tenants. But since 2011, new tenants of existing apartments have tended to be tenants with higher incomes than the previous tenants.

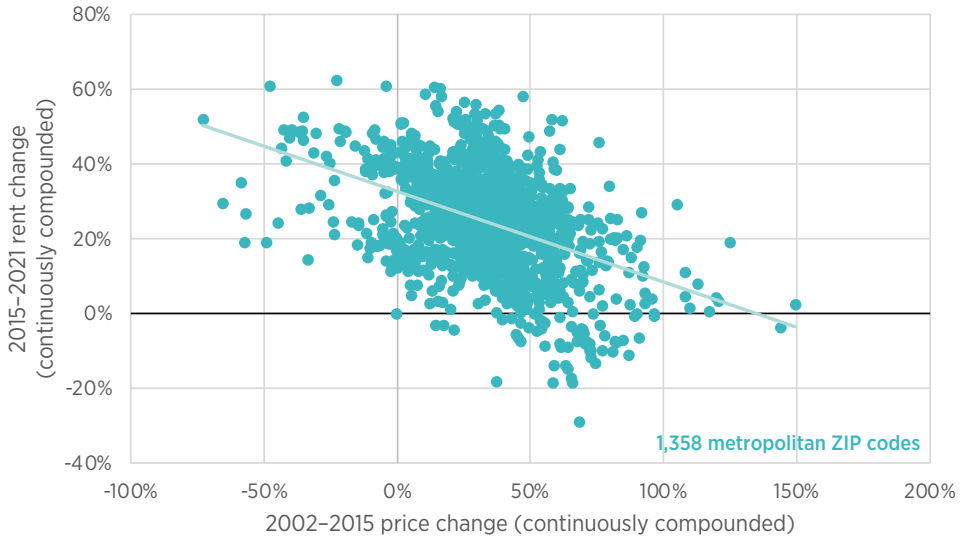
As I theorized and measured in "Price Is the Medium through Which Housing Filters Up or Down," the price/income slope may be a real-time indicator of the rate and direction of the filtering of the existing stock of homes. Before the Great Recession, the association of low construction rates and steepening negative price/income slopes was regionally acute. Since the Great Recession, low construction rates and steepening price/income slopes have become common across metropolitan areas. This has largely been the result of declining construction rates in metropolitan areas with lower average incomes, and the lack of new supply has led to rising rents.

Step 3: Post-crisis increase in rents in MSAs with lower incomes. Myers and Park concluded:

> The present study provides evidence of how much the effectiveness of filtering is increased when overall housing construction is greater. It also supplies evidence of the surprising effect of homeownership decline on the filtering of rental apartments. The collapse of homeownership rates after 2006 shifted eight million more households into rental competition, blocking the downward filtering of apartments and even pulling them upward.

37. Liu, McManus, and Yannopoulos, "Geographic and Temporal Variation," 11, tables 5 and 6.
38. Dowell Myers and JungHo Park, *Filtering of Apartment Housing between 1980 and 2018* (Washington, DC: National Multifamily Housing Council, 2020), https://www.nmhc.org/globalassets/research--insight/research-reports/filtering-data/nmhc-research-foundation-filtering-2020-final.pdf.

FIGURE 15. LOWER PRICES (2002–2015) LEAD TO HIGHER RENTS (2015–2021)

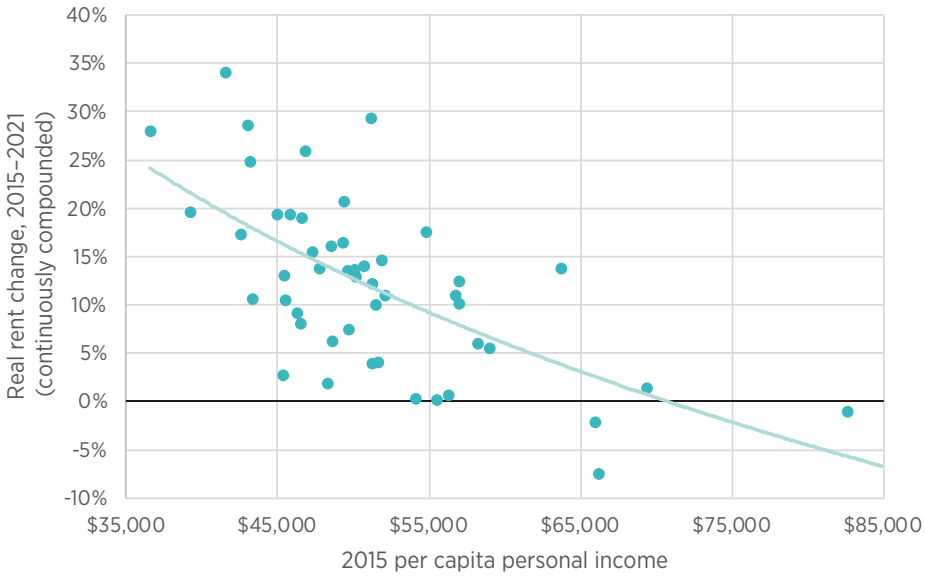


> Thus, we see how low-income access to housing depends on trends that impact the middle class as well. In the end, we are reminded that the housing market is an integrated web of substitutions serving a diversity of people, all of whom are struggling for shelter, and none of whom can be neglected without consequences for the others.[39]

Increasing rents are the process through which households with lower incomes are driven from the existing stock of housing. As noted above, the pressure on rising prices and rents is not uniform across an MSA; where housing is not filtering down, the rising costs are loaded systematically more onto neighborhoods with lower incomes. On the transition from the middle scenario to the rightmost scenario in figure 11, housing supply is inelastic, which means that rising costs are pressed more onto neighborhoods with lower incomes. As figure 15 shows, there is a strong correlation between ZIP codes where home prices declined from 2002 to 2015 and those where rents subsequently increased from 2015 to 2021. In short, a leftward position on the x-axis in figure 15 shows how deeply into the middle scenario in figure 11 an area was pushed, and an upward position on the y-axis shows the resulting scale of the rightmost scenario in figure 11.

39. Myers and Park, *Filtering of Apartment Housing*, 33.

FIGURE 16. CHANGE IN REAL MEDIAN RENT IN 50 MSAS, 2015–2021



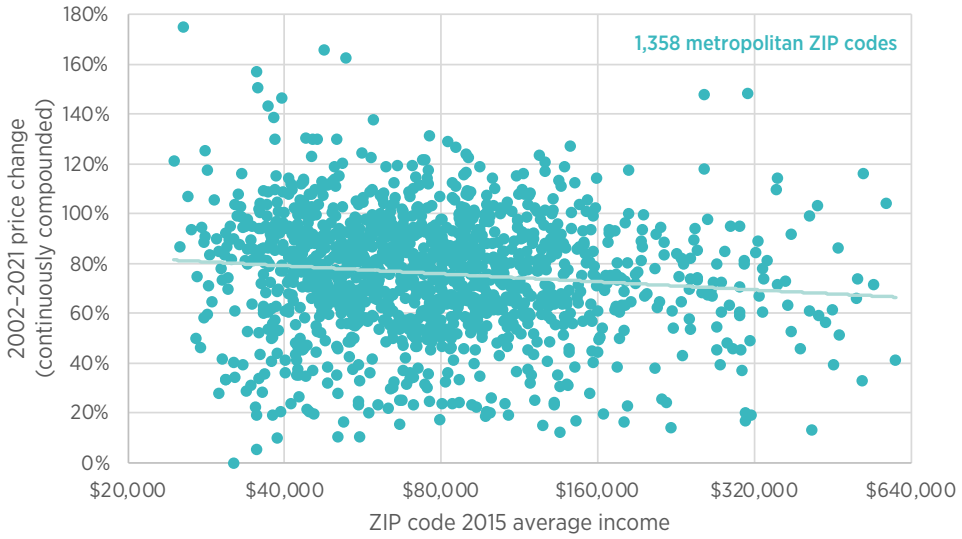
This trend in rents at the ZIP code level is also apparent at the MSA level. Declines in construction activity, shown in figure 14, have been deep and have been correlated with MSA incomes. As figure 16 shows, rents have risen much more sharply in MSAs with low incomes than in MSAs with high incomes.

Summary. If the scenario of figure 11, just described in three steps, were not the dominant driving issue here, this set of correlations would be quite peculiar: First, declining prices were strongly correlated with lower incomes; then declining construction activity was correlated with lower incomes; and then rents increased dramatically where incomes were low and prices had declined, without a robust supply response.

Lacking a robust supply response, higher rents have translated into higher prices.[40] The income-sensitive decline in home prices has now been reversed. As figure 17 shows, for the entire period from 2002 to 2021, the correlation between prices and incomes has been erased. Total price appreciation of the typical home in a ZIP code with low income is similar to the total price appreciation of the typical home in a ZIP code with high income. But that came at the cost of inelas-

40. Erdmann, "Rising Home Prices."

FIGURE 17. PRICE CHANGES, 2002–2021



tic supply and rising rents for families with the lowest incomes. Many markets have moved to the righthand scenario of figure 11.

Furthermore, in ZIP codes with low incomes, rents have been rising faster than incomes. As I discussed in "Rising Home Prices Are Mostly from Rising Rents," the post–Great Recession housing market reflects a bit of a haves-versus-have-nots environment. Rents in high-end ZIP codes have been relatively stable; price inflation there may reflect factors such as low interest rates. But since 2015, low-end ZIP codes have experienced the most price appreciation, and it can essentially all be explained by rent inflation.[41] Because national aggregates do not illuminate this bifurcation in price increases, the existence of low interest rates as a satisfying explanation for rising prices has impeded curiosity about the importance of the more permanent, supply-motivated price and rent inflation.

POTENTIAL SOURCES OF RECENTLY RISING HOUSING COSTS

Several reasons for rising home prices are plausible. Commonly cited reasons for rising prices that, I think, are not particularly supported by the analysis above include (1) mortgage interest rates, which were low and generally declining until

41. Erdmann, "Rising Home Prices."

2022; (2) housing demand due to COVID-19 migration and changes such as more working from home; and (3) supplier consolidation. One potential source of rising home prices that is neither supported nor refuted by the analysis above is (4) changes in the cost of construction due to regulation or market forces. And one potential source of rising home prices that the analysis above suggests may have been underappreciated is (5) a decline in owner-occupier new home sales due to limited mortgage access. The following explores these five possible reasons.

Mortgage Interest Rates

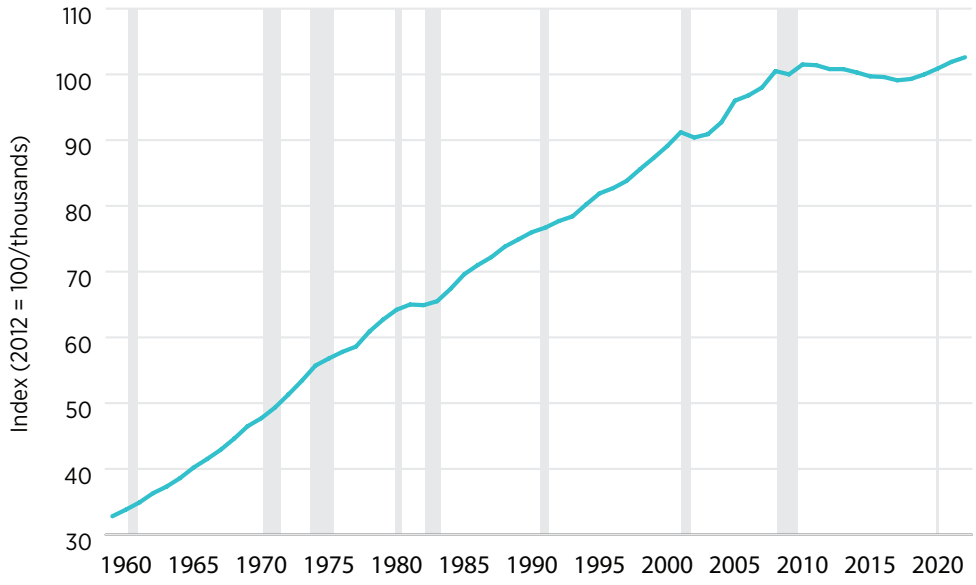
Low interest rates might reasonably cause home prices to rise. As illustrated in figure 10, the relative impact of rising price/rent ratios on prices versus rents might be dependent on supply elasticity—prices rising where supply is inelastic and rents declining where supply is elastic. So it may be more accurate to say that low mortgage rates might be interacting with a decrease in supply elasticity to raise prices.

Steepening price/income slopes might result from home buyers' increasing their housing demand because of low rates, creating more pressure on the existing stock of homes in a supply-constrained market. However, the low rates of construction that have been associated with rising prices suggest that limited supply rather than higher demand is the primary factor. Per capita real housing expenditures have been relatively flat since the global financial crisis, marking a sudden downshift from a relatively linear, decades-long rising trend (see figure 18). In fact, even during the pre-crisis boom, per capita real housing expenditures were below the pre-2000 trend. This is not the pattern one would expect from rate-driven demand, to say the least.

Housing Demand due to COVID-19 Migration and Changes Such as More Working from Home

Pandemic-related migration and shifts in housing consumption, such as more-common working from home, are certainly responsible for higher demand, especially after 2020. However, again, outside of a few hot spots like Austin, the measured increases in the real quantity of housing demanded are quite moderate, about 1 percent each year in 2020 and 2021, well below typical rates of growth before 2008. Intuitively, it would seem that work-from-home trends and migration of affluent families out of the dense urban centers during COVID-19 should lead to a surge of new building, not to the sort of down-market compromises and substitutions into the existing stock of homes that seem to explain steep price/income slopes.

FIGURE 18. REAL PER CAPITA HOUSING EXPENDITURES, 1959–2022



Source: US Bureau of Economic Analysis, LLC. Data captured from FRED graph, accessed April 10, 2023, https://fred.stlouisfed.org/graph/?g=YEtS.

Note: Shaded areas indicate US recessions.

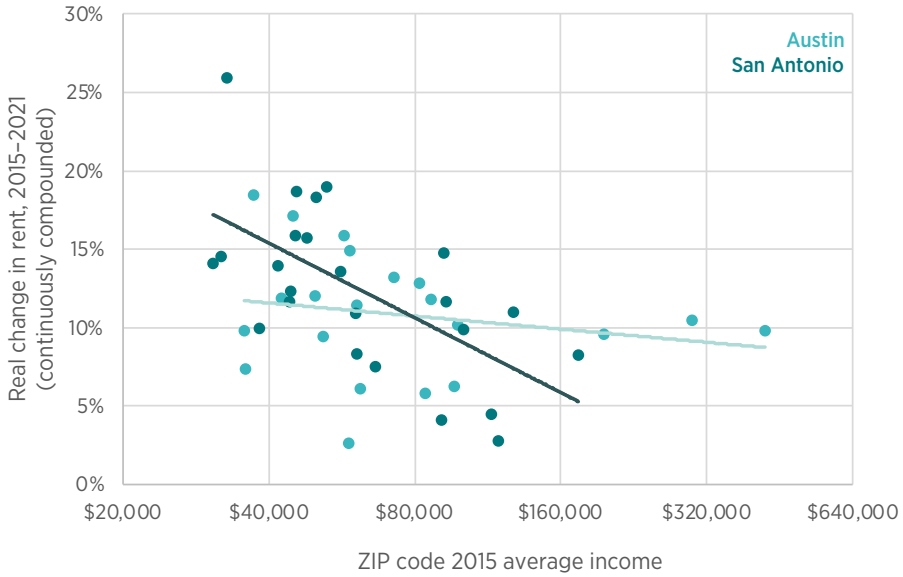
The COVID-19 event created some temporary migratory shifts and regional population booms and price shocks, but COVID-19 may be a distraction from the more persistent story because there was already migration out of the Closed Access cities before COVID-19. Population booms were already pushing prices up, but construction rates remained stubbornly low. The price/income trends shown in figure 8 didn't suddenly spike in 2021; they show a universal, long-term trend. Prices associated with the COVID-19 boom appear inflated only because of an existing rising trend associated with low rates of construction.

The Closed Access cities require a significant amount of annual domestic outmigration. For a brief time, COVID-19 changed the motivations for that migration and the distribution of who was migrating, but net domestic migration for the Closed Access cities was negative when COVID-19 arrived, it had been negative for years before that, and it continues to be negative today. If COVID-19 reduced aggregate demand for shelter in the Closed Access cities, the reduction was small enough relative to the Closed Access cities' supply constraints that their price/income slopes changed little.

FIGURE 19. PRICE/INCOME RATIOS VS. INCOME IN AUSTIN AND SAN ANTONIO, 2006, 2015, AND 2021

Among the cities that are growing, Austin, shown in the top panel of figure 19, is unusual among metropolitan areas where rates of housing construction were high before the Great Recession. It has seen a large uptick in demand and rising average home prices, and has been the fastest-growing metropolitan area in this dataset with the highest rate of permitting. Even though average home prices have risen sharply in Austin, price increases have been more uniform across the metropolitan area. From 2015 to 2021 (the shift from the purple line to the orange line in the top panel of figure 19), the price/income line steepened

FIGURE 20. REAL CHANGE IN RENT IN AUSTIN AND SAN ANTONIO, 2015–2021



only slightly. The only metropolitan areas with less steepening were St. Louis and Pittsburgh.[42] Why did the city with arguably the most intensive inmigration surge of all the major metropolitan areas have among the most benign changes in relative price/income levels? Why was Austin able to increase new housing production more than other cities?

Perhaps a comparison with San Antonio—a metropolitan area just down the highway but with much lower average incomes—will provide a clue. In 2021, housing permits in San Antonio were still below the 2005 peak, while Austin permitted at twice the level it had in 2005.[43] These two Texas cities provide a telling demonstration of the importance of income in post-2008 housing markets. In lower-income San Antonio, the downshift in prices (from the blue line to the purple line in the bottom panel of figure 19) and then the subsequent recovery in prices (from the purple line to the orange line in the bottom panel of figure 19) is quite noticeable. And though the number of ZIP codes with rent data is limited, the difference between Austin and San Antonio in changes in rent versus income from 2015 to 2021, shown in figure 20, is not subtle.

42. See figure 8.

43. US Census Bureau. Data captured from FRED graph, accessed April 10, 2023, https://fred.stlouisfed.org/graph/?g=12BZ4.

I would argue, based on the evidence I have described above, that the relative rent increases in the parts of Austin where incomes are higher is indicative of the relative recent spikes in demand, and that the relative rent increases in the parts of San Antonio where incomes are lower is indicative of intrametropolitan compromises that come from a lack of adequate building. And I would further argue that much of the difference comes from the relative ease with which the average household in Austin qualifies for a mortgage and purchases a new home compared to the average household in San Antonio. In other words, in broad strokes, Austin's changes in price/income and rent/income ratios between 2015 and 2021, shown in figures 19 and 20, reflect a large number of newcomers willing to pay more, which tends to raise prices across the metro temporarily; and San Antonio's changes reflect a large number of existing residents forced to compromise in a housing stock that is not adequately growing, which tends to raise rents on residents with low incomes.

Supplier Consolidation

Luis Quintero has argued that increased market concentration in the construction industry has reduced production.[44] He attributes to market concentration a decline of just over $100 billion, or about 150,000 units annually, in construction activity. The sharp drop in demand after 2005 certainly did lead to a decline in the number of construction firms, and this may have some effect on market activity on the margin. However, the importance of the demand shock makes definitive conclusions on this matter difficult. For instance, some major builders, such as K. Hovnanian Homes and Beazer Homes, have only regained sustainable profitability with the higher revenues associated with the strong market in 2020 and 2021.[45] A thesis of oligopolistic behavior would need to explain why long-suffering firms would forgo potential revenue. Additionally, until recently, monthly sales per community declined at these firms in spite of a declining number of active sales communities.[46] That is reflective of consolidation in reaction

44. Luis Quintero, "Fewer Players, Fewer Homes: Concentration and the New Dynamics of Housing Supply" (Baltimore, MD: Johns Hopkins Carey Business School Research Paper No. 18-18, August 2022), https://ssrn.com/abstract=3303984.
45. See 10-K filings and investor presentations at K. Hovnanian Homes, https://www.khov.com/investor-relations, and Beazer Homes, http://ir.beazer.com/. Both accessed April 10, 2023.
46. See annual and quarterly reports from K. Hovnanian Homes and Beazer Homes (see note 45). For example, K. Hovnanian's "Investor Presentation," slide 10, "Q1 2023 Quarter Contracts per Community by Segment," April 2023, https://khov.gcs-web.com/static-files/18b59d14-95d7-46a6-9135-eb677c1ea404.

to declining total market size rather than oligopolistic margin expansion. Furthermore, supply chain constraints, volatile lumber prices, and high levels of construction job openings during the recent period of growth suggest a willingness and tendency for home builders to expand at the limit of real constraints where demand has been strong. Quintero recognized the difficulty of establishing causality and used a method intended to confirm it. For the reasons described above, I am not sure of the scale of the effect of industry consolidation on supply elasticity. The author's hypothesis is a plausible cause for at least some of the broad shift toward supply inelasticity, though as with most of the other explanations, it doesn't lend itself as an obvious explanation for the peculiar patterns I have highlighted above.

Changes in the Cost of Construction due to Regulation or Market Forces

It seems unlikely that the local governance characteristics such as exclusionary zoning that generally drive supply elasticity would lead to such similar changes of significant scale across major MSAs, though regulation is likely a somewhat important factor in rising housing prices.

Construction costs more generally have risen for several decades, and especially since 2012;[47] rising costs can be expected to increase the cost per square foot of new homes and are also likely an important factor in rising prices, on average.[48]

A Decline in Owner-Occupier New Home Sales due to Limited Mortgage Access

After 2007, tightened lending standards greatly reduced the ability of middle-income households to finance new homes. It is possible that post-crisis regulations meant to prevent predatory lending have also prevented a significant amount of financing for new homes. As I pointed out in "Reassessing the Role of Supply and Demand," the median credit score on newly originated mortgages increased in 2008 by about 40 points relative to the norm before and during the housing boom

47. US Bureau of Economic Analysis, "Gross Private Domestic Investment: Fixed Investment: Residential (Implicit Price Deflator)/Gross Domestic Product: Implicit Price Deflator," accessed February 13, 2023, https://fred.stlouisfed.org/graph/?g=YEEQ.
48. Carmel Ford, "Cost of Constructing a Home" (Washington, DC: National Association of Home Builders Economics and Housing Policy Group, 2020), https://www.nahb.org/-/media/8F04D7F6EAA34DBF8867D7C3385D2977.ashx.

and has remained high. Perhaps the ability to finance new units has been limited to potential home buyers with higher incomes. Rent inflation has continued to be high after the COVID-19 shock, while the production of new housing units remains well below pre-2006 rates. This suggests that the country still has not firmly transitioned to the rightside panel of figure 11.[49] In the meantime, starts in the traditional multiunit rental market have recovered to a level above the pre-crisis level;[50] new home sales for homes priced above $300,000 have recovered to a level above the pre-crisis level; and new home sales for homes priced below $300,000 have remained well below the pre-crisis level.[51] This is further evidence that suggests the reduced buying power and mortgage access for entry-level single-family homes has been important. The construction markets for apartments, which are financed by corporations and investors, and expensive homes for families who are less credit-constrained have been quite strong, while construction of entry-level single-family homes that are generally sold to families who require generous credit markets has practically disappeared.

ADDRESSING THE HOUSING SHORTFALL

It is tempting to conclude that, since rents are rising specifically in ZIP codes with low incomes and in MSAs with low incomes, the units that are being undersupplied are units for households with low incomes. But that is not necessarily the case. New construction in any given year amounts to a very small portion of the total stock of housing. If new units are completed amounting to 1 percent of the housing stock, and at the same time there are migratory shifts of 1 percent of the population into or out of the MSA or between neighborhoods within the MSA, then those migratory shifts can have just as large an effect on supply and

49. Sources of mortgage access analysis that point to conditions that were tighter after 2007 than at any time in the late 1990s or early 2000s include Morris A. Davis, William D. Larson, Stephen D. Oliner, and Benjamin R Smith, "A Quarter Century of Mortgage Risk," *Review of Finance* 27, no. 2 (March 2023): 581–618; Federal Reserve Bank of New York, *Quarterly Report on Household Debt and Credit*, accessed April 10, 2023, https://www.newyorkfed.org/microeconomics/hhdc/background.html; Mortgage Bankers Association, "Mortgage Credit Availability Index," accessed April 10, 2023, https://www.mba.org/news-and-research/research-and-economics/single-family-research/mortgage-credit-availability-index-x241340; and Urban Institute, "Housing Credit Availability Index" (dataset), accessed April 10, 2023, https://www.urban.org/policy-centers/housing-finance-policy-center/projects/housing-credit-availability-index.

50. US Census Bureau and US Department of Housing and Urban Development, "New Privately-Owned Housing Units Started: Units in Buildings with 5 Units or More" (dataset), accessed April 10, 2023, https://fred.stlouisfed.org/series/HOUST5F.

51. The US Census Bureau tracks new homes sold by price; see data at https://www.census.gov/construction/nrs/index.html.

demand in any given neighborhood as the new construction did. As the filtering literature makes clear, discretionary buying and selling activity and migration within the existing stock of homes is more than ample to outweigh the compositional effects of new building. In other words, it doesn't necessarily matter much whether a new unit is a 1,200-square-foot apartment next to a train station or a 5,000-square-foot single-family home with a yard in the exurbs. Whatever the stock of homes is in an MSA, households will shift, substitute, and migrate over time to distribute those homes based on their value and the ability of individual households to afford them.

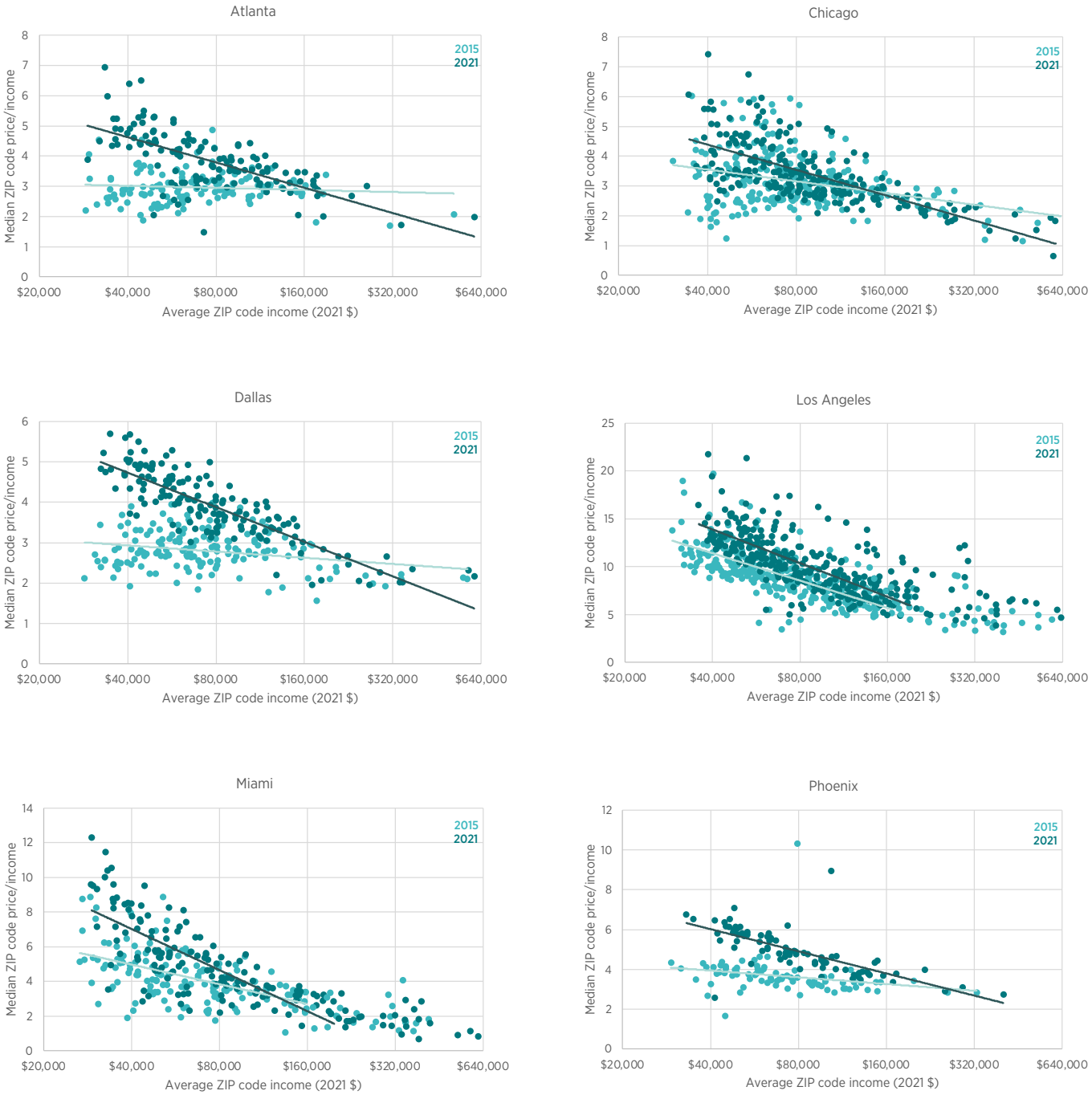
Even while the slope of the typical MSA price/income line has become volatile, the plots still maintain linear patterns. In other words, if you know the price/income ratio in the average ZIP code with an income of $100,000 and the price/income ratio in the average ZIP code with an income of $50,000, you can hazard an accurate guess as to the price/income ratio in the average ZIP code with an income of $75,000. Figure 21 shows the price/income lines of select MSAs in 2015 and 2021. Those linear patterns are the product of countless marginal decisions throughout cities made to adjust housing decisions and locations in order to moderate costs.[52]

Inter-MSA changes and intra-MSA changes reflect different factors. High rent inflation in MSAs with lower incomes, even though population growth has generally been lower in those MSAs than it had been in earlier decades, suggests that low income is an important element constraining supply in those MSAs. But rising rents and prices in ZIP codes with lower incomes within those MSAs are more likely to be a result of a more broad-based lack of housing supply rather than supply specific to any submarkets within the MSA. To put it another way, housing costs have risen at different times in some MSAs with low incomes and some MSAs with high incomes. But in all cases, when housing costs have persistently risen in an MSA, they have risen the most in ZIP codes with low incomes. That was the case in Los Angeles in 2004 and in practically every MSA in 2021.

The key to bringing down costs for ZIP codes with low incomes is building homes of any type. In the current context, it may be that many cities with rising costs will benefit from building more entry-level, smaller homes with fewer amenities. But the broad benefit to affordability for an MSA's lowest-income ZIP

52. Note that the price/income scale differs for the MSAs in figure 21, so that the intra-MSA patterns are more easily discernible for each. Also, for Los Angeles and Miami, where the zero bound creates a nonlinear pattern at high incomes, the regression lines have been truncated to exclude ZIP codes with log income above 12 in 2018, as they were in figure 1.

FIGURE 21. PRICE/INCOME RATIOS VS. INCOME BY ZIP CODE IN SELECTED MSAS, 2015 AND 2021



codes will come more from the addition of the unit than from the targeting of that unit to any particular affordability tier.

Differences between metropolitan areas should clarify this distinction. Based purely on size, quality, and amenities, many units considered "luxury" in Los Angeles would be considered "entry level" in Houston. Supply should meet demand where it exists, but in the long run, affordability is not served by expanding the housing stock with substandard units. The high prices are due to scarcity, not quality. The policy goal should be for the cost of construction to be what matters in determining the price. Leveling the price/income line in Houston probably does not entail increasing the supply of 8,000-square-foot McMansions; on the other hand, building tiny homes or a small number of subsidized units in Los Angeles in an attempt to overcome the high cost of land is probably a case of winning the battle to lose the war.

It could be that cities, in general, were overregulating the construction of multiunit and urban infill housing even before 2008, and that loose lending simply put a Band-Aid over that problem by financing an excess amount of entry-level, single-family construction. When financing for those homes was pulled back after 2008, the underlying constraints may have been exposed, so that no city has been willing and able to approve enough multiunit and urban infill construction in the absence of that financing.

It is likely that hysteresis from the decade of suppressed construction activity lowered the capacity to build, which has only recently been retested. The recent development of an institutional build-to-rent market in single-family tract home construction suggests that prices have now fully moved into the right-hand scenario of figure 11. Continued tight mortgage access means that the new supply will be financed by landlords rather than by owner-occupiers.

An increase in either multiunit or build-to-rent single-family construction may stem further steepening of negative price/income slopes, but it remains to be seen whether that activity will reverse the steepening or the significant increases in rents and rent/income ratios. It is plausible that the costs of landlordship require higher rents and that a market that depends on more rental units will settle at higher rents. Both theory and recent practice suggest that in a market with elastic supply, the primary net effect of generous mortgage access may be lower rents for nonowner tenants. More research would be helpful in this regard. The range of supply conditions and demand conditions, both cross-sectionally and over time, should provide researchers with unprecedented natural experiments through which to form novel answers to these questions.

CONCLUSION

Before the 2008 financial crisis, homes in a handful of metropolitan areas became excessively expensive. That was due to an endemic problem of inelastic housing supply. In the metropolitan areas where that problem existed, housing costs rose the most in the ZIP codes with the lowest incomes.

In recent years, this problem has extended beyond that handful of metropolitan areas, and now home prices across the country are rising in the same way—rents and prices are rising the most in ZIP codes with low incomes. This pattern suggests that rising costs are due to obstacles to new construction that are leaving many metropolitan areas with a lack of adequate housing. This lack of adequate supply leads to countless economic decisions across MSAs by households whose demand for housing is being moderated by rising costs, and those decisions systematically press the rising costs down-market to households of lesser means.

Rising construction costs are surely an aggravating factor pushing the cost of new homes higher in general. The same can be said of widespread regulations against multiunit infill housing. However, the combination of low construction activity and rising rents that has recently been especially noticeable in metropolitan areas with lower incomes suggests that limits to housing supply are related to household income and the ability of households with lower incomes to finance the purchase of new homes under excessively tight lending conditions. The key to reducing costs in those metropolitan areas boils down to more construction, whatever the type of unit. Perhaps, if credit constraints have been a fundamental obstacle to elastic supply, the burgeoning market of new single-family homes built for rent will help to fund more new units and reduce the price/income slopes in major metropolitan areas.

In any case, prices and rents have been rising in ZIP codes with lower incomes and in metropolitan areas with lower incomes, and rents have been rising as a percentage of incomes in many of those areas. Low rates of construction activity well below previous levels in most of the metropolitan areas where rents are newly rising suggest that there are significant new constraints to housing supply in previously affordable markets.

APPENDIX

Data Sources

- Home prices from Zillow Home Value Index (ZHVI) for all homes, both for ZIP codes and for MSAs, accessed June 23, 2022, https://www.zillow.com/research/data/.
- Rents from Zillow Observed Rent Index (ZORI) for all homes and apartments, both for ZIP codes and for MSAs, accessed June 23, 2022, https://www.zillow.com/research/data/.
- Average income for ZIP codes (using the average adjusted gross income [AGI] of all returns) from Internal Revenue Service, "SOI Tax Stats—Individual Income Tax Statistics—ZIP Code Data (SOI)" (dataset), accessed from June 2020 to February 2023, https://www.irs.gov/statistics/soi-tax-stats-individual-income-tax-statistics-zip-code-data-soi. These data are available for 1998, 2001, 2002, and 2004–2017. Extensive data retrieval support for IRS income data was provided by Mercatus Center MA Fellow Austin Fairbanks.
- Average income for MSAs[53] from US Bureau of Economic Analysis, US Department of Commerce, "Table CAINC1. Personal Income Summary: Personal Income, Population, Per Capita Personal Income," (dataset), accessed October 25, 2021, https://apps.bea.gov/iTable/index_regional.cfm.
- Population for MSAs from US Bureau of Economic Analysis, US Department of Commerce, "Table CAINC1. Personal Income Summary: Personal Income, Population, Per Capita Personal Income," (dataset), accessed October 25, 2021, https://apps.bea.gov/iTable/index_regional.cfm.
- Permits issued nationally and for each MSA from US Census Bureau, "Building Permits Survey," accessed February 2023, https://www.census.gov/construction/bps/.
- Household size estimates from US Census Bureau, "Table HH-6. Average Population per Household and Family: 1940 to Present," (dataset),

53. I used the BEA estimates for MSA level analysis rather than aggregating the ZIP code data to avoid compositional issues associated with ZIP-code-level data availability that might reduce the cross-sectional reliability at the MSA level. Conceptually, estimates using either source should produce similar results.

accessed April 10, 2023, https://www.census.gov/data/tables/time-series/demo/families/households.html.

- Average household size from 1995 to 2019 ranged from about 2.65 to 2.52 persons. In the estimates in this paper, I used 2.6 persons. Other factors might call for a larger or smaller estimate when estimating cyclically neutral housing starts in more detailed analysis. For instance, one might use a smaller estimate because the housing stock generally includes more than 10 percent vacant units of several types, which should scale with occupied units in a cyclically neutral market. One might use a larger estimate because there are other types of housing units (e.g., manufactured homes), not captured in the housing starts data, that provide shelter for a small portion of new families.
- Inflation adjustments from US Bureau of Economic Analysis, "Gross Domestic Product: Implicit Price Deflator" (dataset), accessed February 15, 2023, https://fred.stlouisfed.org/series/GDPDEF.

Additional Figures

Figure 22 is an extension of figure 2 that differs from figure 2 in the following ways:

- Total production in this figure is a combination of both manufactured homes shipped and site-built units started.
- This figure covers the period 1966 to 2021.
- Instead of a fixed household size, the number of homes required for population growth is based on the household size of each given year.
- This figure includes a measure of vacant units for sale or rent, so that in addition to the added perspective of more time, vacancies provide a scalar perspective. (Note: some of the increase in vacancies in the late 1980s is due to a change in measurement.)

Figure 23 includes versions of figure 5 for selected MSAs.

FIGURE 22. HOUSING PRODUCTION, 1966–2021

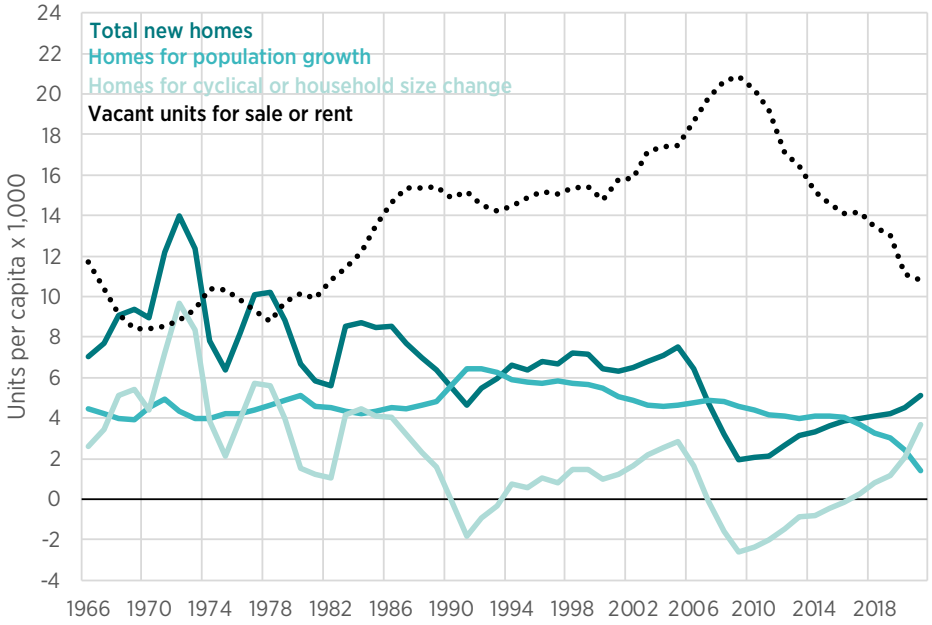


FIGURE 23. TOTAL PERMITS, CYCLICALLY ADJUSTED PERMITS, AND POPULATION GROWTH IN SELECTED MSAs

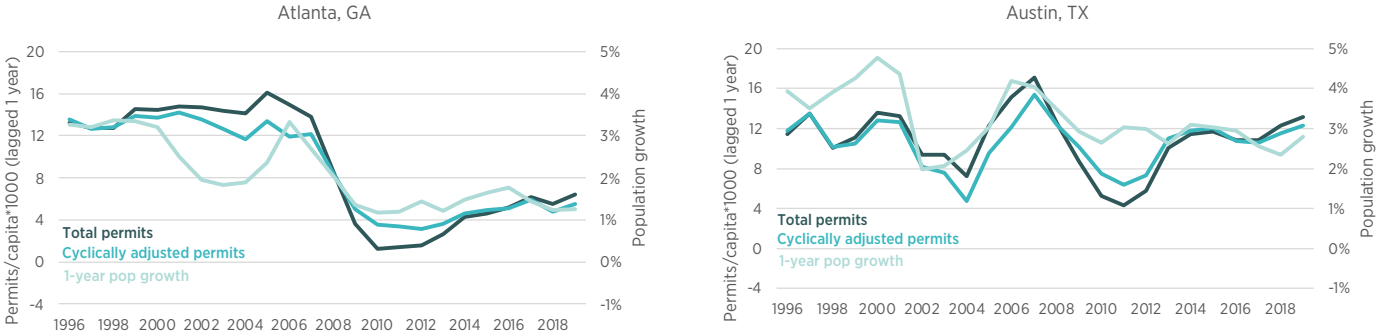


FIGURE 23. TOTAL PERMITS, CYCLICALLY ADJUSTED PERMITS, AND POPULATION GROWTH IN SELECTED MSAs (CONTINUED)

FIGURE 23. TOTAL PERMITS, CYCLICALLY ADJUSTED PERMITS, AND POPULATION GROWTH IN SELECTED MSAs (CONTINUED)

FIGURE 23. TOTAL PERMITS, CYCLICALLY ADJUSTED PERMITS, AND POPULATION GROWTH IN SELECTED MSAs (CONTINUED)

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Kevin Erdmann is a senior affiliated scholar at the Mercatus Center at George Mason University. He has engaged in research with Mercatus about housing finance, land use restrictions, and monetary policy. His first book, *Shut Out: How a Housing Shortage Caused the Great Recession and Crippled Our Economy* (Rowman & Littlefield, 2019), offers a contrarian theory on the causes of the housing boom and bust and details a number of ways in which obstacles to housing supply affect the American economy. Reviews of *Shut Out* have appeared in the *Economic Record*, *Regulation*, and the *Washington Examiner*. His second book, *Building from the Ground Up: Reclaiming the American Housing Boom*, reconsiders the policy decisions that led to the Great Recession and brought the housing market to the condition it is in today. Erdmann's work has appeared in the *Wall Street Journal*, *Barron's*, *National Review*, *USA Today*, and *Politico*, and it has been featured on C-SPAN. Erdmann was a small business owner for 17 years and holds a master's degree in finance from the University of Arizona.

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