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I. Introduction

Real, constant-quality house prices for the nation are 15 percent above their pre-Global Financial (GFC) crisis peak.[1] Concern about a growing housing affordability crisis has spread far beyond professional economists and beyond the traditionally expensive coastal markets.[2] This paper will document and attempt to understand how changes in the nature of housing supply in America have helped lead to our current situation. We begin by reporting four key facts about the changing nature of American housing markets, primarily by using decennial census and *American Community Survey* (*ACS*) data that runs from 1950-2023.

The most important fact is that the intensity of housing production has declined substantially over the last half century or so. As Figure 1 in the next section shows, the 1950s and 1960s were a golden age of new construction, with extremely high rates of housing unit production in any market with growing demand for housing (which was virtually the entire country in those decades). Starting from a base of 36 million housing units in 1950, the national stock increased by 50 million homes over the next three decades to 1980. Housing unit growth rates then dropped by more than one third between the 1970s and the next two decades. In the 1980s and 1990s, the growth rate of housing was barely half the rates seen in the 1950s and 1960s. The first decade of the new century saw slightly less growth followed by significantly lower housing unit production in the 2010s. The most recent data indicate some recovery in housing production, but building levels remain far below their post-war heyday. Standard economic logic suggests that the combination of rising prices and slowing growth in production means that a tepid supply side plays an important role in explaining today's high prices.

These national changes mask important heterogeneity across six metropolitan area housing markets that will be a particular focus of this paper: Atlanta, Dallas, Detroit, Los Angeles, Miami and Phoenix.[3] Figure 2 below shows the differences across these markets in the rate of increase in new supply from 1950s through the 2010s and up to 2023. From the immediate postwar period to the 1970s, there was enormous heterogeneity in the rates of production, driven partially by the robust demand for sunbelt housing in the then relatively less populous markets of Atlanta, Dallas, Miami and Phoenix. The 1980s saw the beginnings of a convergence in these rates, and by the 2010s, all these six markets had similarly low rates of housing supply growth.

Twenty years ago (Glaeser and Gyourko, 2005), the prominent heterogeneity in U.S. housing supply was between extremely high rates of housing production in Sunbelt markets and extremely low rates of housing production in America's large coastal markets (e.g., Boston, New York City, Los Angeles and San Francisco), as well as in markets in apparently long-term decline from deindustrialization (e.g., Cleveland, Detroit). By the 2010s, building levels in key Sunbelt

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[1] See Data Appendix Figure 1 and the discussion later in the paper for more detail.

[2] Just one of many possible examples in the general press is a recent *Wall Street Journal* article and podcast that investigated the rising cost of ownership in Chapel Hill, NC, just over the last 14 years. The article may be accessed here: https://www.wsj.com/podcasts/your-money-matters/how-one-house-in-north-carolina-shows-the-growing-cost-home-ownership/26ad7ea0-c128-48a0-ac10-c6a414df3a0e?page=1 .

[3] Atlanta, Dallas, Miami and Phoenix are four of the ten largest metropolitan areas that have experienced particularly rapid growth. Houston was excluded because of a desire to spread across states. We included Los Angeles because it represents an earlier generation of sunbelt growth explosion and Detroit because it represents industrial decline.

markets such as Miami (FL) and Phoenix did not look much different from historically supply-constrained markets such as Los Angeles or even markets in secular economic decline such as Detroit. The limited data since the 2020 census do not suggest this situation is changing in a material way.

The decline in housing unit production intensity can help explain why housing prices are now so high. An important recent paper by Baum-Snow and Han (2024) estimates highly inelastic supply sides for many very local housing markets in urban areas across the country. This clearly is consistent with a slow rate of supply increase. Orlando and Redfearn (2024) posits that the nature of supply could be changing in previously elastically-supplied metropolitan areas such as Houston in ways that would lead to higher prices in equilibrium. More broadly, Baum-Snow (2023) highlights how housing supply constrains urban growth from the neighborhood level up.[4] Baum-Snow and Duranton's (2025) recent review also explores the link between changing supply conditions and housing affordability.

In the second part of our paper, we shift to estimating supply curves within metropolitan areas to understand the changes, especially in the sunbelt markets that had once been housing supply superstars. In Section III, we present a simple model of housing supply and demand. One central theme of that model is that over periods of twenty years of more, it is almost impossible to imagine a variable that would shift demand and not shift supply as well, because any variable that shifts demand for a location also will shift who lives in the area and residents then determine the permitting environment.[5] Two core implications of our framework are that when supply limitations become more important, the positive correlation between price and construction will diminish and the negative correlation between price and density will move towards zero or even flip sign.

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

[4] Baum-Snow (2023) also makes the important point that there can be benefits, not just costs, to such constraints. Gyourko and McCulloch (2024) provide a recent estimate of the benefits to incumbent residents of restricting density. We do not provide a full welfare analysis of this situation in this paper. Rather, our focus is on documenting key stylized facts about the state of different American housing markets' supply sides, and investigating how they appear to have changed over time.

[5] Baum-Snow and Han (2024) rely on shorter term shocks to demand that come from shifts in local labor demand, which seems quite plausible to us because their period of analysis (four years) seems too short to change the permitting process. However, if the same instrument is used over twenty years, an increasingly prosperous population might put more effort into opposing local building projects.

housing construction, since expensive areas are likely to have the biggest gap between how much consumers value housing units and how much housing costs to build.

We first focus on our six core metropolitan areas, and we follow the results of four different estimation strategies: ordinary least squares, instrumenting with lagged price, instrumenting with geography, and instrumenting with both geography and lagged price. As implied by the discussion above, none of these approaches will solve the problem that unobserved factors which influence demand are correlated with unobserved factors that reduce supply. Consequently, while they will not estimate the actual parametric supply curve, the instrumentation strategies help reduce the direct feedback from construction to price.

The declining relationship between house price and new construction is the dominant fact shown by this analysis. In the overwhelming number of America's largest metropolitan areas, the tract-level correlation between price and housing growth was lower over the 2000 to 2020 period than it had been during the 1970 to 1990 period. Housing construction used to supply high demand areas within metropolitan areas, but that is much less true more recently than in the past. This complements the well-documented fact that, across metropolitan areas, places that build a lot aren't expensive and places that are expensive don't build a lot (Glaeser and Gyourko, 2018).

Where did the empirical housing supply curve flatten most sharply? Variables that are typically thought to correlate with land use regulation reliably predict the shift. The Wharton Residential Land Use Regulatory Index (WRLURI) is reliably correlated with the downward shift. The lagged overall growth in the housing stock in the market is associated with a smaller and less precisely estimated shift. The share of educated workers in the metropolitan area, which is also thought to be one factor that drives land use regulation, is also correlated with the change.

We find that the estimated relationship between density and the growth of housing was initially negative, but became closer to zero over time, which is also compatible with changing supply conditions gaining importance. The shift is weaker for single family housing, and stronger when multi-family units are included in our outcome measures. While more work remains to be done on this issue, the evidence thus far does not suggest that housing supply growth is slowing primarily because particular neighborhoods have become "built out."

When we look at the link between density and the growth in overall housing, there are many more positive relationships, especially during the 2000 to 2020 time period. A natural interpretation of a positive link between density and overall housing growth is that permitting multifamily housing projects is easier in some places than in others. Areas that have density may also have the ability to add more density, perhaps because they have been zoned for multifamily housing. This fact again pushes back on the idea that a lack of land is responsible for the slowdown in America's housing growth.

We also look at interactions between density and price in our six core areas. In the 1970s and 1980s, the sunbelt areas typically built in more expensive, lower density areas. However, that pattern changed over time. Growth became increasingly important in higher density, higher price areas. In Miami and Los Angeles, growth also became concentrated in higher density, lower price areas, probably because it was easier to build high density, multifamily projects in those areas. Again, this work suggests that building has become far more difficult in the higher value parts of sunbelt metropolises, even or especially when those areas have relatively low density levels.

In sum, this paper documents the decline in the rate of new housing production in major metropolitan areas, and fundamental shifts in the empirical housing supply curve. America once responded to demand by delivering more density, but it does no longer. This suggests that not only is America failing to deliver housing in its most production metropolitan areas (Hsieh and Moretti, 2019; Duranton and Puga, 2023), but we are also failing to deliver housing in our most desirable neighborhoods.

The plan of paper is as follows. The next section documents key facts about the current state of American housing markets, especially how they have changed over time. This is followed in Section III with a model that outlines our framework for understanding changes in housing supply. Section IV then outlines our empirical strategy and presents and discusses key results for a select set of markets. The analysis is expanded to a much broader set of markets in Section V, with Section VI concluding the paper.

II. The State of the American Housing Market

Economists have long identified rising prices and declining quantities as evidence of an upward shift or tilt of the supply curve. In this section, we document three facts that suggest that American housing supply has changed. First, housing production has declined dramatically in the U.S. over the last 50 years, and it has been particularly anemic since the Global Financial Crisis (GFC). Moreover, density levels are no longer increasing in many suburban areas. Importantly, these phenomena started long before Covid.

Second, America's housing prices have continued to rise, both in absolute levels and relative to income and production costs. There are increasingly large swaths of previously affordable sunbelt housing markets such as Phoenix and Miami, where it has become far costlier to buy than to build a home, which can imply that housing supply has been artificially restricted (Glaeser, Gyourko and Saks, 2005; Glaeser and Gyourko, 2018).

Third, the construction industry has been transformed, again especially since the Global Financial Crisis. There were 200,000 fewer residential construction workers in 2022 than in 2006 and 100,000 more people remodel homes. Real construction costs have risen by about 35 percent per home since 2000, and the number of firms and employees in the construction industry has declined substantially since the global financial crisis.

Collectively, these facts suggest that a downward shift in the supply of housing has led housing in the U.S. to become increasingly unaffordable. We now turn to a description of the underlying data used in this analysis.

Data Sources

We begin with decennial census data from 1950-2020 and the 5-year ACS sample from 2023, which were downloaded from the IPUMs NHGIS files (https://www.nhgis.org/). We also work with national aggregate data, county-level data, and census-level tract data, which enables us to observe prices, housing quantities and various demographics at different spatial levels over many decades.

The Longitudinal Tract Database (LTDB; Logan, *et. al.* (2014)), based on spatial weighting methods used in Lee and Lin (2017), provides one excellent panel of tracts. Unfortunately, this widely-used data base is problematic given our focus on growth in the number of housing units because the tracts are defined in 2010 based on population. If tracts are defined so that they have reached a fixed number of units in 2010, then mechanically, less populated places are likely to appear to have experienced high growth in the data.[6] This is not an issue for many of the largely cross sectional analyses using the LTDB (e.g., on segregation), but generates a potentially endogenous outcome for us.

Consequently, we construct a 1970-constant census tract database that harmonizes tract boundaries to ensure a geographically consistent measure of key economic variables across the United States over each decade from 1970-2020 and from 2020-2023. Because tract definitions can change each decade, our 'reverse LTDB' aligns historical tract definitions (1970) with source-year tract geometries from subsequent decades (e.g., 1980, 1990, … 2020) using spatial operations and area weighting. The resulting crosswalk enables consistent comparisons of demographic and economic data over time, even when tract boundaries have changed. Our *Technical Documentation Memo*, which is posted as an appendix to this paper, details variable creation at all data levels, and is distinct from our *Data Appendix*.

The reverse LTDB provides three key advantages. One is that by working forward through time, we face no endogenous growth problems. A second is consistent geography over time, which implies a more consistent measure of density.[7] Third, we can account for large additions or

[6] Consider a tract which has a high density area with 2,000 units and a low density area with 0 units in 1990. Presume that the high density area population doubles in 20 years and the low density area sees its population stay the same. When the tract is split, the low density area is grouped with half of the high density area. The result is two tracts: one with high density that did actually grow, but the data indicates it did not; the other tract is lower density that did not actually grow per this example, but the data indicates that it did. This example illustrates how the data series could incorrectly assign growth to non-dense areas, and stagnant growth in dense areas.

[7] For example, we compare and contrast how the tract-level distribution of density changes over time in our *Technical Documentation Memo* using the Phoenix CBSA as an example. Using our 1970-based tract data, we show in Figure 3 below that there is a significant rise in density of about 1.5 units per acre for the median tract between 1970 and 2010, but density stopped growing in the 2010s. Using the LTDB finds that measured density remains extremely low through 1980, with the median tract having close to no housing in 1970. This level and time pattern is driven by the use of 2010 tract definitions. Because Phoenix's population exploded over the last half century, many physically small tracts were created by 2010. These tiny geographies are both plentiful in number and close to empty of housing until recent decades. For this and the other reasons noted just above and below in the text, we prefer to work with our 'reverse LTDB' file, but acknowledge that the benefits these data bring are not without some cost.

losses in units for specific tracts, as well as mean reversion over time in our data, but not always in the LTDB. Typically, these outliers are explained by some major change, often involving infrastructure, in or around the relevant tract that then endogenously changes local amenities. Our *Technical Documentation Memo* goes through a number of examples.

The reverse LTDB has two major disadvantages. Starting in 1970 reduces the effective sample size because the number of tracts is lower in 1970 than in 2010. This reduces the precision of some of the regressions run in the latter part of this paper. The reverse LTBD also covers less of growing metropolitan areas because our 1970-based sample of tracts does not cover the entire market today. Our Technical Documentation Memo includes a CBSA Coverage table that reports the tract count in our data and in the LTDB, as well as the share of the population covered by our tract boundaries. In Charlotte, for example, our 1970 tracts always capture at least 96 percent of the CBSA population in every decade from 1970-2020. In Austin, TX, however, we sometimes only capture 55 percent of the area population. This limitation leads us not to include markets such as Austin in our analysis. Nashville, TN, is another recently growing market that is excluded from our sample.

The Decline in the Intensity of Housing Production

Figure 1 documents the change in housing supply for the U.S. as a whole. The green bars show the total housing stock in the United States in decennial census years from 1950-2020 and for 2023. The blue line reports the average annual rate of change in the total stock over each time period, with the labels for the housing stock on the left side and bottom of the figure. The red line depicts the analogous data for owned units and shows much the same pattern, indicating that the aggregate change is not due to something specific to a particular type of housing unit.

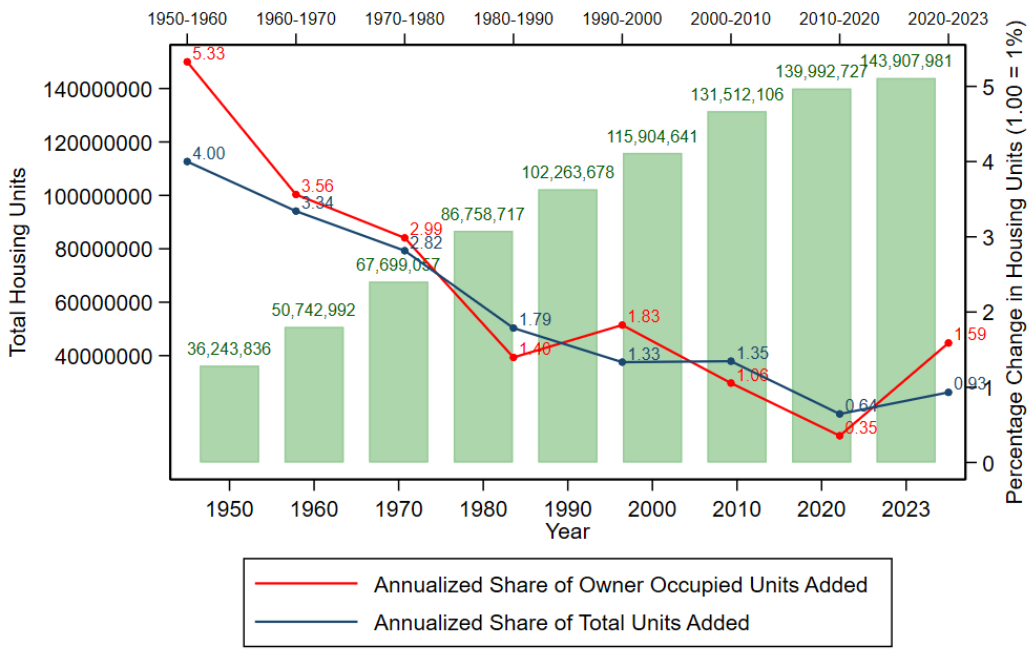
The overall housing stock increased from 36 million units in 1950 to 144 million units in 2023. Somewhat amazingly, America built more than 50 million homes from 1950 to 1980.[8] In the 1950s, the housing stock grew at four percent per year. That rate declined every decade until the

[8] As described in the notes to the table, the 1950 and 1960 housing stock numbers are constructed using the count of homes built before 1950 and 1960, respectively, from 1970 census county-level data. We do this for three reasons. First, most metropolitan areas were not close to having their current number of tracts by 1950 or 1960. Thus, when we aggregate to the CBSA level using tract data, we undercount the number of homes in 1950 and 1960, resulting in a potentially large overestimate in the units added from 1960-1970 especially. Secondly, many of the markets we are interested in, such as Tampa and Phoenix have no tract-level data in 1950. Finally, we have access to county data from 1970 onwards that has full coverage for the entire country, allowing us to consistently construct a market's housing stock. Thus, to match our 1970-onwards sample of counties, and to alleviate the other two shortcomings of aggregating tract data, we use the 'year-built' variable in the 1970 county-level census to identify the stock of homes built before 1950 and 1960 to construct county-level estimates for the entire country. From this, we aggregate to the CBSA level, and obtain market-level housing stocks consistently measured over time. That said, there is a downside to this decision—namely, some homes built before 1950 or 1960 may have been removed from the housing stock before the 1970 census. If we believe that homes roughly depreciate at the same rate across the country, our method consistently undercounts the 1950 and 1960 stock. However, we believe that the added benefit of full coverage, and consistent spatial measurement of a market's stock by using the county-level data is worth this cost. In addition, we conclude that this error is relatively small and can be signed. See our Technical Documentation Memo those details.

2000s, when it flattened out. The construction rate then dropped again the 2010's when the average annual rate of growth in the stocks was a particularly anemic 0.64 percent per year.

The absolute level of production has also declined. We built almost 17 million units in the 1960s and 19 million units in the 1970s. The era of Nixon, Ford and Carter was the high-water mark for the home building industry. In the 2010s, we added fewer than 8.5 million units to the housing stock.[9]

Figure 1: The American Housing Stock and Its Growth, 1950-2023



Note: Housing stock numbers for 1950 and 1960 are constructed using the count of homes built before 1950 and 1960, respectively, in the 1970 census. All others are from the decennial censuses (1970-2020) or built up from county level data from the 2019-2023 5-Year ACS estimates. See the discussion above in the data description subsection for more on these choices.

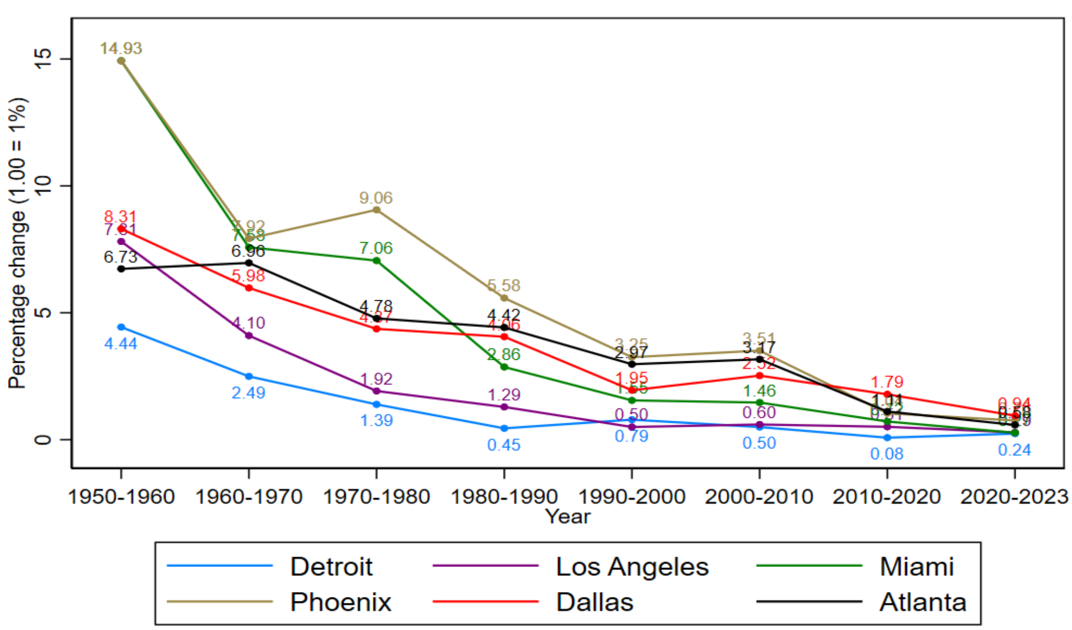
Figure 2 shows that the decline in building rates has occurred across a wide swath of metropolitan areas as represented by our six focal markets: Atlanta, Dallas, Detroit, Los Angeles, Miami and Phoenix. As suggested above, this sextet is meant to capture three different parts of America. Detroit is the quintessential rustbelt metropolis, with a central city that has been declining for decades. Los Angeles represents coastal America, with high prices and high levels of housing regulation. Atlanta, Dallas, Miami and Phoenix are four of the high-fliers of population growth over the last 50 years. They have been places where it was historically relatively easy to build and where prices have historically remained affordable by conventional metrics. We are particularly interested in whether their permissive building environment remains.

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

Throughout the nearly three-quarter century time period we cover, Detroit and Los Angeles have remained at the bottom of the pack in terms of net housing unit production, but even so, their growth was impressive during the early decades. In the 1950s, the housing stock of Los Angeles increased by 7.5 percent per year and the housing stock of Detroit rose by 4.4 percent per year. The city of Detroit's population crested in 1950, but the metropolitan area still experienced massive suburban growth during that decade. But since the 1960s, both areas have experienced far more modest housing growth. In three of the four decades between 1980 and 2020, Detroit's average annual growth rate has been 0.5 percent or less and Los Angeles' average annual growth rate has been 0.6 percent or less. Of course, as our data on housing prices will show, Detroit's weak growth represents limited demand, while Los Angeles' low growth reflects limited supply.

The other four markets from the Sunbelt experienced extraordinary growth through the 1980s, and robust growth through the 2000s. Nevertheless, these areas do differ. Dallas soars in the 1950s, and then its growth declines persistently over time. Miami's growth is also fastest during the 1950s and it then exhibits a long decline. Atlanta's peak growth is in the 1950s and 1960s, and then weakens thereafter, especially from the 1980s onward. Phoenix grows most quickly in the 1970s. Yet, even in the first decade of the 2000s, Atlanta, Dallas and Phoenix all managed annual growth rates over 2.5 percent. In the 2010s, growth of the housing stocks of Atlanta, Miami and Phoenix are all less than 1.2 percent per year. There has been a great convergence in housing production across these six cities.[10]

Figure 2: Growth of Housing Units in Six Metropolitan Areas, 1950-2023



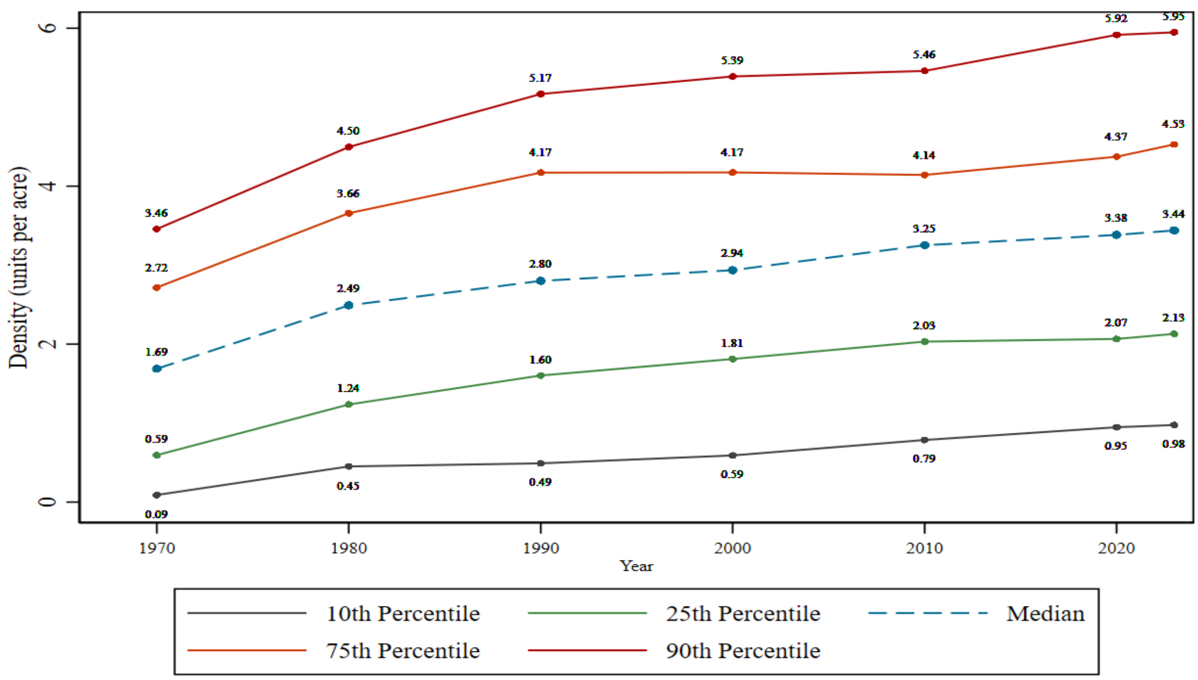
Note: The value for 2020-2023 is the average percentage change over three years. For the years 1950 and 1960, we construct CBSA-level aggregates from 1970's county-level census data on the number of homes built before 1950 and 1960. For each decade in 1970-2000, we construct CBSA-level aggregates from county-level census data from that year. In 2010, 2020 and 2023 we use 2006-2010, 2016-2020 and 2019-2023 5-year ACS county-level estimates to aggregate up to CBSA-level.

[10] Appendix Table 2 reports the analogous data for the 24 CBSAs tracked below in Table 1. We provide summary statistics for various economic indicators of these markets that are discussed or analyzed throughout the paper.

We now turn to two aspects of housing growth: densification and ex-urbanization. In principle, housing growth could decline because we were packing more housing into a fixed area and that has now stopped. Alternatively, there could have been a decline in the extent of building on the edge of the metropolitan area.

Figure 3 examines densification in Phoenix over time. This graph is based on the census tract data described above based on tracts in existence in 1970, with density defined as housing units per acre. The dotted, central line in blue shows median tract level density which increases from 1.69 units per acre in 1970 to 3.25 units per acre in 2010. Between 2010 and 2020, median density only rose by 0.13 units per acre; densification has significantly decreased. The density of the 75th percentile tract remained steady from 1990-2020, and the density of the 90th percentile tract was steady between 2000 and 2010, but it has increased since then. Among lower density tracts, the 25th percentile tract has been pretty steady since 2010. There is ongoing densification for the 10th percentile tract, but density remains quite low at this part of the distribution. Except for the densest tracts, these data are consistent with a density "wall", after which Phoenix tracts stop building, either because of regulation or limited demand.

Figure 3: The Distribution of Housing Density Over Time in the Phoenix Metro Area



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

Table 1 provides a more systematic look at densification of single unit homes, by distance from the urban core and over time for our six focal markets. Data for a wide range of 18 additional markets is provided in Appendix Table 3. We show the percentage change in the number of single housing units per acre by decade among tracts close to the metro core (within 5 miles of the centroid), in the inner suburbs (within 5-10 miles of the core), and in the outer suburbs (more than 10 miles out).

Growth in single unit density is modest among tracts within 5 miles of the urban core. In the 1970s and 1980s, growth was actually negative in our six focal markets (and in most of the other 18 metropolitan areas covered in Appendix Table 3). Beginning in the 1990s, Atlanta, Dallas, Los Angeles, and Phoenix (but not Miami or Detroit) saw increasing density of these homes.[11] In Atlanta and Dallas, densification remains robust in the region five to ten miles from the city center. In Miami and Phoenix, single family density still grew by 10-20 percent in the 2010s at this middle distance. Los Angeles saw substantial densification in the five to ten mile range in the 2010s, but not in the 2000s. As usual, Detroit is an outlier, with growth of single family structures declining by more than 20 percent in both decades of this century. Beyond ten miles from the city center, there always is growth in single unit density, but it clearly is slowing in 2010s.[12] Densification of this most suburban type of housing has slowed materially in the more outlying tracts across a wide range of metropolitan areas.

Table 1: Decadal Percentage Change in Single Housing Unit Density by Miles from the City Center

CBSA	Miles from Center	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020
Atlanta	0-5	-0.087	-0.000	0.042	0.015	0.071
	5-10	-0.074	0.113	0.158	0.044	0.089
	10 Plus	0.526	0.991	0.501	0.204	0.044
Dallas	0-5	-0.023	-0.045	0.088	0.015	0.077
	5-10	0.090	0.041	0.051	0.003	0.123
	10 Plus	0.406	0.480	0.408	0.298	0.152
Miami	0-5	-0.176	0.054	0.107	-0.048	-0.078
	5-10	-0.098	0.065	0.112	-0.031	-0.032
	10 Plus	0.059	0.172	0.352	0.356	0.047
Phoenix	0-5	-0.034	-0.079	0.089	-0.099	0.127
	5-10	0.587	0.039	0.186	0.047	0.017
	10 Plus	1.180	1.270	0.780	0.275	0.133
Los Angeles	0-5	-0.005	-0.165	0.046	0.094	0.028
	5-10	-0.007	-0.016	0.036	-0.019	0.018
	10 Plus	0.178	0.125	0.147	0.004	-0.008
Detroit	0-5	-0.207	-0.264	0.026	-0.196	-0.024
	5-10	-0.047	-0.130	-0.008	-0.165	-0.130
	10 Plus	0.286	0.084	0.182	0.029	0.009

Note: Single family unit density in each distance-to-center ring is calculated by adding all single-unit housing in each distance bin, and dividing by the total acreage of the tracts in that distance bin. A tract is considered within a distance to center bin if its centroid is in that distance bin. Using these decadal density measures, we compute the decadal percentage change for a distance to center bin within a CBSA, which are reported in the table.

[11] Miami has been adding multifamily units in these tracts.
[12] This pattern holds for the other markets tracked in Appendix Table 3, with the exception of the two Mountain regional markets of Denver and Salt Lake City.

This suggests what we call "the density wall hypothesis" raises the possibility that America has stopped growing because we have reached some sort of maximum density limit, at least for single-family type units. In the next section, we will estimate the link between density and housing production, especially for single-family housing. A primary alternative hypothesis is that building just got more difficult everywhere that there was any significant level of density.

Finally, lowering production intensity clearly need not signal anything wrong with a market. Housing is a durable good, and it is possible that what we observe is the 'right' amount of new supply given prices, costs and demographics such as a falling birth rate or lower net in-migration rate. Only prices can help us determine whether the decline in housing production represents a shift in supply or demand. We next turn to that issue.

The Rise in Housing Prices

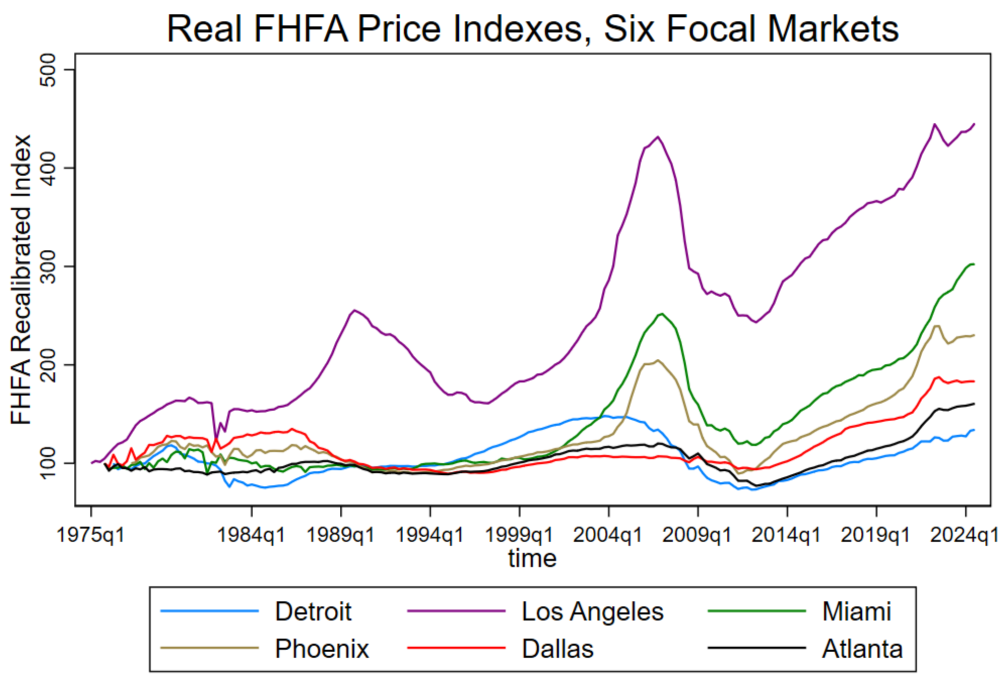
Housing price changes are typically measured with repeat sales indices which are based on the changing sale price for the same home over time. The two most common indices are the Federal Housing Finance Agency (FHFA) and the Case-Shiller Index. These indices are available both at the national level and for particular metropolitan areas. We focus on the same six metropolitan areas that were emphasized previously. We use 1975 as the base year, so all indices equal 100 at that point. In subsequent years, we correct for inflation.

Before turning to the local market data, we discuss that aggregate trends shown in Appendix Figure 1. That plot documents a total of four booms and three busts. The booms and busts have grown larger over time and both indices show a steady rise in national prices. Both trends could reflect increasing limitations on housing supply. Our past work (Glaeser, Gyourko, and Saiz, 2008, Glaeser and Gyourko, 2018) documents that places facing greater housing constraints also experience more extreme housing booms and busts. In 2024, the country appears to be at the crest of the fourth boom, but while such booms have historically been followed by price drops, the decline in building means that new construction now plays less of a role in pushing prices downward.

Figure 4 then shows the price trends for the same six cities depicted in Figure 2, using only the FHFA series for simplicity. While all six indices begin at 100, Los Angeles towers over all the other indices for almost all of the years. Strikingly, five of the six indices remain close to each other and close to 100 for most of the years between 1975 and 1998. The Detroit index is actually significantly below its 1975 value for much of the 1980s, which is compatible with the fact that Detroit built much less than the other cities. The other four cities had prices that remained close to 1975-level real prices, which is compatible with the hypothesis that land was inexpensive, regulations were light, and prices were fundamentally determined by construction costs.

Yet, after 1998 and especially after 2010, a great divergence in prices ensued. Detroit's prices rose to about 140 percent of their levels in 1975 in the years before the global financial crisis, which was larger than the very modest price increases experienced in Atlanta and Dallas. Prices in Phoenix soared to double their level in 1975. In 2005, housing in Miami cost 2.5 times as much as it had in 1975. But, then prices in those cities collapsed. Los Angeles' prices fell, too, but even after the correction, they were three times higher in real terms compared to 1975.

Figure 4: FHFA Repeat Sales Price Indices, Select Markets 1975-2024(3)



Through 2024q3. 1975q1 = 100.

Nationally, housing prices are now 15 percent higher in real terms than they were at their previous peak in 2006, and the gulf between cities has become enormous. In real terms, prices in Los Angeles are now four times their level in 1975, and prices in Miami are three times what they were fifty years ago. Phoenix has also become far more expensive, with prices running 2.5 times higher than their 1975 values. While Atlanta and Dallas did not experience major price booms in 2005, their prices have increased significantly since 2010 and they are now 61 percent and 83 percent more expensive, respectively, than they were in 1975. Only Detroit has remained permanently affordable.

Starkly rising prices in so many markets is incompatible with the view that the decline in new construction is driven by a lack of housing demand. Basic economics implies that sharply rising prices and declines in supply can only indicate a shift in supply. This supply shift could reflect regulation, but it could also represent increased production costs in the building industry (as in Goolsbee and Syverson, 2022) or running out of developable land.

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

Before getting to that material, we first document rental costs in different markets. Molloy, Nathanson and Paciorek (2022) correctly note that housing services can be rented in any market, and rents need not move commensurately with house prices. Those authors document that rents often are not rising much in the most high-priced American housing markets; rather, the price-to-rent ratios in those places are rising. Our data is consistent with their argument, especially in coastal markets. Data Appendix Figure 3 plots sharply rising mean and median tract-level, price-to-rent ratios in the Los Angeles CBSA since 1970, with those multiples increasing from about 15 in 1970 to above 30 by 2010. Real rents are rising for the mean and median tracts in that market, but not nearly as much as prices. Hence, very high house prices in Los Angeles may overstate the severity of the affordability problem. Price-to-rent ratios are rising in the Sunbelt markets, too, but by less. For example, the mean tract ratio in the Atlanta market increases from about 14 in 1970 to just over 20 in 2023. Miami and Phoenix experience similar changes. Dallas's change is more moderate. Among our focal markets, only Detroit's typical tract-level price-to-rent ratio has not risen since 1970.[13] Outside of Detroit, real rents have been rising, not just house price. Hence, basic housing services, not just its capital cost, are increasing somewhat in these markets, too.

In the top panel of Table 2, we show how the price-to-income levels for tracts across the entire United States have changed since 1970. In 1970, 90 percent of all tracts had a price-to-income ratio of no more than 3. Mortgage rates were about 4 percent in 1950, which means that a household bought a house that cost three times its income or less with no downpayment. This further implies that they would be spending less than a fifth of their income to repay that mortgage over 30 years. Seventy-five percent of tracts had price-to-income levels that were no more than 2.35 times their income levels. This is only modestly higher than the price-to-income ratio of 1.77 in 1960 for the median tract.

Over the next thirty years, the median price-to-income ratio rose, but its nearly doubling would only take it to 3.31, which is only 10 percent higher than the 90th percentile of the distribution in 1970. This suggests that the typical American household should have found housing in its neighborhood to be reasonably affordable in 2000. A household that bought a house without a downpayment that was 3.31 times its annual income would have been spending roughly one-quarter of its earnings to pay down a thirty-year mortgage with no downpayment. The price-to-income ratio at the median increased sharply to 5.36 by 2010, but as mortgage rates had fallen to five percent, the share of earnings needed to pay back a 30-year, no downpayment mortgage only rose to 30 percent. By 2020, the median price-to-income ratio tract had fallen to 4.71 before rising again to 5.03 in 2023.

[13] Results for these other markets are in Figures 4-8 in the Data Appendix.

Table 2: Distribution of Tract Level Price-to-Income Ratios by Decade
National, Los Angeles and Phoenix

CBSA	Year	10th	25th	50th	75th	90th
National	1970	1.06	1.36	1.77	2.35	3.00
	1980	1.28	1.99	2.92	3.92	5.61
	1990	1.45	2.29	3.64	5.19	7.45
	2000	1.54	2.27	3.31	4.61	6.96
	2010	2.04	3.43	5.36	7.48	10.13
	2020	1.73	2.90	4.71	7.00	9.86
	2023	2.08	3.22	5.03	7.24	10.08
Los Angeles	1970	1.35	1.56	1.87	2.49	3.53
	1980	2.67	3.33	4.26	5.78	7.83
	1990	3.28	4.21	5.46	7.55	10.79
	2000	2.90	3.31	4.03	5.83	8.84
	2010	5.39	6.27	7.64	10.07	13.50
	2020	5.04	5.82	7.32	9.76	14.24
	2023	5.61	6.36	7.83	10.48	15.37
Phoenix	1970	0.87	1.36	1.61	2.23	2.97
	1980	1.40	2.28	3.02	3.76	5.03
	1990	1.55	2.01	2.49	3.16	4.01
	2000	1.60	1.94	2.43	3.32	4.57
	2010	2.45	3.15	4.00	5.39	7.87
	2020	2.25	2.73	3.68	5.13	7.25
	2023	2.96	3.36	4.37	6.02	7.77

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

Between 1970 and 1990, the 90th percentile price-to-income level increased from 3.0 to 7.5. At the ten percent interest rates that were prevalent in 1990, a household that bought a home that cost 7.5 times its earnings and put no money down would have spent 83 percent of their earnings just to pay back the mortgage. Of course, the many residents of these neighborhoods who had bought their homes years earlier were paying far less than that amount. A second jump for the 90th percentile tract occurred between 2000 and 2010 (despite the housing crash) and since 2010, the 90th percentile ratio has hovered around 10. The 75th percentile tract has also increased, experiencing a sharp jump between 2000 and 2010.

Many of the highest price-to-income tracts are in coastal California and the middle panel of Table 2 reports the data for Los Angeles. The 90th percentile price-to-income ratio increases from a low of 3.53 in 1970 to its current level above 15. It has been above 13 since 2010. The bottom panel of Table 2 reports the analogous data for Phoenix. The 90th percentile tract ranged between 4 and 5 from 1980-2000, but then jumped to over 7 in 2010 and thereafter. While the median price-to-income ratio in Phoenix remains around four, which is modestly below the national average, there are parts of Phoenix where prices are much higher relative to incomes. This fact supports the view that supply is meaningfully constrained in the most attractive parts of Phoenix, which enables prices to remain significantly above construction costs.[14]

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

The R.S. Means Company (now called Gordian) reports the per square foot construction cost for multiple sizes and qualities of homes. We estimate the cost of a 2,000ft^2 average-quality home in each year. This home represents a good (not high) quality unit that meets all building code regulations in a community. This reference unit is smaller than newly-built homes in most markets, but it is not smaller than most existing homes, which constitute the bulk of the stock that transacts.

There is no variation in R.S. Means construction costs within a metropolitan area housing market. Hence, to obtain a CBSA-level estimate, the R.S. Means CBSA indices are used to deflate or inflate that price over time. By correcting the national average square foot cost by the local market index value (divided by 100 given how their data are reported), we obtain the CBSA-specific square foot cost of construction for a 2,000ft^2 average quality home.[15] This physical construction cost estimate is an input into an estimate of overall production cost, which includes the cost of land (20 percent) and a builder's profit (17 percent on land and structure).[16] We define the Minimum Profitable Production Costs (MPPC) of a home as:

$$MPPC_c = A_c \times 2000 \times \left(\frac{1}{1-Land\ Share}\right) \times 1.17,$$

where A is the square foot cost of providing the 2,000 square foot economy average quality home in CBSA *c*, 2,000 represents the square footage to scale up the per square foot costs on our reference building, Land Share is 20 percent[17], and 1.17 represents a 17 percent profit margin for developers.[18] We then estimate a price-to-minimum profitable production cost ratio using tract-level median prices in the numerator and our estimates of MPPC in the denominator. All

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[14]The analogous data for the broader set of 24 CBSAs covered in appendix tables are reported in Appendix Table 4. Those data confirm that there are various other markets with similar patterns.

[15] The R.S Means Company produces cost estimates for four qualities of home: economy, average, custom and luxury, going from lowest to highest quality. The next subsection estimates costs for different qualities of home.

[16] These numbers follow Glaeser and Gyourko (2018).

[17] This is an assumption we (and others) have used before. It was chosen because land shares in elastically supplied housing markets typically have land share in total home costs of no more than 20 percent. The goal is to have a cost that is associated with a relatively 'free' market.

[18] This is a typical margin noted by homebuilders in a survey we conducted some years ago. It is an average over a full housing cycle. It also is consistent with the 9%-11% internal rates of return that publicly traded homebuilders earn over time. The RS Means construction costs data also include a 15% margin for developers. This means our estimates for MPPC are conservatively large, making our P:MPPC an underestimate of the true value.

variation in this ratio within a metropolitan area is driven by differences in prices in the numerator.[19]

Table 3 then reports the share of tracts in a given housing market with median house price at least 20 percent below our estimate of fundamental production costs, the share between 80 and 120 percent of production costs, and the share of tracts with median price at least 20% more than production costs. The top panel of Table 3 describes how virtually the entire housing stock of Los Angeles became more costly than the production costs of delivering that home. As discussed above, net additions to the housing stock in this market have been relatively small for many decades. Nevertheless, through 1980, most tracts have median house prices below or near our estimate of minimum profitable production costs. However, there is a discrete jump from just under 5 percent to just over 25 percent in the share priced more than 1.2 times MPPC between 1970 and 1980. There was an even starker change between 1980 and 1990. Over 60 percent of tracts in the Los Angeles metropolitan area had prices more than 1.2 times our estimate of fundamental production costs by the end of the 1980s. The 1990s saw relative affordability conditions ease, but this did not last. In the 2000s and 2010 through 2003s, between 75 and 93 percent of all tracts become quite expensive compared to our estimate of production costs.

The middle panel of Table 3 reports the analogous shares for the Miami metropolitan area. The share of expensive tracts was just under 15 percent in 1980, rose to 21 percent by 2000, and then doubled to just over 41 percent in 2023. The bottom panel shows how prices relative to costs have evolved in the Phoenix area. Through 1990, this market looks affordable. Barely 5 percent of its tracts had median housing values that were more than 20 percent more than production costs. Moreover, large shares of tracts had prices that were less than 80 percent of prices, which is compatible with the view that new homes in Phoenix were being sold roughly at cost and old homes sold at a discount relative to that amount. However, there was a tripling of the share of 'expensive' tracts between 1990 and 2010, from 5 percent to 18 percent. This share has since increased to nearly 30 percent in 2023.

The data for these two markets seems to suggest that these markets were elastically supplied through the 1980s or 1990s, but that this was not true in 2010. While both of these metropolitan areas experienced large price drops between 2006 and 2010, there still seem to have been significant pockets of their areas in which prices remained much higher than they had been in 1990.[20]

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

[20] Data Appendix Table 5 reports the analogous shares for the broader set of 24 metropolitan areas covered in the Data Appendix. One can see the extensive heterogeneity in price-to-cost conditions across the country. On one extreme is a market such as Detroit, in which we estimate that more than 60 percent of its tracts have prices that are less than 0.8 times fundamental production costs. Miami is the Sunbelt market with the largest share of tracts priced more than 1.2 times construction costs, but many others in the region show meaningful jumps in the same share since the year 2000.

Table 3: Share of Tracts in P:MPPC Bins - Los Angeles, Miami, and Phoenix

CBSA	P:MPPC Bin	1970	1980	1990	2000	2010	2020	2023
Los Angeles	P:MPPC < 0.8	0.856	0.383	0.085	0.149	0.015	0.019	0.011
	0.8 < P:MPPC < 1.2	0.096	0.361	0.292	0.451	0.096	0.232	0.057
	P:MPPC > 1.2	0.048	0.256	0.624	0.400	0.889	0.749	0.932
Miami	P:MPPC < 0.8	0.899	0.657	0.659	0.531	0.288	0.393	0.183
	0.8 < P:MPPC < 1.2	0.081	0.198	0.161	0.258	0.361	0.300	0.403
	P:MPPC > 1.2	0.020	0.145	0.180	0.210	0.351	0.307	0.413
Phoenix	P:MPPC < 0.8	0.955	0.839	0.825	0.683	0.535	0.588	0.346
	0.8 < P:MPPC < 1.2	0.036	0.106	0.122	0.229	0.287	0.268	0.355
	P:MPPC > 1.2	0.009	0.055	0.052	0.088	0.178	0.145	0.298

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

The Evolution of the Residential Construction Industry

The increasing gap between how much it costs to buy a home and the physical cost of production, even in previously high supply growth sunbelt metropolises, is an important fact about American housing markets in recent times. It is noteworthy that this is occurring even as the physical costs of construction are also rising.

In this section, we also document the reduction in the total employment and total number of establishments in the construction industry. There are two common interpretations of the declining number of establishments. One is that it is increasingly difficult to get a permit to build on attractive land sites, which implies low returns to building. Another is that the temporary disruption in building created by the GFC permanently destroyed firms and that is difficult for firms to reopen once they have closed. We present two pieces of evidence in this draft that relate to these two interpretations. First, we document the rebound in establishments and employment in key Texas metropolitan areas where housing supply remains relatively robust. If Dallas and Houston can reconstitute their home construction sectors in the face of strong demand, it seems likely that markets could do the same—if they so desired. Second, we document a dramatic increase in employment and establishments in the remodeling sector, which suggests that at least some formerly ‘building’ human capital has become ‘remodeling’ human capital. Third, we show that the remaining homebuilders are not earning outsized returns relative to the broader market, which suggests that the number of establishments has remained low because of the difficulty of building in major markets, not because it is extremely difficult to restart homebuilders.

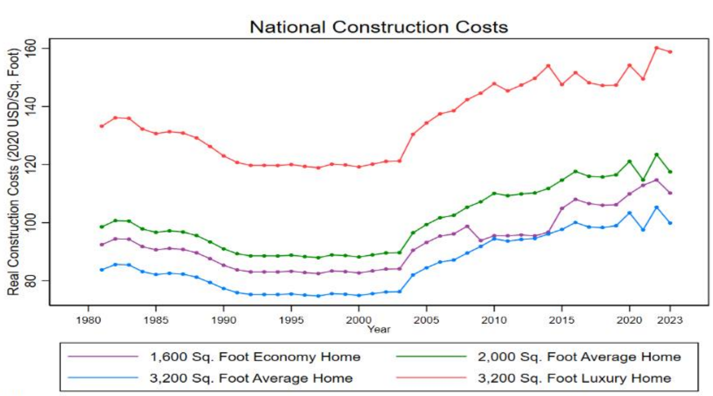
The Changing Physical Cost of Housing Production

Figure 5 shows the national cost changes for four different qualities of homes using the R.S. Means data discussed above: (1) a 1,600ft^2 economy-quality home; (2) a 2,000ft^2 average quality home; (3) a much larger 3,200ft^2 average quality home; and a (4) 3,200ft^2 luxury quality unit. For most of the past 20 years, the average new home size has been closer to 2,500ft^2, but 2,000ft^2 is slightly larger than the average new home in 1980, when our data series begins.

There are a number of noteworthy patterns in these data. One is that larger homes of the same quality have lower physical construction costs per square foot than do smaller homes. This is clear from comparing the level of the 2,000ft^2 average quality home (green line) with that for a 3,200ft^2 home of the same quality (blue line). While there is slight variation in the gap across years, it typically is the case that the cost of the 1,200ft^2 larger home is at least 15 percent lower, so scale does matter. Second, there is not that much difference between the per square foot cost of economy and average quality homes, but luxury quality homes are much more expensive to build. The difference between the 2,000ft^2 average quality home is almost never more than $10 per square foot more costly that the 1,600ft^2 economy quality home. And, that gap includes some scale effect for larger homes being less expensive. However, luxury quality homes are about $40 per square foot more costly to build. Third, regardless of unit quality, real physical construction costs fell slightly from the early 1980s to the early 2000s. They began to rise in 2004, and ultimately increased by about one-third over the ensuring two decades. This is consistent with the analysis of previous research that the residential construction is not very efficient and has become less so in recent years (D'Amico, et. al. (2024); Forster, et. al. (2022); and Goolsbee and Syverson (2023)).

Figure 6 plots the per square foot costs across the six metropolitan areas discussed above. Construction costs are highest in the markets of Detroit and Los Angeles, while costs in the four Sunbelt metros are lower and similar to each other. The R.S. Means data suggest the primary difference is due to labor costs, with the firm presuming that higher cost union labor is used in both Detroit and Los Angeles. The time patterns of costs covary positively and strongly across all markets. Until the mid-2000s, costs are either flat or declining in each market. Their production costs have risen since then.

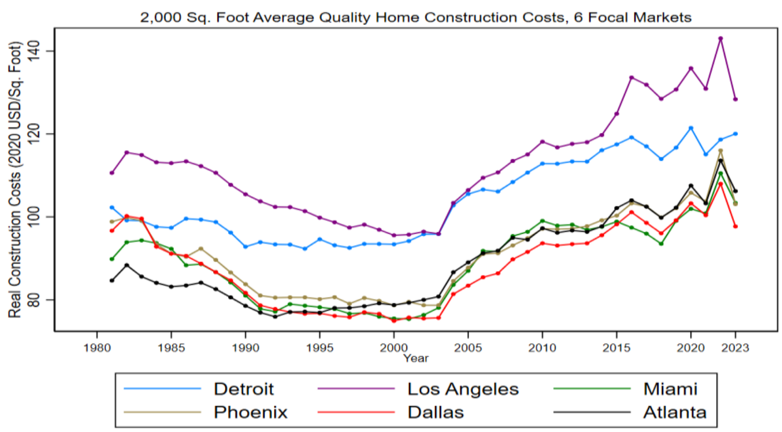
Figure 5: National Real Construction Costs ($2020), Different Quality Homes



Note: The national average square foot costs are taken from the RS Means Construction Cost books. We convert the costs into 2020 real USD values using non-seasonally adjusted all-items CPI for the nation.

Our FHFA repeat sales price index data show that constant quality transactions values rose by 77 percent from 2000 to 2023 (see Appendix Figure 1). As noted above, the real cost of a 2,000 square foot average quality home increased by about 35 percent over the same time period. These two facts suggest that perhaps one-half of the increase in housing costs can be linked to the higher cost of building *per se*. D'Amico et al. (2024) argue that the slow productivity in the construction sector is itself the result of the small scale of projects and businesses, which is in turn the result of either land use regulations or limited land availability. If so, then this rising cost of building is not a distinct factor separate from limited land availability, but rather another example of the consequences of limited land for building new housing units.

Figure 6: 2,000 Sq. Foot Average Quality Home Construction Costs



Note: The city-level square foot costs are taken from the RS Means Construction Cost books. We convert the costs into 2020 real USD values using non-seasonally adjusted all-items CPI for the nation.

Yet, cities differ in how much of their price increases can be linked to rising building costs. In greater Atlanta, the physical production cost per square foot of a 2,000 square foot, economy quality home in 2020 dollars was $76.70 in 1980, $72.23 in 2000 and $97.42 in 2023. The percentage increase between 2000 and 2023 is about one-half of the percentage increase in the real FHFA price index for Atlanta, which suggests that rising construction costs can account for a meaningful fraction of rising prices in that market. In Dallas as well, rising construction costs look to be able to account for a sizable part of the price growth. In Detroit, construction costs actually increased more than housing prices, which suggests very weak demand fundamentals, as higher fundamental production costs cannot be passed along fully to buyers.

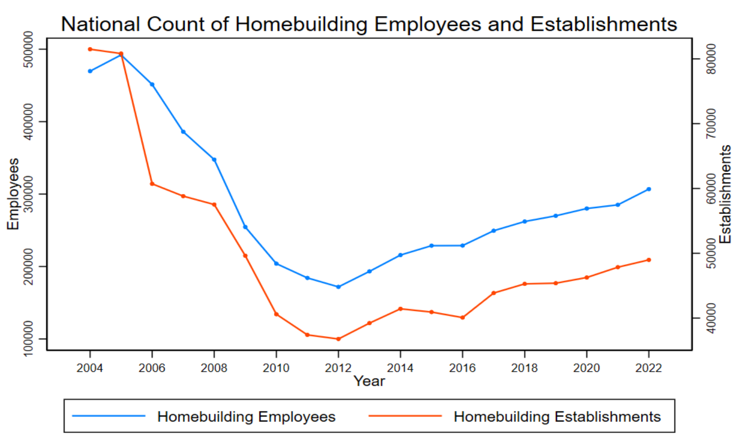
But in Los Angeles, Miami and Phoenix, housing prices went up by far more than construction costs. In Miami, the real cost of building rose by 37 percent between 2000 and 2023, but the real cost of housing rose by a much higher 184 percent. In Phoenix, building became 31 percent costlier between 2000 and 2023, while the cost of buying a home rose by 107 percent, or more than three times the production cost rise. Los Angeles is even more extreme. Consequently, the rise of building costs may be playing a significant, but not exclusive or dominant, role in driving price growth across markets including those in the Sunbelt region, but not in America's most expensive markets (e.g., such as Los Angeles).[21]

The Decline of Construction Employment and Establishments.

We now look at the pattern of employment and establishments in homebuilding. Across the country as a whole, there was a decline in both series after the GFC, which never fully reversed itself. Yet in quickly growing markets such as Dallas and Houston, employment and establishments have both come back strong and are above pre-GFC peak levels. We also see a strongly growing number of establishments and employment in home remodeling. This suggests that firms can start in these industries without that much difficulty, but it just has not been profitable for them to do.

Figure 7 shows the national trends based on data from 146 major markets in homebuilding employment and establishments between 2004 and 2022. We define homebuilding as North American Industrial Classification System (NAICS) codes 236115 (single family housing construction), 236116 (multifamily housing construction) and 236117 (new housing for sale builders). In this and other related figures, the level of employment is shown on the vertical axis on the left, with the number of establishments measured on the right.

Figure 7: Homebuilding Employment and Establishments, 146 Major Markets



Note: We construct 'homebuilding' establishments and employment counts by aggregating over three NAICS codes: 236115 (single family housing construction), 236116 (multi family housing construction), and 236117 (new housing for sale builders). The 'national' counts are the total over the top 149 largest CBSA's. See the appendix for a list of these CBSAs. The CBSA data themselves originate from the County Buisness Patterns (CBP) data, and are aggregated to CBSA's from counties in the same way as our other data construction.

National employment hit a high of 492,000 in 2005 and then fell to 172,000 in 2012. Since 2012, employment has risen to 307,000, which is only 62 percent of its former height. Establishments follow a similar pattern, dropping from a high of 81,000 in 2004 to 37,000 in 2012 and only climbing back to 49,000 in 2022, which is about 60 percent of its former height. This drop is slightly larger than the 29 percent drop in the number of housing units completed between December 2005 and December 2022.

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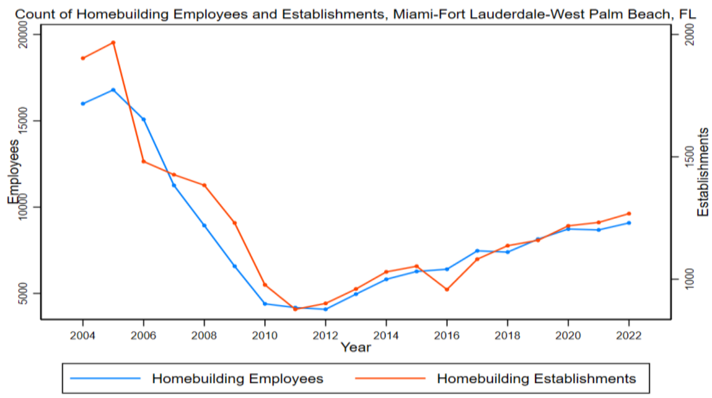
[21] This is consistent with earlier research which also finds that variation in construction costs across markets over time typically cannot account for the extensive heterogeneity in price growth (Gyourko and Saiz (2006)).

Figure 8 shows the same figure just for the Miami metropolitan area. Total home building employment in Miami fell from 17,000 in 2005 to 4,000 in 2012 and has only risen back to 9,000 since then. Establishments show a similar pattern. There were almost 2,000 home building establishments in Miami in 2005 but fewer than 900 in 2012. By 2022, the number of establishments stood at 64 percent of its level in 2005.

Figure 8: Miami CBSA Homebuilding Employment and Establishments



Note: We construct 'homebuilding' establishments and employment counts by aggregating over three NAICS codes: 236115 (single family housing construction), 236116 (multi family housing construction), and 236117 (new housing for sale builders). Miami's CBSA data originate from the County Buisness Patterns (CBP) data, and are aggregated to the CBSA level from the following counties: Broward County, Miami-Dade County, and Palm Beach County

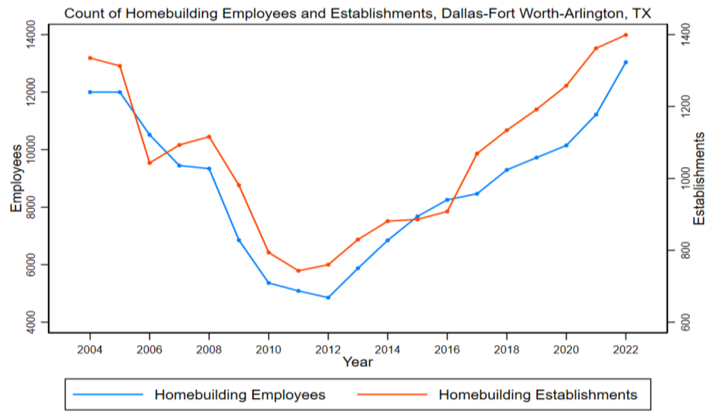
Do these persistent declines in the number of employees and establishments reflect the long-term effects of the GFC, perhaps because the enormous size of the dislocation led to permanent losses in building-related entrepreneurial skill and human capital, or just a change in the difficulty of home building? One way to distinguish between these hypotheses is to look at those metropolitan areas where we believe that building is relatively unfettered.

Figure 9 turns to Dallas. The amount of employment in home-building dropped by more than fifty percent between 2005 and 2012, with the number of home-building establishments declining by 45 between 2004 and 2011. Yet today, there are more homebuilding establishments in Dallas than there were in 2004. The number of homebuilding establishments in Houston is 17 percent higher than it was in 2004.[22]

The construction industry is dominated by tiny firms, which suggests that the barriers to entry are limited. Indeed, if there is less scrutiny of smaller firms for compliance with labor regulations, it may be easier for small firms to function in this industry. Small construction firms have typically opened and closed rapidly. For example in 2022 and 2023, almost one-fifth of establishments in residential building construction (NAICS 2361) had opened in that year according to the Business Dynamics database.[23] This is not unique to that year either, as 17.5 percent of all builders were born during every year since 2011.

[22] Appendix Figure 9 reports the analogous data for Houston. The number of homebuilding establishments in Houston is 17 percent higher than it was in 2004. Austin, TX, shows even more impressive growth in the number of both establishments and employment. That plot and data are available upon request.
[23] https://data.census.gov/table?q=BDSTIMESERIES.BDSNAICS&n=2361.

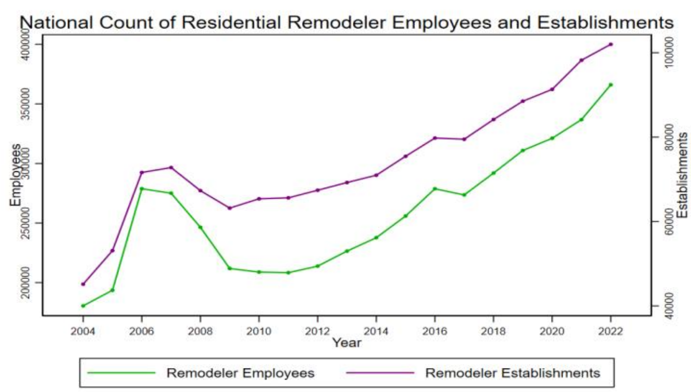
Figure 9: Dallas CBSA Homebuilding Employment and Establishments



Note: We construct 'homebuilding' establishments and employment counts by aggregating over three NAICS codes: 236115 (single family housing construction), 236116 (multi family housing construction), and 236117 (new housing for sale builders). Dallas' CBSA data originate from the County Buisness Patterns (CBP) data, and are aggregated to the CBSA level from the 12 counties that constitute the CBSA.

As a final piece of evidence in favor of the flexibility of the building industry, Figure 10 shows the establishment and employment pattern for the remodeling subsector (NAICS 236118). There was a decline in both remodeling establishments and employment after the Global Financial Crisis, but the trend in both variables reversed after 2010. While there are 200,000 fewer home building employees then than in 2005, there are about 100,000 more remodeling employees than in that year. The growth in remodeling suggests both the flexibility of entry in this sector and that a significant amount of labor and entrepreneurial effort that had once been home-building is now working in the less regulated sector of remodeling.

Figure 10: Residential Remodeler Employment and Establishments, 146 Major Markets



Note: We report 'residential remodeler' establishments and employment counts from a single NAICS codes: 236118. The 'national' counts are the total over the top 149 largest CBSA's. See the appendix for a list of these CBSAs. The CBSA data themselves originate from the County Buisness Patterns (CBP) data, and are aggregated to CBSA's from counties in the same way as our other data construction.

We close this section by reporting data showing that homebuilders have not been earning excessively high returns during the recent boom. Appendix Figure 10 plots the returns of over one dozen publicly-traded homebuilders who are part of the S&P SPDR Homebuilders ETF, along with those for the S&P500 Index. Homebuilders certainly do better than the typical S&P500 firm in good times, but that is to be expected. Homebuilding is a high beta sector for various reasons. However, when one looks at 4, 10, or 15 year periods, builders have not enjoyed higher returns (absolutely or relative to the broader stock market) in the current boom period compared to past boom periods.[24]

III. A Framework for Understanding Changes in Housing Supply

In this section, we consider a one period investment model, which will map into 20 year investment regressions in the next section of the paper. We label the beginning of the period 0 and the end of the period 1. We assume that all households and all housing is homogeneous. The flow utility from owning a home is $\alpha_i D_i^{-\gamma_t} L^{\sigma}$, where L refers to the amount of land associated with the house, α_i captures the exogenous ammenity value and refers to the density level of the neighborhood as a whole. We let $D_{i,0}$ refer to the density as of period 0. The parameter γ_t is time indexed to suggest that density might be considerably less desirable during some periods, such as the 2000s, then in others such as the 1970s.

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

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

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

[24] For example, the relatively high average annualized return earned over the last four years by the publicly-traded homebuilders is below that analogous return earned in six of the previous fourteen 4-year periods in our sample period. Each of those six was also a housing boom period, and to our knowledge, none occurred during or after a time of shrinkage in the number of builders. Comparisons using longer 10 and 15-year periods reach the same conclusion. The last 4- (since Covid), 10- (start of the housing recovery from the GFC) or 15-year (since the GFC) periods are not statistically special compared to earlier periods.

potenitally time-varying parameters. We will assume that $\rho_i D_{i,0}^{\theta_t} \geq 1$ for all neighborhoods, so that these costs are always weakly positive.

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

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

$$(1)\ ln\left(\frac{D_i}{D_{i,0}}\right) = K_0 + \frac{1}{\theta_t+\mu_t} ln(P_H) - \frac{\theta_t}{\theta_t+\mu_t} ln\left(D_{i,0}\right) = K_I + \frac{ln(\alpha_i)-ln(\rho_i)}{\theta_t+\mu_t+\sigma+\gamma_t} - \frac{\sigma+\gamma_t+\theta_t}{\theta_t+\mu_t+\sigma+\gamma_t} ln\left(D_{i,0}\right),$$

and

$$(2)\ ln(P_H) = K_P + \frac{(\theta_t+\mu_t)ln(\alpha_i)+(\sigma+\gamma_t)ln(\rho_i)}{\theta_t+\mu_t+\sigma+\gamma_t} + \frac{\sigma\theta_t-\mu_t(\sigma+\gamma_t+\theta_t)}{\theta_t+\mu_t+\sigma+\gamma_t} ln\left(D_{i,0}\right)$$

where the K_0, K_I and K_P terms reflect constant terms. Amenities (α_i) positively predict prices and building. Local permiting difficulty (ρ_i) predicts positive prices and negatively predicts building.

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

$$(3)\ \frac{(\theta_t+\mu_t)Var\left(ln(\alpha_i)\right)-(\sigma+\gamma_t)Var\left(ln(\rho_i)\right)+(\sigma+\gamma_t-\theta_t-\mu_t)Cov(ln(\rho_i),ln(\alpha_i))}{(\theta_t+\mu_t)^2 Var(ln(\alpha_i))+(\sigma+\gamma_t)^2 Var(ln(\rho_i))+2(\theta_t+\mu_t)(\sigma+\gamma_t)Cov\left(ln(\alpha_i),ln(\rho_i)\right)}.$$

This will only recover the "true" housing supply elastcity $\frac{1}{\theta_t+\mu_t}$ when the variance of $\ln(\rho_i)=0$. If the two local shocks are orthogonal to one another (which seems unlikely to us), then the coefficient will be positive if and only if $Var\left(ln(\alpha_i)\right) > \frac{\sigma+\gamma_t}{\theta_t+\mu_t} Var\left(ln(\rho_i)\right)$. In turn, that implies variation in amenities is going to be larger than the variance in the difficulty of getting approvals. If opposition to building has risen in some areas more than others, then $Var\left(ln(\rho_i)\right)$ should have increased, which implies that the estimated coefficient when building is regressed on price should be lower.

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

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

If $Cov\left((ln(\rho_i), ln(D_{i,0})\right) < 0$, because places with less opposition to growth acquire more density over time. If the variance of $ln(\rho_i)$ increases over time, then we expect to see that the coefficient between initial density and growth will increase (get closer to zero) over time because the positive correlation between density and the ease of building will become relative more important. Glaeser and Ward (2009) report a strong positive correlation between building and initial density levels across towns in Greater Boston, which is compatible with that view that higher density areas have lower values of $ln(\rho_i)$.

Instrumental Variables

In the analysis that follows, we typically instrument for current prices with either lagged prices or geographic variation (such as distance to the central business district) or both. We do not know of any cross-sectional instrument that is correlated with α_i and not ρ_i, or correlated with ρ_i and not α_i, partially because amenities will shape the demographic composition of a neighborhood and the demographic composition of the neighborhood will determine the difficulty of permitting. The fact that both variables enter both equations makes the estimation of housing supply curves inherently challenging. As discussed above, Baum-Snow and Han (2023) solve this by focusing on a relatively short horizon (2000 to 2006 or 2000 to 2010) and assuming that shocks to labor demand will increase the demand for housing over the period without materially impacting the supply of housing.

To see this, we sketch a version of the model with two groups of people, which we label H- and L-types, which have different marginal utilities of cash and reservation locations. The L-types have a marginal utility of income equal to 1, while H-types have a marginal utility of income equal $\frac{1}{\theta} < 1$. The reservation community for the L-types costs nothing and provides no housing related welfare, hence the willingness to pay $\frac{\alpha_i D_i^{-\sigma-\gamma_t}}{r}$. The reservation community for the H-types costs P_H and provides housing related welfare of H_H, and hence the willingness to pay for any other community satisfies $\frac{\alpha_i D_i^{-\sigma-\gamma_t}}{r} - \frac{P_i}{\theta} = H_H - \frac{P_H}{\theta}$ so $P_i = P_H + \theta\left(\frac{\alpha_i D_i^{-\sigma-\gamma_t}}{r} - H_H\right)$.

Moreover, we assume that ρ_i gets multiplied by $\vartheta > 1$ if the community is occupied entirely by H-types rather than L-types. This assumption reflects the possibility that more skilled individuals are more effectively in using political and legal processes, and consequently they are more effective at blocking construction near them. The H-types could also dislike density more, which is suggested by Gyourko and McCulloch (2024), and that would also lead to flatter supply curves in H-type neighborhoods.

At a point in time, when density is fixed, there will be an marginal community which satisfies $\alpha_i D_i^{-\sigma-\gamma_t} = \frac{r(P_H-\theta H_H)}{(1-\theta)}$, at which H- and L-types are willing to pay the same amount, and the rich will live in communities for which $\alpha_i D_i^{-\sigma-\gamma_t} > \frac{r(P_H-\theta H_H)}{(1-\theta)}$ and the poor will live in communities in which $\alpha_i D_i^{-\sigma-\gamma_t} < \frac{r(P_H-\theta H_H)}{(1-\theta)}$. Demand-related instrumental variables typically purport to be shocks to α_i, and a shock to α_i could convert the neighborhood from being a L-type neighborhood to being an H-type neighborhood. This shock will then shift the supply curve as well. Assuming that demand for the city is growing everywhere, the growth in housing in the shocked community can be lower in those communities which were not shocked, because the increase in demand is also associated with a downward shift in the supply elasticity.

More generally, we believe neighborhood change doesn't happen instanteneously and even after an area gentrifies, it can take time for the permitting culture to change. Consequently, there can be short run (e.g., under ten year) shocks to either demand or supply that can essentially satisfy the exclusion restriction, but we are far more skeptical about any longer term shocks. Consider a twenty or thirty year version of the Baum-Snow and Han (2023) instrument, which focuses on hyper-local labor demand. A formerly working-class neighborhood is near an office complex specializing in a particular type of business services. Nation-wide employment in this type of business service soars, and demand for the neighborhood grows from knowledge workers. These knowledge workers move in and also start attending community meetings to oppose new projects. Over five years, only the α_i changes, but over twenty years both the α_i and the ρ_i go up.

Consequently, it is hard to think of any permanent attribute, whether distance to the central business district or elevation that will serve as a valid instrument for either demand or supply. An amenity that impacts the difficulty of building (as in Saiz, 2011) is likely to attract people who like lower levels of density. These people may oppose new development, thereby leading ρ_i to rise. Moreover, their presence may lead to endogenous local amenities, causing α_i to rise, perhaps by attracting more prosperous people who find it easier to stop new projects.

A 'short run instrument' can plausibly shift demand without shifting supply, but we are far more doubtful about the viability of instruments over longer periods of time. Yet, for understanding the U.S. housing affordability problem which has been expanding over decades, it is crucial to understand the long term housing supply, not just high frequency responses. The overall stock of housing is shaped over many decades and that overall stock determines our ability to house the Amerian population.

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

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

IV. **Changes in the Empirical Housing Supply Curve in Six Metropolitan Areas**

We now turn to our estimation of the empirical housing supply curve in six metropolitan areas. We first discuss our methodology and then turn to the results. As discussed above, we use three different instrumental variables strategies, none of which will formally identify the traditional housing supply coefficient ($\frac{1}{\theta_t+\mu_t}$) discussed above.

Estimating the Empirical Housing Supply Curve

For all six cities (and for the 82 metropolitan areas that we discuss in the next section), we use our 1970-based tract level data. We use density levels, which are typically the number of total housing units or single unit homes per acre, and median housing value in the tract. We look at the five decades for which we have our 1970-based tract-level data: 1970-1980, 1980-1990, 1990-2000, 2000-2010 and 2010-2020.

Our first specification uses naïve OLS, which is estimated for each metropolitan area:

(4) $\Delta \log(density_{i,t+1}) = \alpha + \beta_1^t \log(price_{i,t+1}) + \beta_2^t \log(density_{i,t}) + \epsilon_{i,t}$

where *i* indexes the individual census tracts and *t* denotes the starting decade. Thus, if t=1970, then t+1=1980, so that $\Delta \log(density_{i,t+1}) = \log(density_{i,1980})$- $\log(density_{i,1970})$, with each subsequent decade defined analogously

This specification exactly follows the first part of the equality in equation (1). Indeed, if we thought that we had instruments that correlated with demand (but not supply) in 1990 or 2000, then we would actually be able to interpret β_1^{1970} as $\frac{1}{\theta_t+\mu_t}$, but we cannot. We utilize three added instrumental variable strategies that will reduce some of the issues with (4), but still fail to identify the core theoretical supply elasticity, which is why we refer to them as the empirical housing supply elasticities.

Our instrumental variables equations have the following second stage where future price is instrumented with three different set of variables:

(5)$\Delta \log(density_{i,t+1}) = \alpha + \lambda_1^t \log(\widehat{price}_{i,t+1}) + \lambda_2^t \log(density_{i,t}) + \epsilon_{i,t}$

These three specifications only differ in their first stages, where $\log(\widehat{price}_{i,t+1})$ comes from the following first stages. Specification 2 instruments with lagged price as shown in equation (6). Specification 3 instruments with distance and location controls within the CBSA. Specification 4 instruments with both price, distance and location controls.

Our second specification is

(6) $\log(price_{i,t+1}) = \alpha + \delta_1^t \log(price_{i,t}) + u_{i,t}$,

This specification reduces the downward bias in the supply curve elasticity that comes from the negative impact on price of new supply. This is essentially equivalent to regressing housing supply growth on the initial period price, but this still will not recover $\frac{1}{\theta_t+\mu_t}$ unless there is no variation across census tracts in the difficulty of building.

Our third specification is given by

(7) $\log(price_{i,t+1}) = \alpha + \delta_1 distance_i + \delta_2 distance_i^2 + \sum_{q=i}^{8} \delta_q I_q^{Loc} + u_{i,t}$

In this specification, the distance terms refer to the distance from the centroid of the metropolitan area's central tract. We have supplemented distance by subdividing the metropolitan area into eight octants, by drawing circles around the central tracts. If zero degree is a line due east from the centroid, then the octants include tracts that are between -22.5 degrees and 22.5 degrees, 22.5 degrees and 67.5 degrees and so forth.[25] The terms I_q^{Loc} are indicator values that take on a value of one if the tract is in a particular octant.

This approach relies on the fact that distance to the central business district is an amenity. Particular geographic parts of the city may also have different amenity levels. Of course, particular parts of the city may also have more difficult building conditions, perhaps because they have higher amenity levels.

Our fourth specification is

$\log(price_{i,t+1}) = \alpha + \delta_1 distance_i + \delta_2 distance_i^2 + \sum_{q=i}^{8} \delta_q I_q^{Loc} + \delta_4^t \log(price_{i,t}) + u_{i,t}$

This final specification combines the different IV strategies used in the second and third specification. The goal is to create a better first stage fit, and reduce the direct impact of building on price. We now turn to our results for the six metropolitan areas.

Empirical Housing Supply Curves across Six Metropolitan Areas

Table 4 shows our results using single unit housing structures across our six primary markets.[26] We have grouped the four high growth sunbelt cities together, and then followed them with Los Angeles and Detroit. We will discuss the price coefficients first across the entire table and then turn to the density coefficients. The analogous results for all housing units are reported in Table 5. Both tables show results from Specification 4, which uses both location controls and lagged price as instruments. Results for the other three specifications are available in Data Appendix Table 6.

[25] See Appendix Figure 11 for an example using the Atlanta metropolitan area.
[26] This is roughly equivalent to single-family detached units. The decennial censuses do not have an explicit code for that housing, but we can see how many units are in a structure.

Table 4: Regression Tables of Delta Log Single Family Unit Density on Initial Period Log Price for 6 CBSAs

Coefficient	CBSA	(4) Log Price, Distance and Octant IV				
		1970	*1980*	*1990*	*2000*	*2010*
Log Price	Atlanta	0.339	0.159	0.170	0.258	0.100
Log Price SE		*(0.062)*	*(0.042)*	*(0.047)*	*(0.049)*	*(0.037)*
SFR Density		-0.164	-0.230	-0.215	-0.210	-0.124
SFR Density SE		*(0.026)*	*(0.041)*	*(0.041)*	*(0.044)*	*(0.038)*
R2/Wald F		149.343	171.291	137.996	67.955	85.526
Log Price	Dallas	0.432	0.307	0.115	0.078	0.039
Log Price SE		*(0.050)*	*(0.042)*	*(0.023)*	*(0.026)*	*(0.020)*
SFR Density		-0.204	-0.117	-0.078	-0.124	-0.071
SFR Density SE		*(0.021)*	*(0.019)*	*(0.016)*	*(0.015)*	*(0.014)*
R2/Wald F		172.603	311.075	353.268	327.274	407.297
Log Price	Miami	0.192	0.220	0.073	-0.014	0.034
Log Price SE		*(0.093)*	*(0.052)*	*(0.024)*	*(0.035)*	*(0.024)*
SFR Density		-0.297	-0.216	-0.059	-0.103	-0.034
SFR Density SE		*(0.053)*	*(0.043)*	*(0.018)*	*(0.029)*	*(0.022)*
R2/Wald F		425.547	347.041	52492.668	9172.882	54665.700
Log Price	Phoenix	0.593	0.381	0.177	0.009	0.035
Log Price SE		*(0.099)*	*(0.084)*	*(0.047)*	*(0.062)*	*(0.023)*
SFR Density		-0.253	-0.129	-0.077	-0.106	-0.034
SFR Density SE		*(0.042)*	*(0.046)*	*(0.019)*	*(0.031)*	*(0.017)*
R2/Wald F		110.337	140.995	181.990	96.770	189.572
Log Price	Los Angeles	0.124	0.047	-0.013	-0.073	-0.029
Log Price SE		*(0.023)*	*(0.022)*	*(0.015)*	*(0.019)*	*(0.016)*
SFR Density		-0.144	-0.128	-0.062	-0.074	-0.056
SFR Density SE		*(0.022)*	*(0.023)*	*(0.013)*	*(0.020)*	*(0.019)*
R2/Wald F		362.739	353.749	197.087	409.724	346.383
Log Price	Detroit	0.244	0.224	0.142	0.176	0.107
Log Price SE		*(0.032)*	*(0.023)*	*(0.009)*	*(0.019)*	*(0.016)*
SFR Density		-0.119	-0.085	-0.087	-0.083	-0.070
SFR Density SE		*(0.013)*	*(0.019)*	*(0.009)*	*(0.011)*	*(0.011)*
R2/Wald F		369.065	903.208	928.283	344.819	333.012

Notes: Specification 4, which includes the lagged price and location variables as instruments, is reported in the table. The rows presented in Table 5 report the coefficients and standard errors for future price, λ_1^t, and initial period density, λ_2^t, from the second stage regression (5). For each CBSA, the final row in the sub-panel corresponds to the *Kleibergen-Paap rk Wald F statistic* for the first stage regression.

There are a number of consistent patterns across markets. For each of the six markets in Table 4, the price elasticity generally falls over time, although there is a spike in this coefficient in the first decade of the 2000s for Atlanta. The estimated elasticity for the 2010s always is appreciably below that for the 1970s, with a significant decline in coefficient size typically occurring by 1990. These markets used to build more housing in higher priced tracts, but no longer do so. Among the Sunbelt markets, Miami always has the lowest price elasticity estimates. In this sense, it looks more like Los Angeles than its regional compatriots. The price elasticity always is lowest in Los Angeles.

Figure 11 then shows the shifting empirical supply curves over time for the four Sunbelt metros based on the regression results reported in Table 4.[27] The plotted lines depict the predicted housing supply as reflected in the change in density over time for a tract with the median density level (in that year) over the relevant decadal time periods. On the x-axis, the units are measured as individual census tract median price relative to the median price across all tracts in the CBSA, with the log of that ratio being taken. Essentially, the resulting variation in predicted supply reflects changes in the estimated constant. We report predicted supply for (log) price-to-median tract price ratios that run from -0.5 to +0.5. Across each decade starting with the 1970s, there always are many cases within that domain range.

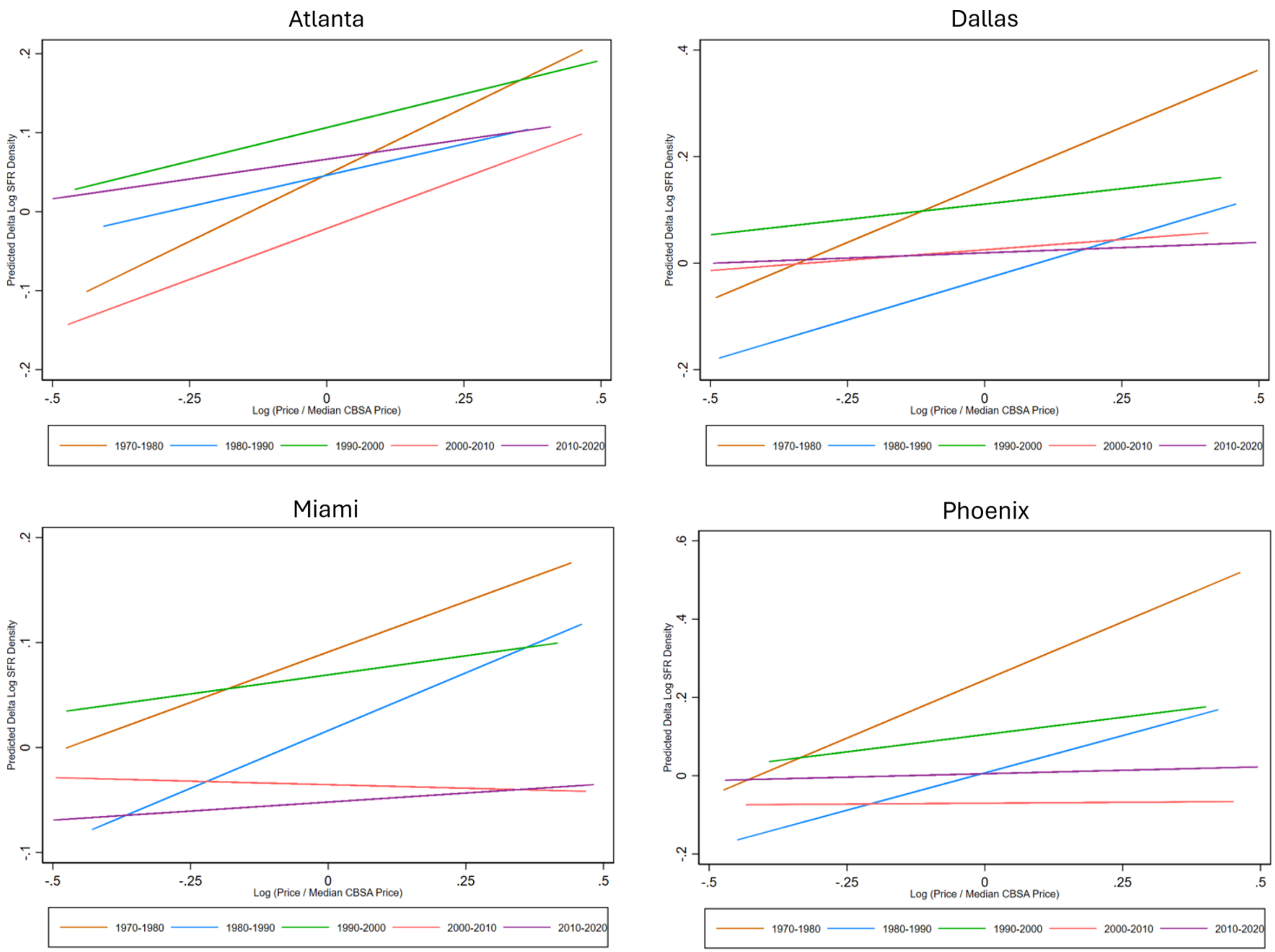
The brown line depicts the empirical housing supply schedule for the 1970s and always is the most steeply sloped. This documents the strong relationship between tract price and density in that first decade. That is, there was more building in the more valuable submarkets. However, this changed in the 1980s in the Atlanta market, with the blue line showing a sharp rotation down and a much flatter relationship. By the first decade of the 2000s, the red line has shifted down sharply, but is no longer so flat. For this market, the housing boom leading up to the GFC appears to have been associated with more building in higher priced tracts, but this did not last. In the 2010s, the purple line becomes much flatter again. This is a common theme in each Sunbelt market: the relationship between predicted density and house price always is much weaker in the 2010s than in the 1970s. In the case of Atlanta, there is now more building in its cheaper tracts, but less in its more valuable ones.

The changes in Dallas are starker. There is a strong positive relationship between predicted density and price in the 1970s, but this disappeared by the 1990s. In the two most recent decades, the relationship is flat (see the red and purple lines). The picture is similar in Phoenix. By the 1990s, the relationship between house value and predicted density has almost disappeared. In this market, the schedule also shifts down in the 2000s and 2010s, and the slope flattened out somewhat, too. The story is more complex in Miami. As in Dallas and Phoenix, the positively sloped relationship in the 1970s (brown line) is gone by the 1990s (green line), but a positive relationship reappeared in the first decade of the 2000s (red line). The pre-GFC housing boom appears to have functioned similarly to what we saw for Atlanta, in the sense that there was more building in more valuable parts of the Miami metro that decade. However the 2010s then change sharply with a negatively sloped schedule (purple line).[28]

Figure 12 reports the results for Los Angeles and Detroit. The only positively sloped lines in the Los Angeles market are for the 1970s and 1980s, and the latter is much flatter. The two most recent decades are negatively sloped. For this long-time supply constrained housing market, the positive relationship between local submarket house value and building disappeared almost entirely about four decades ago. The ongoing decline of Detroit is evident in its plot. In most decades, predicted densities are negative for most of the domain.

[27] Those for the other three specifications are reported in the Data Appendix.
[28] Miami is known for it numerous high rise structures, so we will reexamine this market just below where we report the analogous regression results using all housing units rather than single family units.

Figure 11: Empirical Housing Supply Curves for 4 Sunbelt Markets, Specification 4 (Lagged Price and Location IV)



Notes: When computing predicted values, log single-unit density is held constant at the CBSA-level median.

Figure 12: Empirical Housing Supply Curves for Los Angeles and Detroit, Specification 4 (Lagged Price and Location IV)

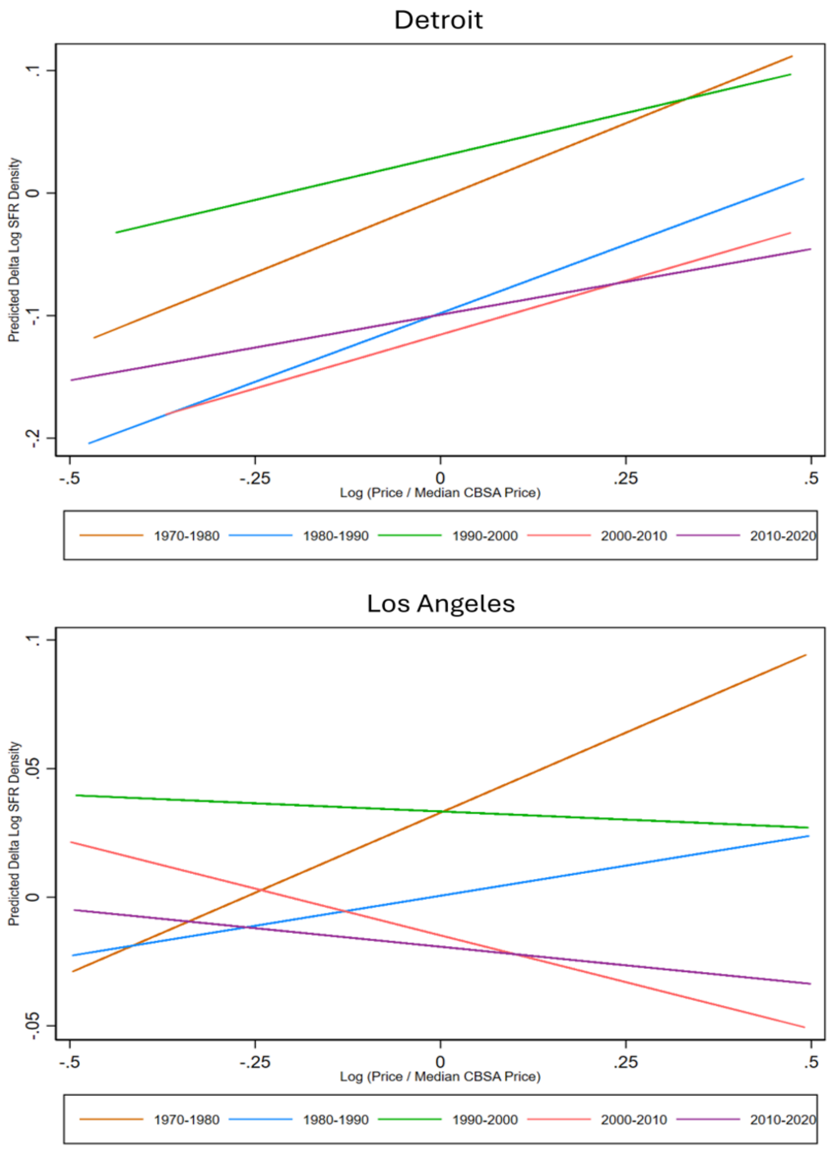


Table 5 then reports our regression results using all housing units. The general pattern of declining price elasticity coefficients holds, although the decline is modest in both the Atlanta and Detroit markets, when we include apartments and other multi-unit homes. Once again, the Los Angeles market never exhibited a high elasticity even in the 1970s. However, the declines in the Dallas, Miami and Phoenix markets are striking. Looking specifically at Dallas, during the era of J.R. Ewing (i.e., before the turn of the century), Dallas built more in places where demand was high. That tendency diminished by 1990s, and it essentially disappeared in the first two decades of the 21st century.

For space reasons, we report the empirical supply curves in the Data Appendix (see Appendix Figures 12-29). Not surprisingly, the pictures differ the most for the Miami market. When multifamily units are included in the analysis, the sharp break in the relationship between local price and predicted density is especially apparent after the 1970s. The schedules are quite flat from the 1980s on, but we do not see the starkly negative slopes in Figure 11 for this market. The differences in the other market are less strong, probably because none has as big a high rise residential sector as Miami. Our results using single unit homes and all housing units both suggest that the empirical supply curve elasticity is declining for all types of housing over time in these six markets.

Table 5: Regression Tables of Delta Log All Unit Density on Initial Period Log Price for 6 CBSAs

Coefficient	CBSA	(4) Log Price, Distance and Octant IV				
		1970	*1980*	*1990*	*2000*	*2010*
Log Price	Atlanta	0.173	0.198	0.127	0.101	0.124
Log Price SE		*(0.049)*	*(0.039)*	*(0.034)*	*(0.041)*	*(0.024)*
Density		-0.195	-0.144	-0.157	-0.150	-0.012
Density SE		*(0.020)*	*(0.015)*	*(0.025)*	*(0.023)*	*(0.016)*
R2/Wald F		114.043	130.570	193.585	78.597	95.855
Log Price	Dallas	0.456	0.228	0.124	0.040	0.033
Log Price SE		*(0.053)*	*(0.034)*	*(0.024)*	*(0.023)*	*(0.014)*
Density		-0.184	-0.114	-0.091	-0.103	-0.041
Density SE		*(0.014)*	*(0.010)*	*(0.008)*	*(0.012)*	*(0.007)*
R2/Wald F		168.101	322.039	365.160	285.656	459.957
Log Price	Miami	0.219	0.162	0.066	0.076	-0.015
Log Price SE		*(0.060)*	*(0.031)*	*(0.021)*	*(0.037)*	*(0.013)*
Density		-0.295	-0.154	-0.055	-0.058	-0.005
Density SE		*(0.031)*	*(0.024)*	*(0.013)*	*(0.019)*	*(0.010)*
R2/Wald F		415.589	3080.023	1672.314	1318.032	4005.602
Log Price	Phoenix	0.474	0.254	0.114	0.030	0.046
Log Price SE		*(0.087)*	*(0.075)*	*(0.033)*	*(0.076)*	*(0.021)*
Density		-0.255	-0.087	-0.077	-0.121	-0.016
Density SE		*(0.042)*	*(0.021)*	*(0.017)*	*(0.032)*	*(0.016)*
R2/Wald F		105.504	132.767	183.416	96.749	160.281
Log Price	Los Angeles	0.123	0.014	0.001	0.005	-0.018
Log Price SE		*(0.018)*	*(0.014)*	*(0.007)*	*(0.013)*	*(0.007)*
Density		-0.131	-0.067	-0.022	-0.047	-0.012
Density SE		*(0.013)*	*(0.011)*	*(0.005)*	*(0.011)*	*(0.005)*
R2/Wald F		335.219	334.636	225.193	410.723	359.681
Log Price	Detroit	0.176	0.180	0.125	0.144	0.127
Log Price SE		*(0.031)*	*(0.021)*	*(0.012)*	*(0.021)*	*(0.012)*
Density		-0.153	-0.057	-0.078	-0.056	-0.009
Density SE		*(0.014)*	*(0.009)*	*(0.012)*	*(0.010)*	*(0.008)*
R2/Wald F		199.257	3047.677	736.771	239.423	254.166

Notes: Specification 4, which includes the lagged price and location variables as instruments, is reported in the table. The rows presented in Table 5 report the coefficients and standard errors for future price, λ_1^t, and initial period density, λ_2^t, from the second stage regression (5). For each CBSA, the final row in the sub-panel corresponds to the *Kleibergen-Paap rk Wald F statistic* for the first stage regression.

We now turn to the density coefficients. In Table 4, the density coefficients are generally negative and statistically significant, indicating that the higher the tract density, the smaller the increases in density in that tract over time. This is consistent with the 'density wall' hypothesis. However, these coefficients typically range from -0.03 to -0.25, which do not imply large economic effects. Even at the very top of that scale, an enormous 50 percent increase in density is only associated with about a 12.5 percent reduction in the production of single unit housing. These relatively small impacts suggest that, while running into some type of 'density wall' has some truth to it, it is not the primary reason that America's housing supply is slowing down. Moreover, the coefficients in all six markets diminished substantially by the 2010s, which suggests that the correlation between density and unobserved permitting permissiveness has become more important over time. Density is not nothing, but it also clearly is not everything.

There is a general pattern of decline in density elasticity over time, with those in Miami and Phoenix being the starkest. The density coefficients in Table 5 are not very different from those in Table 4, although the declines over time tend to be larger. In addition, the coefficients in all six markets are quite small in the 2010s, which suggests that more recently, density is associated with a relative ease of building multifamily housing.

The results in Tables 4 and 5 indicate an economically meaningful change in the ability to build in high demand (i.e., high price) tracts, with that ability declining over time. It is always much lower in the 1990s compared to the 1970s, and falls even more in the 2010s. Density is a constraint on the ability to build, but it has weakened over time, especially related to multifamily units.

While these linear specifications yield important insights, we are also interested in potential interaction effects. To gain insight into their possible role, we turn from regression specifications to manipulation of density and price data as reflected in Table 6. This cross-tabulations table reports the number of housing units delivered over the 1970s for Atlanta for different housing unit density-house price combinations. Tracts are divided into one of three price categories, as reflected in the labels for the rows of the table. Colloquially, tracts are in one of three price groups: Cheap, Moderate or Expensive. Cheap tracts are those with average house prices that are less than 80 percent of the metropolitan area average price (in 1970 for this specific table). Moderate-priced tracts are those with average house prices that are within 20 percent of the metropolitan area average house price (i.e., they have ratios from 0.8-1.2 times the metro average house price). Expensive tracts are those with prices more than 20% above the metropolitan area average.

The columns of Table 6 reflect different levels of tract density. The first column is for tracts with density levels of less than 0.5 units per acre in 1970. The second column contains tracts with higher, but still modest, density levels of 0.5 to 1.5 units per acre. The third and fourth columns capture higher densities of 1.5-2.5 units per acre and 2.5+ units per acre, respectively.

The numbers in each cell reflect the net increase in housing units over the 1970s (1980-1970 levels based on our tract data). Thus, the 12,685 figure in the first column of the first row of Table 6 indicates that tracts with low densities of less than 0.5 units per acre *and* cheap prices that were at least 20 percent below the 1970 metro average in Atlanta saw a 12,685 increase in housing units. The second number in that cell indicates that there were 12 tracts (defined as of 1970) in the Atlanta metropolitan area in 1970 that were both cheap and of very low density. The numbers in every other cell can be interpreted in an analogous manner, with the equivalent of Table 4 available in the appendix for each of our six focal markets for every decade starting with the 1970s.

Price Category		Density Category				
		< 0.5 Units/Acre	0.5 – 1.5 Units/Acre	1.5 - 2.5 Units/Acre	> 2.5 Units/Acre	Total
Below 80%	Sum	12,685	862	1,384	-2,215	12,717
	Count	12	12	10	31	65
Between 80% and 120%	Sum	106,293	37,087	4,656	2,834	150,869
	Count	39	26	29	18	112
Above 120%	Sum	45,552	19,397	1,690	892	67,531
	Count	8	20	7	4	39
Total	Sum	164,530	57,346	7,730	1,511	231,118
	Count	59	58	46	53	216

Table 6: Net Change in Housing Units by Density and Price, 1970s, Atlanta-Sandy Springs-Roswell, GA

Note: On the left axis, prices are measured relative to the mean in the market. Hence, Below 80% implies the tract is less than 80% of the CBSA average. Density is defined as the number of units per acre for all housing units in a tract.

Table 6 shows that there were many housing units created in Moderate and Expensive census tracts that were also relatively low density, which we define as having fewer than 1.5 units per acre. Over 208,000 housing units were built from 1970 to 1980 in the 93 census tracts in the Atlanta metro area captured in the first and second columns of the second and third rows of Table 4.[29] Density was quite inhibiting to growth in the 1970s. Only 10,071 were built during the same decade in the 58 tracts in the four cells in the third and fourth columns of the second and third rows of Table 4.[30] Among the 24 cheaply priced tracts that were of relatively low density, housing units increased by 13,547 (=12,685+862). The remaining 41 tracts that were both cheaply priced and of relatively high density actually saw an 831 unit reduction in their housing stocks between 1970 and 1980 (=1,384-2,215).

Table 7 then reports the share of each of these four groups in the metropolitan area-wide total change in housing units over each decade beginning with the 1970s.

[29] This is the sum of 106,293+37,087+45,552+19,397 (=208,329).
[30] This is the sum of 4,656+2,834+1,690+892 (=10,071).

Table 7: Percentage Changes in Housing Production, Price vs Density by Decade, 6 CBSAs

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

Notes: Low Density tracts are defined as those with less than 1.5 units per acre, while High Density tracts have more than 1.5 units per acre. Low Price tracts are defined as those whose median price is less than 80% of the CBSA-level mean house price. Moderate-to-High Price tracts are those whose median price is 80%+ of the CBSA median.

There is extensive heterogeneity in these results, both across markets and within markets over time. As expected, increases in the share of housing units built in Low Density/Low Price tracts tend to be modest on average. This number has not risen substantially over time except in the Atlanta market.[31] Relatively low numbers of housing unit are built in High Density/Low Price tracts, but these shares have typically risen over time. They have increased by small amounts in Atlanta, Dallas, and Phoenix, but by much more in the Los Angeles and Miami markets. In those

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

cities, where demand is robust almost everywhere, it can be easier to add multifamily units in already dense, if not high value, tracts in those two markets.

Among the Moderate-to-High Price tracts, we generally see declines in the shares arising from Low Density tracts and rising shares from High Density tracts. This fact suggests that it has become harder over time to build in low density, higher house price areas in major markets such as Atlanta (50 percentage point decline in share from the 1970s to the 2010s), Dallas (12 percentage point decline), Los Angeles (20 percentage point decline) and Miami (23 percentage point decline). Interestingly, there is no such decline in the Phoenix market.[32] Concomitantly, it looks to be easier to build in the relatively expensive, higher density tracts (except in Los Angeles, where relatively little building occurs in any event). The share of homes built in these areas increases by over 30 percentage points in Atlanta and Miami. In Dallas and Phoenix, the share built in these areas increases by 9 and 6 points respectively.[33]

V. Changes in the Empirical Housing Supply Curve across the U.S.

We now turn to our results for a broader set of 82 metropolitan areas. This data sample is based on the 100 largest metropolitan areas in the country based on current population, but we drop 18 areas because of data limitations.[34] Figure 13 presents four plots of the price elasticity coefficients from these 82 markets using the single housing unit data set reported in Table 4, comparing the coefficients from the 1970s decadal estimations to those from the 1980s, 1990s, 2000s and 2010s. Each comparison uses results from Specification 4 described above. The 1970-80 estimated coefficient always is reported on the x-axis, with the other decade's coefficient on the y-axis. The dotted lines represent the 45 degree line, not the fitted values, so a market above the dotted line had a higher estimated price coefficient in a decade after the 1970s than it did in the 1970-1980 time period.[35]

The majority of markets are below the 45-degree line in each decadal comparison, indicating that price elasticities fell over time in most American housing markets, not just the six focal areas tracked throughout our paper. In the upper left corner of Figure 13, which compares coefficients from the 1980s to those from the 1970s, 53 out of the 82, or 65 percent of markets had smaller

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

[33] Detroit is an obvious outlier in this table. The first column documents its stark decline in building in general, especially since the turn of the century. It is creating more housing units over time in its relatively few high cost, high density suburbs (final column of Table 7). But, it also is de-densifying at an increasing rate in its inner urban core, which contains cheaper, high density tracts. That is what allows the share of units in the lower density, but not cheap tracts (mostly in the suburbs) to be so high.

[34] A metropolitan area is included only if each of the following two conditions hold: (1) the population coverage of the tracts in place as of 1970 is at least 70 percent; and (2) the number of those tracts is at least 50, which we considered sufficiently large for us to be able to credibly estimate Specification 4, which uses location controls and lagged price in its IV strategy.

[35] Results for all other specification are available upon request.

price elasticity estimates in the 1980s than in the 1970s. In the 1990s (top right plot), the number below the 45 degree line increases to 70, and never falls below 68 thereafter. By the 2000s, in over 4/5th of our markets, the connection between price and construction has diminished over time.[36]

Figure 13: Changes in Price Coefficients Over Time, Single Housing Unit Sample

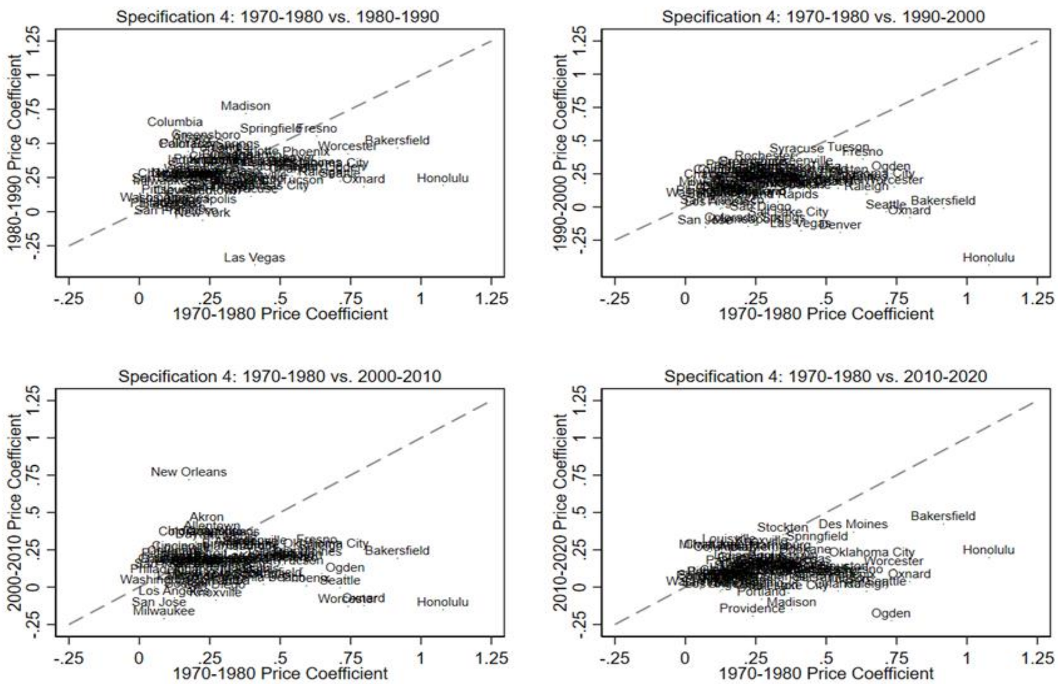
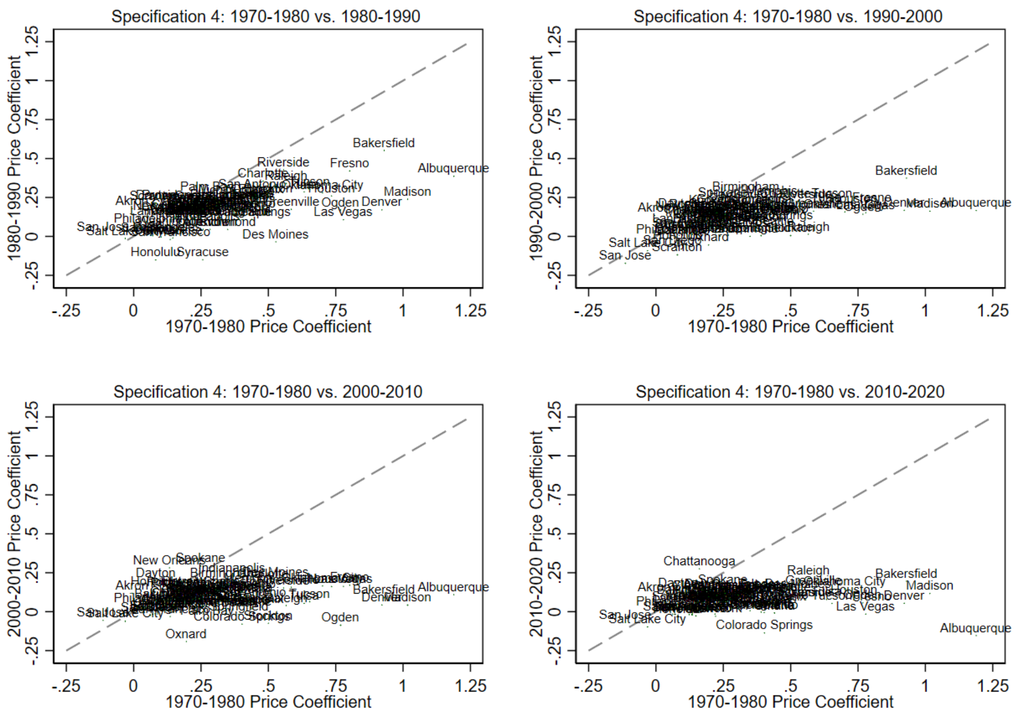


Figure 14 shows the analogous results for all housing units. Most markets still fall below the 45 degree line, so price elasticity estimates fall from their baseline in the 1970s for this sample of all housing units, too.[37] One thing to note is that elasticity estimates tend to be larger than in Figure 13, presumably because of the tendency of some census tracts to have sometimes large increases in density because of multifamily projects. Nevertheless, the flatting of the plots over time is visually apparent.

[36] In the 2010s, there were only seven CBSAs with price elasticity coefficients larger than in 1970. They were Albany(NY), Chattanooga (TN), Columbia (SC), Louisville (KY), Milwaukee (WI), Scranton (PA) and Stockton (CA). All are small, and some are part of a trend toward longer-run industrial decline in some parts of the country.
[37] It never is the case that few than 70 out of the 82 metropolitan areas in our sample fall below the 45 degree line.

Figure 14: Changes in Price Coefficients Over Time, All Housing Unit Sample



Figures 15 and 16 report results for the density coefficients for the single unit housing and all housing samples, respectively. As with our six focal markets, density coefficients for this broader sample of metro areas almost always are negative. However, Figure 15's results indicate that it took time for them become less negative for this broader single unit sample. By the 1990s, there are many more markets where the density impact has become smaller (i.e., less negative). And, there are only two markets whose density coefficients have not become smaller by the 2010s. Hence, it used to be more challenging to build in denser census tracts, but that difficulty has waned over time.

Figure 16's results for the all unit sample shows that the shrinking of (negative) density effects occurred more quickly than for single unit structures. This could be due to the increasing amount of housing being created in higher density places in general, and in the more expensive of those higher density tracts specifically that we saw above in Table 7.

Figure 15: Changes in Density Coefficients Over Time, Single Housing Unit Sample

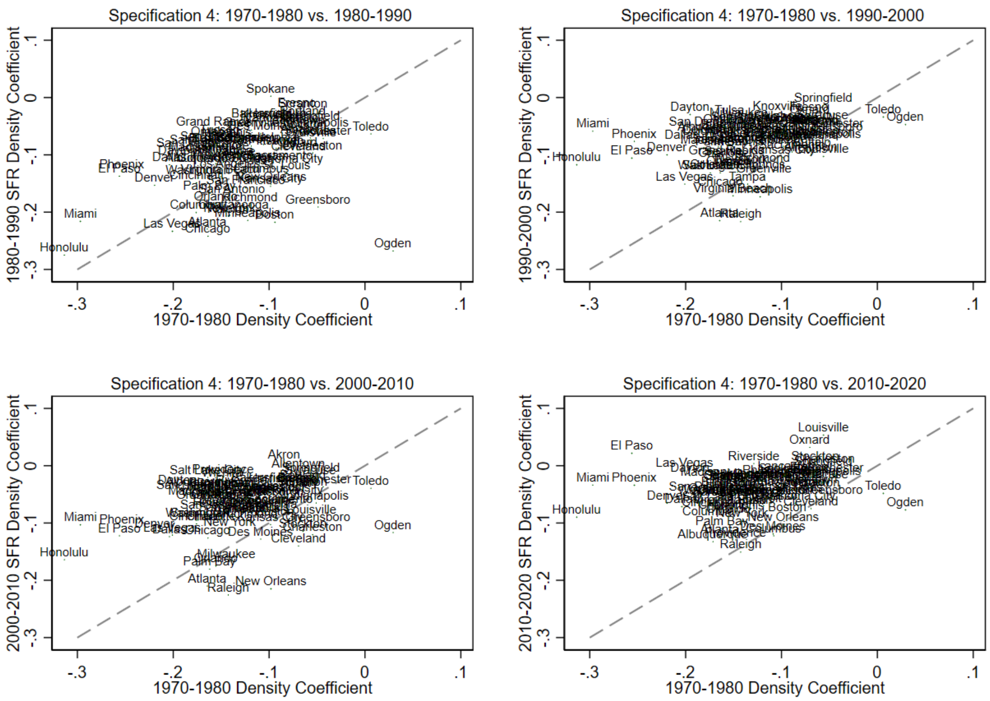
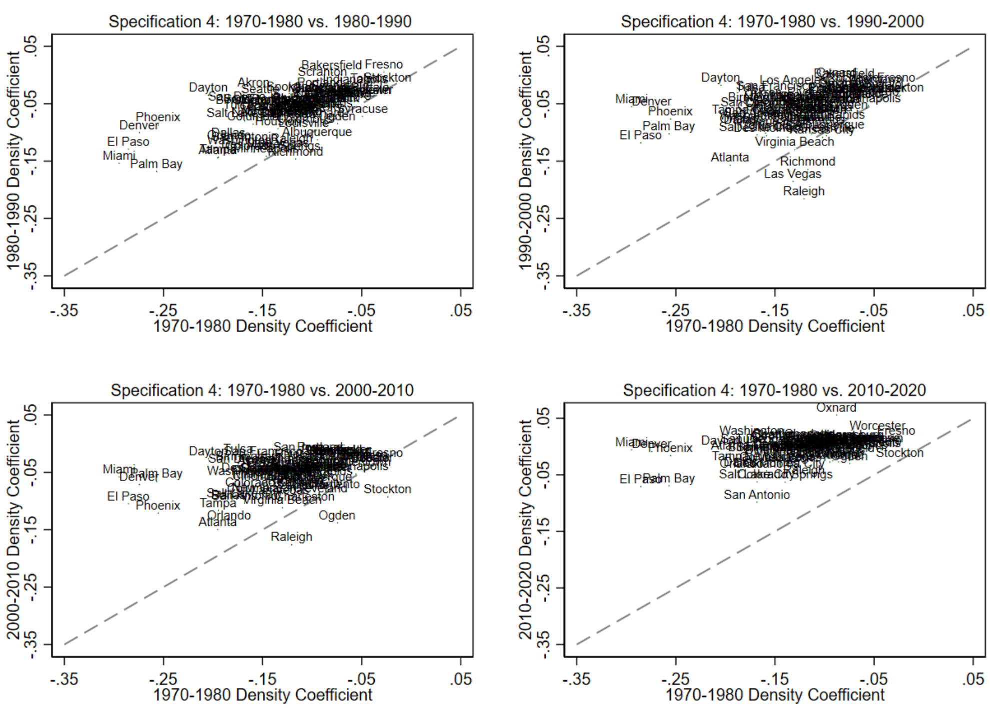


Figure 16: Changes in Density Coefficients Over Time, All Housing Unit Sample



Our last empirical exercise is to regress the specification (4) coefficient estimates from each decadal period on the previous decades' price coefficient[38] for all housing units, and three added variables: the Wharton Residential Land Use Regulation Index (WRLURI), the share with a college degree in at the start of the previous decade, and the average change in density in the CBSA over the decadal period. We run these specifications at the CBSA level, where c denotes a CBSA, and t denotes the decade:

(6a) $\widehat{\lambda_{1,c}^{t+1}} = \alpha + \psi_{1,c}^{t}(\widehat{\lambda_{1,c}^{t}}) + WRLURI_c + u_c.$

(6b) $\widehat{\lambda_{1,c}^{t+1}} = \alpha + \psi_{1,c}^{t}(\widehat{\lambda_{1,c}^{t}}) + \overline{share\ educated_{t,c}} + u_c$, and

(6c) $\widehat{\lambda_{1,c}^{t+1}} = \alpha + \psi_{1,c}^{t}(\widehat{\lambda_{1,c}^{t}}) + \overline{\Delta log\ (density_{t+1})_c} + u_c,$

Table 8 reports results. As expected, the estimated ψ's are positive. These coefficients are lowest in the last column, which regresses the 2010s on the 2000s. This is consistent with the general decline in building intensity after the GFC. The estimated coefficient on the Wharton index is always negative and at least weakly significant. This is not the case for the other two variables, but the coefficient signs are as expected. The share educated coefficient is significant and negative for the first two periods; it remains negative but is imprecisely estimated in the final two periods. Lagged density is the least consistently estimated.

Table 8: Regressing Decadal Price Elasticity on Previous Decade Price Elasticity and Covariates, All Units

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

Note: N=82 in all regressions. Standard errors are in parentheses.

[38] For example, we regress $(\widehat{\lambda_{1,c}^{1980}})$ on $(\widehat{\lambda_{1,c}^{1970}})$ from equation (5). Then, we roll through the decadal pairs regressing $(\widehat{\lambda_{1,c}^{1990}})$ on $(\widehat{\lambda_{1,c}^{1980}})$, $(\widehat{\lambda_{1,c}^{2000}})$ on $(\widehat{\lambda_{1,c}^{1990}})$, and finally $(\widehat{\lambda_{1,c}^{2010}})$ on $(\widehat{\lambda_{1,c}^{2000}})$. These are the columns of table 8.

VI. Conclusion

This paper documents a number of facts about changing conditions across American housing markets. Real, constant-quality prices are at historically high levels in many major markets. Most notably, this is true in a number of Sunbelt region markets ranging from Miami to Tampa-St. Petersburg, as well as Dallas, Phoenix and Atlanta. Many factors contributed to the current situation, including Covid which impacted supply chains, driving up production costs and reducing new supply at a time when demand was increasing. Another was changing Federal Reserve interest rate policy that drove up interest rates, creating the mortgage lock-in effect which lowered the supply of homes available for sale.

In this paper, we have argued that the genesis of today's high house prices goes much further back in time. Real construction costs have risen by about one-third since the turn of the century. This is important, but not even it can fully explain today's pricing. The GFC badly damaged the construction sector, but it does not appear to be responsible for today's situation either. The key driver appears to be that the intensity of housing production has dropped substantially over time, especially in many expanding Sunbelt markets. This decline is something new, as these metropolitan areas were once housing market superstars. More generally, there is a marked convergence in the pace of housing unit production across markets throughout the country: Miami has become far more like Los Angeles.

Our analysis suggests that there has been an economically important flattening of the empirical housing supply curve in these places. Other markets on the coasts and in declining industrial centers went through this in earlier decades. Essentially, within metropolitan areas across the country, we now build less often in the highest demand areas. We also found relatively weak relationships between density and the construction of single family detached housing.

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

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I. Appendix Tables

Appendix Table 1A: National Counts of Owner-Occupied, Renter-Occupied and Vacant Units

Year	Owner Occupied	Renter Occupied	Vacancies
1950	19,187,680	14,624,297	2,431,859
1960	29,407,971	18,271,575	3,063,446
1970	39,885,464	23,559,602	4,253,991
1980	51,796,395	28,593,278	6,369,044
1990	59,031,378	32,916,032	10,316,268
2000	69,816,513	35,663,588	10,424,540
2010	77,186,521	38,540,560	15,970,865
2020	79,926,290	43,974,975	16,349,785
2023	83,736,265	44,985,843	15,185,873

Appendix Table 1B: National Counts of Owner-Occupied, Renter-Occupied and Vacant Units Added Over Time

Year	Owner Occupied Added	Renter Occupied Added	Vacancies Added
1950-1960	10,220,291	3,647,278	631,587
1960-1970	10,477,493	5,288,027	1,190,545
1970-1980	11,910,931	5,033,676	2,115,053
1980-1990	7,234,983	4,322,754	3,947,224
1990-2000	10,785,135	2,747,556	108,272
2000-2010	7,370,008	2,876,972	5,546,325
2010-2020	2,739,769	5,434,415	378,920
2020-2023	3,809,975	1,010,868	-1,163,912

Appendix Table 1C: National Annualized Share Added Owner-Occupied, Renter-Occupied and Vacant Units Over Time (5.3=5.3%)

Year	Share Owner Occupied Added	Share Renter Occupied Added	Share Vacancies Added
1950-1960	5.3	2.5	2.6
1960-1970	3.6	2.9	3.9
1970-1980	3.0	2.1	5.0
1980-1990	1.4	1.5	6.2
1990-2000	1.8	0.8	0.1
2000-2010	1.1	0.8	5.3
2010-2020	0.4	1.4	0.2
2020-2023	1.6	0.7	-2.4

Note: The share of owner, renter and vacancies added is defined as a percentage value, which is the net change in the relevant annual stock throughout the decade divided by the stock at the beginning of the decade

Appendix Table 2: CBSA-Level Annualized Share of Total Housing Stock Added Over Time

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

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

CBSA	Miles from Center	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020
Atlanta	0-5	-0.087	-0.000	0.042	0.015	0.071
	5-10	-0.074	0.113	0.158	0.044	0.089
	10 Plus	0.526	0.991	0.501	0.204	0.044
Charlotte	0-5	-0.050	0.081	0.062	0.019	0.121
	5-10	0.127	0.486	0.425	0.249	0.056
	10 Plus	0.185	0.606	0.436	0.369	0.172
Dallas	0-5	-0.023	-0.045	0.088	0.015	0.077
	5-10	0.090	0.041	0.051	0.003	0.123
	10 Plus	0.406	0.480	0.408	0.298	0.152
Houston	0-5	-0.058	-0.087	0.085	0.108	0.102
	5-10	-0.009	-0.038	0.077	0.025	0.065
	10 Plus	0.768	0.426	0.393	0.310	0.223
Las Vegas	0-5	0.374	0.028	0.094	-0.106	-0.118
	5-10	3.041	1.181	1.604	0.312	0.077
	10 Plus	0.223	2.367	2.598	0.867	0.242
Miami	0-5	-0.176	0.054	0.107	-0.048	-0.078
	5-10	-0.098	0.065	0.112	-0.031	-0.032
	10 Plus	0.059	0.172	0.352	0.356	0.047
Orlando	0-5	-0.115	0.219	0.048	-0.053	-0.037
	5-10	0.219	0.892	0.244	0.025	0.009
	10 Plus	0.561	1.160	0.669	0.370	0.176
Phoenix	0-5	-0.034	-0.079	0.089	-0.099	0.127
	5-10	0.587	0.039	0.186	0.047	0.017
	10 Plus	1.180	1.270	0.780	0.275	0.133
Raleigh	0-5	0.139	0.166	0.110	0.048	0.134
	5-10	0.806	1.469	0.594	0.317	0.121
	10 Plus	0.466	1.046	1.349	0.648	0.388
San Antonio	0-5	-0.061	-0.043	0.062	-0.061	-0.011
	5-10	0.168	0.058	0.115	0.125	0.059
	10 Plus	0.734	1.705	0.570	0.471	0.115
Tampa	0-5	0.009	-0.019	0.045	-0.044	-0.010
	5-10	0.003	0.470	0.108	-0.025	-0.042
	10 Plus	0.277	0.361	0.236	0.097	0.072
Boston	0-5	0.158	-0.137	0.131	0.184	0.058
	5-10	0.094	-0.027	0.053	-0.004	0.037
	10 Plus	0.159	0.123	0.143	0.029	0.040
Los Angeles	0-5	-0.005	-0.165	0.046	0.094	0.028
	5-10	-0.007	-0.016	0.036	-0.019	0.018
	10 Plus	0.178	0.125	0.147	0.004	-0.008
New York	0-5	-0.460	0.087	0.514	-0.145	0.131
	5-10	-0.147	0.046	0.213	-0.049	0.076
	10 Plus	0.117	0.119	0.105	0.016	0.000
San Diego	0-5	-0.063	-0.014	0.080	-0.072	0.061
	5-10	-0.042	0.262	0.037	-0.149	0.101
	10 Plus	0.853	0.564	0.251	0.100	0.105

Appendix Table 3 Continued:

CBSA	Miles from Center	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020
San Francisco	0-5	-0.128	-0.175	0.172	-0.053	0.169
	5-10	0.099	-0.156	0.084	-0.021	0.057
	10 Plus	0.144	0.237	0.139	0.003	0.037
Seattle	0-5	-0.066	-0.008	0.066	-0.004	0.136
	5-10	0.064	0.108	0.079	0.014	0.069
	10 Plus	0.167	0.364	0.306	0.170	0.121
Washington	0-5	-0.028	0.008	0.090	0.040	0.053
	5-10	0.004	0.159	0.081	0.004	0.014
	10 Plus	0.557	0.723	0.319	0.198	0.078
Denver	0-5	-0.065	-0.064	0.153	-0.015	0.019
	5-10	0.178	0.258	0.157	-0.082	0.069
	10 Plus	1.810	1.006	0.476	0.212	0.145
Salt Lake City	0-5	-0.030	-0.069	0.212	-0.109	0.103
	5-10	0.065	0.263	0.184	0.016	-0.000
	10 Plus	0.857	0.874	0.434	0.205	0.209
Chicago	0-5	-0.221	0.261	0.698	0.110	0.016
	5-10	-0.051	0.009	0.056	-0.004	0.017
	10 Plus	0.046	0.347	0.181	0.060	-0.008
Cleveland	0-5	0.010	-0.089	0.060	-0.184	-0.051
	5-10	0.056	-0.009	-0.002	-0.101	-0.082
	10 Plus	0.219	0.166	0.169	0.055	0.011
Detroit	0-5	-0.207	-0.264	0.026	-0.196	-0.024
	5-10	-0.047	-0.130	-0.008	-0.165	-0.130
	10 Plus	0.286	0.084	0.182	0.029	0.009
Philadelphia	0-5	-0.138	-0.068	0.060	-0.251	0.084
	5-10	0.007	0.001	0.020	-0.099	-0.015
	10 Plus	0.234	0.254	0.174	0.059	0.023

Note: We calculate the aggregate single family unit density in each distance-to-center ring by adding all single-unit owner occupied housing in each distance bin, and dividing by the total acreage of the 1970's tracts in that distance bin. A tract is considered within a distance to center bin if it's centroid is in that distance bin. Using these decadal aggregate density measures, we compute the decadal percentage change for a distance to center bin within a CBSA. These percentage changes are the numbers reported in the table.

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

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

Appendix Table 4 Continued:

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

Appendix Table 4 Continued:

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

Appendix Table 4 Continued:

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

Appendix Table 4 Continued:

CBSA	Year	10th	25th	50th	75th	90th
Philadelphia	1970	0.75	0.97	1.40	1.93	2.58
	1980	0.82	1.55	2.28	3.17	3.87
	1990	0.86	1.84	2.71	3.86	5.00
	2000	0.83	1.52	2.32	3.25	4.24
	2010	1.37	2.45	3.67	5.04	6.44
	2020	1.22	2.03	3.00	4.34	5.86
	2023	1.40	2.25	3.19	4.49	5.95

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

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

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

Appendix Table 5 Continued:

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

Appendix Table 5 Continued:

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

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

Appendix Table 6: Regression Tables of Delta Log Single Family Unit Density on Initial Period Log Price for 6 CBSAs, Specification 1, 2 and 3

Coefficient	CBSA	(1) Naive OLS					(2) Log Price IV					(3) Distance and Octant IV				
		1970	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*
Log Price	Atlanta	0.337	0.219	0.181	0.272	0.172	0.314	0.135	0.170	0.264	0.073	0.395	0.177	0.124	0.161	0.158
Log Price SE		*(0.042)*	*(0.043)*	*(0.034)*	*(0.041)*	*(0.030)*	*(0.065)*	*(0.041)*	*(0.049)*	*(0.050)*	*(0.037)*	*(0.064)*	*(0.048)*	*(0.046)*	*(0.068)*	*(0.056)*
SFR Density		-0.165	-0.228	-0.216	-0.213	-0.150	-0.167	-0.230	-0.215	-0.211	-0.114	-0.158	-0.229	-0.211	-0.193	-0.145
SFR Density SE		*(0.021)*	*(0.022)*	*(0.022)*	*(0.027)*	*(0.027)*	*(0.026)*	*(0.042)*	*(0.041)*	*(0.043)*	*(0.037)*	*(0.025)*	*(0.041)*	*(0.041)*	*(0.048)*	*(0.045)*
R2/Wald F		0.426	0.391	0.322	0.259	0.171	793.652	429.801	286.177	354.448	555.232	50.949	35.659	30.477	18.181	19.165
Log Price	Dallas	0.408	0.257	0.155	0.120	0.051	0.453	0.337	0.113	0.073	0.036	0.329	0.271	0.146	0.104	0.057
Log Price SE		*(0.042)*	*(0.034)*	*(0.020)*	*(0.022)*	*(0.019)*	*(0.054)*	*(0.043)*	*(0.024)*	*(0.028)*	*(0.020)*	*(0.083)*	*(0.078)*	*(0.044)*	*(0.030)*	*(0.026)*
SFR Density		-0.205	-0.116	-0.079	-0.125	-0.072	-0.203	-0.118	-0.078	-0.124	-0.071	-0.207	-0.116	-0.079	-0.125	-0.073
SFR Density SE		*(0.014)*	*(0.012)*	*(0.008)*	*(0.010)*	*(0.010)*	*(0.021)*	*(0.019)*	*(0.016)*	*(0.015)*	*(0.014)*	*(0.021)*	*(0.019)*	*(0.016)*	*(0.015)*	*(0.014)*
R2/Wald F		0.408	0.222	0.219	0.255	0.105	845.008	1827.326	1844.494	2170.466	3248.204	34.199	27.540	31.578	28.350	28.820
Log Price	Miami	0.187	0.205	0.035	-0.008	0.050	0.169	0.236	0.075	-0.051	0.044	0.265	0.027	-0.020	0.181	-0.079
Log Price SE		*(0.070)*	*(0.040)*	*(0.019)*	*(0.028)*	*(0.027)*	*(0.093)*	*(0.053)*	*(0.024)*	*(0.040)*	*(0.024)*	*(0.224)*	*(0.129)*	*(0.063)*	*(0.063)*	*(0.056)*
SFR Density		-0.297	-0.217	-0.060	-0.103	-0.035	-0.298	-0.215	-0.059	-0.101	-0.034	-0.292	-0.226	-0.062	-0.112	-0.025
SFR Density SE		*(0.019)*	*(0.016)*	*(0.010)*	*(0.013)*	*(0.017)*	*(0.053)*	*(0.043)*	*(0.018)*	*(0.029)*	*(0.022)*	*(0.056)*	*(0.046)*	*(0.018)*	*(0.032)*	*(0.024)*
R2/Wald F		0.441	0.373	0.085	0.134	0.019	933.904	1987.934	1828.155	526.147	1623.826	134.369	16.159	9340.621	3315.914	6367.266
Log Price	Phoenix	0.567	0.176	0.170	0.101	0.047	0.601	0.414	0.175	0.034	0.032	0.569	0.340	0.220	0.037	0.097
Log Price SE		*(0.089)*	*(0.067)*	*(0.034)*	*(0.048)*	*(0.026)*	*(0.110)*	*(0.081)*	*(0.048)*	*(0.065)*	*(0.024)*	*(0.119)*	*(0.135)*	*(0.055)*	*(0.097)*	*(0.040)*
SFR Density		-0.254	-0.128	-0.077	-0.107	-0.035	-0.253	-0.130	-0.077	-0.107	-0.034	-0.254	-0.129	-0.075	-0.107	-0.039
SFR Density SE		*(0.022)*	*(0.019)*	*(0.012)*	*(0.018)*	*(0.013)*	*(0.042)*	*(0.047)*	*(0.019)*	*(0.031)*	*(0.017)*	*(0.042)*	*(0.045)*	*(0.019)*	*(0.030)*	*(0.016)*
R2/Wald F		0.441	0.193	0.252	0.153	0.044	277.835	720.494	1354.929	516.346	1199.701	21.830	14.158	14.955	12.432	13.554
Log Price	Los Angeles	0.094	0.048	0.016	-0.010	-0.001	0.106	0.056	-0.016	-0.071	-0.028	0.122	0.052	-0.038	-0.060	-0.059
Log Price SE		*(0.019)*	*(0.015)*	*(0.009)*	*(0.018)*	*(0.014)*	*(0.025)*	*(0.023)*	*(0.015)*	*(0.019)*	*(0.016)*	*(0.041)*	*(0.035)*	*(0.024)*	*(0.043)*	*(0.034)*
SFR Density		-0.146	-0.128	-0.062	-0.077	-0.057	-0.145	-0.128	-0.062	-0.074	-0.056	-0.144	-0.128	-0.063	-0.075	-0.055
SFR Density SE		*(0.007)*	*(0.007)*	*(0.005)*	*(0.008)*	*(0.008)*	*(0.022)*	*(0.023)*	*(0.014)*	*(0.020)*	*(0.019)*	*(0.023)*	*(0.022)*	*(0.014)*	*(0.020)*	*(0.019)*
R2/Wald F		0.200	0.167	0.086	0.051	0.027	1912.727	1132.597	596.067	3492.572	2188.211	91.563	102.135	53.616	76.912	79.522
Log Price	Detroit	0.225	0.244	0.152	0.164	0.130	0.238	0.220	0.142	0.178	0.106	0.272	0.180	0.173	0.209	0.073
Log Price SE		*(0.019)*	*(0.015)*	*(0.009)*	*(0.013)*	*(0.012)*	*(0.031)*	*(0.024)*	*(0.009)*	*(0.019)*	*(0.017)*	*(0.041)*	*(0.034)*	*(0.017)*	*(0.027)*	*(0.022)*
SFR Density		-0.122	-0.080	-0.085	-0.084	-0.066	-0.120	-0.086	-0.087	-0.082	-0.070	-0.113	-0.095	-0.082	-0.079	-0.076
SFR Density SE		*(0.009)*	*(0.009)*	*(0.006)*	*(0.007)*	*(0.010)*	*(0.012)*	*(0.020)*	*(0.009)*	*(0.011)*	*(0.011)*	*(0.014)*	*(0.022)*	*(0.010)*	*(0.012)*	*(0.011)*
R2/Wald F		0.347	0.354	0.383	0.267	0.176	2113.124	3891.111	7254.246	2207.029	2567.526	109.252	93.578	90.078	60.259	69.095

Appendix Table 7: Regression Tables of Delta Log Single Family Unit Density on Initial Period Log Price for 24 CBSAs

Coefficient	CBSA	(1) Naive OLS					(2) Log Price IV					(3) Distance and Octant IV				
		1970	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*
Log Price		0.337	0.219	0.181	0.272	0.172	0.314	0.135	0.170	0.264	0.073	0.395	0.177	0.124	0.161	0.158
Log Price SE		*(0.042)*	*(0.043)*	*(0.034)*	*(0.041)*	*(0.030)*	*(0.065)*	*(0.041)*	*(0.049)*	*(0.050)*	*(0.037)*	*(0.064)*	*(0.048)*	*(0.046)*	*(0.068)*	*(0.056)*
SFR Density	Atlanta	-0.165	-0.228	-0.216	-0.213	-0.150	-0.167	-0.230	-0.215	-0.211	-0.114	-0.158	-0.229	-0.211	-0.193	-0.145
SFR Density SE		*(0.021)*	*(0.022)*	*(0.022)*	*(0.027)*	*(0.027)*	*(0.026)*	*(0.042)*	*(0.041)*	*(0.043)*	*(0.037)*	*(0.025)*	*(0.041)*	*(0.041)*	*(0.048)*	*(0.045)*
R2/Wald F		0.426	0.391	0.322	0.259	0.171	793.652	429.801	286.177	354.448	555.232	50.949	35.659	30.477	18.181	19.165
Log Price		0.467	0.313	0.180	0.251	0.144	0.333	0.379	0.169	0.236	0.076	0.637	0.450	0.330	0.259	0.287
Log Price SE		*(0.070)*	*(0.054)*	*(0.041)*	*(0.041)*	*(0.038)*	*(0.091)*	*(0.070)*	*(0.054)*	*(0.042)*	*(0.051)*	*(0.103)*	*(0.079)*	*(0.075)*	*(0.083)*	*(0.074)*
SFR Density	Charlotte	-0.156	-0.106	-0.110	-0.103	-0.089	-0.165	-0.103	-0.110	-0.102	-0.077	-0.146	-0.101	-0.110	-0.103	-0.114
SFR Density SE		*(0.021)*	*(0.019)*	*(0.016)*	*(0.020)*	*(0.021)*	*(0.016)*	*(0.018)*	*(0.017)*	*(0.021)*	*(0.018)*	*(0.016)*	*(0.017)*	*(0.018)*	*(0.025)*	*(0.022)*
R2/Wald F		0.489	0.350	0.299	0.272	0.154	411.048	194.711	1037.161	775.541	574.730	4.728	5.932	10.973	11.113	9.801
Log Price		0.408	0.257	0.155	0.120	0.051	0.453	0.337	0.113	0.073	0.036	0.329	0.271	0.146	0.104	0.057
Log Price SE		*(0.042)*	*(0.034)*	*(0.020)*	*(0.022)*	*(0.019)*	*(0.054)*	*(0.043)*	*(0.024)*	*(0.028)*	*(0.020)*	*(0.083)*	*(0.078)*	*(0.044)*	*(0.030)*	*(0.026)*
SFR Density	Dallas	-0.205	-0.116	-0.079	-0.125	-0.072	-0.203	-0.118	-0.078	-0.124	-0.071	-0.207	-0.116	-0.079	-0.125	-0.073
SFR Density SE		*(0.014)*	*(0.012)*	*(0.008)*	*(0.010)*	*(0.010)*	*(0.021)*	*(0.019)*	*(0.016)*	*(0.015)*	*(0.014)*	*(0.021)*	*(0.019)*	*(0.016)*	*(0.015)*	*(0.014)*
R2/Wald F		0.408	0.222	0.219	0.255	0.105	845.008	1827.326	1844.494	2170.466	3248.204	34.199	27.540	31.578	28.350	28.820
Log Price		0.470	0.286	0.212	0.227	0.113	0.616	0.302	0.213	0.153	0.094	0.562	0.305	0.271	0.253	0.084
Log Price SE		*(0.066)*	*(0.040)*	*(0.033)*	*(0.036)*	*(0.026)*	*(0.116)*	*(0.040)*	*(0.031)*	*(0.041)*	*(0.028)*	*(0.122)*	*(0.067)*	*(0.055)*	*(0.065)*	*(0.046)*
SFR Density	Houston	-0.156	-0.116	-0.084	-0.081	-0.046	-0.155	-0.116	-0.084	-0.077	-0.044	-0.155	-0.116	-0.085	-0.083	-0.043
SFR Density SE		*(0.015)*	*(0.011)*	*(0.011)*	*(0.012)*	*(0.011)*	*(0.020)*	*(0.018)*	*(0.016)*	*(0.012)*	*(0.012)*	*(0.020)*	*(0.018)*	*(0.016)*	*(0.013)*	*(0.012)*
R2/Wald F		0.315	0.307	0.207	0.162	0.079	199.717	878.742	2857.270	1190.982	2995.230	20.559	21.741	22.278	19.984	19.290
Log Price		0.628	-0.287	-0.191	0.095	-0.066	-0.070	-0.437	-0.331	0.175	0.429	0.723	-0.417	-0.260	0.225	0.072
Log Price SE		*(0.288)*	*(0.203)*	*(0.124)*	*(0.049)*	*(0.108)*	*(0.309)*	*(0.382)*	*(0.220)*	*(0.065)*	*(0.450)*	*(0.545)*	*(0.367)*	*(0.270)*	*(0.091)*	*(0.186)*
SFR Density	Las Vegas	-0.195	-0.224	-0.152	-0.124	-0.028	-0.214	-0.238	-0.162	-0.120	0.020	-0.192	-0.236	-0.157	-0.118	-0.014
SFR Density SE		*(0.043)*	*(0.046)*	*(0.032)*	*(0.016)*	*(0.035)*	*(0.060)*	*(0.085)*	*(0.036)*	*(0.019)*	*(0.084)*	*(0.051)*	*(0.079)*	*(0.041)*	*(0.019)*	*(0.055)*
R2/Wald F		0.335	0.288	0.264	0.539	0.014	49.215	495.359	163.200	68.798	5.480	6.540	7.060	5.742	3.676	2.735
Log Price		0.187	0.205	0.035	-0.008	0.050	0.169	0.236	0.075	-0.051	0.044	0.265	0.027	-0.020	0.181	-0.079
Log Price SE		*(0.070)*	*(0.040)*	*(0.019)*	*(0.028)*	*(0.027)*	*(0.093)*	*(0.053)*	*(0.024)*	*(0.040)*	*(0.024)*	*(0.224)*	*(0.129)*	*(0.063)*	*(0.063)*	*(0.056)*
SFR Density	Miami	-0.297	-0.217	-0.060	-0.103	-0.035	-0.298	-0.215	-0.059	-0.101	-0.034	-0.292	-0.226	-0.062	-0.112	-0.025
SFR Density SE		*(0.019)*	*(0.016)*	*(0.010)*	*(0.013)*	*(0.017)*	*(0.053)*	*(0.043)*	*(0.018)*	*(0.029)*	*(0.022)*	*(0.056)*	*(0.046)*	*(0.018)*	*(0.032)*	*(0.024)*
R2/Wald F		0.441	0.373	0.085	0.134	0.019	933.904	1987.934	1828.155	526.147	1623.826	134.369	16.159	9340.621	3315.914	6367.266
Log Price		0.715	0.316	0.143	0.253	0.020	0.454	0.199	0.158	0.166	-0.029	1.090	0.538	-0.202	0.315	-0.036
Log Price SE		*(0.132)*	*(0.141)*	*(0.056)*	*(0.067)*	*(0.043)*	*(0.140)*	*(0.193)*	*(0.052)*	*(0.097)*	*(0.063)*	*(0.365)*	*(0.348)*	*(0.171)*	*(0.141)*	*(0.094)*
SFR Density	Orlando	-0.159	-0.186	-0.124	-0.178	-0.091	-0.154	-0.185	-0.125	-0.174	-0.088	-0.166	-0.188	-0.121	-0.180	-0.087
SFR Density SE		*(0.025)*	*(0.028)*	*(0.015)*	*(0.022)*	*(0.017)*	*(0.027)*	*(0.049)*	*(0.025)*	*(0.029)*	*(0.019)*	*(0.029)*	*(0.050)*	*(0.025)*	*(0.031)*	*(0.021)*
R2/Wald F		0.380	0.324	0.390	0.392	0.207	156.105	102.140	683.576	201.553	659.315	1.932	4.319	2.637	4.785	3.505
Log Price		0.567	0.176	0.170	0.101	0.047	0.601	0.414	0.175	0.034	0.032	0.569	0.340	0.220	0.037	0.097
Log Price SE		*(0.089)*	*(0.067)*	*(0.034)*	*(0.048)*	*(0.026)*	*(0.110)*	*(0.081)*	*(0.048)*	*(0.065)*	*(0.024)*	*(0.119)*	*(0.135)*	*(0.055)*	*(0.097)*	*(0.040)*
SFR Density	Phoenix	-0.254	-0.128	-0.077	-0.107	-0.035	-0.253	-0.130	-0.077	-0.107	-0.034	-0.254	-0.129	-0.075	-0.107	-0.039
SFR Density SE		*(0.022)*	*(0.019)*	*(0.012)*	*(0.018)*	*(0.013)*	*(0.042)*	*(0.047)*	*(0.019)*	*(0.031)*	*(0.017)*	*(0.042)*	*(0.045)*	*(0.019)*	*(0.030)*	*(0.016)*
R2/Wald F		0.441	0.193	0.252	0.153	0.044	277.835	720.494	1354.929	516.346	1199.701	21.830	14.158	14.955	12.432	13.554

Appendix Table 7 Continued:

Coefficient	CBSA	(1) Naive OLS					(2) Log Price IV					(3) Distance and Octant IV				
		1970	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*
Log Price		0.642	0.204	0.235	0.214	0.067	0.585	0.341	0.168	0.252	-0.039	0.707	0.298	0.230	0.236	-0.030
Log Price SE		*(0.146)*	*(0.131)*	*(0.115)*	*(0.081)*	*(0.072)*	*(0.139)*	*(0.100)*	*(0.090)*	*(0.105)*	*(0.087)*	*(0.165)*	*(0.206)*	*(0.106)*	*(0.111)*	*(0.070)*
SFR Density	Raleigh	-0.143	-0.207	-0.221	-0.224	-0.163	-0.143	-0.207	-0.219	-0.227	-0.149	-0.142	-0.207	-0.220	-0.226	-0.151
SFR Density SE		*(0.037)*	*(0.035)*	*(0.040)*	*(0.039)*	*(0.039)*	*(0.024)*	*(0.040)*	*(0.052)*	*(0.051)*	*(0.034)*	*(0.024)*	*(0.039)*	*(0.053)*	*(0.054)*	*(0.038)*
R2/Wald F		0.435	0.444	0.391	0.419	0.285	112.205	122.112	287.403	342.876	113.823	12.008	9.146	8.951	10.604	5.702
Log Price		0.019	0.284	0.124	0.124	0.015	0.292	0.231	0.125	0.126	-0.012	0.209	0.319	0.165	0.083	0.030
Log Price SE		*(0.080)*	*(0.076)*	*(0.022)*	*(0.032)*	*(0.030)*	*(0.117)*	*(0.129)*	*(0.029)*	*(0.034)*	*(0.043)*	*(0.158)*	*(0.107)*	*(0.036)*	*(0.050)*	*(0.042)*
SFR Density	San Antonio	-0.154	-0.173	-0.047	-0.085	-0.024	-0.134	-0.176	-0.047	-0.084	-0.027	-0.140	-0.171	-0.043	-0.088	-0.023
SFR Density SE		*(0.024)*	*(0.020)*	*(0.008)*	*(0.013)*	*(0.014)*	*(0.046)*	*(0.039)*	*(0.008)*	*(0.015)*	*(0.023)*	*(0.047)*	*(0.040)*	*(0.008)*	*(0.016)*	*(0.024)*
R2/Wald F		0.220	0.406	0.351	0.313	0.022	97.581	13.994	1716.690	1659.381	600.672	14.687	15.733	23.345	15.124	17.834
Log Price		0.298	0.316	0.221	0.013	0.125	0.254	0.448	0.192	-0.009	0.112	0.670	0.561	0.286	0.055	0.314
Log Price SE		*(0.057)*	*(0.053)*	*(0.048)*	*(0.031)*	*(0.032)*	*(0.088)*	*(0.078)*	*(0.056)*	*(0.046)*	*(0.035)*	*(0.163)*	*(0.221)*	*(0.180)*	*(0.176)*	*(0.119)*
SFR Density	Tampa	-0.137	-0.115	-0.149	-0.090	-0.073	-0.141	-0.105	-0.151	-0.089	-0.072	-0.107	-0.095	-0.145	-0.092	-0.081
SFR Density SE		*(0.018)*	*(0.019)*	*(0.020)*	*(0.014)*	*(0.018)*	*(0.029)*	*(0.038)*	*(0.076)*	*(0.029)*	*(0.026)*	*(0.029)*	*(0.040)*	*(0.068)*	*(0.032)*	*(0.027)*
R2/Wald F		0.341	0.309	0.283	0.150	0.120	33.985	443.130	956.206	147.360	756.045	96.207	39.469	9.136	5.746	11.136
Log Price		0.109	0.009	0.074	-0.023	0.063	0.154	-0.074	0.086	-0.055	0.035	0.107	0.057	0.061	0.085	0.126
Log Price SE		*(0.034)*	*(0.033)*	*(0.028)*	*(0.041)*	*(0.031)*	*(0.079)*	*(0.058)*	*(0.051)*	*(0.046)*	*(0.034)*	*(0.069)*	*(0.059)*	*(0.048)*	*(0.086)*	*(0.056)*
SFR Density	Boston	-0.100	-0.217	-0.081	-0.093	-0.087	-0.095	-0.219	-0.080	-0.093	-0.085	-0.100	-0.215	-0.081	-0.092	-0.089
SFR Density SE		*(0.015)*	*(0.012)*	*(0.015)*	*(0.016)*	*(0.016)*	*(0.030)*	*(0.023)*	*(0.019)*	*(0.029)*	*(0.020)*	*(0.028)*	*(0.022)*	*(0.019)*	*(0.029)*	*(0.022)*
R2/Wald F		0.091	0.350	0.053	0.049	0.050	383.959	452.252	701.927	1280.788	4800.645	17.899	23.704	31.733	24.466	52.480
Log Price		0.094	0.048	0.016	-0.010	-0.001	0.106	0.056	-0.016	-0.071	-0.028	0.122	0.052	-0.038	-0.060	-0.059
Log Price SE		*(0.019)*	*(0.015)*	*(0.009)*	*(0.018)*	*(0.014)*	*(0.025)*	*(0.023)*	*(0.015)*	*(0.019)*	*(0.016)*	*(0.041)*	*(0.035)*	*(0.024)*	*(0.043)*	*(0.034)*
SFR Density	Los Angeles	-0.146	-0.128	-0.062	-0.077	-0.057	-0.145	-0.128	-0.062	-0.074	-0.056	-0.144	-0.128	-0.063	-0.075	-0.055
SFR Density SE		*(0.007)*	*(0.007)*	*(0.005)*	*(0.008)*	*(0.008)*	*(0.022)*	*(0.023)*	*(0.014)*	*(0.020)*	*(0.019)*	*(0.023)*	*(0.022)*	*(0.014)*	*(0.020)*	*(0.019)*
R2/Wald F		0.200	0.167	0.086	0.051	0.027	1912.727	1132.597	596.067	3492.572	2188.211	91.563	102.135	53.616	76.912	79.522
Log Price		0.230	-0.001	0.063	0.087	0.079	0.231	-0.084	0.047	0.021	0.026	0.044	0.275	0.329	0.248	0.269
Log Price SE		*(0.017)*	*(0.018)*	*(0.016)*	*(0.021)*	*(0.016)*	*(0.044)*	*(0.040)*	*(0.040)*	*(0.042)*	*(0.022)*	*(0.082)*	*(0.082)*	*(0.052)*	*(0.070)*	*(0.037)*
SFR Density	New York	-0.140	-0.205	-0.127	-0.111	-0.098	-0.140	-0.206	-0.128	-0.111	-0.093	-0.165	-0.202	-0.102	-0.113	-0.114
SFR Density SE		*(0.007)*	*(0.006)*	*(0.008)*	*(0.008)*	*(0.008)*	*(0.014)*	*(0.012)*	*(0.014)*	*(0.012)*	*(0.010)*	*(0.014)*	*(0.011)*	*(0.011)*	*(0.013)*	*(0.012)*
R2/Wald F		0.205	0.218	0.087	0.056	0.056	975.908	1126.910	659.055	2359.179	1856.574	23.163	27.556	83.542	76.741	103.770
Log Price		0.305	0.117	0.018	-0.000	0.120	0.263	0.148	-0.043	-0.025	0.042	0.364	0.100	0.001	-0.076	0.163
Log Price SE		*(0.069)*	*(0.049)*	*(0.030)*	*(0.036)*	*(0.035)*	*(0.096)*	*(0.070)*	*(0.069)*	*(0.052)*	*(0.040)*	*(0.133)*	*(0.069)*	*(0.032)*	*(0.075)*	*(0.071)*
SFR Density	San Diego	-0.186	-0.093	-0.054	-0.048	-0.055	-0.187	-0.093	-0.055	-0.048	-0.048	-0.184	-0.093	-0.054	-0.046	-0.059
SFR Density SE		*(0.015)*	*(0.014)*	*(0.012)*	*(0.012)*	*(0.014)*	*(0.022)*	*(0.025)*	*(0.023)*	*(0.016)*	*(0.017)*	*(0.021)*	*(0.025)*	*(0.023)*	*(0.016)*	*(0.018)*
R2/Wald F		0.406	0.144	0.069	0.056	0.076	321.800	322.142	1002.454	535.313	904.898	18.988	34.842	28.386	23.183	24.821
Log Price		0.123	0.018	0.002	0.084	0.011	0.118	-0.043	-0.008	0.104	-0.022	0.114	-0.159	0.005	0.122	-0.006
Log Price SE		*(0.032)*	*(0.029)*	*(0.020)*	*(0.029)*	*(0.024)*	*(0.054)*	*(0.035)*	*(0.025)*	*(0.033)*	*(0.029)*	*(0.068)*	*(0.052)*	*(0.033)*	*(0.049)*	*(0.035)*
SFR Density	San Francisco	-0.125	-0.157	-0.082	-0.058	-0.067	-0.125	-0.158	-0.083	-0.058	-0.065	-0.126	-0.160	-0.082	-0.058	-0.066
SFR Density SE		*(0.011)*	*(0.010)*	*(0.009)*	*(0.010)*	*(0.010)*	*(0.022)*	*(0.025)*	*(0.018)*	*(0.015)*	*(0.018)*	*(0.025)*	*(0.026)*	*(0.018)*	*(0.015)*	*(0.018)*
R2/Wald F		0.209	0.274	0.119	0.060	0.062	663.391	2050.744	2894.224	1989.774	1750.122	34.293	51.265	57.158	52.818	62.713

Appendix Table 7 Continued:

Coefficient	CBSA	(1) Naive OLS					(2) Log Price IV					(3) Distance and Octant IV				
		1970	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*
Log Price	Seattle	0.521	0.223	-0.015	0.055	0.025	0.692	0.252	-0.034	0.003	-0.024	0.577	0.136	-0.066	0.003	0.053
Log Price SE		*(0.088)*	*(0.035)*	*(0.040)*	*(0.037)*	*(0.030)*	*(0.255)*	*(0.049)*	*(0.058)*	*(0.042)*	*(0.026)*	*(0.276)*	*(0.058)*	*(0.071)*	*(0.045)*	*(0.037)*
SFR Density		-0.161	-0.083	-0.108	-0.051	-0.034	-0.161	-0.084	-0.107	-0.047	-0.028	-0.161	-0.081	-0.105	-0.047	-0.037
SFR Density SE		*(0.015)*	*(0.009)*	*(0.011)*	*(0.010)*	*(0.010)*	*(0.035)*	*(0.017)*	*(0.025)*	*(0.017)*	*(0.017)*	*(0.035)*	*(0.018)*	*(0.026)*	*(0.017)*	*(0.018)*
R2/Wald F		0.314	0.236	0.209	0.061	0.029	285.700	1192.865	1391.437	828.276	2853.881	17.952	46.850	45.735	40.594	124.033
Log Price	Washington	0.184	0.057	0.035	0.063	0.034	0.062	0.049	0.051	-0.018	-0.028	0.101	0.043	0.075	0.023	-0.001
Log Price SE		*(0.056)*	*(0.028)*	*(0.023)*	*(0.024)*	*(0.025)*	*(0.125)*	*(0.029)*	*(0.023)*	*(0.027)*	*(0.023)*	*(0.063)*	*(0.035)*	*(0.042)*	*(0.032)*	*(0.034)*
SFR Density		-0.173	-0.140	-0.132	-0.097	-0.060	-0.174	-0.140	-0.132	-0.094	-0.054	-0.174	-0.140	-0.131	-0.096	-0.057
SFR Density SE		*(0.014)*	*(0.010)*	*(0.010)*	*(0.009)*	*(0.012)*	*(0.029)*	*(0.022)*	*(0.025)*	*(0.015)*	*(0.017)*	*(0.028)*	*(0.022)*	*(0.024)*	*(0.016)*	*(0.019)*
R2/Wald F		0.222	0.252	0.242	0.154	0.041	192.312	2382.191	2240.510	1027.604	3860.322	52.912	84.613	57.241	65.384	72.017
Log Price	Denver	0.398	0.345	0.071	0.160	0.118	0.602	0.268	-0.190	0.159	0.057	0.890	0.483	-0.112	0.071	0.095
Log Price SE		*(0.102)*	*(0.068)*	*(0.046)*	*(0.033)*	*(0.036)*	*(0.182)*	*(0.132)*	*(0.102)*	*(0.062)*	*(0.035)*	*(0.279)*	*(0.136)*	*(0.098)*	*(0.064)*	*(0.064)*
SFR Density		-0.227	-0.153	-0.093	-0.114	-0.067	-0.217	-0.159	-0.100	-0.114	-0.065	-0.203	-0.142	-0.098	-0.117	-0.066
SFR Density SE		*(0.022)*	*(0.020)*	*(0.014)*	*(0.012)*	*(0.014)*	*(0.042)*	*(0.047)*	*(0.031)*	*(0.021)*	*(0.017)*	*(0.039)*	*(0.041)*	*(0.029)*	*(0.022)*	*(0.018)*
R2/Wald F		0.395	0.339	0.163	0.329	0.124	137.047	122.848	142.939	78.649	1085.342	7.491	10.292	4.206	6.927	8.578
Log Price	Salt Lake City	0.491	0.173	-0.050	0.090	-0.044	0.394	0.167	-0.108	0.145	-0.021	0.520	0.179	-0.049	0.117	-0.178
Log Price SE		*(0.124)*	*(0.087)*	*(0.066)*	*(0.061)*	*(0.059)*	*(0.187)*	*(0.114)*	*(0.074)*	*(0.082)*	*(0.068)*	*(0.219)*	*(0.121)*	*(0.097)*	*(0.073)*	*(0.087)*
SFR Density		-0.156	-0.087	-0.132	-0.020	-0.067	-0.162	-0.087	-0.131	-0.021	-0.067	-0.154	-0.087	-0.132	-0.020	-0.065
SFR Density SE		*(0.030)*	*(0.027)*	*(0.020)*	*(0.021)*	*(0.021)*	*(0.055)*	*(0.039)*	*(0.040)*	*(0.037)*	*(0.024)*	*(0.049)*	*(0.038)*	*(0.040)*	*(0.037)*	*(0.022)*
R2/Wald F		0.415	0.168	0.358	0.035	0.129	236.761	171.824	543.357	194.033	1068.242	24.679	34.056	96.887	91.144	74.183
Log Price	Chicago	0.221	0.240	0.140	0.173	0.103	0.234	0.213	0.105	0.130	0.103	0.109	0.263	0.121	0.177	0.123
Log Price SE		*(0.024)*	*(0.018)*	*(0.016)*	*(0.018)*	*(0.016)*	*(0.048)*	*(0.030)*	*(0.021)*	*(0.023)*	*(0.015)*	*(0.048)*	*(0.029)*	*(0.023)*	*(0.025)*	*(0.022)*
SFR Density		-0.163	-0.242	-0.159	-0.130	-0.056	-0.162	-0.244	-0.160	-0.125	-0.056	-0.169	-0.241	-0.159	-0.130	-0.058
SFR Density SE		*(0.011)*	*(0.009)*	*(0.009)*	*(0.011)*	*(0.011)*	*(0.021)*	*(0.019)*	*(0.014)*	*(0.013)*	*(0.013)*	*(0.022)*	*(0.019)*	*(0.014)*	*(0.014)*	*(0.015)*
R2/Wald F		0.203	0.394	0.215	0.129	0.044	705.639	1114.836	2457.550	2316.062	8668.480	67.870	102.593	890.308	236.306	152.253
Log Price	Cleveland	0.148	0.114	0.102	0.090	0.061	0.161	0.088	0.081	0.145	0.052	0.093	0.081	0.097	0.148	0.093
Log Price SE		*(0.025)*	*(0.023)*	*(0.022)*	*(0.034)*	*(0.020)*	*(0.032)*	*(0.036)*	*(0.041)*	*(0.054)*	*(0.022)*	*(0.050)*	*(0.049)*	*(0.054)*	*(0.088)*	*(0.048)*
SFR Density		-0.070	-0.097	-0.077	-0.147	-0.076	-0.069	-0.100	-0.080	-0.139	-0.078	-0.078	-0.101	-0.078	-0.138	-0.069
SFR Density SE		*(0.011)*	*(0.010)*	*(0.009)*	*(0.014)*	*(0.012)*	*(0.016)*	*(0.021)*	*(0.014)*	*(0.020)*	*(0.013)*	*(0.018)*	*(0.021)*	*(0.017)*	*(0.023)*	*(0.015)*
R2/Wald F		0.195	0.233	0.207	0.232	0.124	738.502	2001.428	795.038	455.021	1560.153	49.375	36.068	32.104	32.111	83.145
Log Price	Detroit	0.225	0.244	0.152	0.164	0.130	0.238	0.220	0.142	0.178	0.106	0.272	0.180	0.173	0.209	0.073
Log Price SE		*(0.019)*	*(0.015)*	*(0.009)*	*(0.013)*	*(0.012)*	*(0.031)*	*(0.024)*	*(0.009)*	*(0.019)*	*(0.017)*	*(0.041)*	*(0.034)*	*(0.017)*	*(0.027)*	*(0.022)*
SFR Density		-0.122	-0.080	-0.085	-0.084	-0.066	-0.120	-0.086	-0.087	-0.082	-0.070	-0.113	-0.095	-0.082	-0.079	-0.076
SFR Density SE		*(0.009)*	*(0.009)*	*(0.006)*	*(0.007)*	*(0.010)*	*(0.012)*	*(0.020)*	*(0.009)*	*(0.011)*	*(0.011)*	*(0.014)*	*(0.022)*	*(0.010)*	*(0.012)*	*(0.011)*
R2/Wald F		0.347	0.354	0.383	0.267	0.176	2113.124	3891.111	7254.246	2207.029	2567.526	109.252	93.578	90.078	60.259	69.095
Log Price	Philadelphia	0.066	0.030	0.094	0.088	0.039	0.096	0.007	0.069	0.068	0.015	0.065	0.008	0.009	0.091	0.004
Log Price SE		*(0.020)*	*(0.013)*	*(0.013)*	*(0.016)*	*(0.011)*	*(0.027)*	*(0.033)*	*(0.016)*	*(0.027)*	*(0.015)*	*(0.051)*	*(0.053)*	*(0.039)*	*(0.045)*	*(0.030)*
SFR Density		-0.111	-0.077	-0.072	-0.076	-0.019	-0.105	-0.082	-0.078	-0.080	-0.023	-0.111	-0.082	-0.092	-0.075	-0.025
SFR Density SE		*(0.007)*	*(0.005)*	*(0.006)*	*(0.007)*	*(0.005)*	*(0.014)*	*(0.015)*	*(0.010)*	*(0.011)*	*(0.005)*	*(0.018)*	*(0.018)*	*(0.014)*	*(0.014)*	*(0.007)*
R2/Wald F		0.284	0.219	0.275	0.181	0.037	1716.478	2346.869	5831.313	2113.702	3933.289	20.541	25.747	21.136	17.391	17.050

Appendix Table 8: Regression Tables of Delta Log All Unit Density on Initial Period Log Price for 24 CBSAs

Coefficient	CBSA	(1) Naive OLS					(2) Log Price IV					(3) Distance and Octant IV				
		1970	1980	1990	2000	2010	1970	1980	1990	2000	2010	1970	1980	1990	2000	2010
Log Price	Atlanta	0.147	0.187	0.147	0.091	0.106	0.174	0.170	0.118	0.073	0.123	0.218	0.276	0.123	0.208	0.121
Log Price SE		(0.036)	(0.031)	(0.027)	(0.033)	(0.018)	(0.054)	(0.042)	(0.042)	(0.042)	(0.025)	(0.052)	(0.045)	(0.032)	(0.066)	(0.028)
Density		-0.199	-0.145	-0.158	-0.149	-0.009	-0.195	-0.147	-0.157	-0.148	-0.012	-0.190	-0.138	-0.157	-0.157	-0.012
Density SE		(0.014)	(0.015)	(0.016)	(0.019)	(0.014)	(0.021)	(0.016)	(0.025)	(0.022)	(0.017)	(0.019)	(0.015)	(0.025)	(0.023)	(0.014)
R2/Wald F		0.546	0.398	0.344	0.217	0.137	645.741	146.041	271.397	336.939	524.678	31.259	31.745	33.415	20.338	21.951
Log Price	Charlotte	0.378	0.298	0.202	0.180	0.134	0.464	0.349	0.229	0.186	0.096	0.594	0.469	0.295	0.382	0.176
Log Price SE		(0.062)	(0.039)	(0.031)	(0.043)	(0.029)	(0.065)	(0.056)	(0.046)	(0.053)	(0.031)	(0.089)	(0.074)	(0.051)	(0.075)	(0.047)
Density		-0.124	-0.078	-0.087	-0.073	0.006	-0.117	-0.076	-0.086	-0.074	0.011	-0.106	-0.071	-0.085	-0.081	0.001
Density SE		(0.016)	(0.011)	(0.011)	(0.019)	(0.014)	(0.018)	(0.011)	(0.011)	(0.019)	(0.011)	(0.020)	(0.011)	(0.011)	(0.019)	(0.010)
R2/Wald F		0.487	0.454	0.426	0.166	0.146	352.176	213.639	1102.220	731.429	630.334	6.407	7.844	12.013	11.698	11.507
Log Price	Dallas	0.386	0.180	0.150	0.075	0.039	0.484	0.248	0.121	0.038	0.030	0.420	0.161	0.161	0.059	0.055
Log Price SE		(0.035)	(0.026)	(0.016)	(0.017)	(0.013)	(0.058)	(0.036)	(0.024)	(0.024)	(0.014)	(0.065)	(0.047)	(0.029)	(0.025)	(0.020)
Density		-0.187	-0.114	-0.091	-0.104	-0.041	-0.183	-0.115	-0.091	-0.103	-0.041	-0.186	-0.113	-0.091	-0.104	-0.042
Density SE		(0.012)	(0.009)	(0.008)	(0.008)	(0.007)	(0.014)	(0.010)	(0.008)	(0.012)	(0.007)	(0.014)	(0.010)	(0.008)	(0.012)	(0.007)
R2/Wald F		0.439	0.259	0.307	0.243	0.074	955.583	1881.685	1851.534	1541.789	3573.280	36.768	30.025	34.174	31.290	30.812
Log Price	Houston	0.560	0.219	0.183	0.186	0.085	0.842	0.279	0.184	0.162	0.095	0.603	0.328	0.264	0.226	0.086
Log Price SE		(0.060)	(0.030)	(0.029)	(0.032)	(0.019)	(0.118)	(0.037)	(0.027)	(0.038)	(0.024)	(0.123)	(0.064)	(0.055)	(0.062)	(0.042)
Density		-0.138	-0.093	-0.082	-0.071	-0.032	-0.132	-0.094	-0.082	-0.070	-0.033	-0.137	-0.094	-0.083	-0.073	-0.033
Density SE		(0.013)	(0.008)	(0.009)	(0.010)	(0.007)	(0.015)	(0.012)	(0.014)	(0.012)	(0.009)	(0.014)	(0.012)	(0.014)	(0.012)	(0.010)
R2/Wald F		0.367	0.339	0.238	0.160	0.082	205.140	858.402	1315.093	1173.717	3101.083	21.731	23.401	22.128	20.815	19.530
Log Price	Las Vegas	0.482	0.164	0.055	0.085	-0.033	0.471	0.078	0.114	0.156	0.029	0.965	0.182	0.099	0.196	-0.069
Log Price SE		(0.225)	(0.111)	(0.091)	(0.051)	(0.019)	(0.488)	(0.136)	(0.104)	(0.088)	(0.042)	(0.580)	(0.160)	(0.091)	(0.102)	(0.038)
Density		-0.140	-0.129	-0.193	-0.104	-0.034	-0.140	-0.133	-0.188	-0.095	-0.028	-0.126	-0.128	-0.190	-0.090	-0.037
Density SE		(0.033)	(0.022)	(0.024)	(0.019)	(0.007)	(0.063)	(0.042)	(0.033)	(0.030)	(0.015)	(0.055)	(0.040)	(0.037)	(0.033)	(0.015)
R2/Wald F		0.285	0.402	0.521	0.390	0.311	6.951	167.723	146.259	68.948	4.545	6.227	5.854	6.191	3.809	1.549
Log Price	Miami	0.200	0.125	0.065	0.031	-0.000	0.224	0.166	0.070	0.070	-0.015	0.272	-0.026	0.005	0.157	0.022
Log Price SE		(0.048)	(0.026)	(0.015)	(0.022)	(0.011)	(0.060)	(0.033)	(0.021)	(0.044)	(0.013)	(0.181)	(0.072)	(0.038)	(0.070)	(0.029)
Density		-0.296	-0.156	-0.055	-0.059	-0.005	-0.294	-0.154	-0.055	-0.058	-0.005	-0.292	-0.163	-0.057	-0.056	-0.005
Density SE		(0.014)	(0.011)	(0.009)	(0.011)	(0.007)	(0.031)	(0.024)	(0.013)	(0.019)	(0.010)	(0.034)	(0.026)	(0.014)	(0.019)	(0.009)
R2/Wald F		0.568	0.363	0.131	0.074	0.001	735.353	307.351	1857.265	482.172	1684.503	152.071	360.114	336.677	422.864	600.936
Log Price	Orlando	0.325	0.132	0.097	0.112	0.025	0.176	0.163	0.021	0.042	0.053	1.057	0.136	-0.159	0.235	-0.032
Log Price SE		(0.106)	(0.082)	(0.053)	(0.066)	(0.026)	(0.114)	(0.105)	(0.059)	(0.082)	(0.030)	(0.343)	(0.151)	(0.141)	(0.138)	(0.043)
Density		-0.183	-0.118	-0.087	-0.138	-0.043	-0.184	-0.117	-0.089	-0.139	-0.043	-0.178	-0.118	-0.093	-0.137	-0.043
Density SE		(0.021)	(0.018)	(0.014)	(0.021)	(0.010)	(0.024)	(0.021)	(0.019)	(0.029)	(0.010)	(0.023)	(0.020)	(0.020)	(0.027)	(0.010)
R2/Wald F		0.427	0.301	0.265	0.288	0.154	195.068	97.217	477.381	189.165	675.804	2.451	4.478	3.792	6.232	4.307
Log Price	Phoenix	0.402	0.189	0.093	0.042	0.040	0.457	0.265	0.110	0.048	0.042	0.536	0.377	0.165	-0.097	0.052
Log Price SE		(0.071)	(0.053)	(0.026)	(0.039)	(0.017)	(0.090)	(0.080)	(0.033)	(0.079)	(0.022)	(0.113)	(0.080)	(0.036)	(0.067)	(0.028)
Density		-0.258	-0.090	-0.078	-0.121	-0.016	-0.256	-0.087	-0.077	-0.120	-0.016	-0.253	-0.083	-0.073	-0.127	-0.016
Density SE		(0.020)	(0.017)	(0.010)	(0.016)	(0.010)	(0.041)	(0.021)	(0.017)	(0.032)	(0.016)	(0.043)	(0.020)	(0.017)	(0.033)	(0.015)
R2/Wald F		0.489	0.170	0.288	0.218	0.042	340.615	475.225	1356.746	519.557	1064.040	18.919	14.878	17.277	13.212	13.153

Appendix Table 8 Continued:

Coefficient	CBSA	(1) Naive OLS					(2) Log Price IV					(3) Distance and Octant IV				
		1970	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*
Log Price	Raleigh	0.411	0.200	0.045	0.059	0.152	0.572	0.455	0.035	0.045	0.241	0.565	0.310	0.096	-0.012	0.072
Log Price SE		*(0.110)*	*(0.120)*	*(0.065)*	*(0.077)*	*(0.076)*	*(0.145)*	*(0.230)*	*(0.056)*	*(0.081)*	*(0.082)*	*(0.151)*	*(0.130)*	*(0.071)*	*(0.071)*	*(0.059)*
Density		-0.128	-0.130	-0.215	-0.176	-0.051	-0.120	-0.119	-0.215	-0.176	-0.056	-0.121	-0.125	-0.214	-0.175	-0.046
Density SE		*(0.026)*	*(0.030)*	*(0.020)*	*(0.035)*	*(0.035)*	*(0.022)*	*(0.026)*	*(0.026)*	*(0.049)*	*(0.034)*	*(0.021)*	*(0.023)*	*(0.025)*	*(0.049)*	*(0.037)*
R2/Wald F		0.477	0.323	0.687	0.333	0.105	129.092	102.967	325.971	364.451	114.481	12.150	14.948	10.631	10.198	7.954
Log Price	San Antonio	0.190	0.286	0.129	0.076	0.096	0.510	0.261	0.131	0.086	0.049	0.402	0.316	0.179	0.085	0.072
Log Price SE		*(0.061)*	*(0.050)*	*(0.021)*	*(0.028)*	*(0.027)*	*(0.097)*	*(0.114)*	*(0.025)*	*(0.033)*	*(0.034)*	*(0.100)*	*(0.067)*	*(0.030)*	*(0.047)*	*(0.043)*
Density		-0.194	-0.121	-0.079	-0.104	-0.095	-0.161	-0.123	-0.079	-0.103	-0.099	-0.172	-0.119	-0.074	-0.103	-0.097
Density SE		*(0.020)*	*(0.015)*	*(0.008)*	*(0.012)*	*(0.014)*	*(0.032)*	*(0.020)*	*(0.010)*	*(0.016)*	*(0.021)*	*(0.031)*	*(0.019)*	*(0.010)*	*(0.017)*	*(0.019)*
R2/Wald F		0.450	0.438	0.524	0.363	0.301	132.355	17.713	1724.111	1518.520	639.125	17.041	20.104	25.466	17.225	19.995
Log Price	Tampa	0.402	0.218	0.168	0.006	0.051	0.372	0.224	0.195	-0.012	0.029	0.891	0.473	0.257	0.319	0.230
Log Price SE		*(0.047)*	*(0.035)*	*(0.023)*	*(0.026)*	*(0.018)*	*(0.070)*	*(0.053)*	*(0.041)*	*(0.039)*	*(0.015)*	*(0.131)*	*(0.139)*	*(0.086)*	*(0.192)*	*(0.091)*
Density		-0.199	-0.143	-0.075	-0.116	-0.031	-0.202	-0.143	-0.073	-0.115	-0.029	-0.139	-0.118	-0.068	-0.125	-0.043
Density SE		*(0.015)*	*(0.014)*	*(0.012)*	*(0.013)*	*(0.011)*	*(0.020)*	*(0.020)*	*(0.016)*	*(0.022)*	*(0.016)*	*(0.019)*	*(0.019)*	*(0.016)*	*(0.024)*	*(0.016)*
R2/Wald F		0.639	0.457	0.332	0.261	0.063	37.067	438.633	923.463	162.448	730.200	49.496	22.338	17.536	7.208	20.277
Log Price	Boston	0.079	0.018	0.038	-0.013	-0.013	0.067	-0.001	0.021	-0.036	-0.029	0.041	-0.004	0.055	0.051	0.023
Log Price SE		*(0.020)*	*(0.014)*	*(0.012)*	*(0.012)*	*(0.010)*	*(0.034)*	*(0.028)*	*(0.017)*	*(0.013)*	*(0.008)*	*(0.042)*	*(0.022)*	*(0.018)*	*(0.023)*	*(0.017)*
Density		-0.076	-0.041	-0.036	-0.024	-0.005	-0.077	-0.042	-0.036	-0.025	-0.004	-0.079	-0.042	-0.035	-0.022	-0.005
Density SE		*(0.006)*	*(0.004)*	*(0.004)*	*(0.003)*	*(0.003)*	*(0.012)*	*(0.005)*	*(0.004)*	*(0.003)*	*(0.002)*	*(0.012)*	*(0.004)*	*(0.004)*	*(0.003)*	*(0.002)*
R2/Wald F		0.230	0.171	0.112	0.086	0.006	310.992	342.224	687.023	1291.057	4954.868	25.504	41.517	57.207	66.676	119.275
Log Price	Los Angeles	0.125	0.018	0.001	-0.009	-0.017	0.113	0.019	-0.001	-0.001	-0.023	0.149	0.061	0.004	0.061	0.010
Log Price SE		*(0.014)*	*(0.010)*	*(0.005)*	*(0.011)*	*(0.005)*	*(0.020)*	*(0.014)*	*(0.008)*	*(0.013)*	*(0.007)*	*(0.024)*	*(0.019)*	*(0.010)*	*(0.023)*	*(0.009)*
Density		-0.131	-0.067	-0.022	-0.047	-0.012	-0.132	-0.067	-0.023	-0.047	-0.012	-0.129	-0.065	-0.022	-0.046	-0.012
Density SE		*(0.005)*	*(0.005)*	*(0.003)*	*(0.004)*	*(0.003)*	*(0.013)*	*(0.011)*	*(0.005)*	*(0.011)*	*(0.005)*	*(0.013)*	*(0.010)*	*(0.005)*	*(0.011)*	*(0.005)*
R2/Wald F		0.293	0.101	0.038	0.068	0.016	1466.330	1143.818	526.566	3461.936	2127.688	87.135	106.072	57.121	81.746	77.630
Log Price	New York	0.120	0.046	0.005	0.026	-0.024	0.130	0.134	-0.020	0.062	-0.034	0.377	0.367	0.196	0.162	-0.008
Log Price SE		*(0.009)*	*(0.008)*	*(0.006)*	*(0.009)*	*(0.004)*	*(0.033)*	*(0.016)*	*(0.015)*	*(0.012)*	*(0.005)*	*(0.077)*	*(0.062)*	*(0.030)*	*(0.025)*	*(0.010)*
Density		-0.079	-0.054	-0.022	-0.023	0.001	-0.079	-0.053	-0.021	-0.023	0.001	-0.078	-0.051	-0.031	-0.025	0.000
Density SE		*(0.003)*	*(0.002)*	*(0.002)*	*(0.002)*	*(0.002)*	*(0.007)*	*(0.005)*	*(0.003)*	*(0.002)*	*(0.002)*	*(0.007)*	*(0.005)*	*(0.004)*	*(0.003)*	*(0.002)*
R2/Wald F		0.172	0.120	0.031	0.029	0.010	259.811	1276.411	676.197	2293.168	2201.341	50.030	44.713	70.727	104.476	159.682
Log Price	San Diego	0.144	0.002	-0.003	-0.026	-0.017	0.046	0.002	-0.086	-0.012	-0.021	0.137	0.016	0.029	-0.001	0.020
Log Price SE		*(0.058)*	*(0.028)*	*(0.025)*	*(0.025)*	*(0.011)*	*(0.094)*	*(0.035)*	*(0.068)*	*(0.036)*	*(0.011)*	*(0.101)*	*(0.036)*	*(0.027)*	*(0.078)*	*(0.021)*
Density		-0.171	-0.051	-0.058	-0.040	0.001	-0.176	-0.051	-0.061	-0.040	0.001	-0.172	-0.051	-0.056	-0.040	-0.001
Density SE		*(0.013)*	*(0.009)*	*(0.009)*	*(0.008)*	*(0.004)*	*(0.022)*	*(0.012)*	*(0.018)*	*(0.008)*	*(0.005)*	*(0.021)*	*(0.011)*	*(0.015)*	*(0.008)*	*(0.005)*
R2/Wald F		0.400	0.108	0.116	0.088	0.009	309.656	291.267	1004.930	499.638	832.040	22.615	38.965	33.052	32.369	28.447
Log Price	San Francisco	0.177	-0.020	0.012	-0.031	-0.016	0.161	-0.017	0.032	-0.037	-0.026	0.027	-0.069	0.033	0.013	0.011
Log Price SE		*(0.029)*	*(0.014)*	*(0.011)*	*(0.013)*	*(0.010)*	*(0.068)*	*(0.018)*	*(0.019)*	*(0.015)*	*(0.008)*	*(0.054)*	*(0.023)*	*(0.018)*	*(0.021)*	*(0.023)*
Density		-0.148	-0.055	-0.032	-0.026	-0.015	-0.148	-0.055	-0.032	-0.026	-0.015	-0.154	-0.056	-0.032	-0.026	-0.016
Density SE		*(0.009)*	*(0.005)*	*(0.004)*	*(0.004)*	*(0.004)*	*(0.019)*	*(0.009)*	*(0.007)*	*(0.005)*	*(0.010)*	*(0.020)*	*(0.009)*	*(0.007)*	*(0.005)*	*(0.010)*
R2/Wald F		0.323	0.158	0.079	0.068	0.031	541.920	519.160	140.477	1953.461	1784.354	39.696	50.069	63.473	59.380	58.576

Appendix Table 8 Continued:

Coefficient	CBSA	(1) Naive OLS					(2) Log Price IV					(3) Distance and Octant IV				
		1970	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*	*1970*	*1980*	*1990*	*2000*	*2010*
Log Price	Seattle	0.335	0.114	0.056	0.010	-0.006	0.460	0.107	0.061	0.010	-0.013	0.472	0.109	0.029	0.048	0.014
Log Price SE		*(0.059)*	*(0.025)*	*(0.027)*	*(0.028)*	*(0.013)*	*(0.136)*	*(0.033)*	*(0.027)*	*(0.025)*	*(0.013)*	*(0.194)*	*(0.046)*	*(0.035)*	*(0.031)*	*(0.015)*
Density		-0.153	-0.039	-0.058	-0.056	0.009	-0.152	-0.038	-0.058	-0.056	0.009	-0.152	-0.039	-0.056	-0.057	0.007
Density SE		*(0.010)*	*(0.007)*	*(0.007)*	*(0.008)*	*(0.004)*	*(0.024)*	*(0.008)*	*(0.013)*	*(0.013)*	*(0.005)*	*(0.023)*	*(0.008)*	*(0.014)*	*(0.013)*	*(0.005)*
R2/Wald F		0.400	0.101	0.138	0.129	0.011	101.416	542.887	1644.685	952.876	2942.584	19.859	45.040	46.112	51.337	128.696
Log Price	Washington	0.130	0.045	0.009	0.049	0.015	0.085	0.036	0.011	0.024	-0.015	0.224	0.086	0.020	0.031	-0.051
Log Price SE		*(0.041)*	*(0.023)*	*(0.022)*	*(0.020)*	*(0.016)*	*(0.056)*	*(0.021)*	*(0.022)*	*(0.024)*	*(0.015)*	*(0.052)*	*(0.026)*	*(0.024)*	*(0.023)*	*(0.015)*
Density		-0.173	-0.128	-0.084	-0.060	0.014	-0.174	-0.128	-0.084	-0.061	0.015	-0.172	-0.126	-0.084	-0.061	0.016
Density SE		*(0.009)*	*(0.008)*	*(0.008)*	*(0.007)*	*(0.006)*	*(0.014)*	*(0.013)*	*(0.013)*	*(0.010)*	*(0.006)*	*(0.013)*	*(0.013)*	*(0.013)*	*(0.010)*	*(0.006)*
R2/Wald F		0.368	0.316	0.165	0.133	0.011	261.537	2127.323	2155.432	758.459	4132.779	62.065	101.935	62.787	110.737	119.225
Log Price	Denver	0.586	0.189	0.170	0.057	0.063	0.920	0.123	0.189	0.045	0.029	1.432	0.449	0.072	-0.012	0.148
Log Price SE		*(0.113)*	*(0.051)*	*(0.028)*	*(0.031)*	*(0.027)*	*(0.184)*	*(0.093)*	*(0.059)*	*(0.052)*	*(0.024)*	*(0.345)*	*(0.147)*	*(0.063)*	*(0.067)*	*(0.058)*
Density		-0.294	-0.099	-0.059	-0.071	-0.009	-0.274	-0.103	-0.058	-0.071	-0.009	-0.244	-0.087	-0.061	-0.072	-0.008
Density SE		*(0.022)*	*(0.015)*	*(0.009)*	*(0.011)*	*(0.009)*	*(0.045)*	*(0.031)*	*(0.010)*	*(0.020)*	*(0.010)*	*(0.044)*	*(0.025)*	*(0.010)*	*(0.019)*	*(0.010)*
R2/Wald F		0.508	0.205	0.240	0.141	0.026	162.117	165.682	163.592	124.195	1150.264	8.809	12.301	5.368	6.893	8.245
Log Price	Salt Lake City	0.031	0.065	0.010	-0.010	-0.095	-0.003	-0.010	-0.126	-0.046	-0.116	-0.061	-0.054	-0.128	-0.136	-0.164
Log Price SE		*(0.087)*	*(0.063)*	*(0.066)*	*(0.066)*	*(0.052)*	*(0.133)*	*(0.100)*	*(0.116)*	*(0.109)*	*(0.046)*	*(0.146)*	*(0.112)*	*(0.101)*	*(0.089)*	*(0.064)*
Density		-0.164	-0.075	-0.101	-0.097	-0.062	-0.166	-0.080	-0.106	-0.099	-0.063	-0.170	-0.082	-0.106	-0.104	-0.066
Density SE		*(0.026)*	*(0.021)*	*(0.019)*	*(0.021)*	*(0.019)*	*(0.029)*	*(0.021)*	*(0.030)*	*(0.035)*	*(0.026)*	*(0.029)*	*(0.019)*	*(0.029)*	*(0.033)*	*(0.026)*
R2/Wald F		0.323	0.152	0.253	0.199	0.140	162.759	22.847	223.482	204.199	1115.846	16.249	15.442	27.350	27.710	32.992
Log Price	Chicago	0.172	0.133	0.079	0.052	0.045	0.146	0.135	0.087	0.062	0.044	0.160	0.157	0.106	0.090	0.045
Log Price SE		*(0.013)*	*(0.010)*	*(0.010)*	*(0.010)*	*(0.004)*	*(0.025)*	*(0.018)*	*(0.014)*	*(0.011)*	*(0.005)*	*(0.021)*	*(0.019)*	*(0.015)*	*(0.015)*	*(0.006)*
Density		-0.117	-0.081	-0.068	-0.056	-0.002	-0.120	-0.081	-0.068	-0.057	-0.002	-0.119	-0.081	-0.069	-0.059	-0.002
Density SE		*(0.005)*	*(0.005)*	*(0.005)*	*(0.005)*	*(0.002)*	*(0.009)*	*(0.012)*	*(0.006)*	*(0.006)*	*(0.002)*	*(0.007)*	*(0.011)*	*(0.006)*	*(0.007)*	*(0.002)*
R2/Wald F		0.371	0.230	0.147	0.104	0.096	624.731	1100.968	2361.042	2280.279	8218.503	323.389	125.977	265.043	195.700	173.914
Log Price	Cleveland	0.189	0.133	0.061	0.050	0.091	0.148	0.129	0.122	0.080	0.104	0.220	0.141	0.129	0.125	0.199
Log Price SE		*(0.030)*	*(0.020)*	*(0.020)*	*(0.030)*	*(0.018)*	*(0.062)*	*(0.039)*	*(0.044)*	*(0.050)*	*(0.038)*	*(0.079)*	*(0.038)*	*(0.046)*	*(0.073)*	*(0.051)*
Density		-0.086	-0.035	-0.066	-0.097	-0.032	-0.096	-0.036	-0.053	-0.091	-0.029	-0.079	-0.034	-0.052	-0.082	-0.002
Density SE		*(0.011)*	*(0.008)*	*(0.008)*	*(0.011)*	*(0.009)*	*(0.025)*	*(0.012)*	*(0.012)*	*(0.016)*	*(0.016)*	*(0.030)*	*(0.011)*	*(0.012)*	*(0.019)*	*(0.018)*
R2/Wald F		0.335	0.213	0.245	0.220	0.149	372.483	1168.526	674.088	376.848	789.716	23.597	25.357	21.586	108.227	426.655
Log Price	Detroit	0.159	0.163	0.128	0.126	0.120	0.175	0.181	0.125	0.144	0.127	0.235	0.200	0.157	0.159	0.169
Log Price SE		*(0.019)*	*(0.014)*	*(0.010)*	*(0.011)*	*(0.008)*	*(0.031)*	*(0.021)*	*(0.013)*	*(0.021)*	*(0.012)*	*(0.037)*	*(0.028)*	*(0.014)*	*(0.026)*	*(0.017)*
Density		-0.158	-0.063	-0.077	-0.061	-0.012	-0.154	-0.056	-0.077	-0.056	-0.009	-0.137	-0.049	-0.068	-0.053	0.007
Density SE		*(0.009)*	*(0.009)*	*(0.006)*	*(0.006)*	*(0.007)*	*(0.014)*	*(0.010)*	*(0.011)*	*(0.010)*	*(0.008)*	*(0.015)*	*(0.011)*	*(0.011)*	*(0.012)*	*(0.009)*
R2/Wald F		0.478	0.282	0.365	0.270	0.256	306.849	3309.819	4441.894	1714.558	1976.783	44.513	647.947	62.548	47.517	51.293
Log Price	Philadelphia	0.020	0.061	0.019	0.038	0.033	0.067	0.068	-0.007	0.034	0.012	0.095	0.072	-0.057	0.063	0.027
Log Price SE		*(0.020)*	*(0.011)*	*(0.014)*	*(0.015)*	*(0.005)*	*(0.025)*	*(0.017)*	*(0.023)*	*(0.025)*	*(0.009)*	*(0.073)*	*(0.041)*	*(0.047)*	*(0.042)*	*(0.016)*
Density		-0.112	-0.054	-0.063	-0.055	0.005	-0.103	-0.053	-0.069	-0.056	0.001	-0.098	-0.052	-0.081	-0.050	0.004
Density SE		*(0.007)*	*(0.004)*	*(0.006)*	*(0.006)*	*(0.002)*	*(0.012)*	*(0.008)*	*(0.013)*	*(0.009)*	*(0.003)*	*(0.021)*	*(0.012)*	*(0.018)*	*(0.011)*	*(0.003)*
R2/Wald F		0.255	0.237	0.147	0.120	0.030	1838.251	3095.278	5378.473	2134.281	4839.521	19.948	23.136	19.697	16.895	19.567

Appendix Table 9: Percentage Changes in Housing Production, Price vs Density by Decade, 24 CBSAs

CBSA	Year	Total change in units	Low Density/Low Price	Low Density/Moderate-to-High Price	High Density/Low Price	High Density/Moderate-to-High Price
Atlanta	1970s	231118	0.059	0.901	-0.004	0.044
	1980s	297572	0.045	0.884	0.019	0.052
	1990s	258881	0.046	0.860	0.001	0.093
	2000s	331861	0.320	0.508	0.051	0.121
	2010s	164869	0.204	0.395	0.053	0.347
Charlotte	1970s	82315	0.338	0.644	-0.010	0.027
	1980s	90483	0.077	0.841	0.000	0.083
	1990s	130171	0.029	0.912	-0.003	0.062
	2000s	188666	0.080	0.857	0.014	0.050
	2010s	135852	0.085	0.686	0.034	0.195
Dallas	1970s	347958	0.136	0.694	0.005	0.165
	1980s	389433	0.126	0.674	0.020	0.180
	1990s	338408	0.110	0.753	-0.002	0.139
	2000s	497227	0.138	0.722	0.023	0.118
	2010s	444406	0.136	0.570	0.041	0.252
Houston	1970s	501757	0.161	0.626	0.028	0.185
	1980s	300195	0.066	0.762	0.002	0.171
	1990s	266766	0.097	0.734	0.001	0.168
	2000s	497157	0.119	0.707	0.026	0.148
	2010s	450950	0.148	0.602	0.056	0.194
Las Vegas	1970s	87645	0.070	0.775	0.065	0.091
	1980s	104140	0.030	0.683	0.036	0.251
	1990s	244370	0.018	0.810	0.039	0.133
	2000s	277571	-0.001	0.542	0.008	0.451
	2010s	80348	0.000	0.502	0.016	0.482
Miami	1970s	595427	0.238	0.444	0.083	0.236
	1980s	416262	0.039	0.654	0.055	0.252
	1990s	299419	0.051	0.596	0.099	0.253
	2000s	275001	0.091	0.267	0.170	0.472
	2010s	179585	0.064	0.121	0.262	0.552
Orlando	1970s	143446	0.369	0.575	-0.002	0.058
	1980s	183976	0.205	0.752	0.002	0.041
	1990s	159473	0.078	0.791	0.031	0.100
	2000s	254531	0.072	0.795	0.093	0.041
	2010s	146772	0.073	0.734	0.065	0.129
Phoenix	1970s	286947	0.178	0.627	0.046	0.149
	1980s	292202	0.060	0.637	0.044	0.259
	1990s	300577	0.014	0.817	0.011	0.159
	2000s	378479	0.075	0.775	0.030	0.119
	2010s	177490	0.027	0.696	0.063	0.214
Raleigh	1970s	42775	0.143	0.839	0.010	0.008
	1980s	60844	0.067	0.872	0.024	0.037
	1990s	81941	0.035	0.963	-0.003	0.005
	2000s	112276	0.270	0.705	0.008	0.017
	2010s	90053	0.222	0.530	0.031	0.216
San Antonio	1970s	104922	0.079	0.843	-0.002	0.081
	1980s	118320	0.159	0.698	-0.006	0.149
	1990s	75788	0.063	0.799	-0.025	0.163
	2000s	152965	0.061	0.732	0.025	0.182
	2010s	143790	0.086	0.612	0.039	0.263

Appendix Table 9 Continued:

CBSA	Year	Total change in units	Low Density/Low Price	Low Density/Moderate-to-High Price	High Density/Low Price	High Density/Moderate-to-High Price
Tampa	1970s	245312	0.069	0.699	0.014	0.217
	1980s	184074	0.019	0.701	0.009	0.271
	1990s	86748	0.016	0.744	-0.026	0.266
	2000s	121485	0.030	0.708	0.045	0.217
	2010s	81557	0.107	0.534	0.073	0.286
Boston	1970s	152718	0.064	0.597	0.032	0.307
	1980s	114802	0.030	0.585	0.133	0.252
	1990s	75407	0.150	0.564	0.030	0.256
	2000s	65070	0.199	0.455	0.241	0.105
	2010s	118236	0.077	0.264	0.224	0.435
Los Angeles	1970s	577763	0.049	0.412	0.039	0.500
	1980s	453678	0.082	0.359	0.166	0.394
	1990s	211335	0.074	0.433	0.167	0.326
	2000s	188100	0.145	0.413	0.186	0.256
	2010s	231359	0.057	0.196	0.278	0.470
New York	1970s	451598	0.070	0.484	0.058	0.389
	1980s	330989	0.065	0.562	0.061	0.311
	1990s	432481	0.063	0.272	0.256	0.409
	2000s	195056	0.237	0.370	0.247	0.146
	2010s	419158	0.042	0.095	0.303	0.561
San Diego	1970s	258396	0.018	0.669	0.043	0.270
	1980s	207288	0.054	0.638	0.139	0.170
	1990s	93689	0.070	0.649	0.081	0.200
	2000s	103943	0.108	0.604	0.068	0.220
	2010s	64619	0.073	0.180	0.145	0.602
San Francisco	1970s	220410	0.193	0.459	0.156	0.193
	1980s	146540	0.127	0.407	0.194	0.271
	1990s	114608	0.165	0.402	0.156	0.277
	2000s	80411	0.252	0.444	0.221	0.083
	2010s	106133	0.101	0.235	0.220	0.444
Seattle	1970s	199102	0.075	0.749	0.041	0.134
	1980s	206438	0.053	0.656	0.032	0.259
	1990s	197972	0.223	0.455	0.095	0.227
	2000s	184163	0.208	0.417	0.119	0.256
	2010s	184081	0.132	0.244	0.139	0.484
Washington	1970s	251831	0.151	0.629	0.066	0.154
	1980s	284964	0.151	0.619	0.036	0.194
	1990s	221132	0.244	0.513	0.061	0.182
	2000s	247493	0.206	0.432	0.099	0.264
	2010s	228625	0.083	0.305	0.238	0.374
Denver	1970s	191374	0.105	0.745	0.034	0.116
	1980s	120569	0.084	0.518	0.029	0.369
	1990s	99918	0.037	0.674	0.056	0.234
	2000s	121201	0.107	0.569	0.076	0.247
	2010s	128889	0.076	0.337	0.116	0.472
Salt Lake City	1970s	74747	0.102	0.707	0.058	0.133
	1980s	40244	0.102	0.661	0.024	0.213
	1990s	53487	0.100	0.605	0.063	0.232
	2000s	45692	0.306	0.578	0.058	0.059
	2010s	63373	0.101	0.472	0.199	0.228

Appendix Table 9 Continued:

CBSA	Year	Total change in units	Low Density/Low Price	Low Density/Moderate-to-High Price	High Density/Low Price	High Density/Moderate-to-High Price
Chicago	1970s	452907	0.050	0.773	-0.009	0.186
	1980s	183950	0.059	0.863	-0.161	0.239
	1990s	324451	0.101	0.677	0.032	0.191
	2000s	262746	0.142	0.678	-0.015	0.195
	2010s	147127	0.109	0.276	0.064	0.552
Cleveland	1970s	100412	0.078	0.783	-0.049	0.188
	1980s	40206	-0.016	1.108	-0.271	0.179
	1990s	56651	-0.005	0.982	-0.124	0.147
	2000s	43233	0.083	1.145	-0.235	0.007
	2010s	28666	0.018	0.844	-0.249	0.387
Detroit	1970s	258898	0.039	0.828	-0.005	0.138
	1980s	115810	0.016	1.001	-0.247	0.229
	1990s	145227	0.003	1.001	-0.171	0.167
	2000s	75078	0.021	1.161	-0.397	0.215
	2010s	36451	0.052	1.121	-0.696	0.523
Philadelphia	1970s	281105	0.124	0.654	0.054	0.167
	1980s	198526	0.011	0.863	-0.046	0.172
	1990s	166499	0.016	0.913	-0.010	0.081
	2000s	110567	0.055	1.121	-0.183	0.007
	2010s	147523	0.024	0.453	0.200	0.324

Appendix Table 10: Specification 1 -- Regressing Decadal Price Elasticity on Previous Decade Price Elasticity and Covariates, All Units

Coefficients	Decadal Specifications			
(a) WRLURI	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.379	0.490	0.251	0.379
	0.069	*0.081*	*0.096*	*0.069*
WRLURI	-0.058	-0.050	-0.044	-0.058
	0.018	*0.016*	*0.017*	*0.018*
(b) Share Educated	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.452	0.589	0.384	0.452
	0.069	*0.076*	*0.087*	*0.069*
$\overline{share\ educated_{t,c}}$	-0.178	-0.235	-0.003	-0.178
	0.182	*0.152*	*0.159*	*0.182*
(c) Lagged Density	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.482	0.614	0.388	0.482
	0.069	*0.075*	*0.083*	*0.069*
$\overline{\Delta log\ (density_{t+1})_c}$	-0.110	-0.045	0.149	-0.110
	0.092	*0.111*	*0.103*	*0.092*

Note: N=82 in all regressions. Standard errors are in parentheses.

Appendix Table 11: Specification 2 -- Regressing Decadal Price Elasticity on Previous Decade Price Elasticity and Covariates, All Units

Coefficients	**Decadal Specifications**			
(a) WRLURI	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.272	0.316	0.331	0.189
	0.048	*0.070*	*0.111*	*0.087*
WRLURI	-0.051	-0.068	-0.048	-0.060
	0.030	*0.023*	*0.027*	*0.021*
(b) Share Educated	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.302	0.349	0.388	0.246
	0.046	*0.072*	*0.107*	*0.087*
$\overline{share\ educated_{t,c}}$	-0.829	-0.333	-0.240	-0.320
	0.302	*0.239*	*0.261*	*0.216*
(c) Lagged Density	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.258	0.392	0.416	0.305
	0.054	*0.073*	*0.105*	*0.085*
$\overline{\Delta log\ (density_{t+1})_c}$	0.111	-0.172	-0.171	0.343
	0.102	*0.123*	*0.187*	*0.143*

Note: N=82 in all regressions. Standard errors are in parentheses.

Appendix Table 12: Specification 3 -- Regressing Decadal Price Elasticity on Previous Decade Price Elasticity and Covariates, All Units

Coefficients	**Decadal Specifications**			
(a) WRLURI	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.289	0.356	0.352	0.192
	0.039	*0.074*	*0.107*	*0.069*
WRLURI	-0.071	-0.093	-0.055	-0.049
	0.034	*0.030*	*0.034*	*0.022*
(b) Share Educated	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.294	0.402	0.360	0.222
	0.040	*0.075*	*0.097*	*0.072*
$\overline{share\ educated_{t,c}}$	-0.234	-0.654	-0.949	-0.147
	0.361	*0.311*	*0.320*	*0.235*
(c) Lagged Density	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.313	0.448	0.434	0.254
	0.048	*0.078*	*0.098*	*0.069*
$\overline{\Delta log\ (density_{t+1})_c}$	-0.103	-0.354	-0.478	0.157
	0.127	*0.163*	*0.237*	*0.151*

Note: N=82 in all regressions. Standard errors are in parentheses.

Appendix Table 13: Specification 1 -- Regressing Decadal Price Elasticity on Previous Decade Price Elasticity and Covariates, Single Family

Coefficients	Decadal Specifications			
(d) WRLURI	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.160	0.253	0.099	-0.120
	0.079	*0.064*	*0.128*	*0.102*
WRLURI	-0.088	-0.074	-0.130	-0.072
	0.043	*0.025*	*0.033*	*0.032*
(e) Share Educated	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.142	0.273	0.253	-0.047
	0.079	*0.066*	*0.133*	*0.092*
$\overline{share\ educated_{t,c}}$	-0.673	-0.410	-0.321	-0.722
	0.454	*0.274*	*0.362*	*0.297*
(f) Lagged Density	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.138	0.292	0.289	-0.024
	0.087	*0.066*	*0.131*	*0.103*
$\overline{\Delta log\ (density_{t+1})_c}$	-0.006	0.103	0.160	-0.040
	0.192	*0.129*	*0.221*	*0.179*

Note: N=82 in all regressions. Standard errors are in parentheses.

Appendix Table 14: Specification 2 -- Regressing Decadal Price Elasticity on Previous Decade Price Elasticity and Covariates, Single Family

Coefficients	Decadal Specifications			
(a) WRLURI	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.289	0.251	0.157	0.020
	0.063	*0.098*	*0.091*	*0.119*
WRLURI	-0.058	-0.112	-0.137	-0.077
	0.044	*0.043*	*0.038*	*0.043*
(b) Share Educated	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.282	0.267	0.227	0.056
	0.064	*0.099*	*0.096*	*0.107*
$\overline{share\ educated_{t,c}}$	-0.291	-1.003	-0.476	-1.109
	0.466	*0.455*	*0.417*	*0.405*
(c) Lagged Density	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.270	0.285	0.257	0.138
	0.065	*0.100*	*0.097*	*0.121*
$\overline{\Delta log\ (density_{t+1})_c}$	0.089	-0.391	0.055	0.131
	0.184	*0.217*	*0.261*	*0.248*

Note: N=82 in all regressions. Standard errors are in parentheses.

Appendix Table 15: Specification 3 -- Regressing Decadal Price Elasticity on Previous Decade Price Elasticity and Covariates, Single Family

Coefficients	**Decadal Specifications**			
(a) *WRLURI*	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.235	0.244	0.088	-0.038
	0.072	*0.069*	*0.128*	*0.091*
WRLURI	-0.081	-0.150	-0.128	-0.079
	0.063	*0.041*	*0.054*	*0.043*
(b) *Share Educated*	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.219	0.280	0.175	-0.029
	0.072	*0.072*	*0.125*	*0.084*
$\overline{share\ educated_{t,c}}$	0.261	-1.113	-0.579	-1.370
	0.664	*0.447*	*0.554*	*0.412*
(c) *Lagged Density*	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.229	0.281	0.204	0.009
	0.077	*0.074*	*0.124*	*0.099*
$\overline{\Delta log\ (density_{t+1})_c}$	-0.073	-0.356	0.002	-0.026
	0.276	*0.216*	*0.342*	*0.262*

Note: N=82 in all regressions. Standard errors are in parentheses.

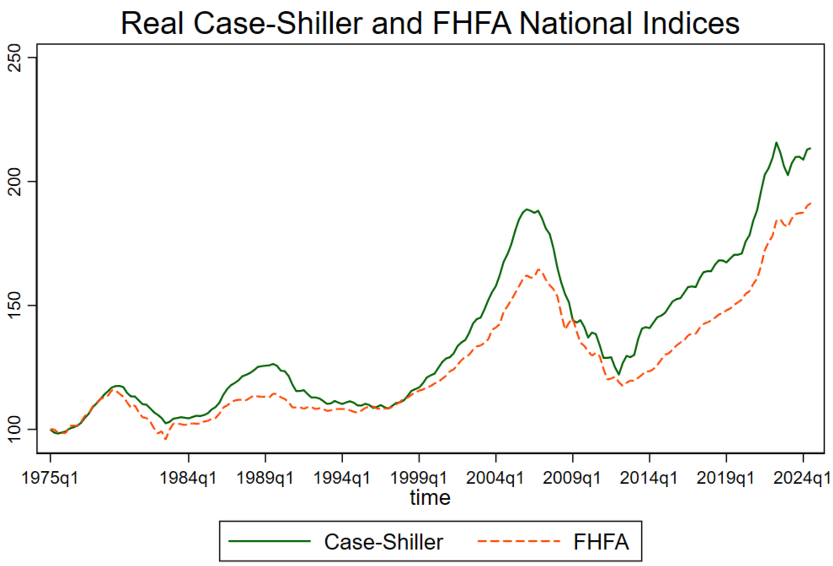
Appendix Table 16: Specification 4 -- Regressing Decadal Price Elasticity on Previous Decade Price Elasticity and Covariates, Single Family

Coefficients	**Decadal Specifications**			
(a) *WRLURI*	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.244	0.262	0.200	-0.087
	0.079	*0.083*	*0.101*	*0.107*
WRLURI	-0.057	-0.101	-0.132	-0.094
	0.047	*0.036*	*0.036*	*0.037*
(b) *Share Educated*	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.230	0.272	0.281	-0.027
	0.078	*0.083*	*0.109*	*0.095*
$\overline{share\ educated_{t,c}}$	-0.230	-1.119	-0.377	-1.107
	0.487	*0.376*	*0.407*	*0.349*
(c) *Lagged Density*	*(1980 on 1970)*	*(1990 on 1980)*	*(2000 on 1990)*	*(2010 on 2000)*
$\psi_{1,c}^{t}$	0.220	0.288	0.314	0.027
	0.084	*0.086*	*0.107*	*0.113*
$\overline{\Delta log\ (density_{t+1})_c}$	0.045	-0.322	0.012	-0.019
	0.201	*0.184*	*0.249*	*0.222*

Note: N=82 in all regressions. Standard errors are in parentheses.

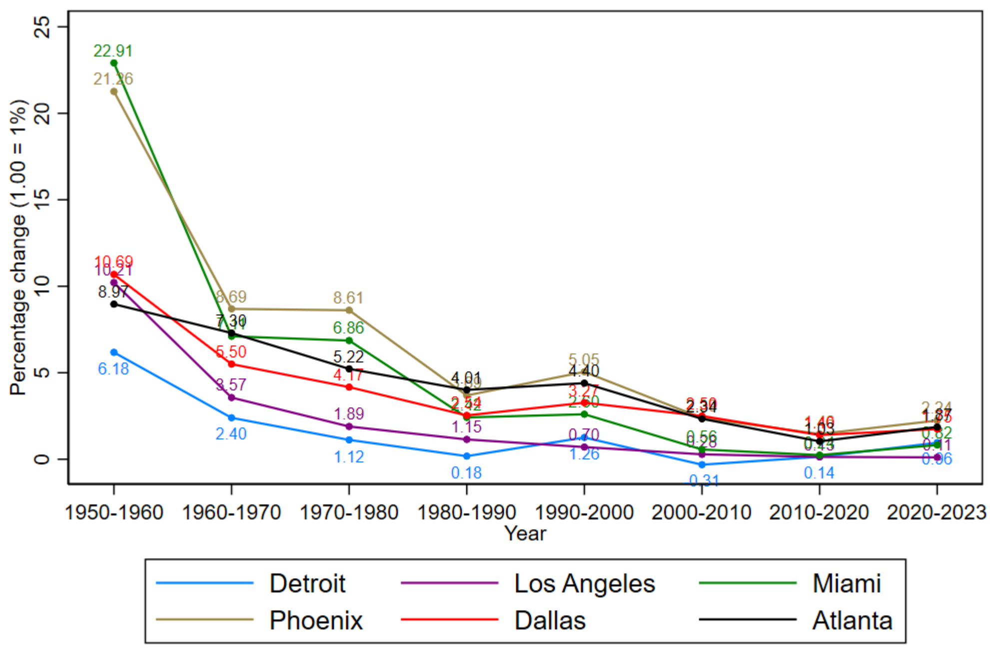
II. Appendix Figures

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



Case-Shiller through 2024q3, FHFA through 2024q3. 1975q1 = 100.

Appendix Figure 2: Growth of Owner-Occupied Housing Units in Six Metropolitan Areas, 1950-2023

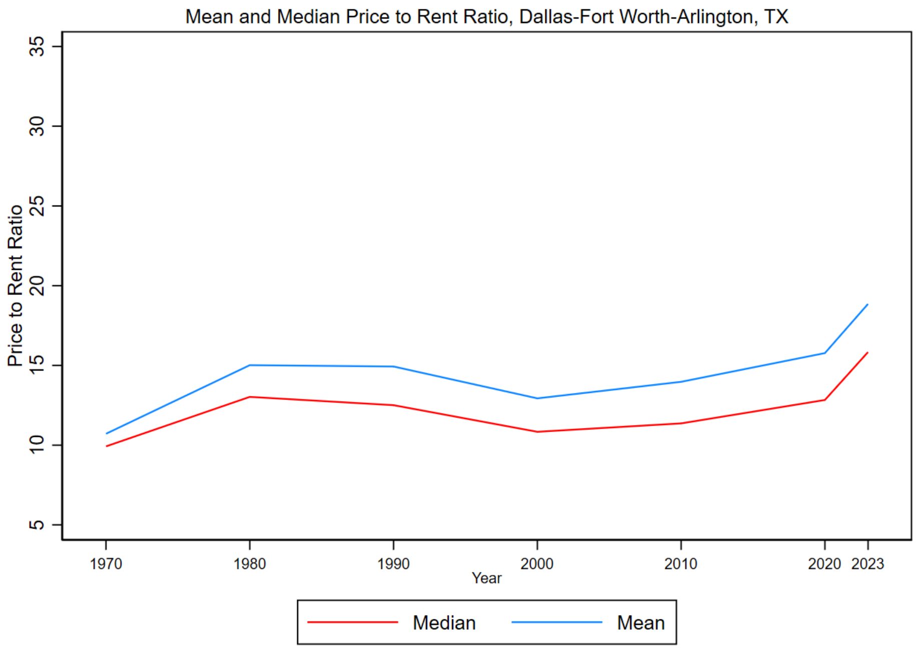


Note: Average annual growth rates for 950 and 1960 are constructed using the count of homes built before 1950 and 1960, respectively, in the 1970 census. All others are from the decennial censuses (1970-2020) or built up from county level data from the 2019-2013 5-Year ACS estimates. See the discussion above in the data description subsection for more on these choices.

Appendix Figure 3: Mean and Median Price to Rent Ratio, Los Angeles-Long Beach-Santa Ana, CA

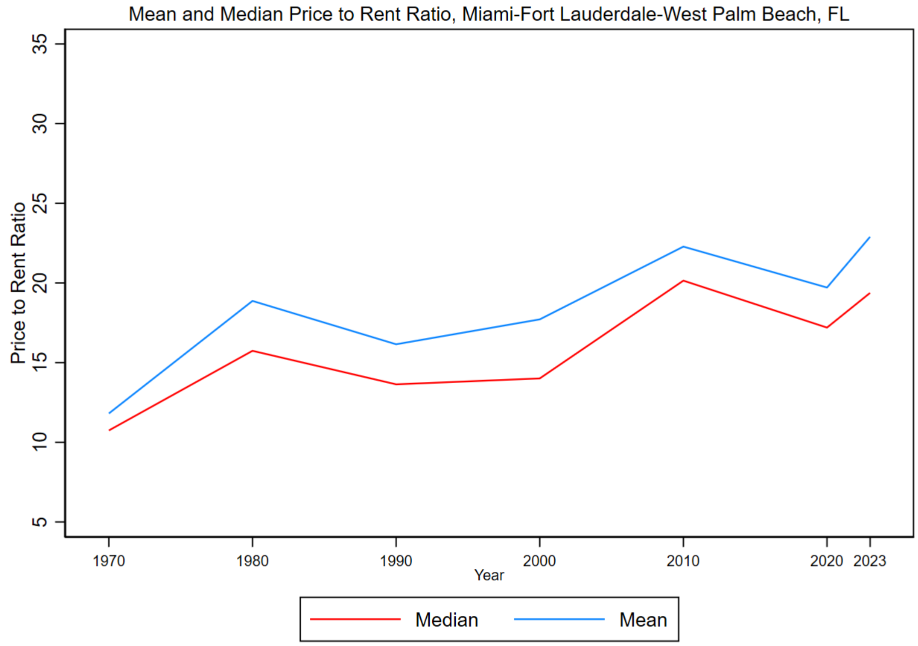
Appendix Figure 4: Mean and Median Price to Rent Ratio, Atlanta-Sandy Springs-Roswell, GA

Appendix Figure 5: Mean and Median Price to Rent Ratio, Dallas-Fort Worth-Arlington, TX



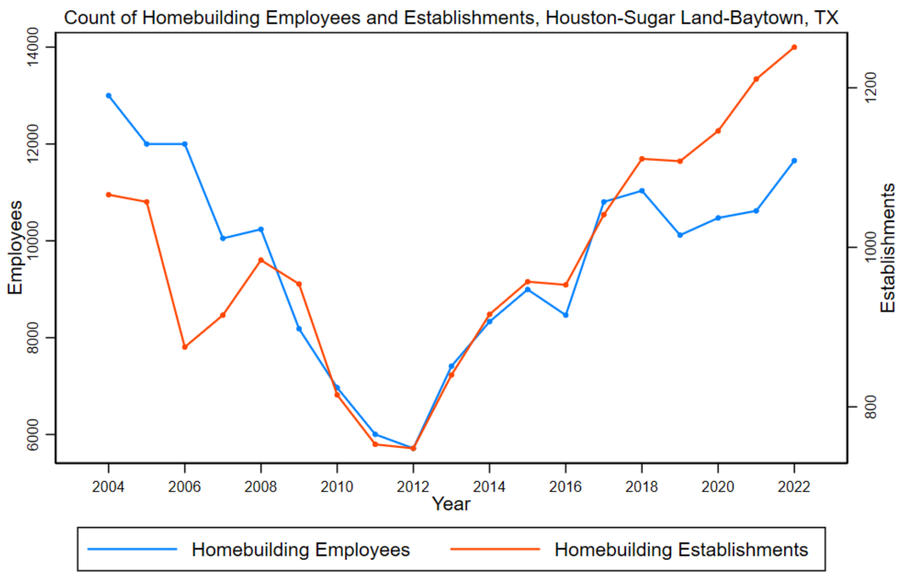
Appendix Figure 6: Mean and Median Price to Rent Ratio, Detroit-Warren-Livonia, MI

Appendix Figure 7: Mean and Median Price to Rent Ratio, Miami-Fort Lauderdale-West Palm Beach, FL



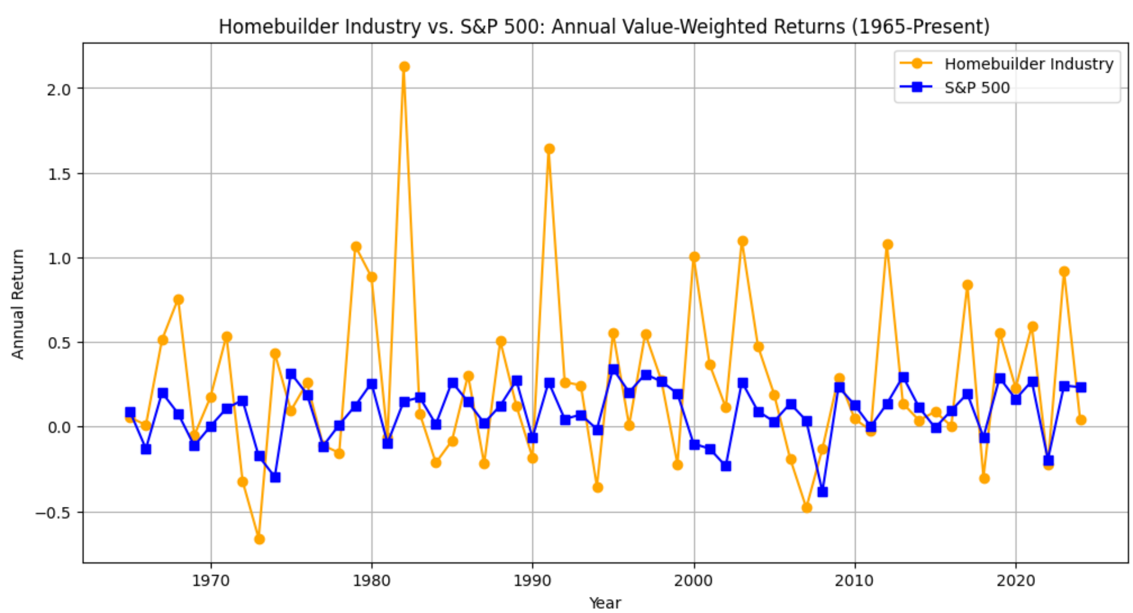
Appendix Figure 8: Mean and Median Price to Rent Ratio, Phoenix-Mesa-Glendale, AZ

Appendix Figure 9: Houston CBSA Homebuilding Employment and Establishments

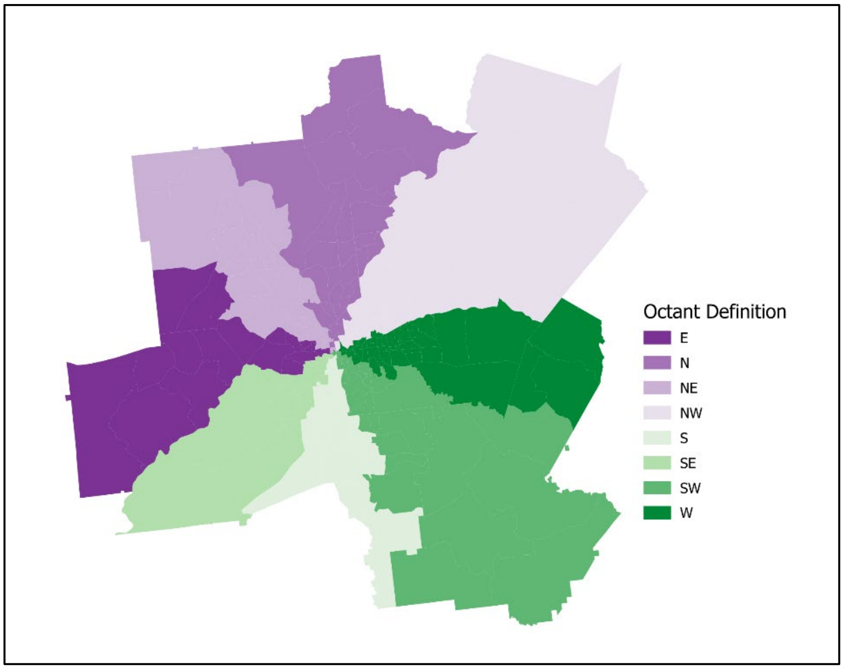


Note: We construct 'homebuilding' establishments and employment counts by aggregating over three NAICS codes: 236115 (single family housing construction), 236116 (multi family housing construction), and 236117 (new housing for sale builders). Houston's CBSA data originate from the County Buisness Patterns (CBP) data, and are aggregated to the CBSA level from the 10 counties that constitute the CBSA.

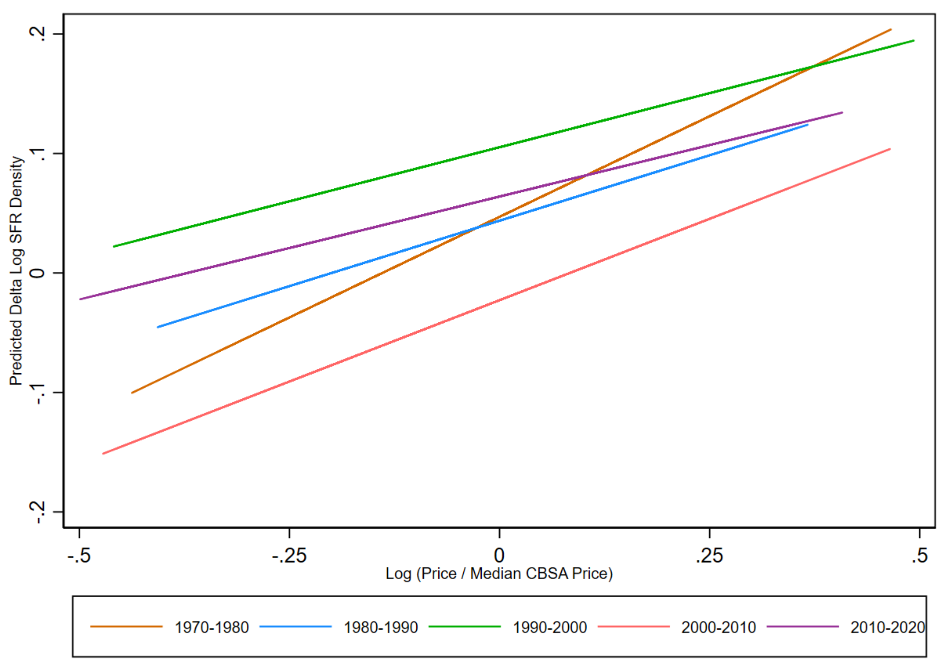
Appendix Figure 10: Annual Value-Weighted Returns, Homebuilders and the S&P500



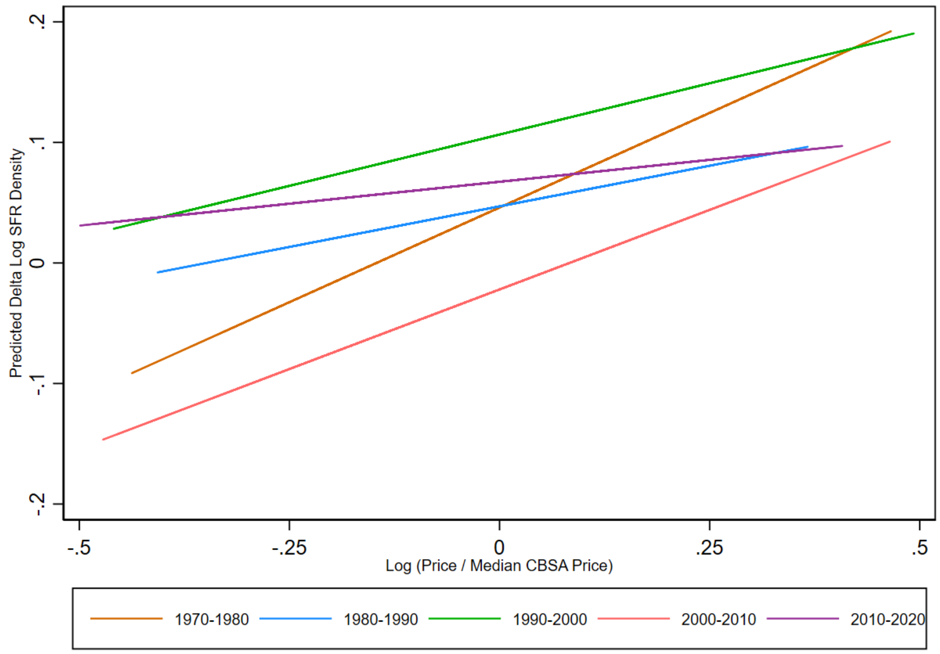
Appendix Figure 11: Atlanta CBSA Octant Definition



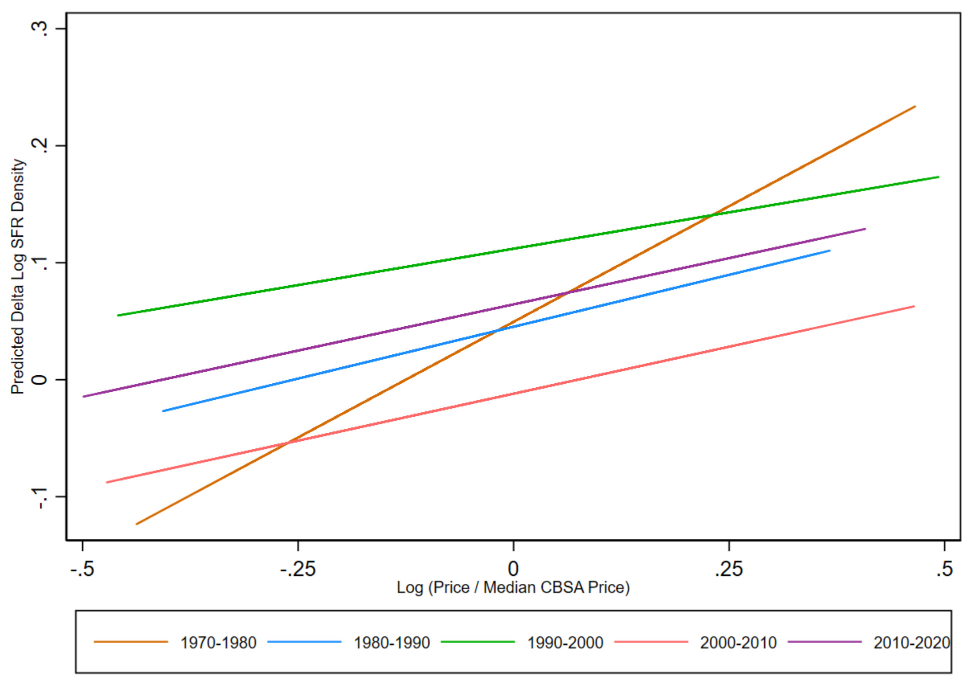
Appendix Figure 12: Empirical Housing Supply Curves for Atlanta, Specification 1 (Naïve OLS)



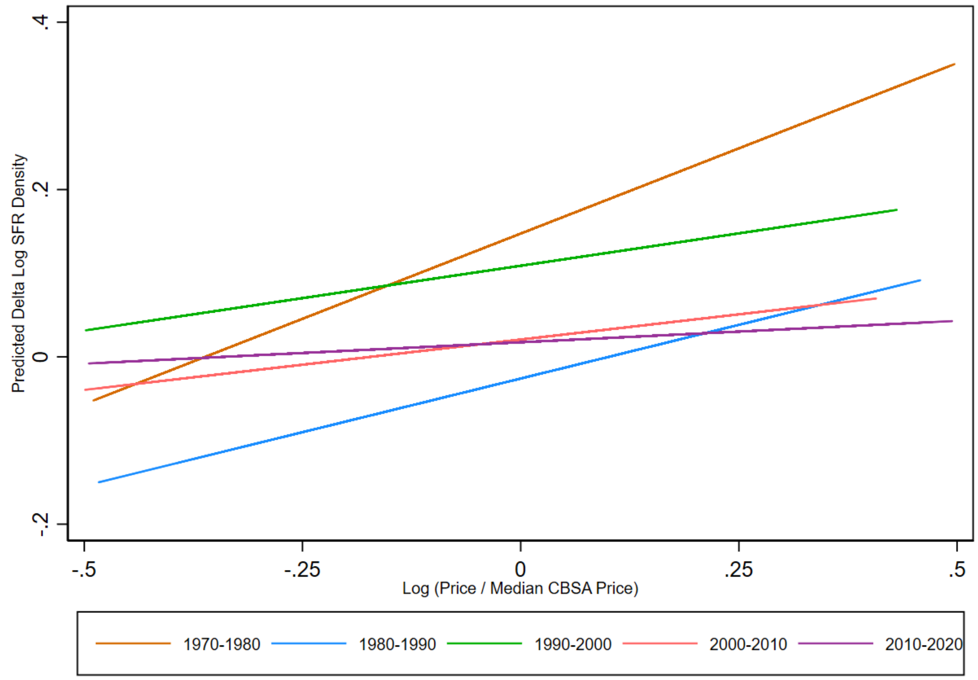
Appendix Figure 13: Empirical Housing Supply Curves for Atlanta, Specification 2 (Lagged Price IV)



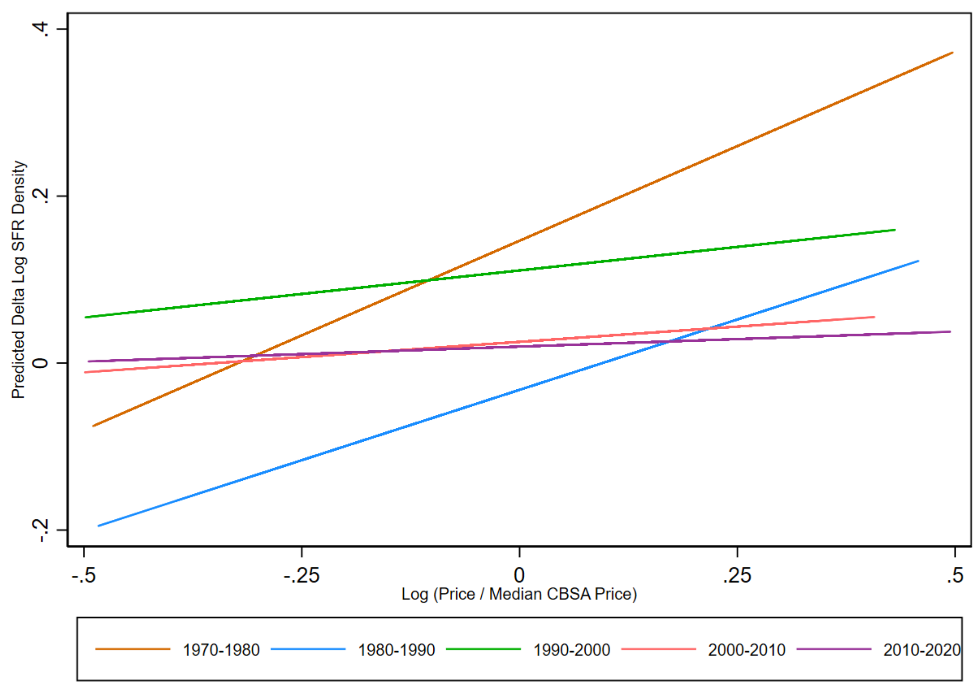
Appendix Figure 14: Empirical Housing Supply Curves for Atlanta, Specification 3 (Location IV)



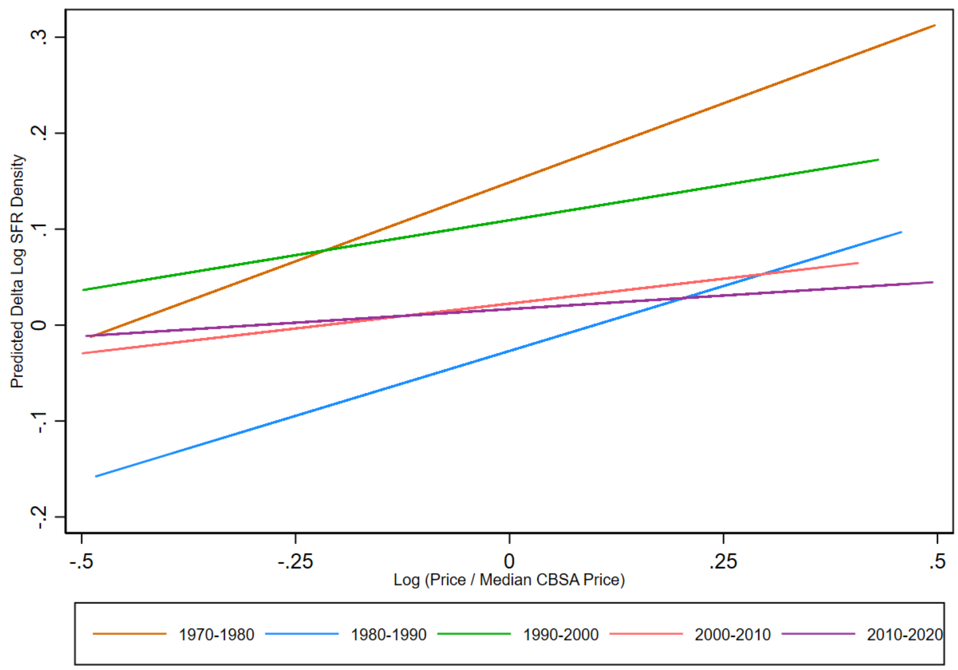
Appendix Figure 15: Empirical Housing Supply Curves for Dallas, Specification 1 (Naïve OLS)



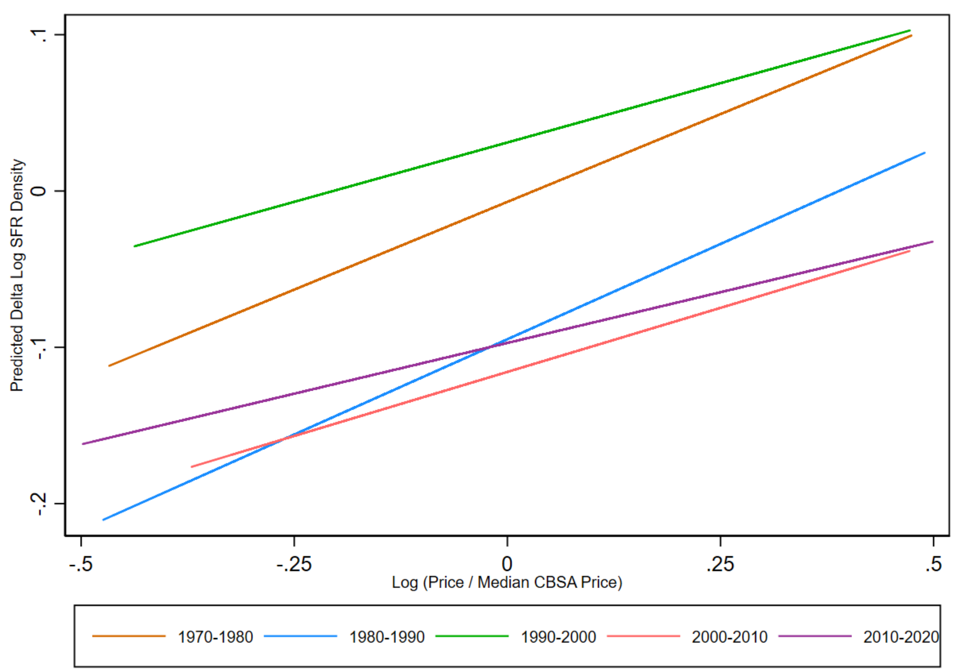
Appendix Figure 16: Empirical Housing Supply Curves for Dallas, Specification 2 (Lagged Price IV)



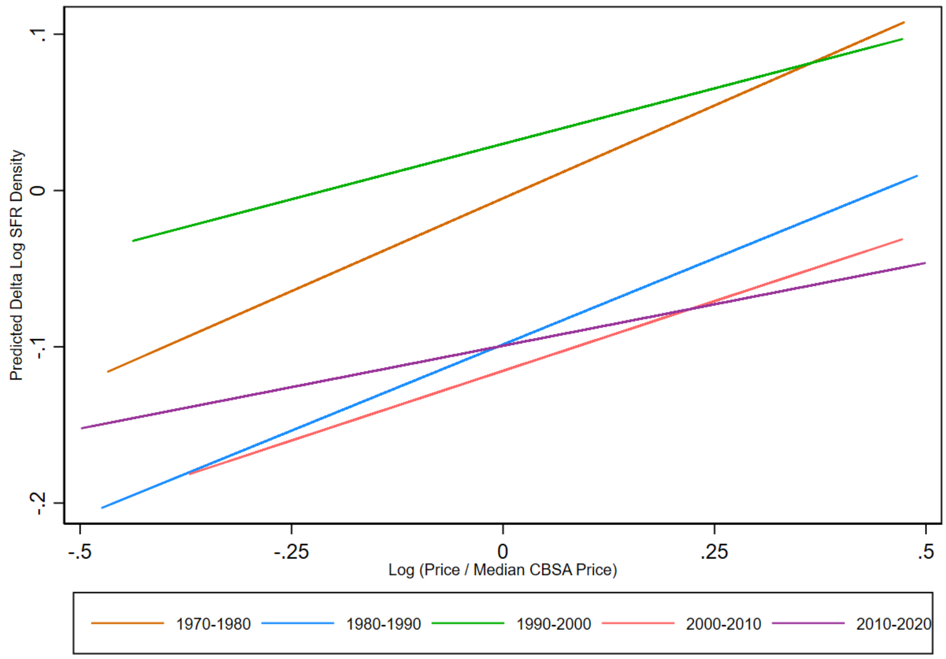
Appendix Figure 17: Empirical Housing Supply Curves for Dallas, Specification 3 (Location IV)



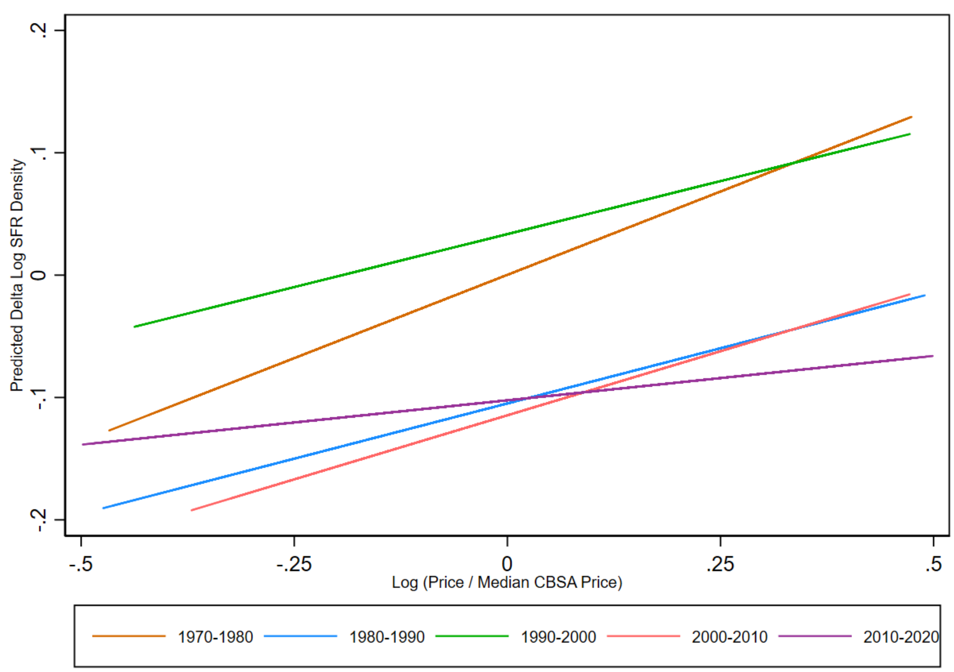
Appendix Figure 18: Empirical Housing Supply Curves for Detroit, Specification 1 (Naïve OLS)



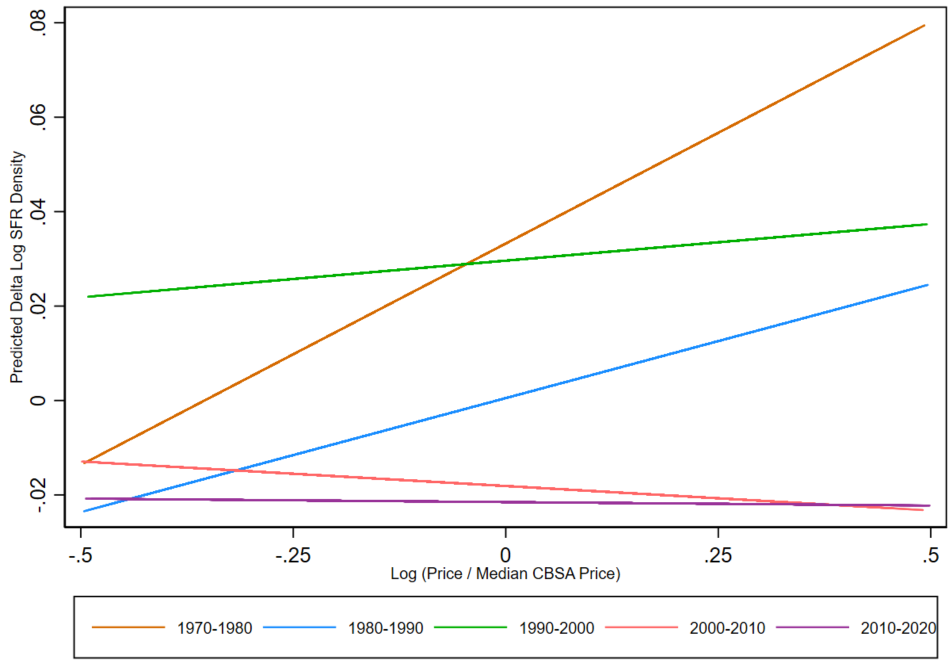
Appendix Figure 19: Empirical Housing Supply Curves for Detroit, Specification 2 (Lagged Price IV)



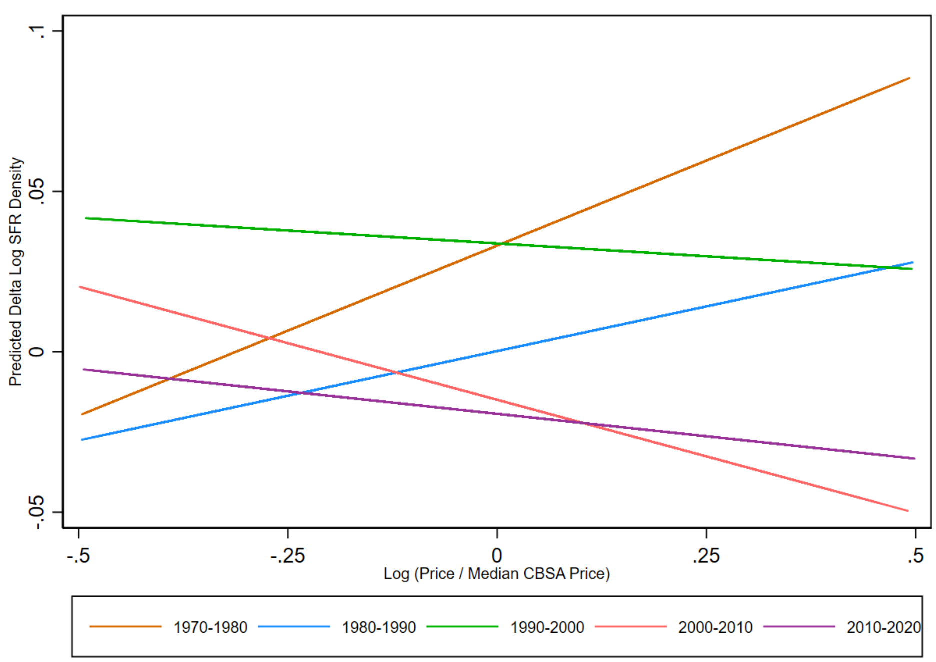
Appendix Figure 20: Empirical Housing Supply Curves for Detroit, Specification 3 (Location IV)



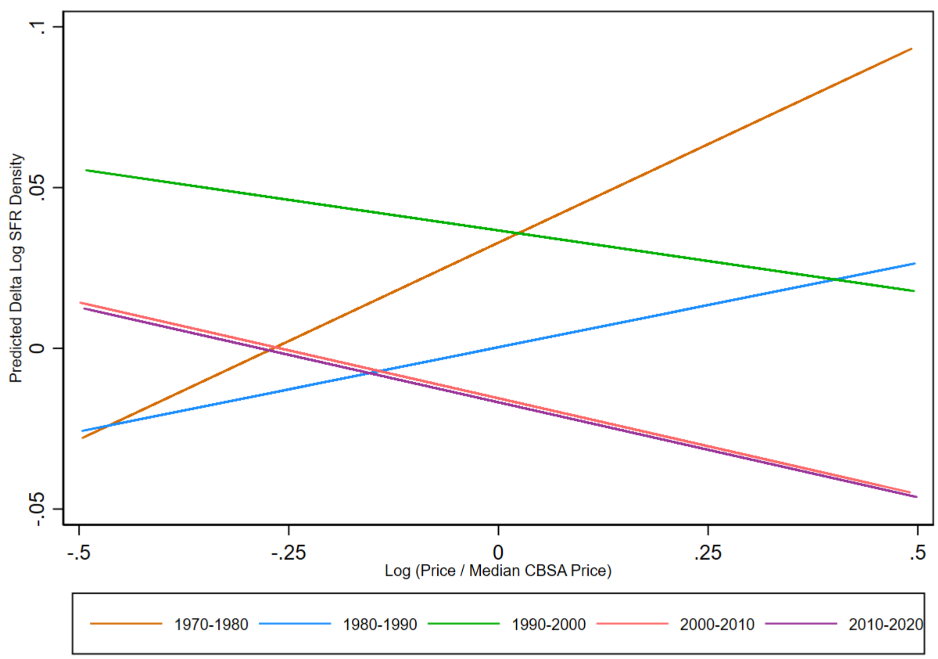
Appendix Figure 21: Empirical Housing Supply Curves for Los Angeles, Specification 1 (Naïve OLS)



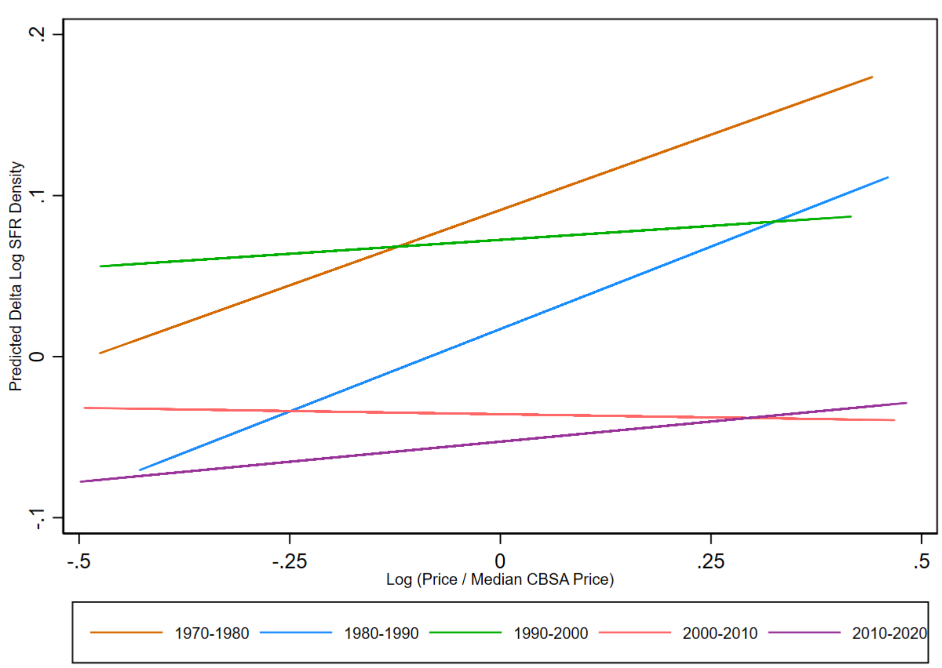
Appendix Figure 22: Empirical Housing Supply Curves for Los Angeles, Specification 2 (Lagged Price IV)



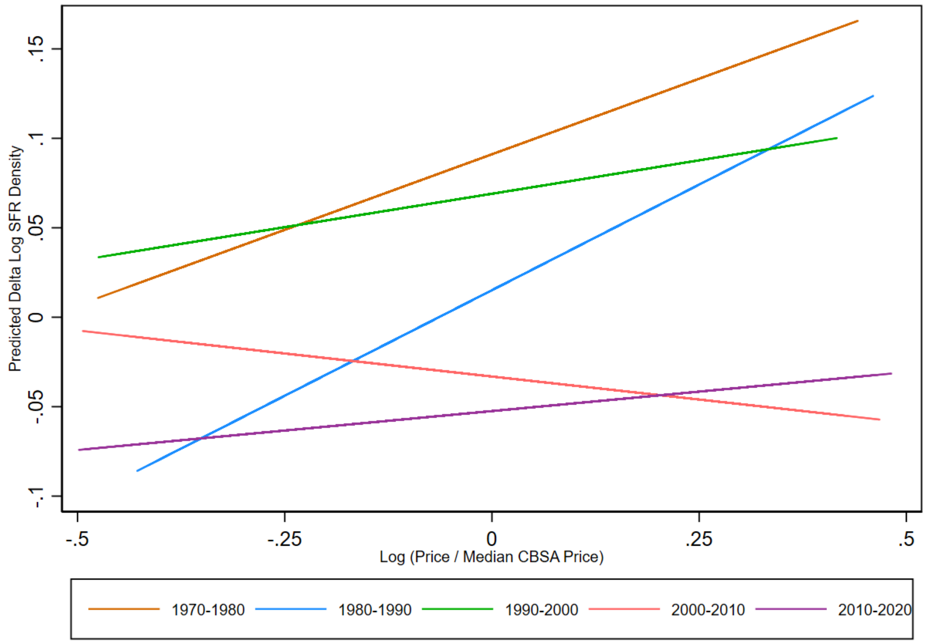
Appendix Figure 23: Empirical Housing Supply Curves for Los Angeles, Specification 3 (Location IV)



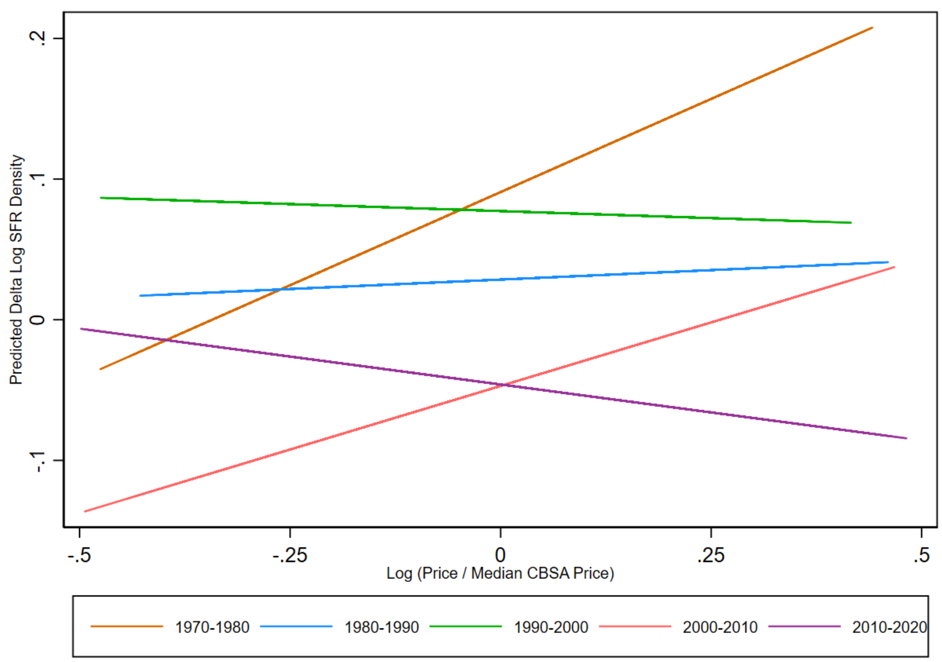
Appendix Figure 24: Empirical Housing Supply Curves for Miami, Specification 1 (Naïve OLS)



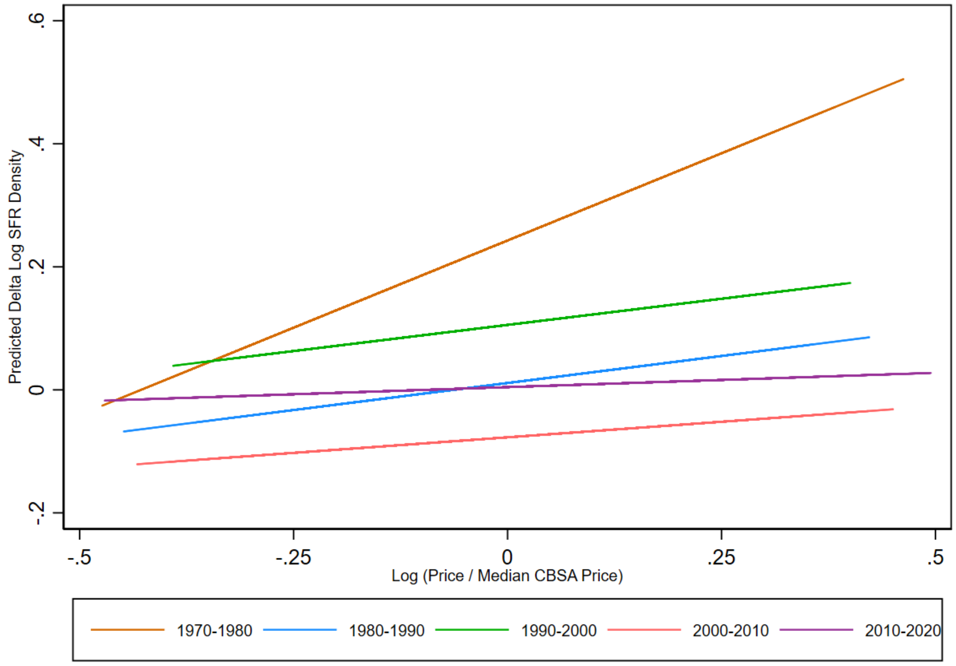
Appendix Figure 25: Empirical Housing Supply Curves for Miami, Specification 2 (Lagged Price IV)



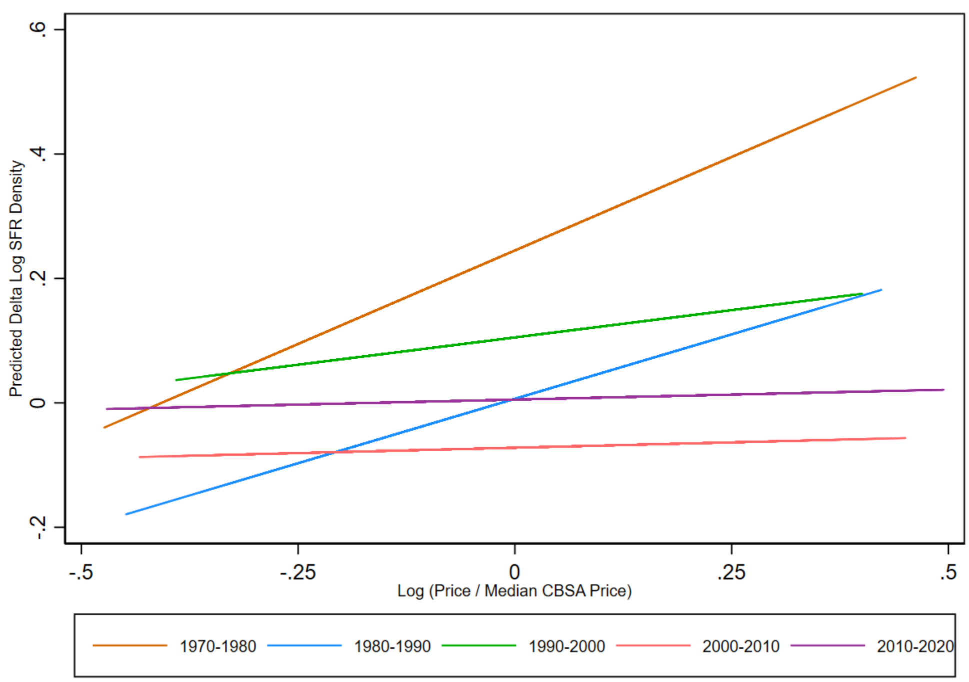
Appendix Figure 26: Empirical Housing Supply Curves for Miami, Specification 3 (Location IV)



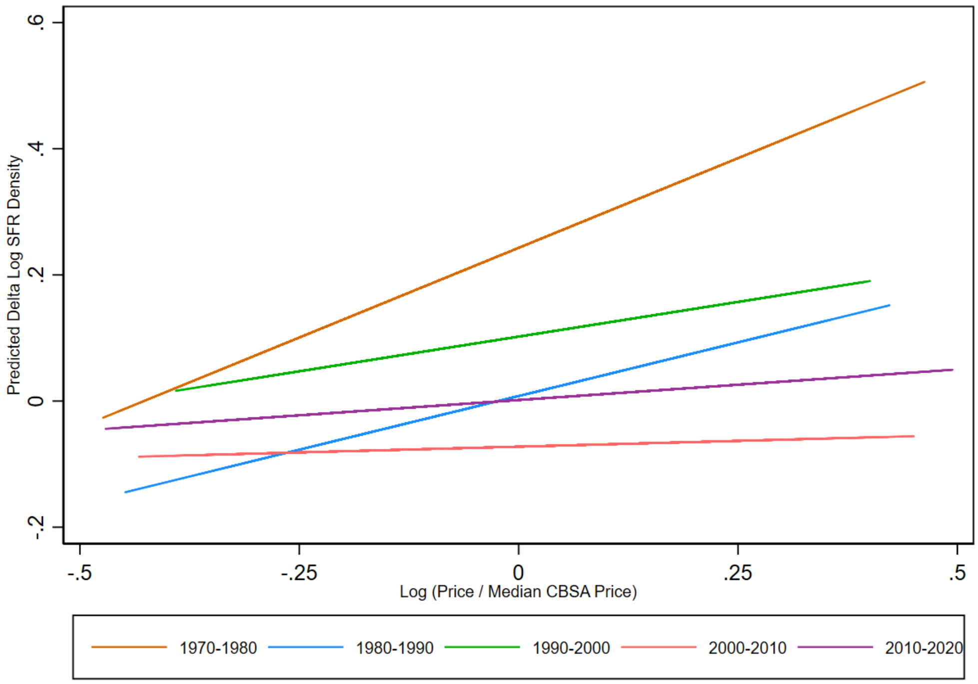
Appendix Figure 27: Empirical Housing Supply Curves for Phoenix, Specification 1 (Naïve OLS)



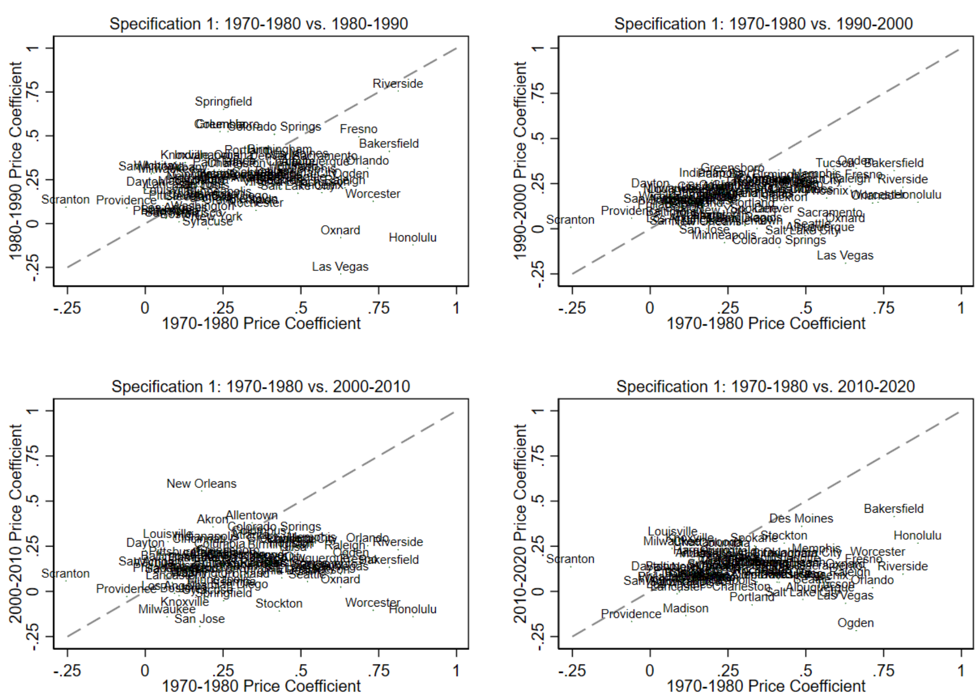
Appendix Figure 28: Empirical Housing Supply Curves for Phoenix, Specification 2 (Lagged Price IV)



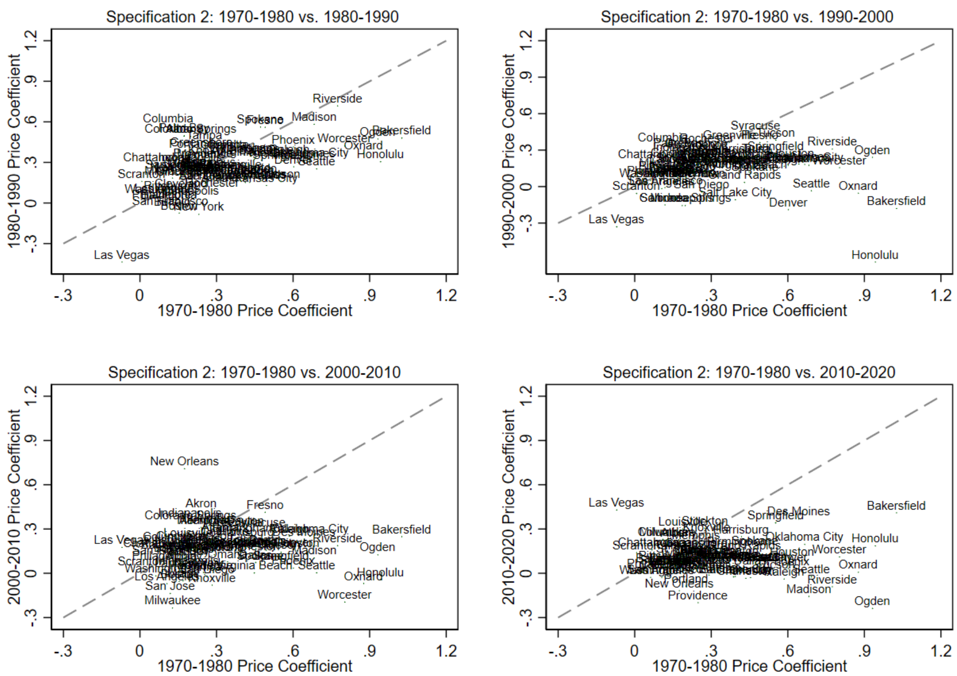
Appendix Figure 29: Empirical Housing Supply Curves for Phoenix, Specification 3 (Location IV)



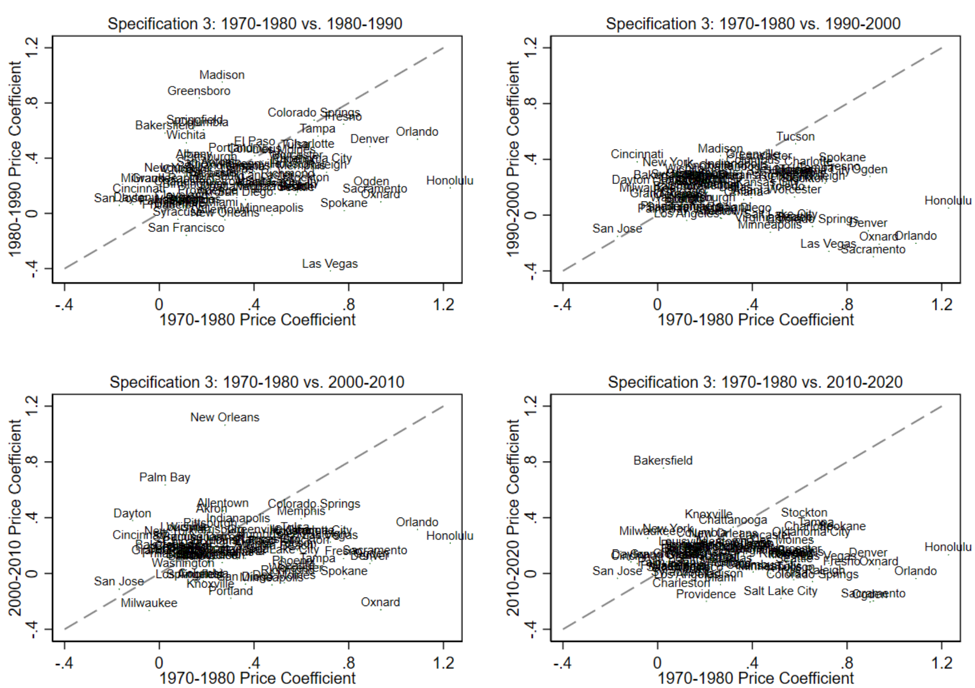
Appendix Figure 30: Specification 1, Changes in Price Coefficients Over Time, Single Housing Unit Sample



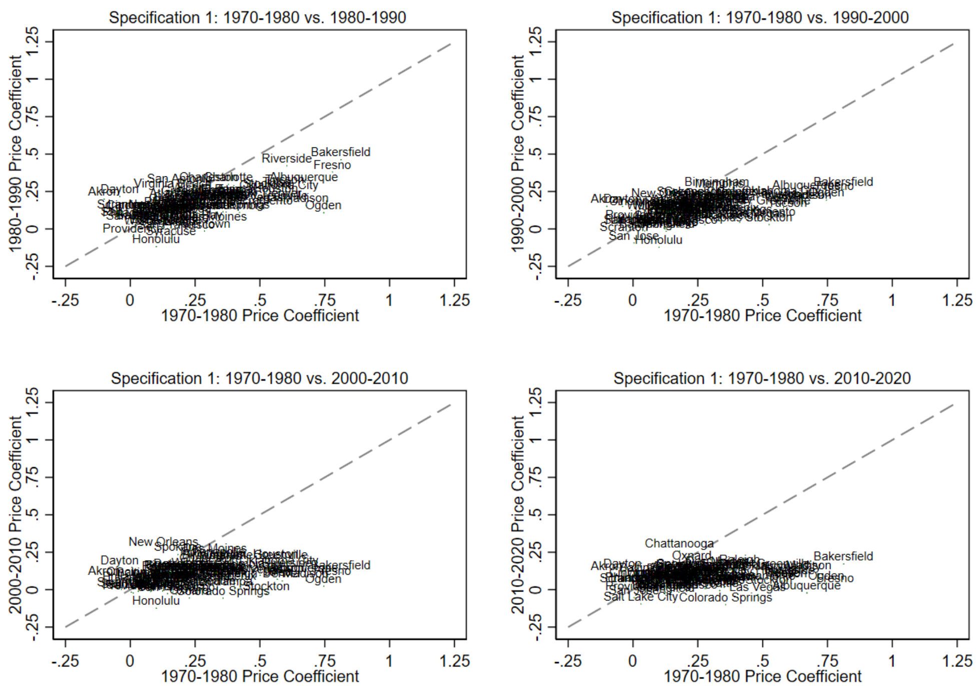
Appendix Figure 31: Specification 2, Changes in Price Coefficients Over Time, Single Housing Unit Sample



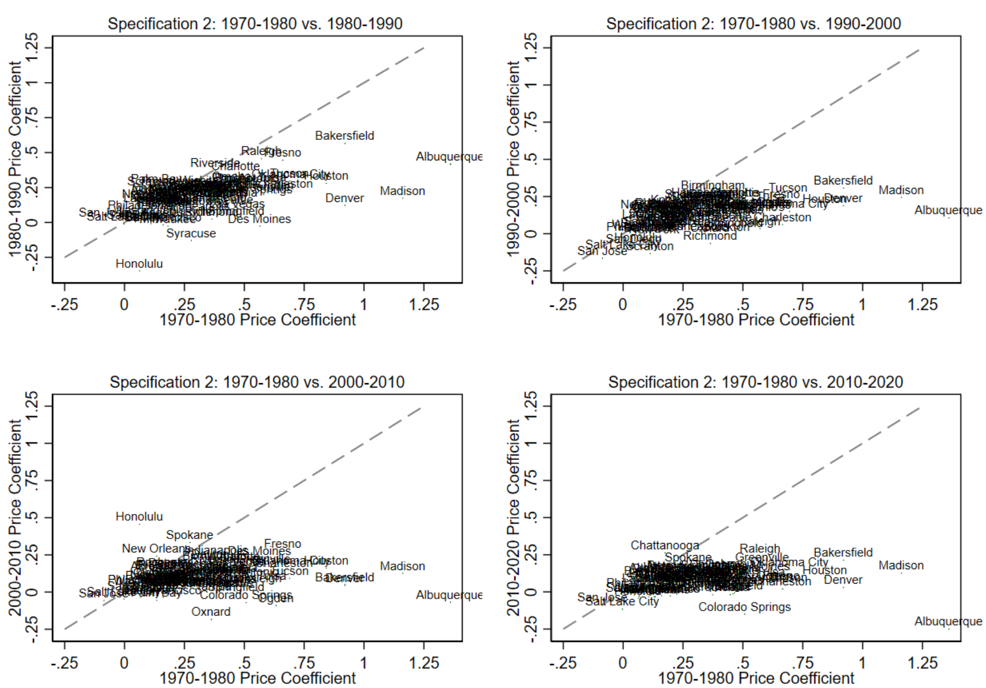
Appendix Figure 32: Specification 3, Changes in Price Coefficients Over Time, Single Housing Unit Sample



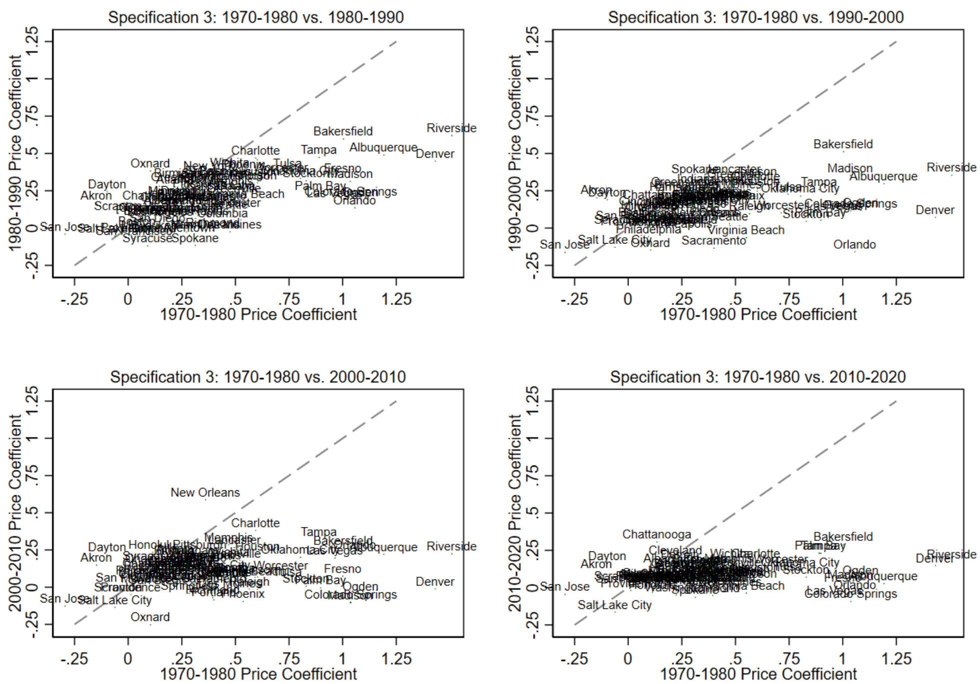
Appendix Figure 33: Specification 1, Changes in Price Coefficients Over Time, All Housing Unit Sample



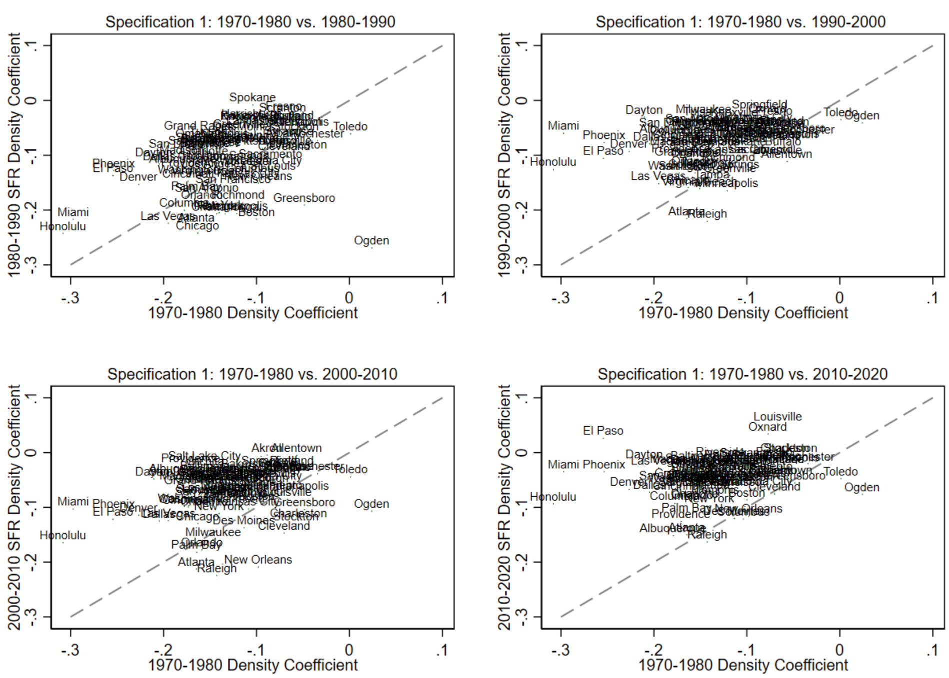
Appendix Figure 34: Specification 2, Changes in Price Coefficients Over Time, All Housing Unit Sample



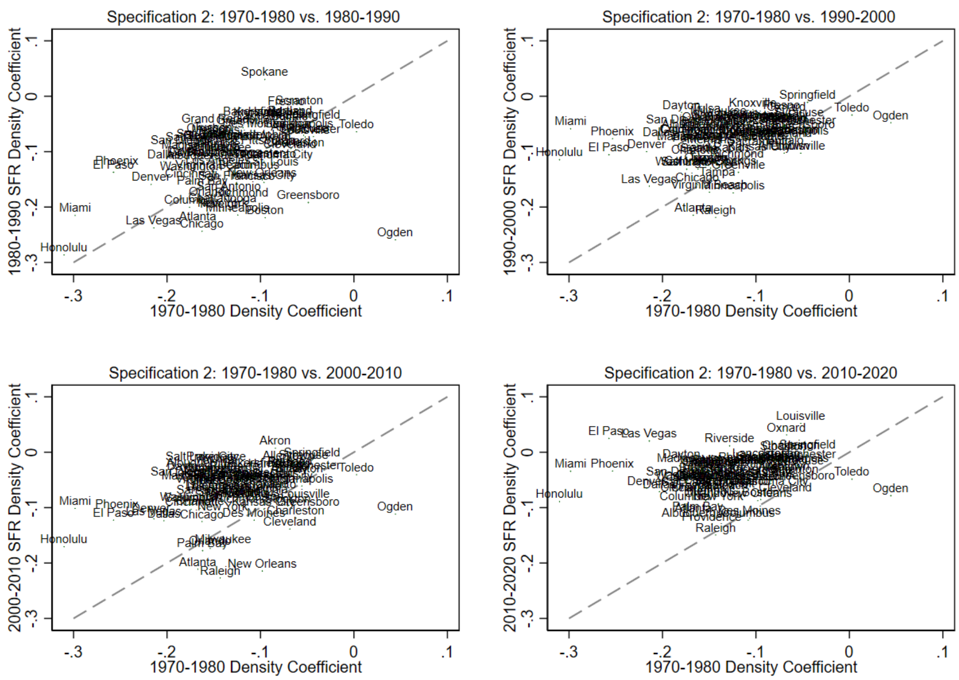
Appendix Figure 35: Specification 3, Changes in Price Coefficients Over Time, All Housing Unit Sample



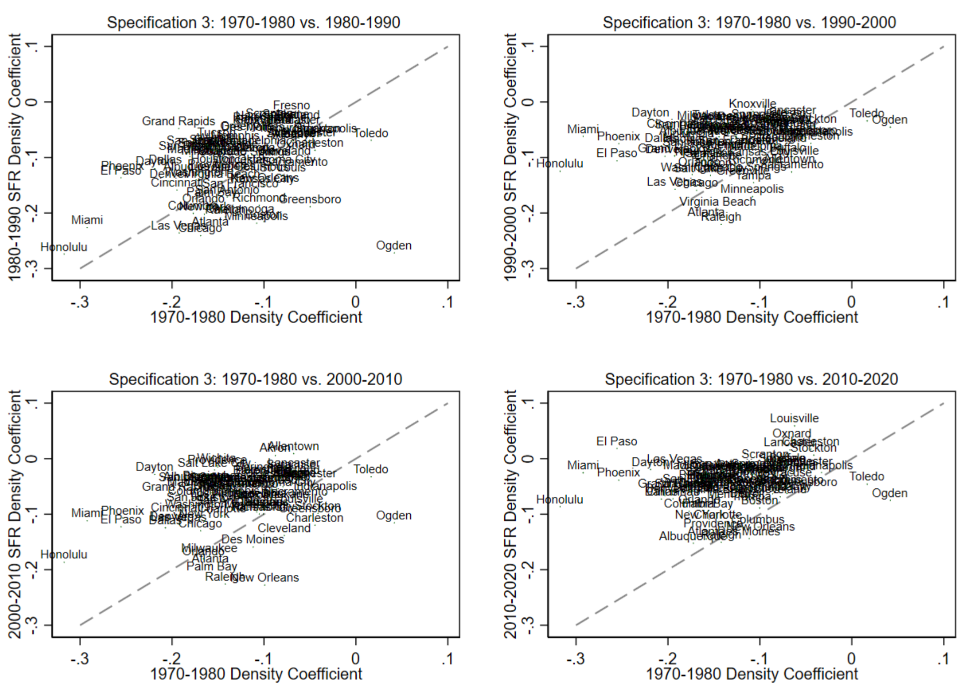
Appendix Figure 36: Specification 1, Changes in Density Coefficients Over Time, Single Housing Unit Sample



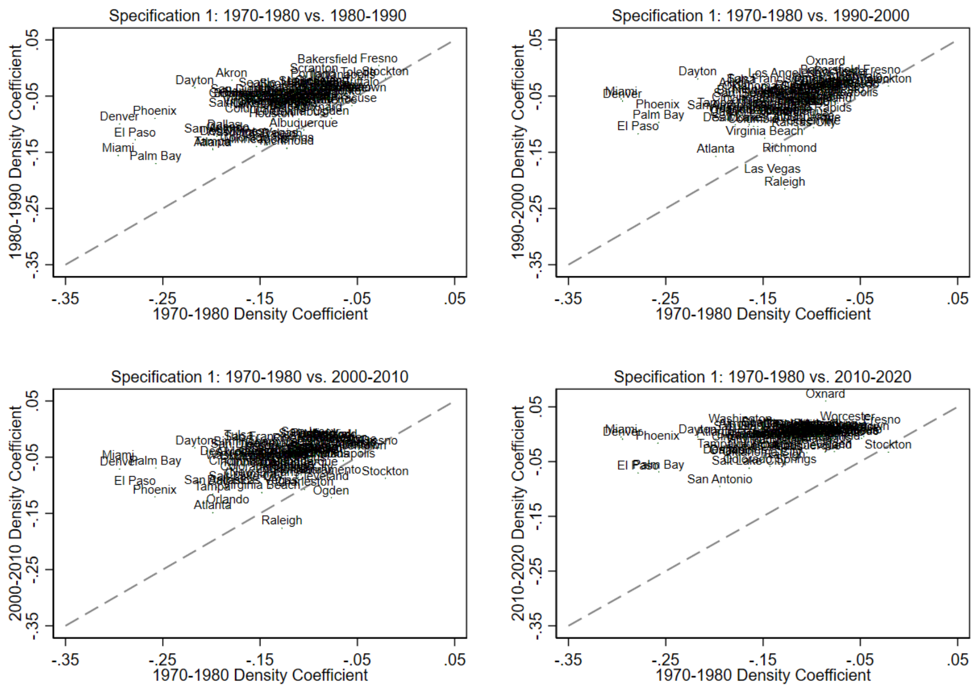
Appendix Figure 37: Specification 2, Changes in Density Coefficients Over Time, Single Housing Unit Sample



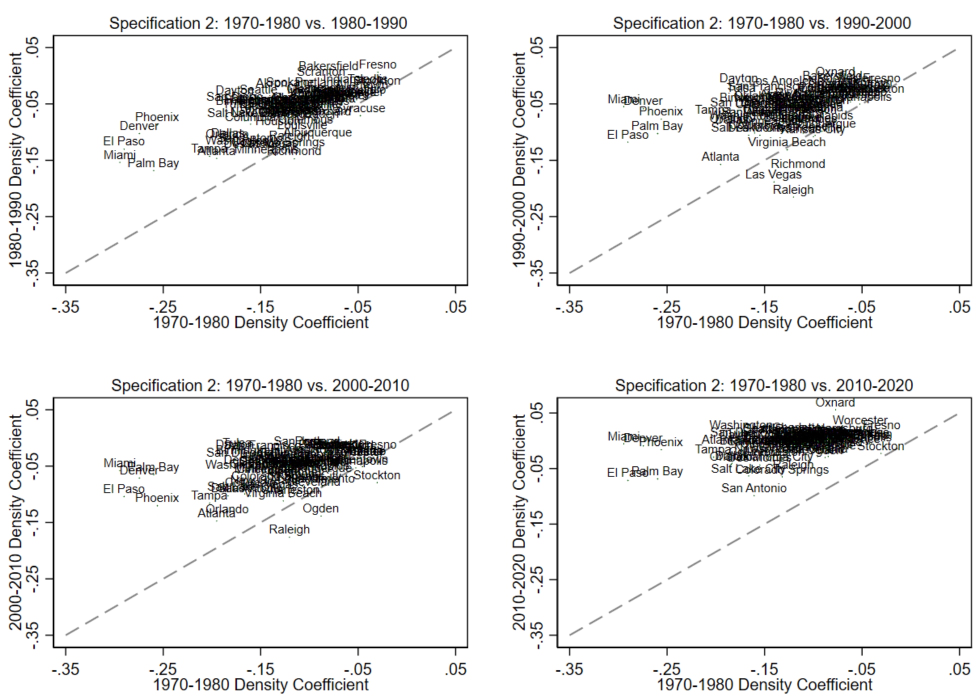
Appendix Figure 38: Specification 3, Changes in Density Coefficients Over Time, Single Housing Unit Sample



Appendix Figure 39: Specification 1, Changes in Density Coefficients Over Time, All Housing Unit Sample



Appendix Figure 40: Specification 2, Changes in Density Coefficients Over Time, All Housing Unit Sample



Appendix Figure 41: Specification 3, Changes in Density Coefficients Over Time, All Housing Unit Sample