The Effect of Land Supply for New Homes on Residential Investment and House Prices*

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Abstract

We use parcel-level data to provide new facts on the level and distribution of land available for residential development, focusing on New England housing markets between 2007 and 2021. Most buildable parcels are small, with large buildable parcels scarce in most geographic markets. Large buildable parcels are less available in more populous markets, become more scarce as populations grow, and have become more scarce over time. Markets with fewer large parcels experience higher price growth and lower residential development relative to price growth. We present evidence consistent with developer returns to scale in parcel size, meaning that fragmentation of buildable land across small, disjoint parcels increases house prices by lowering construction productivity and making development less responsive to demand. In counterfactual simulations from a simple calibrated model, we show that recombining small buildable parcels into larger ones, while holding the total amount of buildable land fixed, would increase supply, raise construction productivity, and reduce house price growth.

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In recent years, the US has experienced rising house prices relative to income, a low supply of new housing units, and flat-to-negative construction productivity growth (Molloy *et al.* 2020, Goolsbee and Syverson 2023, Garcia and Molloy 2023). Policymakers concerned about housing affordability have devoted increasing attention to these trends. A large body of academic research argues that land use regulations play a central role in explaining these patterns by constraining housing supply (e.g., Gyourko and Molloy 2015, Glaeser and Gyourko 2018, D'Amico *et al.* 2024).

In this paper, we explore an additional hypothesis that could explain these trends: in many high-cost markets, large plots of buildable land are scarce, constraining the level and efficiency of residential construction. This mechanism is consistent with some patterns in "superstar" cities (Duranton and Puga 2023), and if quantitatively important, implies that reforming land use restrictions alone may be insufficient to address housing supply constraints. Despite its importance for evaluating housing policy, little comprehensive research exists on this alternative explanation (Baum-Snow and Duranton 2025).[1] This is partly because there is limited detailed historical parcel-level data on land available for residential development.

We provide new facts on the distribution of buildable land and study its impact on housing supply. We address the data challenge using a parcel-level dataset maintained by the Federal Reserve Bank of Boston to measure the buildable land distribution in New England and track its development since 2007. We show that in expensive areas, the supply of buildable land is fragmented across many small, disjointed parcels. This could limit the scale of new construction projects, which potentially reduces efficiency, raises the unit cost of development, and makes construction less responsive to economic fluctuations. While fragmented land supply could result from population density or past land use restrictions, it implies that regulatory reform alone might be insufficient to address housing supply constraints.

Housing market analysts have long emphasized the importance of scale in residential construction. As Baily and Solow (2001) summarized from a McKinsey Global Institute report on construction productivity:

> "Scale matters... Where large plots of land are zoned for residential housing, developers... exploit the benefits of scale by building large numbers of similar houses at the same time. Elsewhere... plots... accommodate only a few houses and the result is lower productivity."

There are stark differences across housing markets in the size of available parcels, which mean that construction must occur at very different scales. Figure 1 gives an example that

[1] "Rather than institutional factors, it may have been available land that became scarce and limited new constructions... More systematic evidence on land scarcity, including the lack of large parcels to develop new subdivisions, is greatly needed" (p. 389).

compares typical buildable plots within a 15-minute drive of the city center in Charleston, South Carolina and Boston, Massachusetts, based on July 2025 sales listings. Charleston has a 4,600-acre greenfield plot available for residential development, where a builder could simultaneously construct many single-family homes. Boston has a 0.1-acre plot available for infill construction, where a developer could build a single townhome.

We first build a parcel-level dataset to track the development of buildable land in New England. We use a panel of public tax assessor records collected by the Warren Group, a real estate data firm, and maintained by the Boston Fed. The Boston Fed has archived the Warren Group's New England data feed each month since 2007 and applied harmonized data cleaning across time, so the dataset has consistent historical coverage. The Warren Group specializes in the New England market, and so better standardizes records across different municipalities that have often inconsistent reporting standards. Compared to other sources that offer similar products, such as CoreLogic, the Warren data covers a greater share of total land area and has more detailed information on land use. The data has sufficient detail to identify vacant parcels available for residential development, and track the buildable acreage in each year developed into residential units within arbitrarily-granular geographic markets.

We use this data to document five facts. First, most buildable parcels in New England are small, and most housing markets have few large buildable parcels in absolute terms. Second, large buildable parcels have become more scarce over time. Third, large buildable parcels are more scarce in more populous markets, and become more scarce as populations grow. Fourth, markets where large buildable parcels are more scarce experience more rapid price growth. Fifth, markets where large buildable parcels are more scarce have lower development relative to price growth.

These facts indicate that development is more efficient on larger plots, and the price elasticity of supply is higher where available land is concentrated on larger parcels. To more precisely characterize how the buildable land size distribution impacts development, we present a simple empirical model of housing supply with returns to scale in parcel size. In the model, builders decide whether to develop parcels of variable size. They face fixed development costs to prepare parcels for construction, so that larger parcels develop at a lower price per housing unit. This implies increasing returns to scale in parcel size, and connects the size distribution of available parcels to aggregate housing supply. The theory implies that holding fixed the total land supply and house prices, housing supply is increasing in average parcel size.

We present suggestive calibrations of the model using our parcel-level data, which indicates meaningful returns to scale in parcel size and reproduces our empirical facts. We use the calibrated model to show how house prices, housing supply, the price elasticity of housing supply, and construction productivity would change under different distributions of buildable land and different returns to scale in parcel size. In counterfactual simulations, we show that both the *level* and *distribution* of buildable land is important. Specifically, recombining fragmented parcels of buildable land into larger parcels meaningfully reduces house prices, increases housing supply, and improves construction productivity, even holding fixed the total *acreage* of buildable land.

Our results complement the findings of an existing literature that studies how the supply of buildable land impacts construction. Saiz (2010) argued that physical constraints imposed by local terrain limit the supply of buildable land in many US cities, and can help explain differences in metro-level housing supply elasticities. In their study of neighborhood-level housing supply elasticities, Baum-Snow and Han (2024) similarly finds that metro-level terrain correlates with supply elasticities.

While these papers focus on the overall amount of buildable land available across housing markets, we emphasize measuring the *distribution* of land. Our data allows us to observe buildable parcels directly, unlike Saiz (2010) and Baum-Snow and Han (2024) that rely on remote sensing data to identify buildable land. This allows us to take a stance on project *scale* imposed by the land supply distribution, and show how a scarcity of large plots reduces the efficiency of new development by reducing project scale.[2] D'Amico *et al.* (2024) also emphasize returns to scale in development, but focus on a different mechanism: project scale is limited by local control and zoning regulations, rather than the availability of large parcels.

Sections 1-5, respectively, describe our data and our approach to measuring buildable land and tracking development; our five empirical facts; the model of developer returns to scale in parcel size; model calibration and counterfactuals; and the policy implications of our analysis.

1 Measuring the supply of buildable land.

This section describes our data sources and approach to measuring the distribution of buildable land. We combine parcel-level data from multiple administrative sources maintained by the Federal Reserve System to develop a comprehensive view of available land and development activity. Our analysis focuses on New England, where the Boston Fed maintains relatively more detailed data on residential development; however, we supplement our New England data with information on other markets for comparison.

[2] Baum-Snow and Duranton (2025) also study project size, but use the size distribution of *developed* parcels to make inferences about the size of buildable parcels.

1.1 Data sources.

1.1.1 Warren Group tax assessor data.

Our primary data source is a parcel-level panel of public tax assessor records collected by the Warren Group, a real estate data firm. The data contains the universe of tax parcels in covered municipalities, with information on parcel longitude and latitude, assessed value, parcel size in acres, land use codes, and the characteristics of improvements, such as the number of beds and baths in residential structures.

The Federal Reserve Bank of Boston has received monthly data updates from the Warren Group since 2007 covering Massachusetts, Connecticut, and Rhode Island.[3] Using repeated observations of individual parcels over time, we can track parcel-level development. By aggregating to arbitrarily granular geographic units, we can also track development at the level of local housing markets over time.

The Warren Group data is similar to real estate data products from other companies such as CoreLogic. We use Warren data in our analysis because it has two advantages over other sources. First, the Boston Fed has maintained repeated snapshots based on monthly Warren data feeds, ensuring data coverage is consistent across time. Second, because Warren has historically focused on a small set of New England municipalities, land use designations are granular and reliable. This is particularly true for parcels that fall outside of the single-family residential land use category.

To illustrate the strengths of the Warren Group data, Figure 2 compares the coverage of Warren Group and CoreLogic tax assessor records for Massachusetts, Connecticut, and Rhode Island for 2007-2021. In each dataset, we restrict to year-end snapshots of parcels with land use information, and remove duplicated entries. We then calculate total acreage across covered parcels each year in each dataset, and plot the ratio of total covered acreage to total acreage in each state.[4]

Figure 2 shows that between 2011 and 2021, the Warren Group data covers around 80% of the total area of Massachusetts, 85% of the total area of Connecticut, and 67% of the total area of Rhode Island.[5] By comparison, CoreLogic coverage is poor before 2015. Thereafter, CoreLogic's coverage is typically about 10 percentage points lower than Warren, and especially

[3]The Warren Group has traditionally focused on real estate intelligence in the New England region. The Boston Fed has focused on coverage of New England states because of its mandate to monitor New England economic activity.

[4]We calculate total acreage using 2010 Census Bureau estimates, and subtract coastal area from total area.

[5]Our approach gives a lower bound on coverage because it includes all non-coastal state area, including water area. Some water area (e.g., navigable waterways) are public land that is not parceled out and reported in assessor public records. This is especially relevant for Rhode Island, where the Census Bureau reports that 30% of the state's area is inland water.

in Connecticut and Rhode Island, coverage varies significantly year-to-year. The variable coverage indicates that parceled acreage drops out of the data before reappearing in a way that could give a distorted view of development activity.

1.1.2 CoStar listings.

For cross-regional comparisons, we supplement assessor records with commercial real estate listings from CoStar. CoStar is a listing service that includes properties for sale, including vacant land that is available for residential construction. We downloaded all listings of buildable land for sale in July 2025 within New England states and South Carolina. This lets us compare the size distribution of sites available for developers to purchase across high and low cost markets.

1.1.3 Public data.

We supplement these administrative sources with several public data sets.

FHFA repeat sales indices. To estimate price growth by county, zip code, and Census tract, we use house price indices published by the Federal Housing Finance Agency (FHFA). The indices use repeated sales or appraisals for single-family properties covered by conforming mortgages. We use the annual series reported by the FHFA.

American Community Survey demographics. We download local housing market demographic characteristics from the American Community Survey (ACS) 5-year estimates, accessed via the Census Bureau API. We obtain estimates of the local number of households, household income, rents, and self-reported home values. These variables are used to examine heterogeneity across housing market types.

1.2 Buildable land dataset construction.

We use the Warren Group data to form a parcel-level panel to track the development of buildable land in New England.

Processing historical Warren data. We start with the Boston Fed's historical records of Warren Group data and clean the data as follows. First, we retain the most recent observation for each parcel-fiscal year combination. Second, we remove duplicate records arising from mid-year reassessments or data entry errors by keeping the observation with the latest entry date within each parcel-year. Third, we create a balanced panel structure by forward-filling and backward-filling missing observations for parcels that appear in at least two consecutive years. This procedure ensures that temporary gaps in reporting are not misclassified as development.

Land use classifications. We classify each parcel-year observation into one of the following mutually-exclusive land use categories:

(i) *Residential Vacant*: Parcels with residential zoning and no occupied structures. These parcels represent the stock of readily buildable land for housing development.

(ii) *Single-Family Residential*: Parcels with 1-3 single-family units. This includes single-family detached homes as well as townhouses and condominiums with up to 3 units.

(iii) *Multi-Family Residential*: Parcels with structures containing four or more units. This includes both multi-unit condominiums, rented apartments, and group dwellings.

(iv) *Non-Residential Vacant*: Parcels designated for commercial, industrial, institutional, or other non-residential uses with no structures present.

(v) *Non-Residential Developed*: Non-residential parcels with structures.

(vi) *Mixed/Unclassified*: Parcels with mixed-use designations or land use codes that do not fit cleanly into the above categories.

This classification scheme enables us to track the flow of land from vacant to developed status and to distinguish between single-family and multi-family development.

We apply this classification scheme using land use codes reported by the Warren Group. In our sample, there are 284 land use codes that are designed to correspond to Massachusetts Board of Assessors land use designations prepared by the Department of Revenue (Massachusetts Department of Revenue 2019). In some cases, the Warren Group reports codes that do not correspond to the most recent guidelines, perhaps due to outdated codes used by recorders in local areas. For these codes, we manually classify the land use codes using a combination of the code's digit structure and a visual review of the parcels using Google Street View.[6]

Defining buildable land. Our primary analysis only considers residential vacant parcels as buildable. It is theoretically possible for a developer to use any parcel for residential development, tearing down any structures present and petitioning for a land use re-designation if needed. In practice, such steps are costly and legally difficult, meaning much development occurs on land that is already vacant and designated for residential use.

[6] Land use codes follow a three-digit hierarchy, with the first digit signifying major classification, and the second digit signifying minor classification. For example, the land use code "120" does not have a Board of Assessors designation. But it is close to "12" (non-transient group quarters) and Street View inspection shows that properties with code 120 appear to be boarding houses, so these parcels are categorized as multi-family residential.

This approach is maximally conservative, as it avoids inappropriately classifying non-buildable parcels as buildable. However, it might miss opportunities to build residential units on farmland, vacant commercial land, or commercial land with structures that are not presently in use (e.g., redevelopment of urban warehouse districts).

We therefore consider two additional definitions in robustness exercises that are less restrictive. The first intermediately-restrictive definition includes all vacant non-residential land. The second, least restrictive definition includes all land with no residential structures.

Measuring the development rate with aggregate transitions. It is challenging to systematically identify how vacant land is developed. If development does not change how a parcel is identified with the county assessor office, then we can identify residential vacant parcel development using year-over-year changes in parcel-level land use. However, for large projects, developers often subdivide large parcels into smaller parcels or combine smaller parcels. Such re-parceling often leads to new parcel identifiers. Granular information on such subdivision and recombination is typically unavailable.

To overcome this challenge, rather than tracking development at the parcel-level, we aggregate to the level of local housing markets, and track changes in the total acreage within each of the above land use categories. We can track how residential vacant land transitions into developed single-family and multi-family residential properties by estimating changes in overall acreage within each of these categories.

Our approach to measuring land development avoids the need to track parcel-level changes. Because we have parcel-level data, we can apply the approach to arbitrarily granular local housing markets. In practice, in most of our analysis, we aggregate to the zip code level; much of our conclusions below hold if we aggregate to counties or census tracts instead. The downside of this approach is that we cannot only observe net changes across land use categories, rather than gross flows between land use categories. For example, we cannot separate tear-downs that result in developed single-family residential land converted into residential vacant land from residential vacant land developed into single-family residential.

Formally, we estimate the *development rate* in market m and year t as:

$$\text{Development Rate}_{mt,t-k} := \frac{\Delta\ \text{Residential Developed}_{mt}}{\text{Buildable Land}_{m,t-k}} \tag{1}$$

This gives the share of buildable land available in $t-k$ developed into residential units between year $t-k$ and year t. In this expression, $\text{Buildable Land}_{m,t-k}$ is the total acreage of buildable land in $t-k$, and $\Delta\text{Residential Developed}_{mt,t-k}$ is the change in the acreage of developed residential land between t and $t-k$, measured as:

$$\begin{aligned}\Delta \text{ Residential Developed}_{mt,t-k} := & \left(\text{Single-fam Residential}_{mt} + \text{Multi-fam Residential}_{mt}\right) \\ & - \left(\text{Single-fam Residential}_{m,t-k} + \text{Multi-fam Residential}_{m,t-k}\right) \\ & + \text{Residential Developed Exit}_{mt,t-k} \end{aligned} \quad (2)$$

where Residential Developed Exit$_{mt,t-k}$ is the acreage of single-family and multi-family developed parcels that appear to exit the sample between $t-k$ and t. Accounting for the exit of parcels from the sample captures depreciation, tear-downs, or conversions into other land use for property currently used for residential units.

2 Summary statistics.

Table 1 presents summary statistics for the Warren Group data.

Panel (a) presents summary statistics where parcels are the unit of observation. The typical parcel is small, with median size of 0.29 acres. This belies considerable dispersion: the standard deviation of parcel size is 22 acres, and the 99th percentile parcel has 31 acres. The parcel size distribution is right-skewed, as the mean parcel size of 2 acres lies above the median parcel size.

The average residential developed parcel is small, at 0.8 acres for single-family and 1.5 acres for multi-family. Residential developed parcels are smaller than residential vacant parcels: while single-family and multi-family developed parcels have an average size of 0.8 acres and 1.5 acres, respectively, residential vacant parcels have an average size of 3.3 acres. This shows the limitations of using the size distribution for developed parcels to infer the distribution of buildable land, as in Baum-Snow and Duranton (2025).

Most buildable parcels are small. The median residential vacant parcel is 0.5 acres, which could produce only three single-family homes with 25th-percentile lot sizes. Even the 90th-percentile residential vacant parcel, with 6.5 acres, could only produce around 40 single-family homes with 25th-percentile lot sizes. Large buildable parcels become more available using less conservative definitions of buildable land – for example, the 90th percentile non-residential vacant parcel has 22.5 acres, and the 90th percentile non-residential developed parcel has 16 acres.

Panel (b) presents summary statistics where zipcodes are the unit of observation. We show the fraction of land in each zipcode in each land use category, and annual development rates using our most, intermediate, and least restrictive definition of buildable land. About 84% of land in the average zip code is developed, evenly split between residential and non-residential.

Of the 16% that remains, about 13% is vacant, again evenly split between residential and nonresidential.[7]

In the average zipcode, 7% of land is residential vacant – the most conservative definition of buildable land. This belies significant heterogeneity across markets. In the 25th percentile zipcode, only 1.8% of land is residential vacant, while in the 90th percentile zipcode, 14.7% of land is residential vacant.

In the average zipcode, about 7% of residential vacant land is developed into residential units between 2018 and 2019. There is again significant heterogeity, with development rates of 0.6% in the 25th percentile zipcode and 18.8% in the 90th percentile zipcode.[8] Development rates are generally lower using the more generous definitions of buildable land, because the denominator in the development rate is increasing as a larger share of local land is considered buildable.

Panel (c) shows results where counties are the unit of observation. Many of the qualitative patterns are similar as the zipcode case.

3 Empirical facts on the supply of buildable land.

Using our parcel-level panel, we document five empirical facts about the supply of buildable land. Throughout, we primarily consider local housing markets defined by zip code, although we find similar results if we aggregate more coarsely (with counties) or with more granularity (with census tracts). We also focus our analysis on housing markets between 2013 and 2019, the period after the housing crisis but before housing market disruption related to the Covid-19 pandemic.

Facts 1-3 document basic summary statistics and trends about the buildable land distribution in New England. Facts 4 and 5 show how the buildable land distribution relates to house price growth and investment.

3.1 Fact 1. The typical buildable parcel is small.

Buildable parcels are small in most New England housing markets. To illustrate, we take parcels observed in 2019, and first calculate the size in acres of the 90th percentile buildable parcel

[7]The remaining 3% of land is undevelopable – for example, underwater land or marshes.

[8]The table shows development rates for zipcodes where development rates lie between zero and one. Development rates could be outside that range if (i) there were no buildable land in 2018 (in which case the fraction of buildable land developed is undefined); (ii) there was a net decrease in acreage of residential land (e.g., many vacant units were demolished); or (iii) the increase in residential acreage exceeded the lagged acreage of developed land (e.g., because of new acreage covered in county assessors offices).

within each zipcode, to show the size of a typcial large plot. Then, we rank zipcodes by the size of their 90th-percentile buildable plot. Figure 3 plots the size of the 90th-percentile parcel against the fraction of zipcodes with a larger 90th-percentile parcel (equal to one minus the zipcode's percentile rank in the zipcode distribution). The vertical axis gives the fraction of zipcodes with a 90th-percentile plot that is larger than the size indicated on the horizontal axis. The blue series shows results for the most restrictive buildable land definition (only residential vacant parcels), while the red series shows results for the least restrictive definition (all vacant and non-residential developed parcels).

The figure shows that large plots are scarce in most housing markets. Using the restrictive buildable land definition, only about 10% of New England zipcodes have a 90th-percentile buildable plot larger than 10 acres. This result is robust to the definition of buildable land, rising to only 12.5% using the less restrictive definition.

The low availability of large buildable plots in most housing markets would have less of an impact on aggregate development if at least some markets had an abundance of large plots for sale. However, using CoStar data, we find that large buildable plots for purchase are scarce in New England in absolute terms as well. Figure 4 plots in blue on the vertical axis the share of New England buildable parcels available for sale in July 2025 with acreage exceeding the acreage indicated on the horizontal axis. About 2% of buildable parcels for sale are larger than 100 acres, constituting 30% of buildable acres for sale. To put that in context, the red line shows comparable figures for South Carolina, where construction activity is more robust and property prices are much lower. A much greater share of buildable land is within large parcels: 4% of buildable parcels for sale are larger than 100 acres, constituting 60% of buildable acres.

3.2 Fact 2. Large buildable parcels have become more scarce over time.

In New England, large parcels have become less available over time. Figure 5 shows the average acreage of the median, 75th percentile, and 90th percentile buildable parcel across zip codes in each year since 2012. The size of buildable plots has shrunk appreciably over time – the 50th, 75th, and 90th percentile plot has declined by about 23%, 33%, and 26%, respectively.

3.3 Fact 3. Buildable parcels are smaller in more populous markets.

Large parcels are more scarce in more populous markets. Figure 6a groups zipcodes into quintiles by 2019 population, and within each quintile plots the average size of the median, 75th percentile, and 90th percentile buildable parcel in 2019. The median, 75th percentile, and 90th percentile parcels are much smaller in more populous markets. For example, for zipcodes in smallest quintile, a buildable parcel must have more than 12 acres to be in largest 10%, while for zipcodes in the largest population quintile, a buildable parcel only needs around 2.5 acres to be in the largest 10%.

Furthermore, places with greater population growth experience a decline in availablity of large plots. Figure 6b groups zipcodes into quintiles based on population growth between 2013 and 2019, and for zipcodes within each quintile, plots the average change in size of the the median, 75th percentile, and 90th percentile buildable plot. Across the buildable land distribution, places with more population growth saw a decrease in parcel quantiles, indicating increased scarcity of large parcels. The decrease is especially pronounced for 90th percentile buildable plots.

These patterns suggest two mechanisms that could explain the availability of large parcels. First, as people move into an area, dispersed settlements break up large contiguous parcels – for example, a subdivision that breaks a large farm into two pieces. Second, developers could select on parcel size, so that places with larger population growth have a depleted stock of large plots available for subsequent development.

3.4 Fact 4. Price growth is higher in markets with fewer large parcels.

Places with low initial availability of large buildable plots experience more price growth in subsequent years. This is consistent with small buildable plots constraining the level and efficiency of new development. Figure 7 groups zip codes into quintiles by the acres in the median, 75th percentile, and 90th percentile buildable parcel in 2013, and within each quintile, plots average price growth between 2013 and 2019. Markets where the large parcels are scarce show much stronger price growth over this period. For example, places where the 90th percentile buildable plot had under one acre in 2013 saw 50% nominal price growth, while places where the 90th percentile buildable plot had 25 acres saw around 20% price growth.

The relationship between price growth and parcel size is convex. Price growth is much lower in places where the 90th percentile buildable parcel has 10 acres compared to where the 90th percentile buildable parcel has 1 acre, but there is little difference in price growth compared to a place where the 90th percentile buildable parcel has 25 acres. This is consistent with developer scale efficiencies for projects of a certain size, after which point the benefits of incremental scale decline.

Of course, price growth reflects many factors, some of which might correlate with the buildable parcel size distribution. However, we find that the availability of large buildable parcels incrementally explains price growth above basic housing market demographic characteristics.

Where m indexes zipcode, we run cross-sectional regressions of the form:

$$\%\Delta \text{Price}_m = \beta_0 + \beta_1 \cdot \text{Acres90}_m + X_m' \cdot \delta + \gamma_{g(m)} + \epsilon_m \tag{3}$$

where $\%\Delta\text{Price}_m$ is 2013-2019 price growth, Acres90_m is the acreage of the 90th percentile buildable parcel, X_m is a vector of housing market characteristics, and $\gamma_{g(m)}$ is a set of fixed effects for group m.

Table 2a shows coefficient estimates. Column (1) estimates equation (3) without Acres90_m, using 2013 population, 2013 log income, 2013-2019 log income growth, and the 2013 price-to-rent ratio as explanatory demographic variables. The predictors have expected signs. For example, higher price growth predicts higher income growth, consistent with positive demand shocks, and a higher price-to-rent ratio predicts higher price growth, consistent with price-to-rent ratios capitalizing (partially) correct expectations about future price growth. These demographics explain 21% of cross-sectional variation in price growth.

Column (2) regresses price growth on Acres90_m, and confirms that places with smaller 90th percentile buildable parcels – and hence fewer available large buildable plots – experienced higher price growth from 2013-2019. Variation in the 90th percentile buildable parcel size explains 9.5% of price growth variation. Column (3) shows that the availability of large buildable plots retains explanatory power in a specification including other control variables. The coefficient on Acres90_m is statistically unchanged, and the R-squared increases 14% (3.3pp).

Table 2b repeats the analysis, but includes state fixed effects. The results are similar, and if anything, imply that the availability of large parcels, proxied with the Acres90_m measure, has *greater* incremental explanatory power for price growth relative to basic demographic predictors. Appendix Table C.1 shows similar results with even more granular county fixed effects.

3.5 Fact 5. Development rates correlate less with buildable parcel size than price growth does.

The relationship between buildable parcel size in 2013 and development rates from 2013-2019 is much weaker than the relationship between buildable parcel size in 2013 and price growth from 2013-2019. Figure 8 groups zipcodes into quintiles by acres in the median, 75th percentile, and 90th percentile buildable parcel in 2013, and within each quintile plots the average fraction of 2013 buildable land developed between 2013 and 2019 (given by $\text{Development Rate}_{m,2019,2019-2013}$). Places with smaller buildable parcels in 2013 saw more development.

However, the proportional differences in development by buildable plot size are *much* lower than the proportional differences in price growth by buildable plot size shown in Figure 7. This suggests that supply is less price-elastic in places with smaller buildable plots. Focusing on the 90th percentile plot size cut in Figure 8, around 27% of 2013 buildable land was developed between 2013 and 2019 in places with the smallest plots. Figure 7 shows prices grew in those places by 50%, an elasticity of 0.5. The equivalent elasticity was nearly double in places with the largest buildable plots in 2013 – 17% of 2013 buildable land was developed between 2013 and 2019, and where prices grew by 18%.

4 Returns to scale and the supply of buildable land.

Facts 4 and 5 in Section 3 suggest that development is more efficient on larger plots. However, quantifying the impact of plot size on developer efficiency requires a more precise model of the developer production process. In this section, we introduce a simple model of returns to scale in residential housing development that reproduces the empirical patterns in Section 3. We present suggestive evidence that development exhibits return to scale in parcel size, and show how varying returns to scale and the buildable land distribution impacts house prices and the efficiency of development. Appendix A gives derivations.

4.1 Empirical model of developer returns to scale.

A region has housing market segments indexed by m with floorspace Q_{mt} in year t. Each market segment has a fixed mass N_m of developers who use land and capital to meet the demand for new floorspace from homeowners. Buildable parcels in market m and year t have a_{mt} acres of land, where a_{mt} has time-varying distribution described the the CDF A_t. House prices equate regional floorspace demand and supply.

Developers. Developers indexed by j are endowed with one parcel of buildable land. They choose the amount of floorspace per acre H_{jt} to build to maximize static profits, given a price per unit of floorspace P_{mt}.

Developers face both fixed and variable costs in parcel development. Fixed costs f_{jmt} include administrative costs from permitting, unit design, and procurement, as well the costs of infrastructure used by all units (e.g., roads in a subdevelopment and communal facilities). Variable costs $C_{mt}(H)$ include the costs of material and labor. Developers face an identical problem conditional on developing their parcel. Floorspace per acre satisfies:

$$\pi_{jmt} = \pi_{mt} := \max_H P_{mt} \cdot H - C_{mt}(H) \implies C'_{mt}(H^*) = P_{mt} \tag{4}$$

Developer j builds if total variable profits exceed fixed costs: $\pi_{mt}(P_{mt}) \cdot a_{mt} \geq f_{jmt}$

We parameterize variable costs as log-linear in floorspace: $C_{mt}(H) := c_{mt} \cdot \frac{\alpha-1}{\alpha} \cdot H^{\frac{\alpha}{\alpha-1}}$. Given this parameterization and equation (4), variable profits are $\pi_{0mt} \cdot P_{mt}^{\alpha} \cdot a_{mt}$, where π_{0mt} is a constant that depends on α and the constant c_{mt}. We parameterize fixed costs as: $f_{jmt} := f_{mt} \cdot a_{mt}^{1-\rho} \cdot \exp(\epsilon_{jmt})$, where ϵ_{jmt} follows a logistic distribution. Developer j then builds if:

$$\underbrace{\pi_{0mt} \cdot P_{mt}^{\alpha} \cdot a_{mt}}_{\text{variable profits}} - \underbrace{f_{mt} \cdot \overbrace{a_{mt}^{1-\rho} \cdot \exp(\epsilon_{jmt})}^{\text{returns to scale}}}_{\text{fixed costs}} \geq 0 \tag{5}$$

The parameter ρ determines returns to scale in parcel size. If $\rho = 0$, then parcel size a_{mt} has no impact on the development decision, and there are no returns to parcel size in development. If $\rho > 0$, then variable profits increase faster than fixed costs for larger parcels, meaning development exhibits *increasing* returns to scale. If $\rho < 0$, then variable profits increase more slowly than fixed costs for larger parcels, and development exhibits *decreasing* returns to scale.

In our model, under increasing returns to scale in parcel size, it is more efficient to develop a given amount of floorspace as part of one large project rather than many large projects. The model of returns to scale in housing development in D'Amico *et al.* (2024) also has this feature, but emphasizes different mechanisms. In our model, project scale is constrained by the buildable land distribution, and project consolidation is efficient because it reduces duplication of fixed lot preparation costs. In D'Amico *et al.* (2024), project scale is constrained by local regulation, and project consolidation is efficient because developers have a limited span of control: it is costly to effectively monitor many project simultaneously.

Integrating across developers j in year t, the development probability of an individual parcel is:

$$q_{mt} := \frac{\exp(\rho \cdot \ln a_{mt} + \alpha \ln P_{mt} + \ln(\pi_{0mt}/f_{mt}))}{1 + \exp(\rho \cdot \ln a_{mt} + \alpha \ln P_{mt} + \ln(\pi_{0mt}/f_{mt}))} \tag{6}$$

The total supply of floorspace in market m and year t is $Q_{mt}^{S}(P_{mt}) := N_m \cdot a_{mt} \cdot q_{mt}(a_{mt}, P_{mt}; \cdot)$.

Housing demand. A regional representative household has demand for new total regional floorspace ΔQ_t^D. Total floorspace demand depends on a regional price index P_t. The representative household pays price $P_{mt} := \mu_{mt} \cdot P_t$ per unit of floorspace. The coefficients μ_{mt} normalize quality differences across markets and over time due to unit characteristics or local amenities.

We paramterize regional demand for floorspace as log-linear:

$$\Delta \ln Q_t^D(P) := \eta_0 + \eta_1 \cdot (\ln P - \ln P_{t-1}) \tag{7}$$

Equilibrium. The regional price of floorspace equates new floorspace supply and demand:

$$\Delta Q_t^D(P_t) = \sum_m Q_{mt}^S(\mu_{mt} \cdot P_t) \tag{8}$$

4.2 Estimating developer returns to scale.

We next take the model to the data. The empirical counterpart of the modeled development probability q_{mt} is the development rate, given by Development Rate$_{m,t+1,t}$ in equation (1). Rearranging equation (6) and defining $\ln(\pi_{0mt}/f_{mt}) := \delta_m + \nu_t + \varepsilon_{mt}$ yields an estimating equation that is log-linear in development odds $q_{mt}/(1-q_{mt})$:

$$\begin{aligned}\ln \frac{q_{mt}}{1-q_{mt}} &= \rho \cdot \ln a_{mt} + \alpha \cdot \ln P_{mt} + \delta_m + \nu_t + \varepsilon_{mt} \implies \\ \Delta \ln \frac{q_{mt}}{1-q_{mt}} &= \rho \cdot \Delta \ln a_{mt} + \alpha \cdot \Delta \ln P_{mt} + \Delta\delta_t + \Delta\varepsilon_{mt}\end{aligned} \tag{9}$$

where the second line takes first differences to eliminate the time-invariant market-specific component of fixed costs and variable profits.

The coefficient of interest in equation (9) is ρ, which controls returns to scale. Ideally, we would estimate coefficients in equation (9) with an instrument for average parcel size a_{mt}. This would avoid bias arising from correlation between unobserved local factors that lead to changes in both the development rate and parcel size. For example, if developers expect an increase in relative demand for multi-unit condos in urban areas, they may develop places with small plots suitable for multi-unit buildings more rapidly than larger plots suitable for efficient single-family development. This would create downwards bias in our coefficient estimates.

Absent an instrument, we present suggestive results that add increasingly restrictive control variables, and show that coefficient estimates are stable across specifications. Throughout, we show how our conclusions would differ with different estimates of the returns to scale parameter ρ.

Table 3 shows coefficient estimates for equation (9). The first column has no fixed effects, which consistently estimates ρ assuming that $\Delta\varepsilon_{mt} + \Delta\delta_t$ is mean-independent of $\Delta \ln a_{mt}$, conditional on price growth ΔP_{mt}. The second column adds year fixed effects. This avoids bias from, for example, developers expecting a region-wide increase in demand for multi-unit housing. The third column adds year-by-state fixed effects, controlling for any unobserved time-varying, state-level characteristics that jointly affect the change in parcel size and the development rate. The fourth column flexibly controls for the state-by-time impacts of local demographic characteristics.

The coefficient on parcel size is stable and positive across specifications. This indicates increasing returns to scale in residential construction. In the fourth column, with the most stringent specification, a 1% increase in parcel size implies a 0.5 increase in log development odds.

What do these results imply about the price elasticity of housing supply? We calibrate A_t using the CDF of buildable plot sizes in New England, and calculate a modeled price elasticity of supply as $\Delta Q^S/\Delta P$ for a 10% increase in house prices relative to 2018 levels.

Figure 9 plots the modeled price elasticity of supply varies against the returns to scale parameter ρ. Based on the estimate of ρ in Column (4) of Table 3, the New England price elasticity of supply is 0.27. This is lower than the national average floorspace supply elasticity of 0.42 between 2000 and 2010 reported in Baum-Snow and Han (2024), consistent with relatively higher housing supply constraints in New England compared to the rest of the nation. The modeled supply elasticity is increasing in ρ. As ρ increases, fixed development costs grow more slowly with parcel size. This means larger parcels are more efficient to develop, which makes large developments more responsive to changes in prices which increase variable profits.

4.3 The impacts of changing the buildable land distribution.

The results in the previous section suggest that parcel development exhibits returns to scale in parcel size. This implies that holding fixed the total amount of buildable land, making more large parcels available – for example, by re-combining smaller disjoint parcels – could increase development rates and reduce house prices.

We investigate the importance of the parcel size distribution by conducting two counterfactual exercises, using our model calibrated to the New England housing market in 2018. First, we simulate price growth from 2018-2019 if the buildable parcel size distribution in New England matched the buildable parcel size distribution in South Carolina, holding fixed the total amount of buildable land. To do so, we assume that a_{mt} in New England followed the parcel size CDF in South Carolina, and adjust N_m so that $\sum_m N_m a_{mt}$ is unchanged. This captures the incremental impact of increasing the share of land on large parcels, holding fixed total buildable land supply. Second, we simulate price growth from 2018-2019, assuming that the New England buildable land distribution followed the land distribution in South Carolina, allowing the total amount of land to expand as well. This captures the joint impact of changing the level and distribution of available land.

Figure 10 shows the impacts on price growth from 2018-2019, the supply of new floorspace, and developer productivity.[9] Blue bars show the results of the "land reorganization" counter-

[9]We define developer productivity as the ratio of modeled floorspace produced to modeled variable and fixed

factual, where we increase the share of buildable land on large parcels, but hold the total supply of buildable land fixed. Red bars show the results of the "land supply expansion" counterfactual where the level and distribution of buildable land increases.

In the "land reorganization" counterfactual, price growth decreases by around 1pp. This is 34% decrease in price growth relative to the 2.9% increase in prices actually observed from 2018-2019. Price growth is less strong because an increase in developer productivity expands housing supply.

Land reorganization achieves much of the price impacts as land supply expansion. In the land supply expansion counterfactual, price growth declines by 3pp, meaning that land reorganization explains one-third of the price impacts of greater buildable land supply.

Appendix Figure B.1 shows how counterfactual price and productivity results vary for different estimates of the returns to scale parameter ρ. A higher value of ρ implies lower prices and higher productivity. Interestingly, the counterfactual price predictions are fairly stable for ρ between 0.25 and 0.75.

5 Policy implications and conclusions.

We draw three policy conclusions from our results. First, in built-up markets, a low availability of large plots creates a physical supply constraint that reduces construction productivity and increases house prices. Easing regulations in a way that encourages infill development of small plots may increase the *level* of buildable land supply. But even with such changes, buildable land is still inefficiently distributed across plots.

Second, policy moves to increase availability of large plots for development are more efficient than changes that facilitate an equivalent acreage of infill development on small plots. This suggest policymakers should prioritize redevelopment of under-used government, commercial, or industrial sites. For example, the Massachusetts State Lands for Homes initiative has proposed a number of government-owned sites to be redeveloped into housing. One proposed project is for redevelopment of the Erich Lindemann and Charles F. Hurley Buildings, which occupy 6.5 acres of land adjacent to Boston's Beacon Hill neighborhood and currently house administrative and outpatient services for the Massachusetts Department of Mental Health (Division of Capital Asset Management and Maintenance 2024). This would add a parcel with acreage at the 90th percentile of the entire *New England* buildable parcel distribution, providing especially significant scale in a city.

Third, our results highlight the path dependence of development in growing areas. In-

production costs.

cremental development that unintentionally breaks up large greenfield plots may make future development less efficient. City planners should thus encourage incremental development that maintains large greenfield sites for future use.

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Figures.

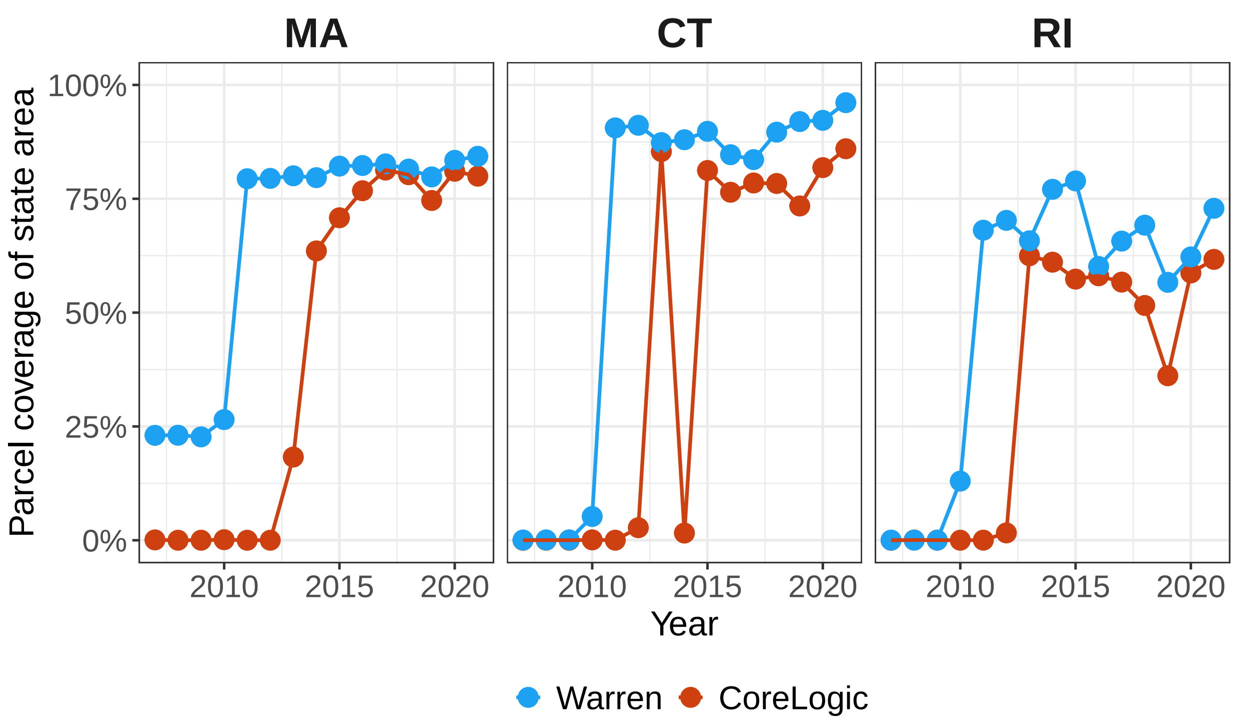
Figure 1: Examples of buildable plots across housing markets.

(a) 4,600-acre buildable plot in Charleston, SC.

(b) 0.1-acre buildable plot in Boston, MA.

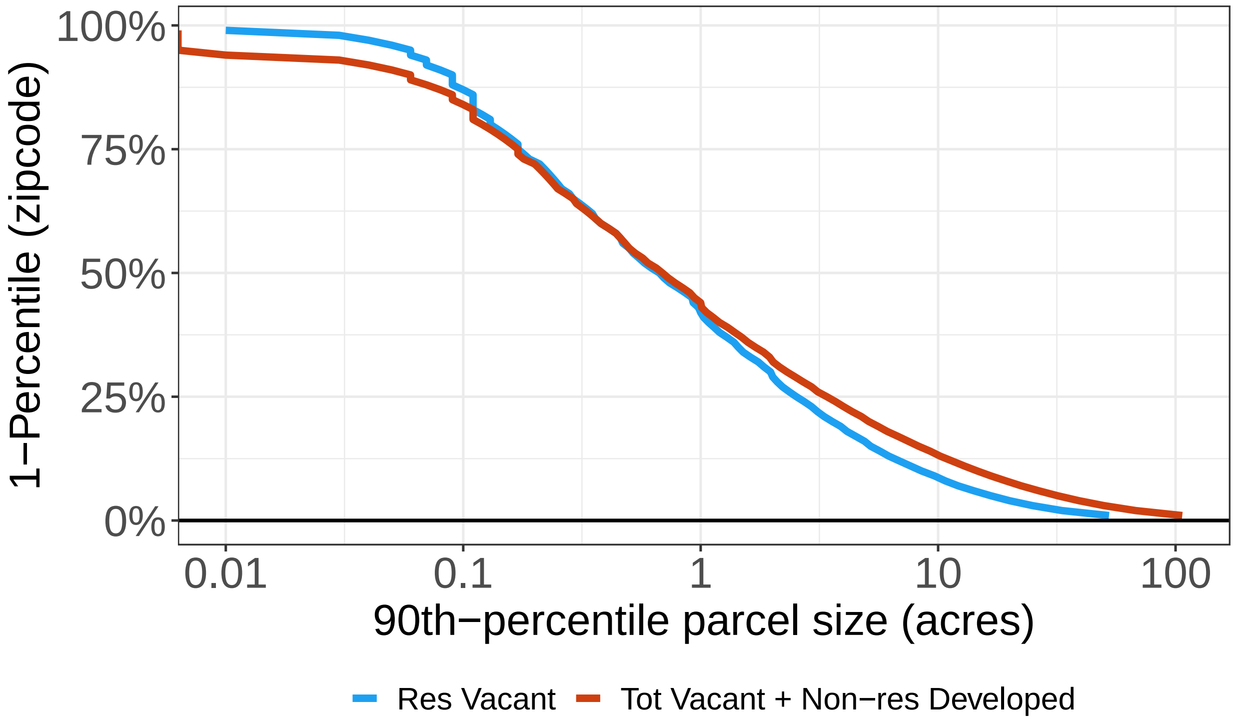
Source: CoStar. The figures show examples from CoStar listings of buildable plots for sale in Charleston, South Carolina and Boston, Massachusetts in July 2025. Both plots are a 15-minute drive of the city centers of their respective cities.

Figure 2: Data coverage, Warren Group vs. CoreLogic.



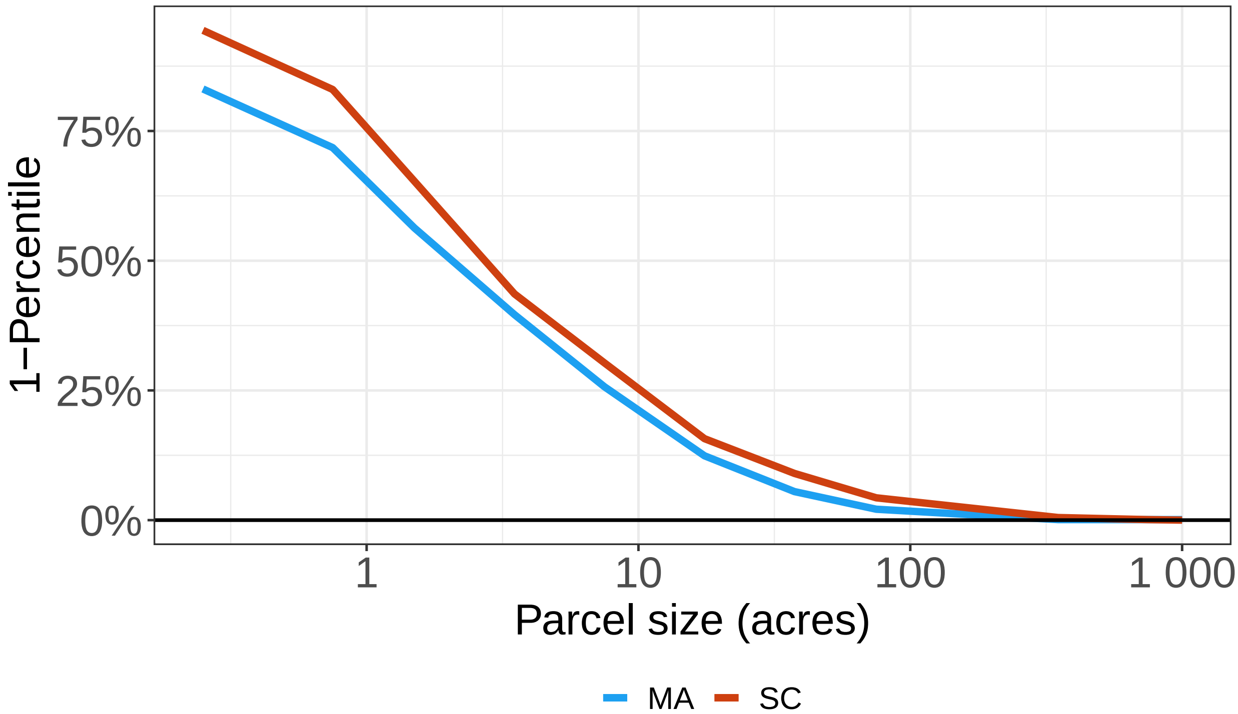
Source: Warren Group and CoreLogic. The figure plots the fraction of total land area in each state covered by parcel-level annual assessor records in Warren Group and CoreLogic public records data. Acreage covered by parcel-level records is calculated by summing the acreage of parcels with non-missing land use designations in each assessed year. Total acreage equals non-coastal land area estimated from 2010 Census boundaries.

Figure 3: Buildable land distribution by zipcode.



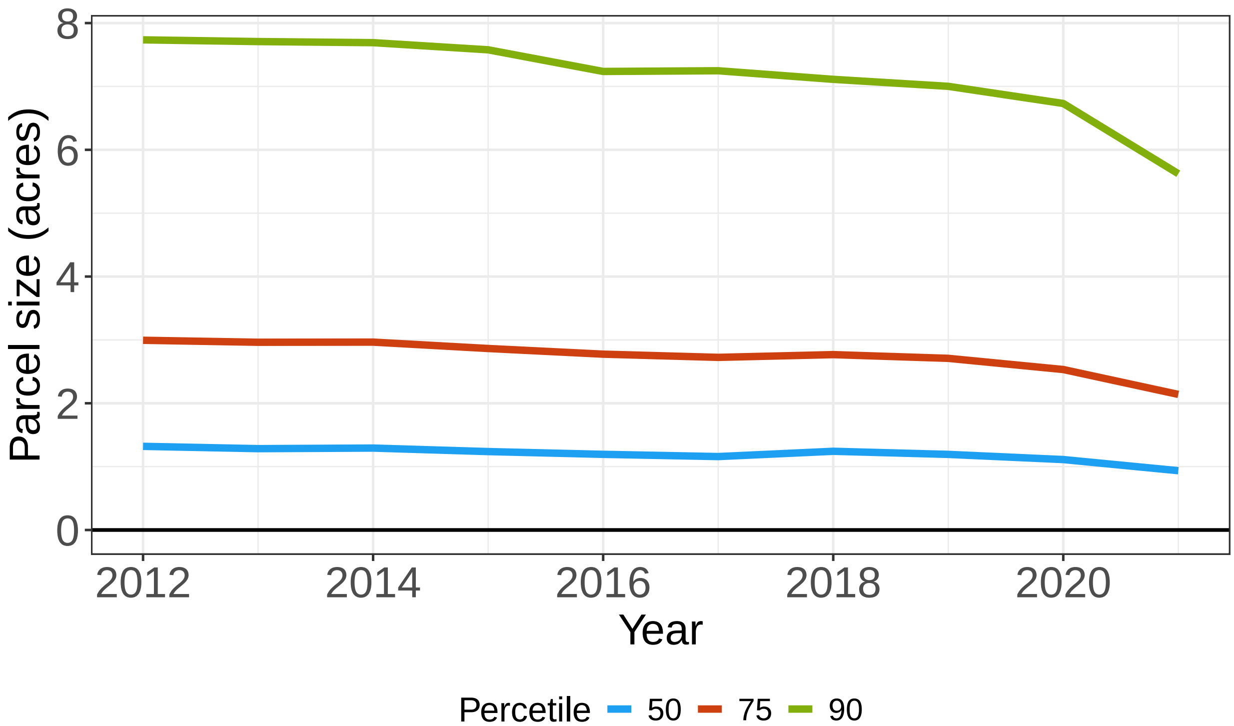
Source: Warren Group. In this figure, we rank zipcodes by the size in acres of the 90th-percentile parcel within the zipcode, and plot the size of the 90th-percentile parcel against one minus the zipcode's percentile. The blue series shows results using the most restrictive definition of buildalble land (only including residential vacant land), while the red series shows results using the least restrictive definition (including all vacant and non-residential developed land).

Figure 4: Buildable land distribution for sale: Massachusetts vs. South Carolina.



Source: CoStar. This figure plots the size in acres of buildable parcels for sale in July 2025 on the horizontal axis against one minus percentile rank on the vertical axis. The blue series shows results for Massachusetts and the red series shows results for South Carolina.

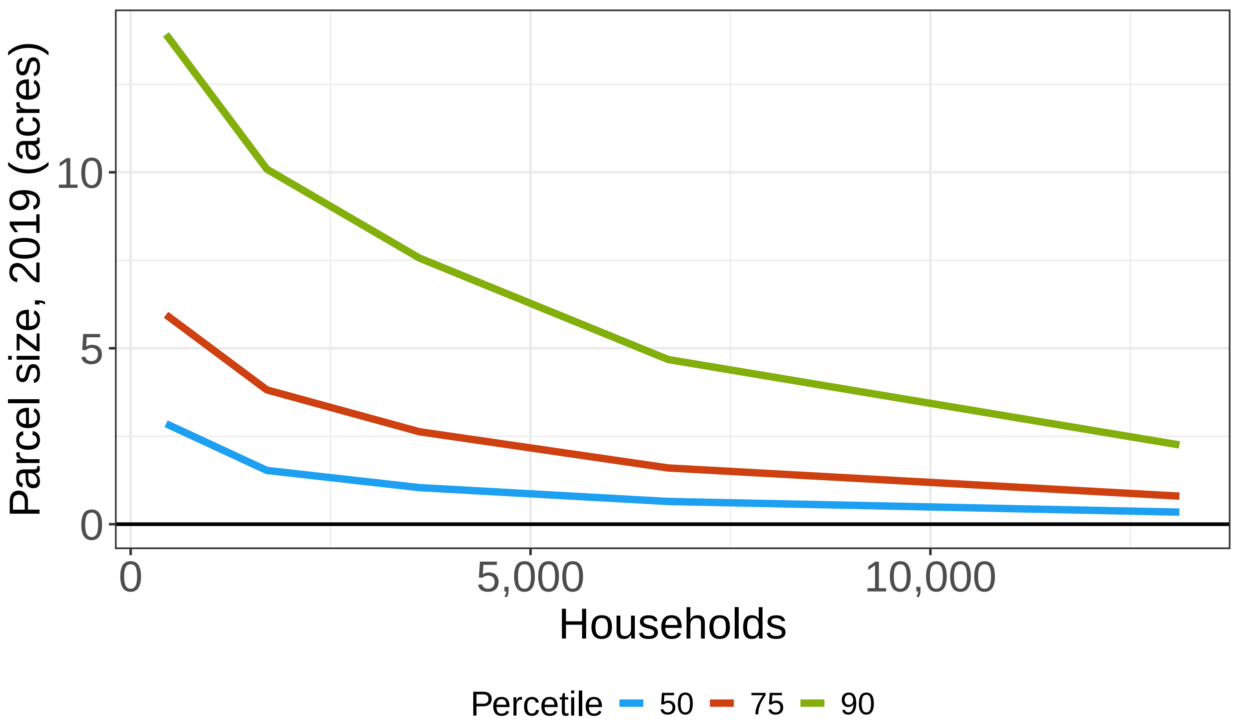
Figure 5: Buildable land distribution over time.



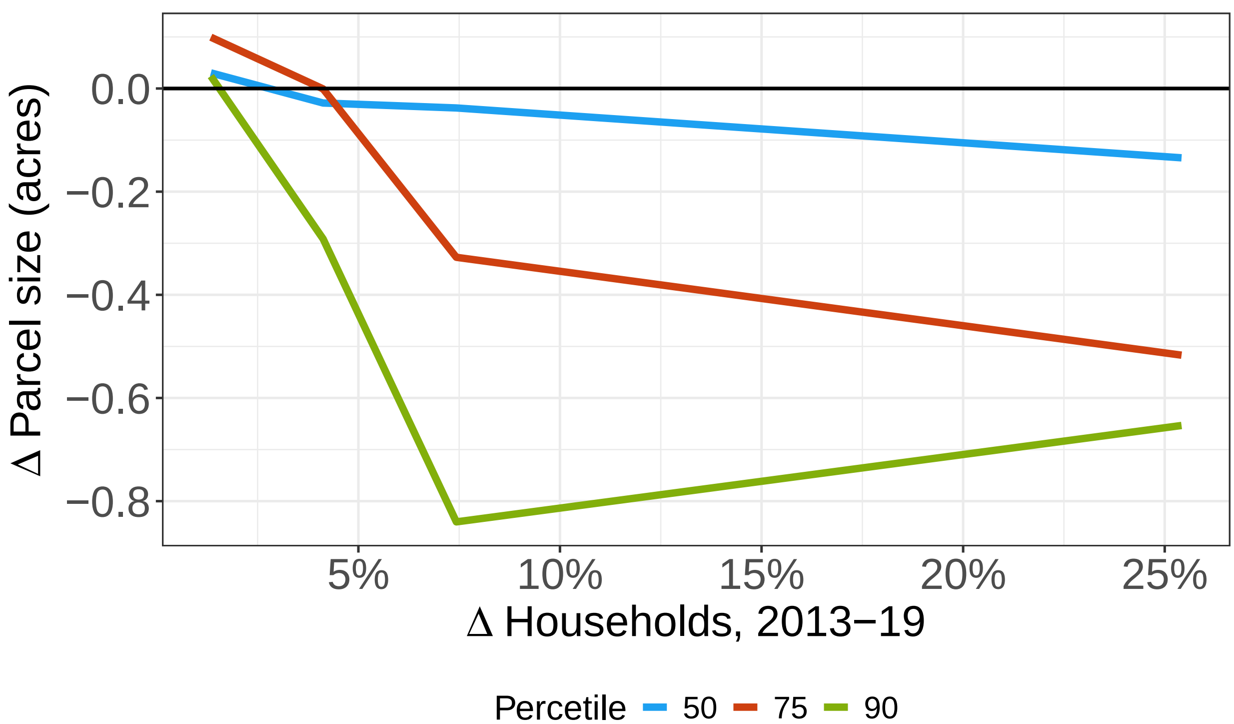
Source: Warren Group. The figure calculates the acreage of the median, 75th percentile, and 90th percentile buildable parcel for each zipcode and year from 2012-2021, and plots the average quantile across zipcodes for each year.

Figure 6: Buildable land distribution by population.

(a) Levels, 2019.

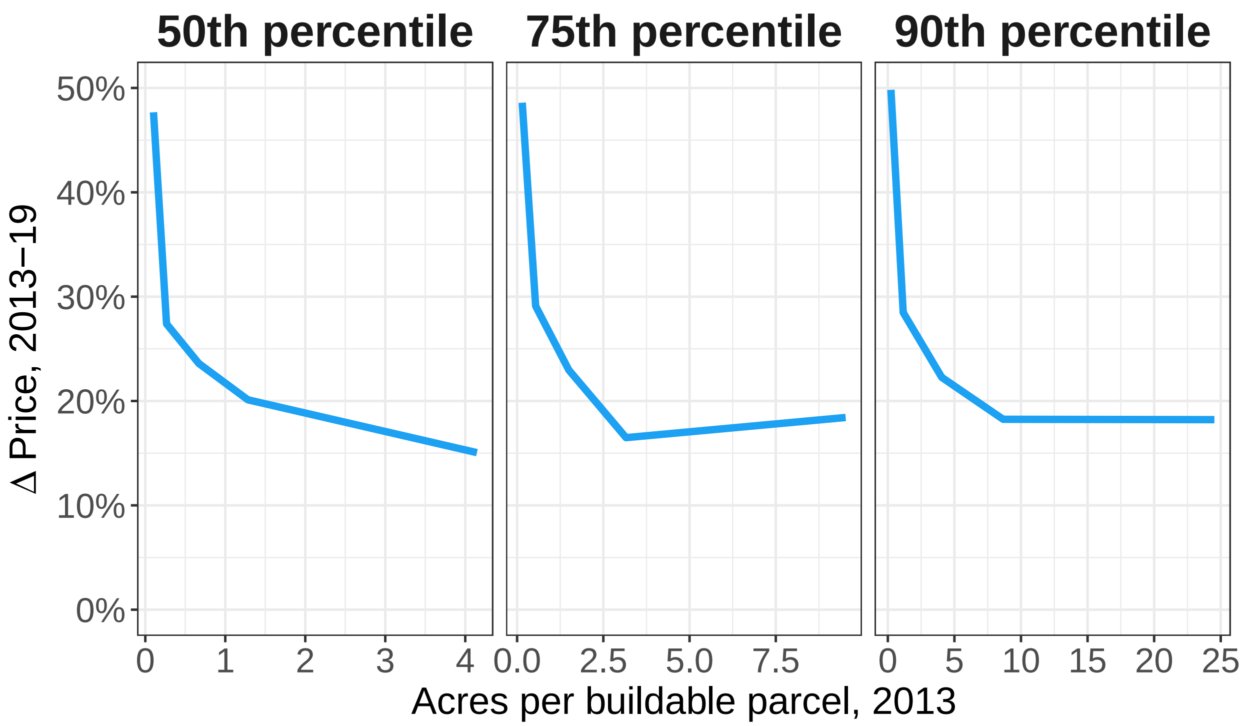


(b) Changes, 2013-2019.



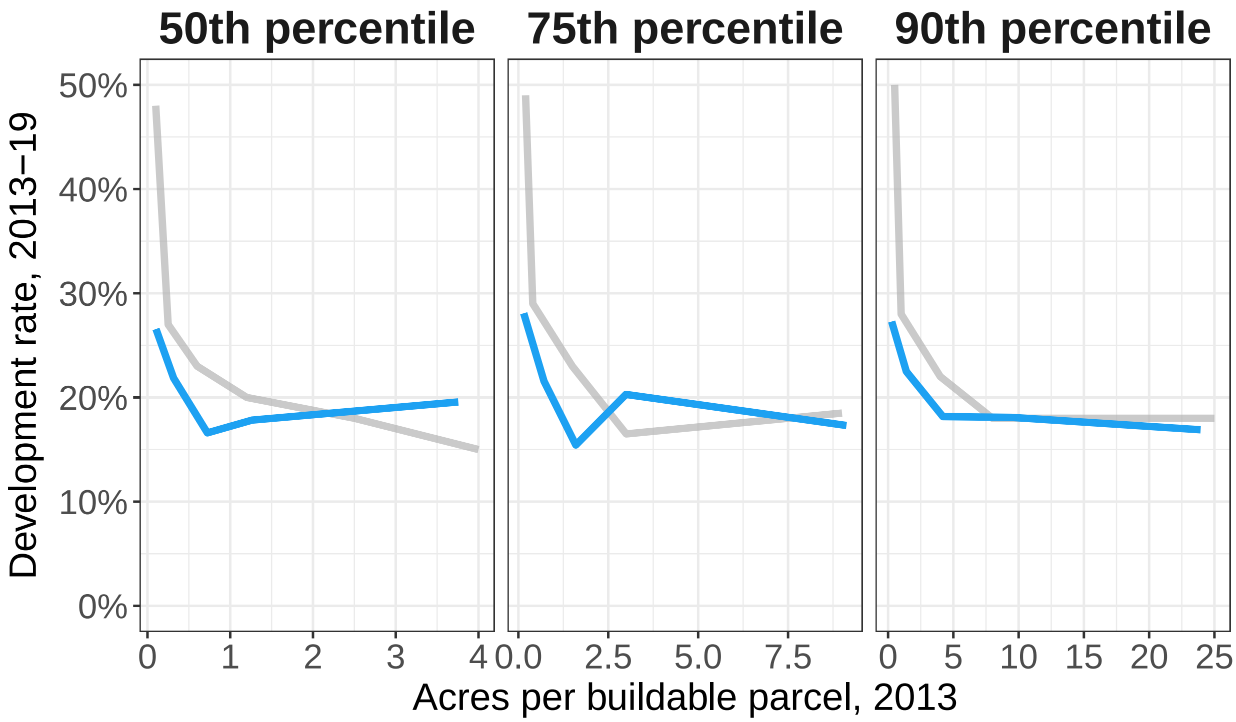
Source: Warren Group. The figure groups zipcodes into quintiles based on the acreage in the median, 75th percentile, and 90th percentile buildable parcel in 2013, and plots average price growth within each parcel between 2013 and 2019. Each panel shows results for a different quantile.

Figure 7: Price growth by availability of large buildable parcels.



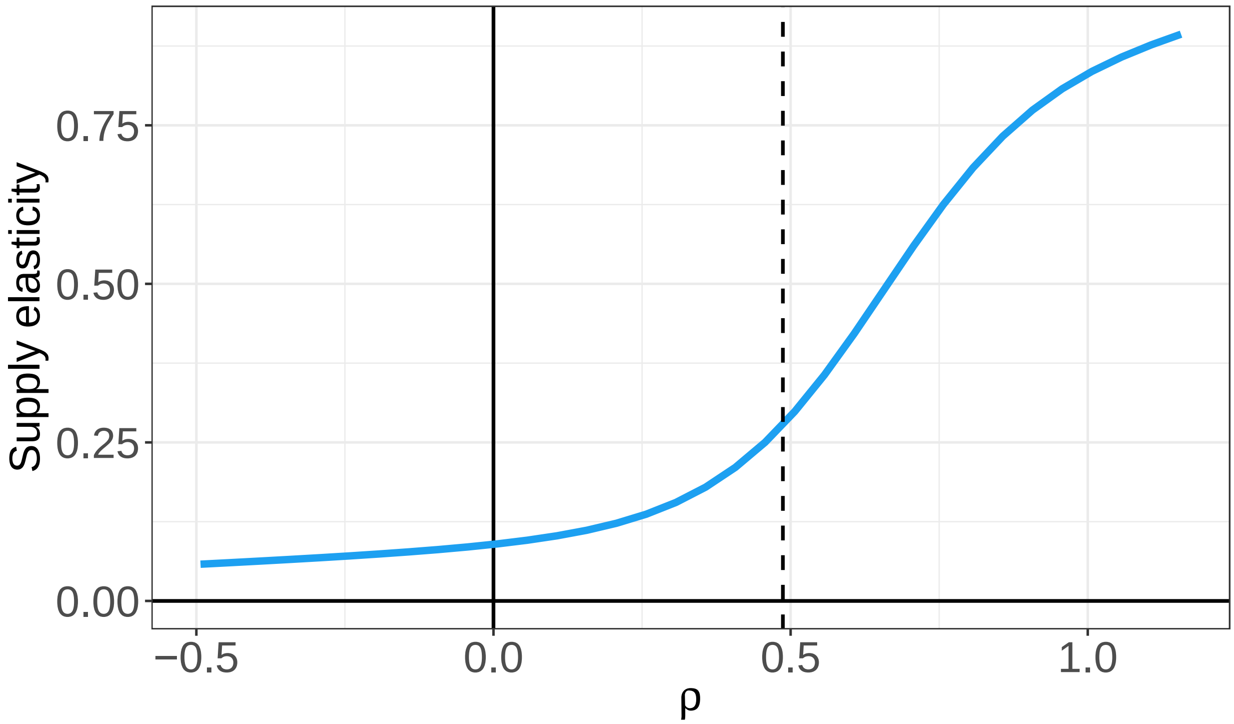
Source: Warren Group. The figure groups zipcodes into quintiles based on the acreage of the median, 75th percentile, and 90th percentile buildable parcel for each zipcode in 2013, and within each quintile calculates average price growth from 2013-2019.

Figure 8: Development rates by availability of large buildable parcels.



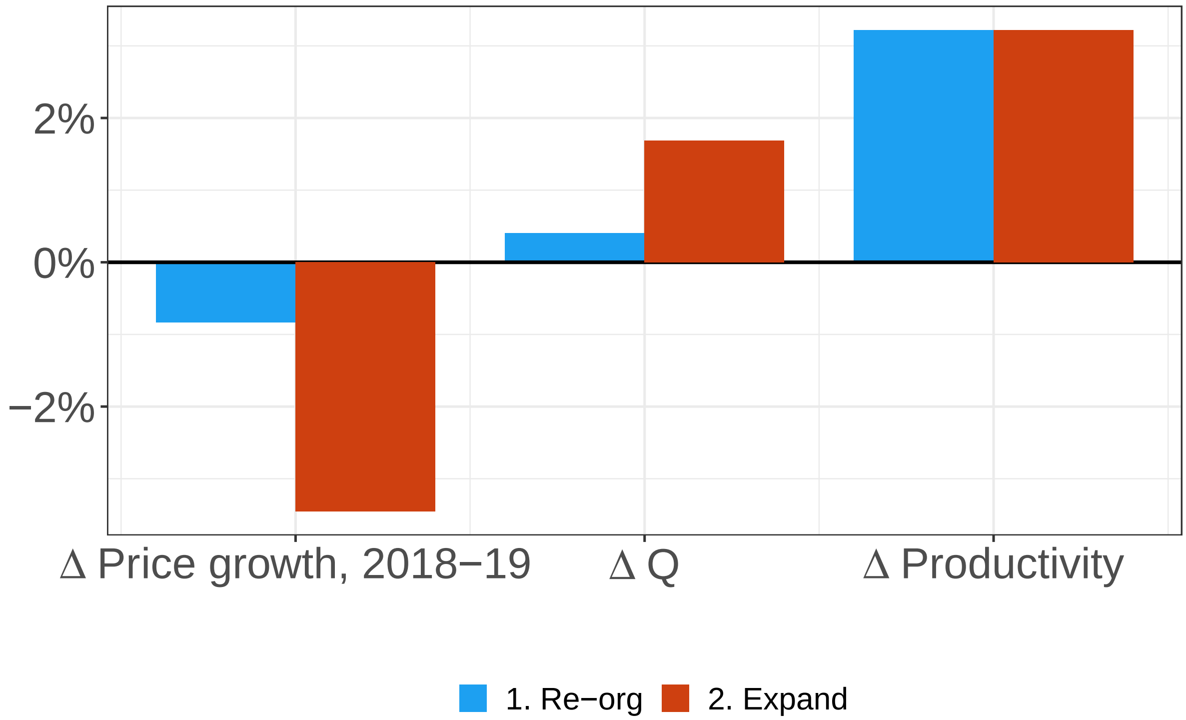
Source: Warren Group. The figure groups zipcodes into quintiles based on the acreage of the median, 75th percentile, and 90th percentile buildable parcel for each zipcode in 2013, and within each quintile calculates the average fraction of buildable land developed between 2013 and 2019. The average fraction of buildable land developed between 2013 and 2019 is given by Development $\text{Rate}_{m,2019,2019-2013}$ as defined in equation (1). The light gray line reproduces the series from Figure 7.

Figure 9: Housing supply elasticity vs. returns to scale in parcel size.



Source: Author's calculations and Warren Group. The figure plots the modeled price elasticity of housing supply as a function of the returns to scale parameter ρ. A higher value of ρ indicates greater returns to scale in parcel size. The supply elasticity is calculated as $\Delta \ln Q^S / \Delta \ln P$, where ΔQ^S is the modeled increase in housing supply due to a 10% increase in prices relative to 2018, and $\Delta \ln P = \ln(1.1)$. The vertical dashed line shows the estimate from Column (4) in Table 3.

Figure 10: Counterfactual results.



Source: Author's calculations and Warren Group. The figure plots results of the land reorganization counterfactual (blue) and land supply expansion counterfactuals (red). The first column shows percentage point changes in price growth from 2018-2019. The second column shows percent changes in the quantity of floorspace produced. The third column shows percent changes in modeled developer productivity, measured as the ratio of floorspace produced to total (fixed + variable) costs.

Tables.

Table 1: Summary statistics: Warren Group data.

Variable	N	Mean	SD	p25	p50	p75	p90	p99
Panel A: Parcels.								
Parcel size (acres)	4,263,371	1.988	21.799	0.120	0.290	0.900	2.340	31.460
Residential vacant (acres)	193,278	3.328	15.130	0.150	0.520	2.020	6.533	48.000
SF residential (acres)	3,421,580	0.818	5.629	0.120	0.270	0.690	1.600	8.510
MF residential (acres)	49,468	1.564	11.294	0.120	0.190	0.390	1.320	30.180
Non-res vacant (acres)	65,854	9.276	31.729	0.090	0.870	6.910	22.547	119.000
Non-res developed (acres)	388,855	7.637	45.109	0.150	0.680	3.710	16.010	107.000
Panel B: Zipcodes.								
Residential vacant (share)	944	0.069	0.098	0.018	0.046	0.087	0.147	0.392
SF residential (share)	944	0.403	0.224	0.271	0.401	0.534	0.692	0.988
MF residential (share)	944	0.017	0.038	0.001	0.006	0.019	0.046	0.144
Non-res vacant (share)	944	0.064	0.093	0.008	0.035	0.079	0.158	0.453
Non-res developed (share)	944	0.419	0.225	0.279	0.396	0.511	0.704	1.000
All vacant (share)	944	0.133	0.135	0.043	0.099	0.187	0.288	0.599
All non-res (share)	944	0.552	0.224	0.416	0.538	0.673	0.886	1.000
Development rate, res vacant	566	0.069	0.133	0.006	0.021	0.063	0.188	0.685
Development rate, all vacant	586	0.049	0.115	0.003	0.012	0.039	0.107	0.645
Development rate, all nonres	643	0.015	0.061	0.000	0.003	0.009	0.025	0.246
House price (thous), 2013	749	322.466	159.915	227.131	283.587	363.300	496.554	1020.040
% Δ Price, 2013-2019	747	24.578	17.004	10.435	25.521	33.868	43.746	78.738
Avg family income (thous), 2013	833	114.195	49.324	85.689	104.734	129.053	172.866	305.966
% Δ Income, 2013-2019	830	20.654	18.901	11.206	18.566	27.583	39.716	81.847
N hhlds (thous), 2013	855	5.020	4.759	1.289	3.469	7.448	11.688	20.983
% Δ N hhlds, 2013-2019	848	4.544	22.312	-1.987	2.299	7.133	13.190	91.015
Price/rent ratio, 2013	782	24.318	9.873	18.253	22.526	27.442	35.519	61.835
Panel C: Counties.								
Residential vacant (share)	33	0.068	0.065	0.026	0.046	0.093	0.117	0.249
SF residential (share)	33	0.490	0.236	0.371	0.530	0.679	0.728	0.793
MF residential (share)	33	0.011	0.017	0.003	0.008	0.010	0.018	0.076
Non-res vacant (share)	33	0.047	0.040	0.013	0.039	0.072	0.106	0.140
Non-res developed (share)	33	0.373	0.194	0.232	0.329	0.418	0.644	0.930
All vacant (share)	33	0.115	0.089	0.051	0.069	0.189	0.200	0.315
All non-res (share)	33	0.488	0.237	0.305	0.448	0.599	0.942	0.984
Development rate, res vacant	26	0.097	0.177	0.012	0.044	0.085	0.204	0.737
Development rate, all vacant	26	0.041	0.045	0.010	0.022	0.055	0.112	0.153
Development rate, all nonres	26	0.020	0.035	0.003	0.008	0.014	0.042	0.139

Source: Warren Group, FHFA, and ACS. The table presents summary statistics for the Warren Group panel for parcels in Massachusetts, Rhode Island, and Connecticut. Unless otherwise noted, the summary statistics are for the 2019 cross section. Each row presents observation count, mean, standard deviation, and 25th, 50th, 75th, 90th, and 99th percentiles for the variable indicated in the first column. The unit of observation in Panel (a) is a parcel. The unit of observation in Panel (b) is a zipcode. The unit of observation in Panel (c) is a county. Variables are defined in Section 1. For development rate calculations in panel B and panel C, we condition on markets where the development rate lies between 0 and 1.

Table 2: Price growth by buildable land distribution

(a) No fixed effects.

	% Δ Price, 2013-2019		
	(1)	(2)	(3)
Variables			
N hhlds (thous), 2013	0.0109**		0.0075**
	(0.0040)		(0.0032)
Ln(Income), 2013	-0.1393**		-0.1468**
	(0.0619)		(0.0601)
Δ Ln(Income), 2013-2019	0.2197**		0.1977**
	(0.0828)		(0.0771)
Price / rent, 2013	0.0047***		0.0045***
	(0.0015)		(0.0016)
Acres, p90 residential vacant		-0.0057***	-0.0038***
		(0.0018)	(0.0010)
Observations	728	728	728
R^2	0.21283	0.09634	0.24676
Adjusted R^2	0.20847	0.09509	0.24154

SEs clustered by county
****: 0.01, **: 0.05, *: 0.1*

(b) State fixed effects.

	% Δ Price, 2013-2019		
	(1)	(2)	(3)
Variables			
N hhlds (thous), 2013	0.0103***		0.0066***
	(0.0027)		(0.0022)
Ln(Income), 2013	-0.0478		-0.0553
	(0.0380)		(0.0358)
Δ Ln(Income), 2013-2019	0.1310**		0.1039**
	(0.0505)		(0.0430)
Price / rent, 2013	0.0002		-2.7×10^{-5}
	(0.0008)		(0.0008)
Acres, p90 residential vacant		-0.0058***	-0.0042***
		(0.0014)	(0.0011)
Fixed-effects			
State	Yes	Yes	Yes
Observations	728	728	728
R^2	0.55151	0.53215	0.59298
Within R^2	0.20945	0.17531	0.28255

SEs clustered by county
****: 0.01, **: 0.05, *: 0.1*

Source: Warren Group. The tables shows results from estimating versions of equation (3) without fixed effects (panel (a)) and with state fixed effects (panel (b)). Column (1) shows results without $Acres90_m$ as an explanatory variable, Column (2) shows results with only $Acres90_m$ as an explanatory variable, and Column (3) shows results with all regressor.

Table 3: Developer returns to scale in parcel size

	Δ Ln(Development odds)			
	(1)	(2)	(3)	(4)
Variables				
Δ ln(Parcel size)	0.5893***	0.5998***	0.5077***	0.4873***
	(0.1753)	(0.1698)	(0.1597)	(0.2182)
Δ ln(Price)	4.727**	6.379***	8.233***	9.153***
	(1.793)	(2.032)	(1.966)	(2.013)
Fixed-effects				
Year		Yes		
Year-State			Yes	Yes
Demog. x Year-State	No	No	No	Yes
Observations	4,407	4,407	3,510	3,097

SEs clustered by county
****: 0.01, **: 0.05, *: 0.1*

Source: Warren Group. The tables shows first difference estimates of coefficients in equation (9) for zip codes from 2012-2021. The outcome variable is the change in log development odds, estimated as $\Delta \ln q_{mt}/(1-q_{mt})$. The explanatory variables are the change in the log average plot size in acres and the change in the log FHFA house price index. Column (1) has no fixed effects. Column (2) includes year fixed effects. Column (3) includes year-by-state fixed effects. Column (4) includes both year-by-state fixed effects and demographic controls that vary by year-state.

Online appendix to: "The Effect of Land Supply for New Homes on Residential Investment and House Prices"

Justin Katz and Paul Willen

February 2026

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A.1 Derivation of equation (5). 1

B Additional figures. 2

C Additional tables. 3

A Model details.

A.1 Derivation of equation (5).

From the FOC $C'_{mt}(H^*) = P_{mt}$ and the parameteriation of $C_{mt}(\cdot)$:

$$c_{mt} \cdot H^{\frac{1}{\alpha-1}} = P_{mt} \implies H^* = c_{mt}^{-1} \cdot P^{\alpha-1} \tag{A.1}$$

Hence:

$$\pi_{mt}(P) = P^{\alpha} \cdot \left(c_{mt}^{-1} - c_{mt}^{\frac{1}{\alpha-1}} \cdot \frac{\alpha - 1}{\alpha} \right) \tag{A.2}$$

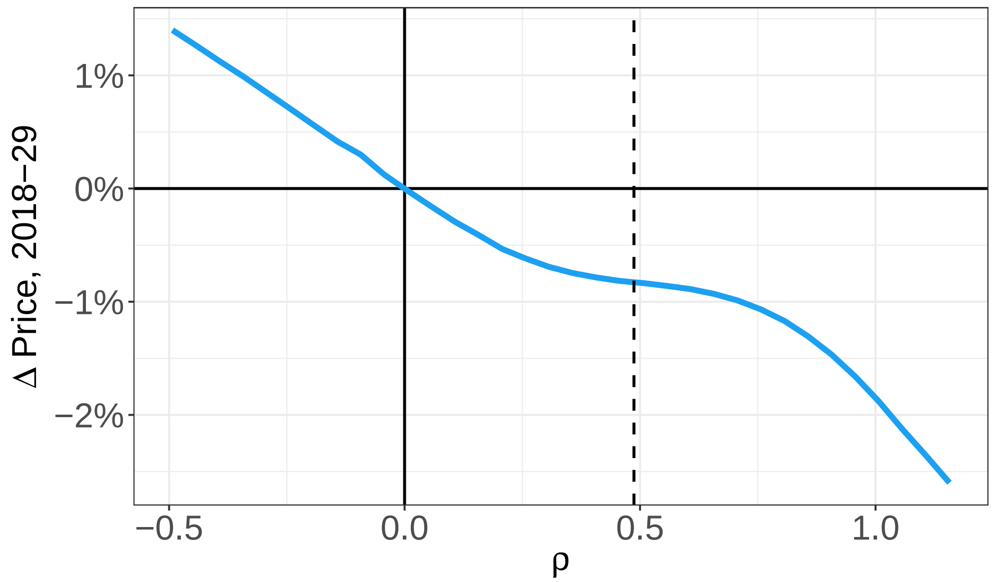
$$= \pi_{0mt} \cdot P^{\alpha} \tag{A.3}$$

where $\pi_{0mt} := c_{mt}^{-1} - c_{mt}^{\frac{1}{\alpha-1}} \cdot \frac{\alpha-1}{\alpha}$. Multiplying variable profits from floorspace per acre by parcel acreage, and subtracting parameterized fixed costs gives equation (5).

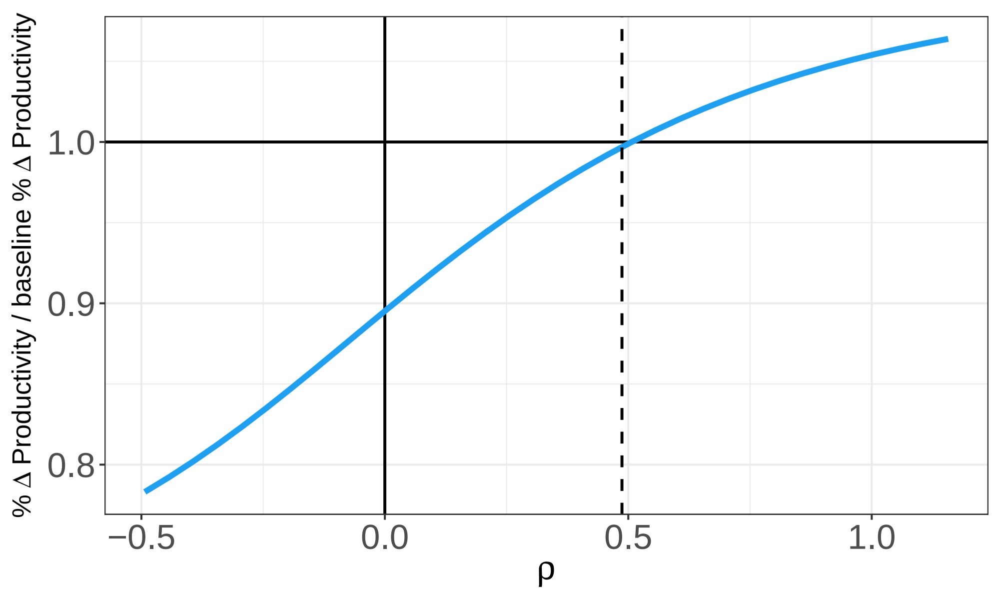
B Additional figures.

Figure B.1: Counterfactual sensitivity.

(a) Price growth, 2018-2019.



(b) Productivity growth.



Source: Author's calculations and Warren Group. The figure plots results from the land reorganization counterfactual for different values of ρ. The vertical dashed line shows estimates from Column (4) in Table 3. Panel (a) shows the impact on price growth from 2018-2019 in percentage points. Panel (b) shows the impact on the percent change in productivity, defined as the ratio of floorspace produced to total costs (fixed + variable).

C Additional tables.

Table C.1: Price growth by buildable land distribution – county fixed effects.

	% Δ Price, 2013-2019		
	(1)	(2)	(3)
Variables			
N hhlds (thous), 2013	0.0037**		0.0027**
	(0.0014)		(0.0011)
Ln(Income), 2013	-0.1122***		-0.1086***
	(0.0206)		(0.0208)
Δ Ln(Income), 2013-2019	0.0239		0.0221
	(0.0346)		(0.0327)
Price / rent, 2013	-0.0007		-0.0007
	(0.0005)		(0.0005)
Acres, p90 residential vacant		-0.0033***	-0.0019**
		(0.0010)	(0.0008)
Fixed-effects			
County	Yes	Yes	Yes
Observations	728	728	728
R^2	0.78254	0.72643	0.78865
Within R^2	0.26498	0.07534	0.28563

SEs clustered by county
****: 0.01, **: 0.05, *: 0.1*

Source: Warren Group. This table replicates Table 2b, except includes county, rather than state, fixed effects. See the notes to Table 2b for details.