Z is for Zoning: An Examination of the Heterogeneous Effects of Land-Use Regulation Changes on Housing Prices[1]

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Dedicated to "Shrubman"

Abstract: This paper examines the relationship between changes in land use regulations and housing prices across U.S. municipalities. To measure the change in regulatory intensity, I utilize the Wharton Residential Land Use Regulatory Index (WRLURI) from 2006 and 2018. I regress municipal-level housing price growth, measured as the real percentage change in the FHFA House Price Index matched at the municipal level, on the change in regulatory intensity. Special attention is given to how the relationship between regulatory changes and housing price growth interacts with initial housing tenure composition, specifically the shares of renters and homeowners, to evaluate the Homevoter Hypothesis, which suggests homeowners support stricter land use regulations to preserve or enhance property values. Our results indicate that municipalities experiencing increased regulatory restrictiveness tend to see higher real housing price growth, which is notably stronger in areas initially characterized by high homeownership rates. The paper closes with examining into the specific policies that homeowners prefer and how those preferences have changed over time as a mechanism for these effects.

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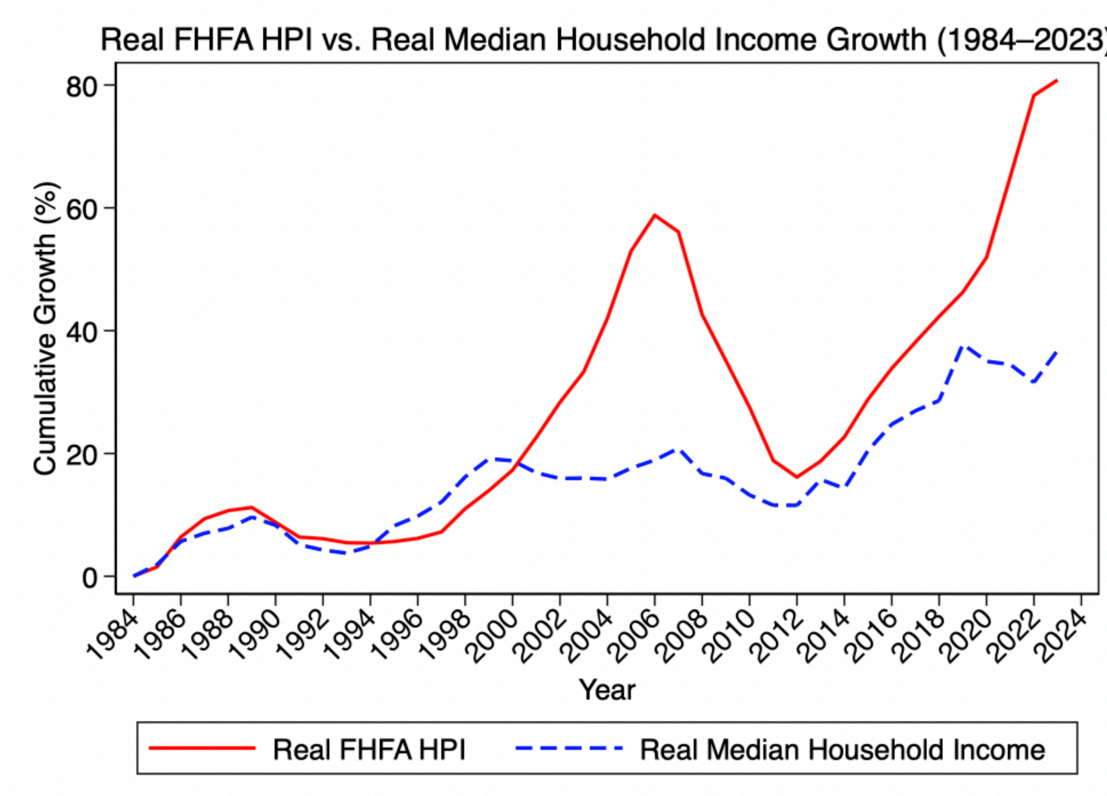
1. Introduction

Understanding housing market dynamics is increasingly critical as homeownership, long regarded as a cornerstone of the American Dream, becomes less attainable for many Americans. From 1984 to 2023, real house prices have climbed dramatically, far outpacing the growth in real median household income. This gap means that many families find it increasingly difficult to afford homeownership or even market-rate rents, as housing costs claim ever-larger shares of their income (Quigley and Raphael, 2004; Alboury, Ehrlich, and Liu, 2016; Hermann and Whitney, 2024). This paper pulls from urban economics and public choice theory to examine how land-use regulations influence housing prices and how this relationship varies according to a municipality's homeowner share.

Figure 1: Real Changes in Housing Prices and Real Median Household Income Growth between 1984 to 2023.



Source: Federal Housing Finance Agency (HPI) and U.S. Census Bureau via FRED, Federal Reserve Bank of St. Louis.

This paper investigates how changes in the stringency of land-use regulations, as measured by the Wharton Residential Land Use Regulatory Index (WRLURI), influences real housing price growth in U.S. municipalities between 2006 and 2018, focusing specifically on how this relationship varies with the initial homeowner share (percentage of occupied homes with a homeowner). Addressing this question is essential because identifying the impact of regulatory policies on housing affordability is critical for guiding effective urban policy and land-use reform. Analyzing variation by municipal level homeowner share allows us to test three theories. First, homeowners enact more regulations overall to restrict housing supply and increase home values, which is the Homevoter Hypothesis (Fischel 2001). Second, conditional on the magnitude of regulatory tightening, high homeowner-share municipalities experience disproportionately larger housing price increases, potentially due to more stringent enforcement or greater capitalization of regulatory changes into home values. Third, high homeowner share municipalities favor different regulations than low homeowner share municipalities.

To answer this research question, I construct a measure of changes in regulatory intensity by calculating the first difference of the Wharton Residential Land Use Regulatory Index ($\Delta WRLURI$) between 2006 and 2018 for municipalities, similar to techniques used in previous research (Schoof 2021; Lin 2023; Oluku and Cheng 2023). I then regress municipality-level housing price growth, captured as the percentage change in the real FHFA House Price Index, on this regulatory change index. My econometric framework includes demographic, economic, political, and geographic control variables, as well as state and regional fixed effects to account for broader market trends. I examine heterogeneity in the effect of regulatory changes by interacting the change with each municipality's initial homeowner share, thus enabling an analysis of whether the $\Delta WRLURI$ relationship between regulatory stringency and housing prices varies with the homeowner share. Finally, I examine which policies homeowners prefer and how those preferences have changed between 2006 and 2018. By identifying the specific regulatory shifts favored by homeowners and their implications for housing prices, this analysis provides a novel contribution that deepens our understanding of the mechanisms underlying the Homevoter Hypothesis.

I find that municipalities experiencing increased relative regulatory restrictiveness had higher housing price growth, suggesting that tighter regulations constrain housing supply, driving prices upward. These findings remain robust after controlling for various economic, demographic, and geographic factors, though not for state and regional fixed effects.

Municipalities with higher initial homeowner share exhibit a stronger positive relationship between regulatory tightening and housing price growth. This finding extends the Homevoter Hypothesis, which argues that homeowners advocate for restrictive land-use policies to enhance their property values. I demonstrate not only that homeowner-dominated areas tend to pursue more stringent regulations, but also that, conditional on a given level of regulatory tightening, these areas experience disproportionately greater housing price increases, potentially due to more effective enforcement or stronger capitalization into home values. In contrast, municipalities with lower homeowner shares (higher renter populations) show weaker price responses to regulatory changes. This homeowner-driven difference underscores the importance of local housing tenure composition in shaping how land-use policies impact housing markets.

To understand homeowner-driven differences in regulatory impacts, I break the WRLURI into its subindexes to examine which specific policies homeowners prefer and how these preferences shifted between 2006 and 2018. By examining these individual components, this paper reveals nuanced shifts in regulatory preferences, highlighting that while homeowners initially favored stringent political and approval processes, these regulations diminished over time, potentially due to changes in preferences caused by the already high baseline regulations. Policies concerning open-space requirements and density restrictions remained consistently valued, reflecting ongoing homeowner priorities related to neighborhood quality and property value preservation.

This paper makes three main contributions to the existing literature. First, it is among the first to explicitly analyze the interaction between changes in local regulatory stringency, captured by the Wharton Residential Land Use Regulatory Index, and initial homeowner share when examining housing price growth. While prior studies have speculated about the political incentives of homeowners influencing land-use policies, none have empirically tested whether homeowner-dominated communities systematically differ in their response to regulatory changes at the municipal level. Second, I break WRLURI into its subindexes in order to find which policies homeowners gravitate toward, allowing for a more nuanced discussion. Third, this study uses municipal-level data, allowing for a more granular analysis on land-use regulations, which allows for the examination of relationships that average out on larger levels.

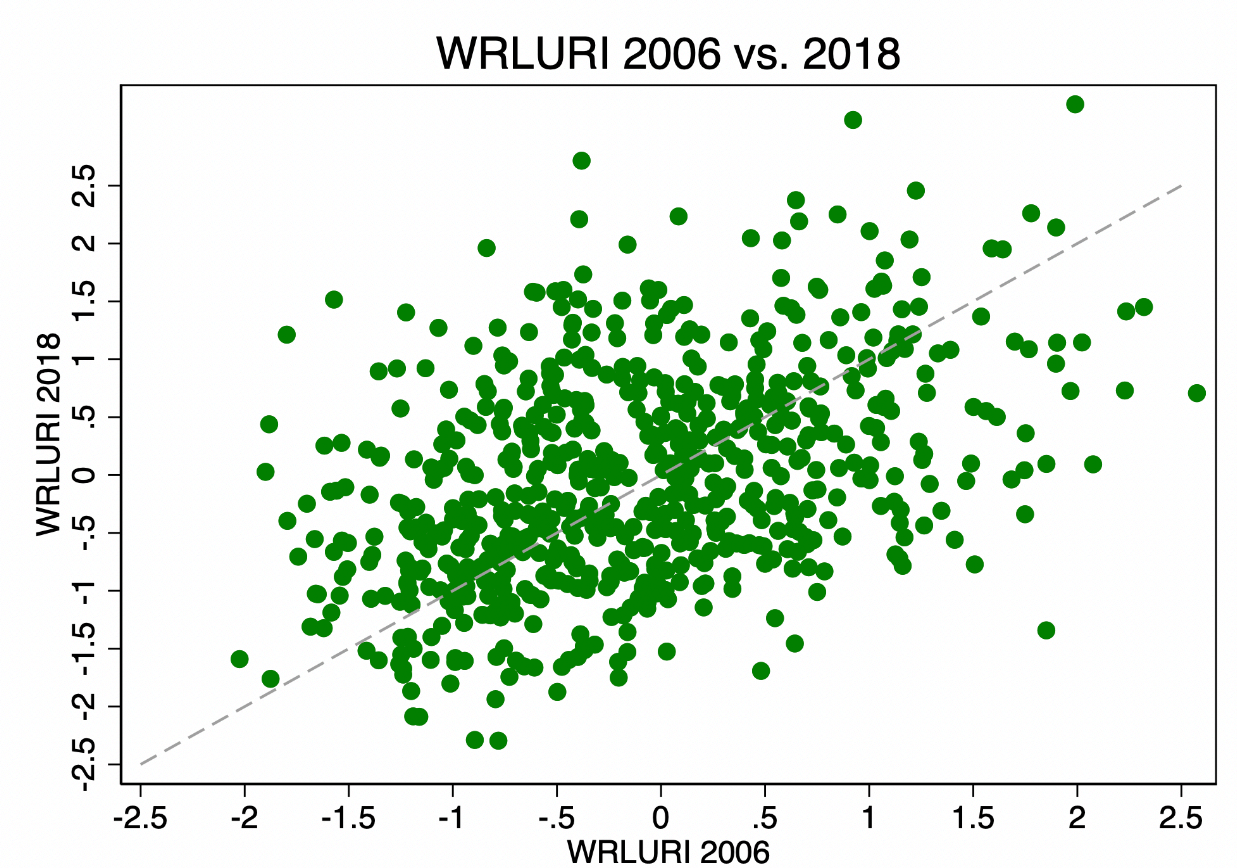
2. Literature Review

The current literature has extensively discussed the relationship between land-use regulation and housing prices. For example, Gyourko and Molloy (2014) review numerous studies and conclude that local building codes and land use regulations tend to reduce housing supply elasticity and raise local housing prices. Quigley and Raphael (2005) showed that cities with stricter land-use regulations had higher housing prices, which reduced housing affordability, effectively imposing a regulatory tax on new development and limiting housing availability.

Early efforts to quantify local regulatory environments include the development of composite indices. The first Wharton Residential Land Use Regulatory Index (WRLURI) was introduced by Gyourko, Saiz, and Summers (2008) using a 2005 to 2006 national survey of local governments and summarized the restrictiveness of land-use regulation in over 2,600 municipalities, measuring factors like zoning approval processes, supply restrictions, development fees, and open space requirements. Numerous studies utilizing the WRLURI have documented that areas with higher regulatory index values (more restrictive regimes) tend to have higher housing prices (Gyourko, Saiz, and Summers, 2008; Harris and Lin, 2024; Landis & Reina, 2021) and less construction (Saiz, 2010), all else equal. However, one limitation was that such indices were often available for only a single time period, making it difficult to analyze changes over time.

Gyourko, Hartley, and Krimmel (2019) updated the WRLURI for the late 2010s. The new WRLURI for 2018 was methodologically consistent with the 2006 survey, allowing for comparisons after roughly a decade. They found no evidence that the housing bust during the Great Recession led many jurisdictions to substantially loosen regulations; on the contrary, already highly regulated markets (especially large coastal metropolitan areas) became modestly more restrictive on average, which suggests that regulatory stringency tends to either stay the same or increase slightly over time rather than decrease. Some communities did experience some changes with some adopting slightly less stringent stances and others ratcheting up controls, providing variability that can be analyzed.

Figure 2: The relationship between the 2006 and 2018 WRLURI.



Note: Each dot represents a municipality's standardized WRLURI value in 2006 (x-axis) and 2018 (y-axis). The dashed line is the 45-degree line indicating no change in relative regulatory restrictiveness between years. Points above the line represent municipalities that became relatively more restrictive over time, while points below indicate those becoming less restrictive.

Given the observed persistence in regulatory restrictiveness from 2006 to 2018, it is critical to consider the underlying political incentives driving these regulatory patterns. The Homevoter Hypothesis (Fischel, 2001) provides a compelling framework by linking housing tenure to regulatory outcomes. In communities where homeowners form the majority of voters, elected officials face pressure to maintain strict zoning and slow growth. Whereas places with more renters or transient populations might face less pressure to impose restrictive regulations.

Empirical evidence supports this idea: for example, Hilber and Robert-Nicoud (2013) show that U.S. metropolitan areas with higher homeownership rates tend to have more stringent land use controls, consistent with homeowners' collective interest in preventing overbuilding. Gyourko and Molloy (2015) found that high homeowner-share areas tended to have stricter land-use regulations compared to high renter-share areas, which suggests that renters (despite benefiting from greater housing supply and lower rents) exert less political influence in local land-use decisions. This is partly due to renters being less organized politically and lacking direct financial stakes in property values, unlike homeowners whose wealth is closely tied to their homes. The Homevoter Hypothesis helps explain the cross-sectional link between housing tenure composition and land-use regulatory intensity identified in previous literature. However, existing studies typically use cross-sectional approaches at a single point in time, restricting their ability to analyze changes in regulations over time and assess the relationship between these regulatory changes and subsequent home price growth. In contrast, my analysis explicitly examines these dynamic relationships, thus providing a deeper understanding of how regulatory changes interact with homeowner preferences to affect housing market outcomes.

On the other hand, it could be that communities with high homeownership rates also happen to be located in areas with less developable land. Saiz (2010) demonstrates that limited developable land inherently reduces housing supply elasticity, thereby amplifying the price effects of regulatory constraints. Despite these insights, existing studies generally examine regulation in cross-sectional contexts, limiting their ability to distinguish clearly between homeowner political preferences and supply elasticity explanations, especially regarding how regulatory changes influence housing price growth. This paper addresses this gap by explicitly measuring the relationship between changes in land-use regulations and subsequent home price growth over time at the municipal level.

3. Data & Methodology

3.1 FHFA HPI

This paper's goal is to determine how municipal-level changes in land-use regulations interact with local homeowner share to influence real housing price growth. To answer this question, I regress municipality-level housing price growth on changes in regulatory intensity. Our dependent variable is the percentage change in housing prices from 2006 to 2018, measured by the Federal Housing Finance Agency House Price Index (FHFA HPI). The FHFA HPI is a repeat-sales index capturing average price changes based on repeat transactions or refinancings of the same properties, derived from mortgage data purchased or securitized by Fannie Mae or Freddie Mac. I will run multiple regressions examining this data on the municipality (place) level.

The FHFA has county-level and census tract data but not municipal-level data, s use Geocorr (Geographic Correspondence Engine) to match census tracts to municipalities (places) and aggregate to the municipal level using the housing stock as a weight. Geocorr is an online geographic data tool maintained by the Missouri Census Data Center, which facilitates the cross-referencing and matching of geographic areas across different Census and administrative boundaries, such as census tracts and municipalities (Missouri Census Data Center, 2022).

I also run a separate regression matching county-level HPI to municipal-level regulatory data. This approach effectively assigns the regulatory changes observed in surveyed municipalities to the entire county. Such an assignment may be reasonable if regulations are implemented uniformly at the county level or if these policies are spatially correlated across municipalities within the same county. However, this likely introduces measurement error in treatment assignment by overlooking within-county variation in regulatory changes.

Nevertheless, this assumption is convenient because it mitigates the measurement noise associated with aggregating census tract data.

If I calculated the percentage change in HPI with this data, it would be the nominal percentage change in housing prices between 2006 and 2018. Therefore, I adjust the index into real terms by adjusting the HPI in 2018 to be in 2006 constant dollars by using the Consumer Price Index for All Urban Consumers (CPI-U), which measures changes in the average prices paid by urban consumers for a market basket of goods and services (U.S. Bureau of Labor Statistics, 2023):

$$Real\_HPI_{i,2018} = HPI_{i,2018} \times \frac{CPI_{2006}}{CPI_{2018}} = HPI_{i,2018} \times \frac{201.558}{251.100} = HPI_{i,2018} \times 0.8027$$

Where *i* represents a municipality and consequently

$$Real\_HPI_{i,2006} = HPI_{i,2006}$$

Thus, the percentage change in real housing prices for each municipality *i* between 2006 and 2018 is calculated as follows:

$$\%\Delta \mathrm{HPI}_i = \frac{\mathrm{Real\_HPI}_{i,2018} - \mathrm{HPI}_{i,2006}}{\mathrm{HPI}_{i,2006}} \times 100$$

3.2 ΔWRLURI

The Wharton Residential Land Use Regulatory Index (WRLURI), introduced in 2006 by Gyourko, Saiz, and Summers (2008), is a standardized index measuring the restrictiveness of local land-use regulations across U.S. municipalities. To construct the index, the researchers surveyed municipal planning officials nationwide, asking detailed questions regarding regulatory practices such as zoning restrictions, approval processes and delays, growth control policies, lot-size minimums, density constraints, open-space requirements, and local political influence in planning decisions. The survey was sent out to 6,896 municipalities with only 2,649 municipalities responding, leading to some possible bias. More populated municipalities responded at a greater rate than lesser populated municipalities. The WRLURI's numerical values serve as indicators of how intensely local governments regulate land use, directly influencing housing supply, affordability, and the pace of residential construction. The survey was updated in 2018 by Gyourko, Hartley, and Krimmel (2019), allowing for a comparison across time periods and the construction of our key dependent variable:

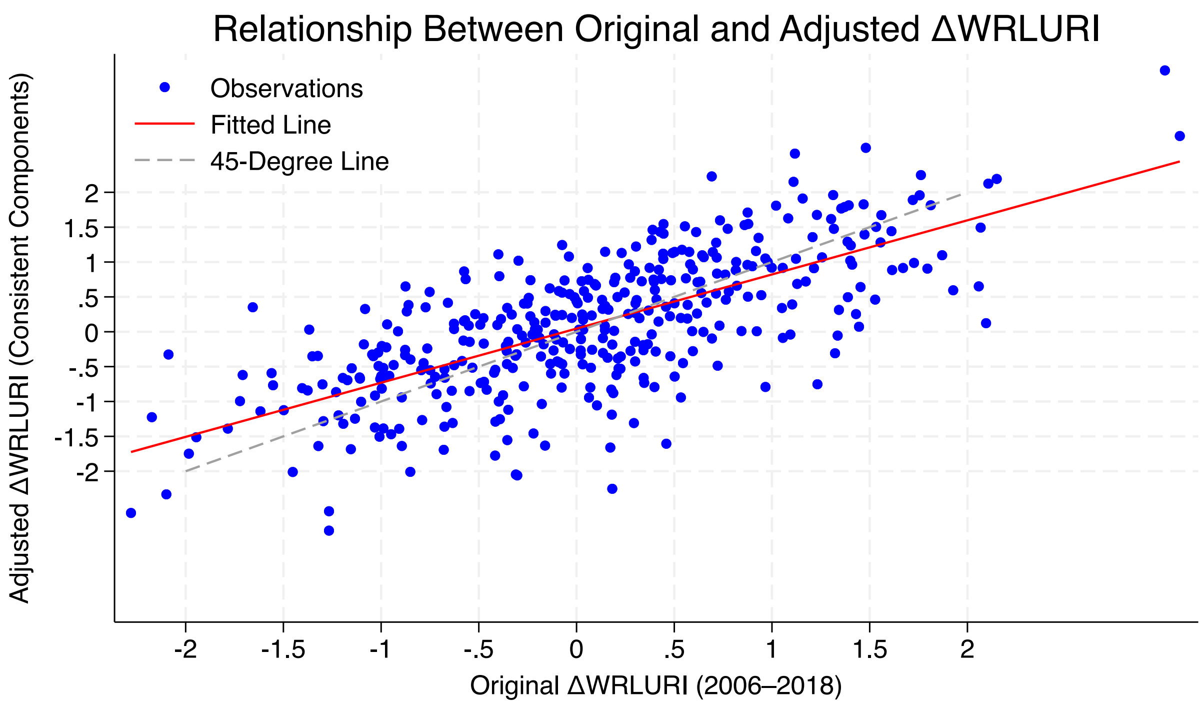
$$\Delta WRLURI_i = WRLURI_{i,2018} - WRLURI_{i,2006}$$

where *i* represents a municipality.

Thus, as positive value of $\Delta WRLURI$ would suggest an increase of land-use regulations between 2006 and 2018 relative to the other municipalities surveyed, while a negative value would suggest deregulation.

The 2006 and 2018 surveys were different in that they included different questions and weighting methods. For greater comparability, I include an adjusted $\Delta WRLURI$ ($\Delta WRLURI^{adjusted}$), which includes questions that were only explicitly in both surveys for municipal level as a means of comparison to see how sensitive our results are to how the index is calculated. The method of constructed this adjusted $\Delta WRLURI$ is provided in Appendix 8.1. Due to data limitations, the number of observations of $\Delta WRLURI^{adjusted}$ is just 388 compared to 634 for $\Delta WRLURI$ leading to a significant reduction in sample size and therefore power. This reduction in observations occurs because the adjusted index requires municipalities to have provided complete responses to a consistent set of survey questions across both the 2006 and 2018 WRLURI surveys. Municipalities with non-responses to these specific questions in either year were excluded from the adjusted analysis. $\Delta WRLURI^{adjusted}$ prioritizes accuracy and comparability over maximizing sample size, in contrast to the broader $\Delta WRLURI$, which includes more assumptions to retain as many observations as possible. Figure 3 illustrates the relationship between the original $\Delta WRLURI$ and the $\Delta WRLURI^{adjusted}$. The strong positive correlation (0.7073) indicates general consistency between the two measures, though deviations from the 45-degree line reflect differences arising from changes in survey questions and weighting. This comparison helps validate the robustness of the regulatory intensity measure used in my analysis.

Figure 3: This graph shows the relationship between ΔWRLURI and $\Delta \text{WRLURI}^{\text{adjusted}}$.



Note: The adjusted $\Delta \text{WRLURI}^{\text{adjusted}}$ is recalculated using only the regulatory components consistently measured in both survey years (2006 and 2018). The fitted regression line (solid red) illustrates the general relationship between the original and adjusted indices, while the dashed 45-degree line shows points of exact equivalence.

3.3 Demographic, Economics, and Geographic Controls

I incorporate several demographic, economic, and geographic control variables to account for differences in demand, economic conditions, and physical constraints across places. Unless otherwise noted, all controls are derived from the American Community Survey (ACS) 5-Year Estimates for the periods 2006–2010 and 2014–2018. ACS 5-Year Estimates for 2006–2010 serve as proxies for 2006, while estimates from 2014–2018 proxy for 2018. I obtained these ACS datasets from the IPUMS National Historical Geographic Information System (Manson et al. 2024), a comprehensive database providing standardized census data and GIS-compatible boundary files to facilitate historical and spatial research.

First, I include population growth (%ΔPopulation), the percentage change in population from 2006 to 2018, as a proxy for housing demand; areas with faster population growth generally experience greater housing needs. However, I acknowledge that the justification for including %ΔPopulation as a control may vary. For example, in localities with very strict land-use regulations, limited housing construction can itself constrain population growth. In such cases, a low population increase may not signal weak demand, but rather, it reflects that fewer new housing units were built, and thus fewer people could move in under the supply restrictions. By including population change as a control, I capture baseline demand pressures while acknowledging that stringent regulation might suppress population gains even in high-demand areas. Baseline population level in 2006 is included to account for differences in initial municipality size, since larger populations may reflect distinct housing market dynamics and regulatory environments compared to smaller areas. I also control for the percentage of the population classified as urban in 2000, as reported in the 2000 U.S. Census, to account for fundamental differences in housing market structure between urban and rural areas.

Next, I account for local economic conditions by including controls for changes in real median household income, as well as the baseline unemployment and poverty rates in 2006. Growth in real median household income (calculated similarly to the $\%\Delta HPI$) captures rising local purchasing power and economic prosperity, which can enhance housing demand. Additionally, I use the 2006 median household income as a baseline economic control since wealthier communities generally differ in their housing market dynamics and preferences for land-use regulation and public goods compared to lower-income areas. The unemployment rate and poverty rate in 2006 reflect initial local job market conditions and socioeconomic hardship, respectively. Higher initial unemployment and poverty levels may indicate a weaker local economy, which could suppress housing price growth. These variables allow me to control for the local economy allowing variations in housing prices to reflect regulatory impacts rather than underlying economic disparities.

Median age of the housing stock in 2006 is included to capture differences in development history across areas. Communities dominated by older homes may have experienced relatively little recent construction, possibly due to supply constraints or a lack of demand for new housing. Thus, housing stock age provides context on historical development patterns, and controlling for it helps account for baseline differences in the built environment that might influence current housing supply.

Demographic characteristics are also included as control variables, specifically the percentage of the non-white population (%Minority) and the percentage with a college degree or greater in 2006 (%College). The minority share captures demographic differences in housing market access, influenced historically by discriminatory practices such as redlining (Aaronson, Hartley, and Mazumder, 2021), which limited homeownership and economic opportunities for minority communities. Educational attainment proxies local human capital and socioeconomic status, which affects housing preferences of public goods, such as higher desires for better public schools, and civic engagement in land-use policymaking (Black, 1999; Milligan, Moretti, and Oreopoulos, 2004). Including these demographic variables helps isolate the distinct impact of land-use regulations from broader community characteristics rooted in historical and structural factors.

While this paper primarily focuses on the homeowner share to explain regulatory patterns, political composition could also influence land-use policies. To account for this possibility, I include the 2004 Democratic presidential vote share (%Democrat) as a control by matching county-level data to the municipal level. These variable proxies the county's baseline political orientation, as communities with a higher Democratic voter share typically favor more stringent land-use regulations and zoning policies (Ornstein, 2023). Thus, the Democrat share helps account for ideological differences across municipalities that influence development and regulation, allowing for the separation of effects of regulatory changes and political composition on changes in housing prices.

Table 1: Shows the correlations between the Democrat share and land-use regulations.

	WRLURI 2006	*WRLURI 2018*	*ΔWRLURI*
%*Democrat*	0.2445	0.0665	-0.1522
Q1 %*Democrat*	0.1855	0.1553	0.0060
Q2 %*Democrat*	0.2102	0.1663	-0.0101
Q3 %*Democrat*	0.2787	0.1824	-0.1024
Q4 %*Democrat*	0.1182	-0.0395	-0.1436

Note: Each cell reports correlation coefficients between the indicated regulatory intensity measure (columns) and either the overall municipal Democratic voter share (first row) or quartile indicators for the Democratic voter share (rows 2-5, where Q1 is the lowest Democratic share quartile and Q4 the highest).

Table 1 shows a weak positive correlation between %Democrat and WRLURI in 2006, suggesting that municipalities with higher shares of Democratic voters were somewhat more likely to have stricter land-use regulations compared to municipalities with higher Republican voter shares, aligning with previous research. Interestingly, there is a weak negative correlation between %Democrat and ΔWRLURI indicating that municipalities initially characterized by a higher Democratic voter share tended to see a relative decrease in land-use regulatory stringency between 2006 and 2018. The correlation between %Democrat and the 2018 WRLURI is substantially weaker, which is not surprising given the 14-year gap. When breaking %Democrat into quartiles, the relationship between %Democrat and the 2006 WRLURI becomes less clear. However, it remains evident that municipalities with the highest initial %Democrat experienced larger reductions in regulatory intensity over the studied period.

Finally, I include several institutional and geographic controls. I add state or regional (defined by Census Divisions) fixed effects to account for state-level and regional-level factors that affect all municipalities within a state or region, thereby focusing our analysis on within-state or within-region variation. Additionally, I control for terrain using the Area Ruggedness Scale, developed by the USDA Economic Research Service (ERS), which quantifies terrain irregularities such as slopes and elevation differences. It is a dummy variable that goes from 1 (level) to 6 (extremely rugged). I aggregate the census tract ruggedness data to the municipal level using census tract land areas as weights. Including terrain ruggedness helps separate geographic constraints from regulatory-changes effects on housing development, ensuring that our analysis accurately isolates the impact of local land-use regulations.

3.4 Housing Tenure Composition

I examine the relationship between housing tenure composition and changes in the Wharton Residential Land Use Regulation Index ($\Delta WRLURI$). Housing tenure is categorized into homeowner-occupied, renter-occupied, and vacant housing units. I define homeowner share as the percentage of occupied housing units that are owner-occupied in 2006, with renter share representing the remaining occupied housing units. Since homeowner and renter shares sum to

100%, my analysis focuses on homeowner share since renter share instead would yield similar insights with an opposite sign.

Table 2: Renter Households Defined as "Rent Burdened" by Income.

Income Group	*2005-2009*	*2010-2014*	*2015-2019*	*Δ2005-2019*
All Households	36.901%	38.819%	36.553%	-0.348
< $10,000	68.573	66.309	63.514	-5.059
$10,000–$19,999	72.102	75.902	75.482	3.38
$20,000–$34,999	46.531	56.041	62.924	16.393
$35,000–$49,999	17.738	24.821	33.116	15.378
$50,000–$74,999	6.065	9.178	13.499	7.434
$75,000–$99,999	1.882	2.744	4.319	2.437
$100,000 or more	0.505	0.610	0.746	0.241

Note: Data obtained from IPUMS NHGIS ACS 5-year datasets. Severe rent burden is defined *arbitrarily* to be ≥35% of income. Notice that the Department of Housing and Urban Development defines rent burdened to be ≥30% of income. Δ2005-2019 is measured in percentage points.

Table 3: Homeownership Rates by Income.

Income Group	*2005-2009*	*2010-2014*	*2015-2019*	*Δ2005-2019*
All Households	66.750%	64.656%	64.267%	-2.483
< $10,000	36.897	35.917	38.332	1.435
$10,000–$19,999	45.925	43.080	42.348	-3.577
$20,000–$34,999	54.449	52.121	49.979	-4.47
$35,000–$49,999	62.686	59.729	56.380	-6.306
$50,000–$74,999	72.217	68.355	63.775	-8.442
$75,000–$99,999	80.982	76.670	71.847	-9.135
$100,000-$150,000	87.349	83.906	79.947	-7.402
$150,000 or more	91.770	89.643	87.761	-4.009

Notes: Data obtained from IPUMS NHGIS ACS 5-year datasets. Δ2005-2019 is measured in percentage points.

Table 2 and Table 3 provide historical context for our analysis. Table 2 demonstrates that renters that are "rent burdened," defined as households spending 35% or more of their income on housing, have significantly increased among middle-income renters, highlighting growing affordability pressures within rental markets. Table 3 shows declining homeownership rates across nearly all income groups, especially among moderate-income and higher-income households.[3] Together, these shifts underscore the relevance of examining how local land-use

[3] The increase in the homeownership rate for those making less than $10,000 per year is most likely a consequence of Baby Boomers retiring rather than an increase of income mobility for the poor.

regulatory changes interact with housing tenure composition to influence housing affordability and prices.

Table 4: Correlations between Homeowner Share and Land-Use Regulations.

	WRLURI 2006	*WRLURI 2018*	*ΔWRLURI*
Homeowner Share	0.2115	0.1168	-0.0741
Q1 Homeowner Share	0.0567	0.0552	0.0100
Q2 Homeowner Share	-0.0448	0.0530	0.0915
Q3 Homeowner Share	0.3093	0.1877	-0.0970
Q4 Homeowner Share	0.0325	-0.0455	-0.0695

Note: This table presents correlation coefficients between homeowner share and measures of land-use regulations (WRLURI) for 2006, 2018, and the change (ΔWRLURI) between 2006 and 2018. Quartiles (Q1–Q4) categorize municipalities by their initial homeowner share, with Q1 and Q2 representing renter-dominated communities and Q3 and Q4 representing homeowner-dominated communities.

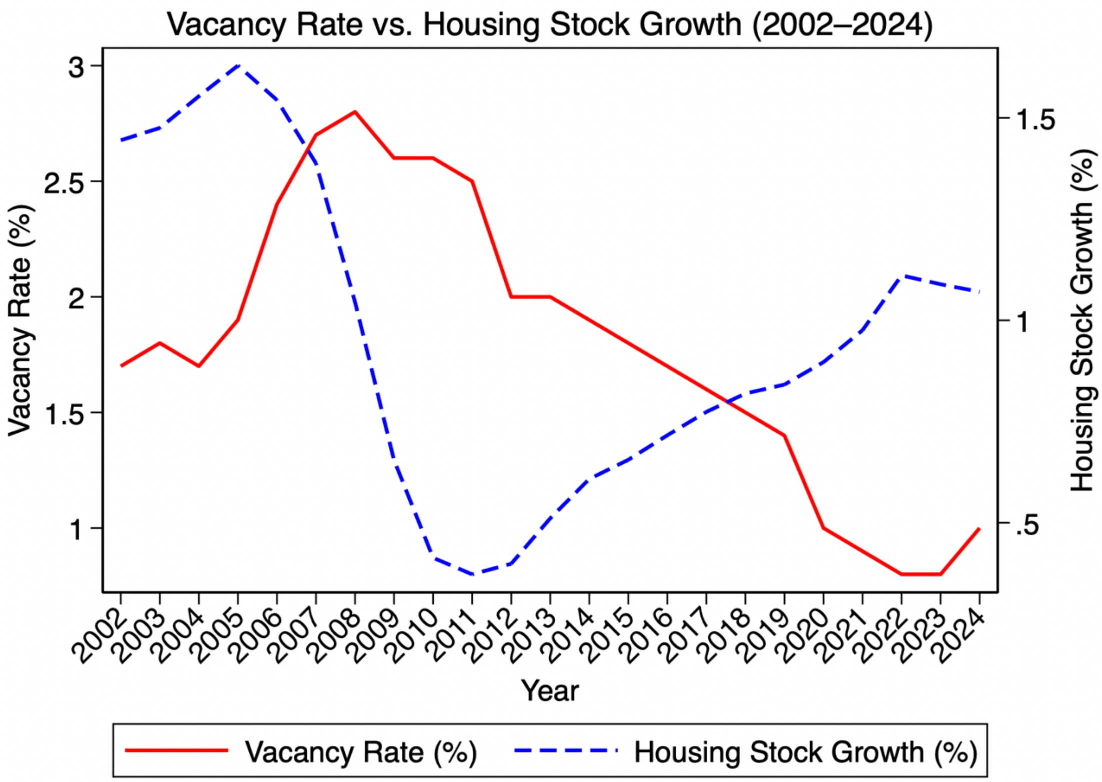
Table 4 shows a weak positive correlation between the homeowner share and WRLURI in 2006, suggesting that municipalities with higher homeowner shares were somewhat more likely to have stricter land-use regulations compared to municipalities with higher renter shares. Interestingly, there is a weak negative correlation between the homeowner share and ΔWRLURI indicating that municipalities initially characterized by a higher homeowner share tended to see a relative decrease in land-use regulatory stringency between 2006 and 2018. The correlation between the homeowner share and the 2018 WRLURI is weaker, but still tells a similar story.

When examining correlations between homeowner-share quartiles and regulatory intensity, municipalities in higher homeowner-share quartiles (particularly the third quartile) exhibit stronger positive correlations with the 2006 WRLURI. Even more notably, municipalities dominated by homeowners show negative correlations with changes in WRLURI from 2006 to 2018, indicating relative decreases in regulatory intensity. Municipalities dominated by renters display positive correlations, reflecting relative increases. These correlation patterns suggest a form of ‘regulatory catch-up,’ where renter-dominated municipalities increased regulatory stringency relative to homeowner-dominated municipalities. Such patterns may indicate an upper limit to regulatory intensity preferred by homeowners.

The correlation between homeowner share (%Owner) and Democratic voter share (%Democrat) is relatively weak (0.0568), suggesting potential independent influences. When both variables are included simultaneously in regression analysis (Table 6), homeowner share becomes statistically insignificant, possibly due to collinearity or overlapping explanatory power with %Democrat. Nevertheless, given the relatively low correlation between these variables and the conceptual priority of homeowner share in testing the Homevoter Hypothesis, I focus primarily on %Owner as a more direct measure of homeowner-driven regulatory preferences.

I also control for the vacancy rate in 2006, which captures the level of excess housing supply within a community. Higher vacancy rates typically reflect weaker local housing demand, structural market issues, or mismatches between housing supply and demand, all of which could independently influence local housing price dynamics. A higher vacancy rate may mitigate the price impacts of stricter land-use regulations, as the existing surplus of vacant homes can absorb some of the increased demand pressures without significantly driving up prices (Molloy, 2014).

Figure 2: Vacancy Rate and Housing Stock Growth over time.



Source: U.S. Census Bureau and U.S. Department of Housing and Urban Development via FRED, Federal Reserve Bank of St. Louis.

The past two decades have seen substantial fluctuations in the U.S. housing market, particularly following the Great Recession. New housing construction sharply declined after the bubble burst, causing vacancy rates for for-sale homes to spike near 3% by the late 2000s. Excess inventory was rapidly absorbed, pushing vacancy rates below 1% by the mid-2010s. Despite a rebound in the housing stock growth, vacancy rates remain extremely low into the 2020s, indicating ongoing supply constraints relative to strong demand.

The correlation between initial vacancy rates (%Vacant) and regulatory changes ($\Delta WRLURI$) is low (0.0436). While this suggests vacancy rates are unlikely to bias the direct estimate of regulatory impacts, I include vacancy rate as a control because it could mediate how regulatory changes translate into housing price growth.

For consistency, the term *base controls* refers explicitly to the following set of variables (all in 2006 unless a percent change which would be between 2006 and 2018): population; percent change in population; median household income; percent change in real median household income; median year of the housing stock; percentage of minority (non-white) population; percentage of the population with a college degree or higher; unemployment rate; poverty rate; percentage of occupied housing units that are owner-occupied; vacancy rate; percentage of the population classified as urban in 2000; and Area Ruggedness Scale dummies. Notably, the Democratic vote share (%Democrat) is not included among these base controls, because treating it separately avoids conflating ideology with underlying demographic and economic factors that more directly influence housing market dynamics. The Democratic share correlates moderately with community characteristics such as income (0.3096), educational attainment (0.3199), and to a lesser extent, urban population share (0.0998). These correlations suggest Democratic share may reflect broader socioeconomic or demographic factors rather than independently driving regulatory decisions. Moreover, the Homevoter Hypothesis emphasizes homeowner preferences rather than partisan affiliation, further justifying the exclusion of Democratic share from the base controls.

Table 5: Summary statistics for dependent and independent variables.

Variable	*Observations*	*Mean*	*Standard Deviation*	*Min*	*Max*
$\%\Delta \boldsymbol{HPI}$	625	-9.282	17.937	-59.399	67.799
$\Delta \boldsymbol{HPI}^{county}$	634	-10.573	16.774	-43.009	33.726
$\Delta \boldsymbol{WRLURI}$	634	0.116	0.950	-2.280	3.097
$\Delta \boldsymbol{WRLURI}^{adjusted}$	421	0.083	1.010	-3.927	3.749
2006 Population	634	40563.99	89731.46	2516	1450206
%Δ***Population***	634	6.680	10.754	-15.548	93.194
2006 Median Household Income	634	56598.96	24727.03	20068	219620
%Δ***Median Household Income***	634	-6.977	9.918	-40.055	36.162
2006 Median Year Home Built	634	1972.967	14.51362	1939	2003
2006 %***Minority***	634	19.674	15.633	0	86.532
2006 %***College Degree***	634	30.229	16.175	2.393	81.595
2006 %***Unemployed***	634	7.401	3.13	0	24.328
2006 %***Poverty***	634	13.028	8.220	.460	46.561
2006 %***Renter***	634	33.516	13.351	1.563	75.983
2006 %***Vacant***	634	9.691	6.471	0	59.673
Area Ruggedness Scale	634	1.569	0.991	1	6
%***Democrat in 2004 Presidential Election***	632	45.356	12.719	11.635	75.181
2000 %***Urban Population***	634	96.556	9.638	0	100

4. Empirical Framework

4.1 Base Regression

This paper employs a first-difference regression approach to estimate the impact of changes in land-use regulations on housing price changes between 2006 and 2018. The primary regression specification is:

$$\%\Delta HPI_i = \beta_0 + \beta_1 \Delta WRLURI_i + (\%\Delta X_i)'\beta_2 + {Z_i}^{(2006)\prime}\gamma + \mu_s + \epsilon_i$$

where, for municipality i, $\%\Delta HPI_i$ represents the percentage change in real housing prices from 2006 to 2018 (either aggregated up from the census level using the housing stock or matched with county level data); $\Delta WRLURI_i$ is the change in the Wharton Residential Land Use Regulatory Index from 2006 to 2018 (either the adjusted or unadjusted measure); $\%\Delta X_i$ is a vector of control variables that represent percent change. Population and income growth, which capture demographic and economic changes, fall in the category; ${Z_i}^{(2006)}$ is a vector of control variables containing initial municipality characteristics such as the median household income, baseline population, and homeowner share in 2006. μ_s represents state or region (defined by Census Divisions) fixed effects, and ϵ_i is an error term clustered at the county level.

The coefficient of interest is β_1, which measures how a one-unit increase in the $\Delta WRLURI$ (i.e., a one standard deviation increase in the change in relative intensity of land use regulations) is associated with the real percentage change in house prices, holding other factors constant. A positive β_1 would indicate that tighter land use regulations lead to higher house price growth, consistent with the hypothesis that restrictive regulation constrains supply and thus pushes prices up.

I incorporate state or region fixed effects, denoted by μ_s, where s represents the state or region that a municipality is located. This means the coefficient β_1 is identified by comparing counties within the same state or region. State fixed effects absorb state-specific influences, such as statewide economic conditions, housing market dynamics, or policy factors that affect all municipalities within a given state (e.g. Dillion vs Home Rule state), whereas regional fixed effects help controls for regional market trends (e.g. decreases in home values in the Rust Belt due to decreases in manufacturing jobs). I rely on within-state or within-region variation in regulation changes and housing price growth to estimate the effect of interest.

4.2 Testing Heterogeneity with Homeowner Share

To test how the relationship between regulatory change and price change might differ depending on housing tenure composition, I extend the model with interaction terms to allow us to perform a difference-in-differences. To interpret this model as a difference-in-differences, the critical assumption required is parallel trends that, in the absence of regulatory changes, municipalities with different homeowner shares would have experienced similar trends in housing prices. However, given that WRLURI data is only available at two points in time (2006 and 2018), I cannot directly test this parallel-trends assumption with my data. Nevertheless, I consider:

$$\%\Delta HPI_i = \beta_0 + \beta_1 \Delta WRLURI_i + \beta_2 (\Delta WRLURI_i \times OwnerShare_{i,2006})$$
$$+ \beta_3 \, OwnerShare_{i,2006} + (\%\Delta X_i)' \beta_4 + Z_i^{(2006)\prime} \gamma + \mu_s + \epsilon_i$$

Here, $OwnerShare_{i,2006}$ is the percentage of occupied housing units that are owner-occupied in 2006 in municipality i. The term $\Delta WRLURI_i \times OwnerShare_{i,2006}$ allows the effect of regulatory changes on prices to vary with the initial homeowner share. A positive and significant β_2 would indicate that homeowner-dominated areas experience disproportionately larger price increases for a given level of regulatory tightening. Such a result would both align with and extend the Homevoter Hypothesis: homeowners might not only advocate for more stringent land-use regulations but could also enforce existing regulations more strictly, further amplifying housing price responses. Whereas a negative or insignificant β_2 would suggest homeowner-dominated communities neither disproportionately capitalize nor more rigorously enforce regulatory tightening, a finding that would limit the broader implications of the Homevoter Hypothesis without directly contradicting its original claims.

I will also examine interactions using renter share and vacancy rate separately, exploring whether these factors moderate the impact of regulatory changes differently. Since homeowner and renter shares are perfectly collinear (they sum to 100%), I cannot include both simultaneously in regressions with a constant term. Therefore, analyzing homeowner share alone sufficiently captures these effects, as the inclusion of renter share instead would yield similar insights with an opposite sign. I anticipate that a higher renter share (corresponding directly to a lower homeowner share) will weaken the positive relationship between regulatory tightening and housing price growth, as renters typically possess fewer incentives and less political power to constrain housing supply. A higher vacancy rate, indicating a market less constrained by existing demand pressures, should also mitigate housing price responses to increased regulatory stringency.

I also include the main effect of $\mathrm{OwnerShare}_{i,2006}$ as β_3 . This captures any direct relationship between the initial homeownership rate and the subsequent house price change, independent of regulatory change. For example, one might expect that places with very high homeowner share could have slower baseline growth (if they are more built-out or less dynamic), or perhaps faster growth (if they are more stable communities with better amenities). Including this term ensures that the interaction's meaning is truly about the differential effect of $\Delta WRLURI_i$ by homeowner share, not confounded by homeowner share being correlated with some other omitted factor affecting prices.

The regression analysis employs Ordinary Least Squares (OLS). While our first-difference approach helps mitigate concerns about time-invariant unobserved factors, several limitations remain. Although the $\Delta WRLURI$ measure captures changes between 2006 and 2018, potential endogeneity issues exist, as unobserved factors could simultaneously affect both regulatory changes and housing prices. Additionally, reverse causality remains possible, since rising housing prices might prompt municipalities to implement stricter regulations rather than regulations driving price changes.

While we include controls for observable confounding factors such as population and income growth, our results should generally be interpreted as identifying associative relationships rather than strictly causal effects. However, in the difference-in-differences framework specifically, a causal interpretation hinges critically on the parallel trends assumption that housing price trends would have evolved similarly across municipalities with different homeowner shares in the absence of regulatory changes. Since this assumption cannot be met with this data, the causal interpretation in the difference-in-differences is uncertain. Additional identification strategies, such as instrumental variables, would help further validate causality but lie beyond the scope of this analysis. Therefore, I present these findings as exploratory evidence of the relationship between land-use regulatory changes, housing price growth, and homeownership composition.

5. Results

5.1 Base Controls with %ΔHPI

I begin by examining the core relationship between changes in land use regulation and changes in housing prices at the municipal level using the %ΔHPI that was calculated by aggregating census level data to the municipal level with the housing stock. Table 6 shows our main regression results, estimating the effects of changes in local regulatory intensity (ΔWRLURI) on real housing price growth (%ΔHPI). Column 1, our base specification without fixed effects, indicates a positive and marginally significant relationship between regulatory tightening and housing price appreciation. It suggests a one-unit increase in ΔWRLURI (indicating a one-unit increase in the change in regulatory intensity between 2006 and 2018 relative to other municipalities) is associated with a 1.392 percentage point increase in real housing prices, holding all other controls constant.

However, this relationship becomes statistically insignificant once state (Column 2) and region (Column 3) fixed effects are introduced. The loss of significance in these columns is consistent with the idea that zoning regulations are largely influenced by state-level policies, which may limit the independent variation observed at the municipal level, and that regional-level trends shape the direction of land-use regulations. I further explore potential moderating factors through interaction terms. Interaction terms between ΔWRLURI and the homeowner share and vacancy rate were tested and found insignificant (Appendix 8.2.1 and 8.2.2). This insignificance could result from measurement noise introduced when aggregating the census-level HPI to municipal level based on housing stock. Supporting this interpretation, analyses using $\%\Delta HPI^{county}$ shows significant and meaningful effects for municipalities in the highest homeowner-share quartile (Section 5.3). This contrast suggests the census-level aggregation may obscure true underlying relationships. Control variables such as population growth, median income growth, vacancy rates, and unemployment rates behave as expected, indicating our model is capturing local market conditions.

Table 6: Effect of Changes in WRLURI on Housing Price (%ΔHPI) at the Municipal Level

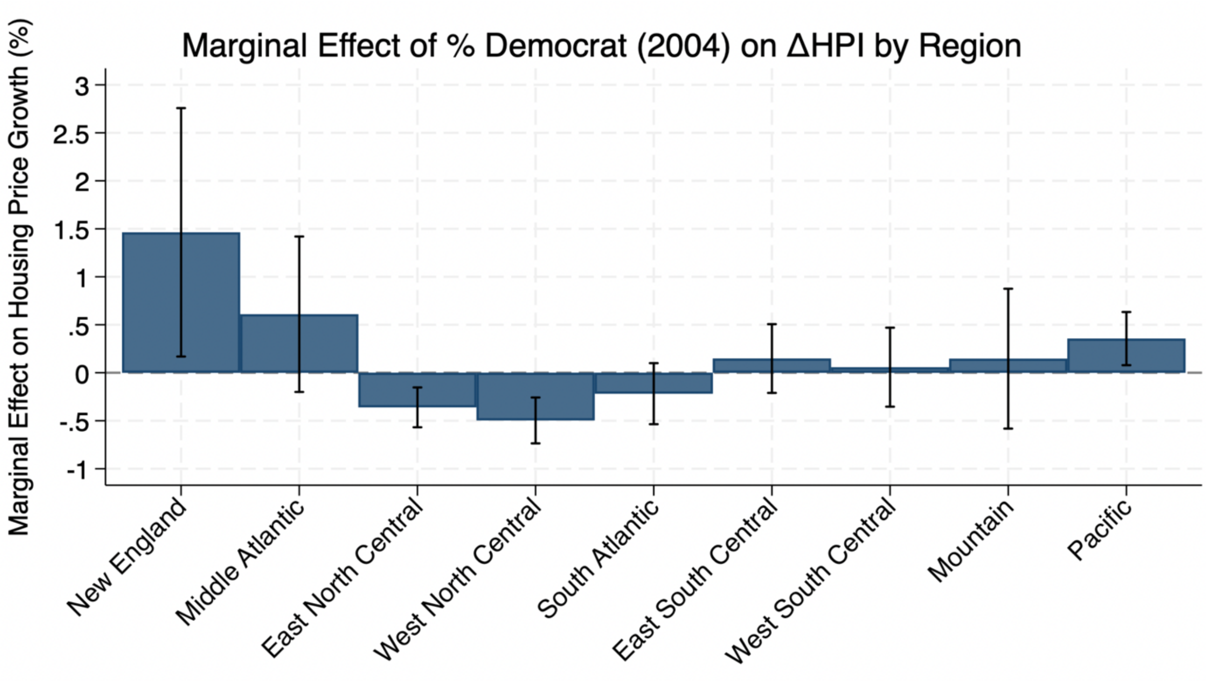
VARIABLES	(1) %ΔHPI	(2) %ΔHPI	(3) %ΔHPI	(4) %ΔHPI	(5) %ΔHPI
ΔWRLURI	1.392*	0.228	0.263	0.754	5.828**
	(0.771)	(0.528)	(0.612)	(0.737)	(2.654)
2006 Population	0.000	0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
%ΔPopulation	0.689***	0.262***	0.474***	0.670***	0.654***
	(0.094)	(0.061)	(0.075)	(0.093)	(0.091)
2006 Median Household Income	-0.000	0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
%ΔMedian Household Income	0.266***	0.182***	0.225***	0.278***	0.279***
	(0.063)	(0.051)	(0.057)	(0.062)	(0.062)
2006 Median Year Home Built	-0.175***	-0.215***	-0.341***	-0.243***	-0.239***
	(0.063)	(0.052)	(0.061)	(0.062)	(0.062)
2006 %Minority	-0.034	-0.042	-0.137**	0.013	0.020
	(0.067)	(0.051)	(0.057)	(0.065)	(0.065)
2006 %College Degree	0.057	0.131**	0.186***	0.104	0.106
	(0.077)	(0.058)	(0.072)	(0.075)	(0.074)
2006 %Unemployed	-1.589***	-0.085	-0.316	-1.300***	-1.303***
	(0.256)	(0.210)	(0.239)	(0.275)	(0.274)
2006 %Poverty	0.301**	-0.346***	-0.184	0.222	0.224
	(0.146)	(0.104)	(0.128)	(0.158)	(0.158)
2006 %Owner	-0.043	-0.141*	-0.116	-0.040	-0.049
	(0.094)	(0.078)	(0.077)	(0.094)	(0.094)
2006 %Vacant	-0.438***	-0.217**	-0.541***	-0.450***	-0.455***
	(0.085)	(0.089)	(0.079)	(0.079)	(0.080)
2000 %Urban Population	0.050	0.069**	0.074	0.118**	0.125**
	(0.073)	(0.034)	(0.075)	(0.056)	(0.057)
Area Ruggedness Scale	X	X	X	X	X
State Fixed Effects		X			
Region Fixed Effects			X		
%Democrat in 2004 Presidential Election				-0.287***	-0.275***
				(0.094)	(0.095)
ΔWRLURI× %Democrat in 2004 Presidential Election					-0.113*
					(0.058)
Constant	346.489***	420.643***	658.398***	549.835***	542.074***
	(123.148)	(103.437)	(117.309)	(127.600)	(127.144)
Observations	625	625	625	623	623
R-squared	0.273	0.695	0.477	0.304	0.309
Adjusted R-squared	0.251	0.659	0.454	0.282	0.286

Standard errors clustered at county level.
X = dummies included
* p<0.10, ** p<0.05, *** p<0.01

5.2 Heterogeneity with %Democrat

Columns 4 and 5 extend the analysis by incorporating political composition, specifically the percentage of Democratic voters (%Democrat) from the 2004 Presidential Election, as a potential moderator of the relationship between regulatory changes and housing price growth. The interaction between ΔWRLURI and %Democrat produces a negative and statistically significant coefficient. This result suggests that municipalities with higher Democratic voter shares experienced relatively weaker housing price growth in response to increased regulatory stringency. Additionally, when the interaction term is included, the main coefficient for $\Delta WRLURI$ increases considerably to 5.828, indicating a larger baseline impact in areas with lower Democratic shares.

Figure 3: Marginal Effect of a 1 Percentage Point Increase in Democrat Voter Share (2004) on Housing Price Growth, by Census Division.



However, interpreting this interaction requires caution due to significant regional heterogeneity. After running a regression interacting Democratic voter share with region dummies, the marginal effects are shown in Figure 3. For example, the New England and Middle

Atlantic regions exhibit positive marginal effects, suggesting that in these areas, municipalities with higher Democratic voter shares experience stronger housing price appreciation following regulatory tightening. In contrast, regions like East North Central show clear negative marginal effects, implying that municipalities with higher Democratic shares in these areas experience smaller or even negative price changes.

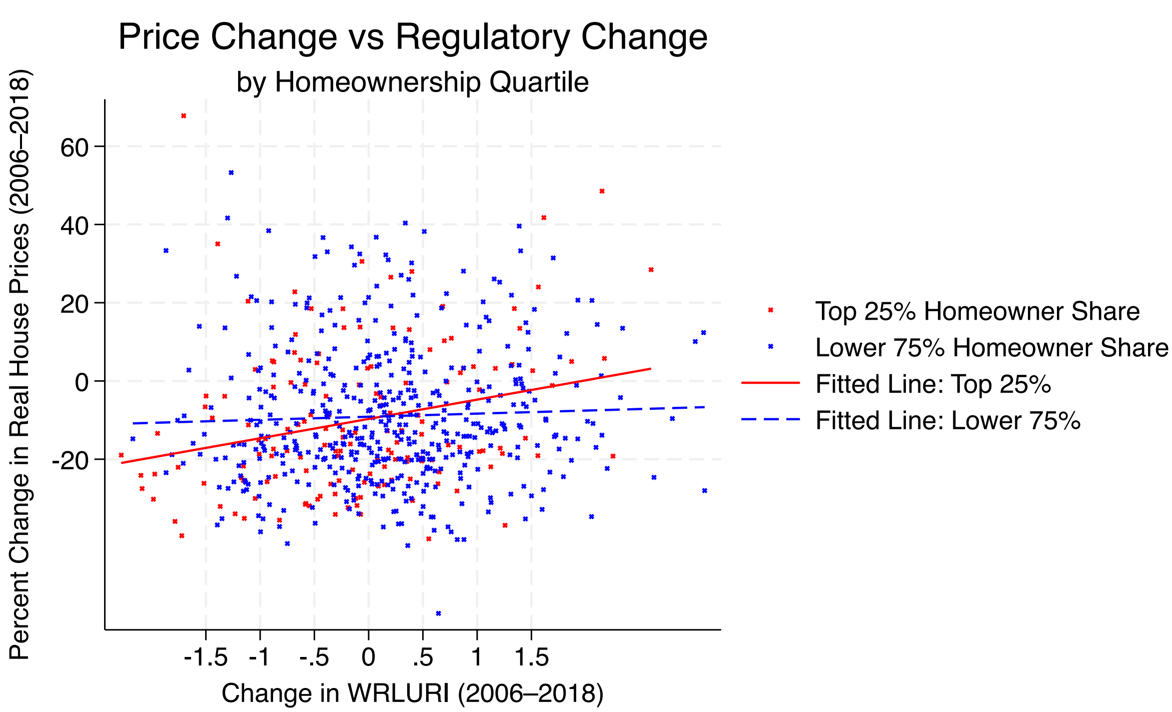
A plausible explanation for these mixed regional effects lies in the initial regulatory conditions. Correlation analysis indicates a positive relationship (0.2445) between Democratic voter shares and the initial 2006 WRLURI, suggesting that municipalities characterized by higher Democratic shares tended to have stricter baseline regulations. Therefore, municipalities with already strict regulations may have had less scope or political incentive to further tighten land-use regulations, resulting in smaller incremental price impacts from additional regulatory increases, rather than it being an inherent characteristic of the Democrat share.

5.3 Base Controls with $\%\Delta HPI^{county}$

Table 7 presents regression results using county-level housing price data (%ΔHPI) matched to municipal-level regulatory changes ($\Delta WRLURI$). Notably, the interaction term between $\Delta WRLURI$ and the initial homeowner share (%Owner in 2006) is positive and statistically significant (Column 3). This result indicates that the effect of regulatory tightening on housing price growth is stronger in municipalities with higher initial homeownership rates, aligning with predictions from the Homevoter Hypothesis. Specifically, each additional one percentage point increase in a municipality's initial homeowner share amplifies the impact of a one-unit increase in the change in regulatory intensity on housing price growth by approximately 0.087 percentage points, holding other factors constant.

Breaking down homeowner shares into quartiles further illuminates this relationship (Column 4). Specifically, municipalities in the top quartile of homeownership (the highest 25%) exhibit a significantly stronger response to regulatory tightening compared to those in lower quartiles. The interaction term for this top quartile is statistically significant and substantial at 3.257, suggesting that municipalities with the highest initial homeowner shares experience 3.257 percentage points greater housing price growth for each unit increase in the change in regulatory intensity, compared to the lowest homeowner share quartiles. This difference is visually supported by the scatterplot (Figure 4), which clearly illustrates a steeper positive relationship between regulatory changes and housing price growth in communities within the top 25% of homeowner shares compared to the lower 75%.

Figure 4: Housing Price Growth vs. Regulatory Changes, by Homeowner Share Quartile



However, achieving statistical significance with these interaction terms requires omitting the percentage of households in poverty from our regressions. The necessity of dropping the poverty rate arises due to the high negative correlation (-0.69) between poverty and homeowner share, potentially causing multicollinearity issues. Therefore, while the interaction effect aligns well with theoretical predictions, interpretation should consider this limitation, as the distinct effects of poverty and homeownership cannot be simultaneously isolated in the current specification. The same relationship discovered between the Democrat voter share and housing prices continues to exist in this specification (Columns 5 and 6).

In all regressions (both with %ΔHPI and %ΔHPI$^{\boldsymbol{county}}$), the $\Delta WRLURI^{adjusted}$ was also tested but never yielded a significant coefficient (see Appendix 8.2.4 and 8.2.5), despite its strong correlation with the original ΔWRLURI. This lack of significance likely stems from the removal of certain survey questions in both periods to maintain consistency, reducing meaningful variation in the adjusted index. Consequently, although the original $\Delta WRLURI$ might be biased due to comparability issues, it contains richer information and greater variability that appears relevant for capturing actual regulatory changes. Nevertheless, I will used the adjusted subindexes used to construct $\Delta WRLURI^{adjusted}$ in the next section.

Table 7: Effect of Changes in WRLURI on Housing Price ($\%\Delta HPI^{county}$) at the Place Level

VARIABLES	(1) $\%\Delta HPI^{county}$	(2) $\%\Delta HPI^{county}$	(3) $\%\Delta HPI^{county}$	(4) $\%\Delta HPI^{county}$	(5) $\%\Delta HPI^{county}$	(6) $\%\Delta HPI^{county}$
ΔWRLURI	1.365* (0.707)	-3.202** (3.287)	-4.415 (3.427)	0.562 (1.381)	0.782 (0.672)	5.404** (2.614)
2006 Population	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
%ΔPopulation	0.635*** (0.076)	0.632*** (0.076)	0.615*** (0.077)	0.606*** (0.079)	0.617*** (0.074)	0.604*** (0.075)
2006 Median Household Income	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000** (0.000)	0.000 (0.000)	0.000 (0.000)
%ΔMedian Household Income	0.213*** (0.059)	0.212*** (0.059)	0.217*** (0.060)	0.209*** (0.060)	0.226*** (0.058)	0.227*** (0.058)
2006 Median Year Home Built	-0.124** (0.603)	-0.121** (0.060)	-0.126** (0.059)	-0.121** (0.057)	-0.182*** (0.061)	-0.181*** (0.060)
2006 %Minority	-0.059 (0.059)	-0.057 (0.059)	-0.033 (0.058)	-0.037 (0.062)	-0.016 (0.060)	-0.010 (0.060)
2006 %College Degree	-0.119 (0.074)	-0.114 (0.072)	-0.097 (0.076)	-0.066 (.071)	-0.077 (0.072)	-0.078 (0.072)
2006 %Unemployed	-1.680*** (0.234)	-1.669*** (0.236)	-1.343*** (0.237)	-1.250*** (0.234)	-1.430*** (0.256)	-1.432*** (0.255)
2006 %Poverty	0.539*** (0.157)	0.520*** (0.156)			0.456*** (0.162)	0.465*** (0.163)
2006 %Owner	-0.004 (0.074)	-0.006 (0.074)	-.097 (0.086)		0.003 (0.070)	0.011 (0.070)
2006 %Vacant	-0.433*** (0.086)	-0.428*** (0.087)	-0.382*** (0.098)	-0.386*** (0.097)	-0.449*** (0.080)	-0.451*** (0.081)
2000 %Urban Population	0.025 (0.071)	0.014 (0.071)	-0.006 (0.062)	-0.011 (0.059)	0.091 (0.056)	0.098* (0.055)
Area Ruggedness Scale	X	X	X	X	X	X
ΔWRLURI× 2006 % Owner		0.068 (0.047)	0.087* (0.050)			
%Owner Quartile Dummies				X		
ΔWRLURI× Q2 %Owner Share				0.514 (1.951)		
ΔWRLURI× Q3 %Owner Share				-0.766 (1.877)		
ΔWRLURI× Q4 %Owner Share				3.257* (1.926)		
%Democrat in 2004 Presidential Election					-0.257*** (0.094)	-0.247*** (0.095)
ΔWRLURI× %Democrat in 2004 Presidential Election						-0.103* (0.057)
Constant	244.519** (117.560)	243.410** (118.441)	264.369** (114.188)	248.159** (111.419)	359.704*** (122.164)	355.775*** (120.683)
Observations	634	634	634	634	632	632
R-squared	0.272	0.274	0.255	0.259	0.301	0.306
Adjusted R-squared	0.250	0.253	0.233	0.232	0.279	0.283

Standard errors clustered at county level.
X = model includes dummies
* p<0.10, ** p<0.05, *** p<0.01

5.4 Policy Preferences of Homeowners

To investigate the specific types of land-use regulations favored by homeowners, Table 8 reports the results from separate regressions analyzing the relationship between the initial homeowner share and $\Delta WRLURI^{adjusted}$. Each row of the table corresponds to a distinct regression, with the dependent variable indicated in the left-hand column. The key coefficient shown is for homeowner share, capturing how higher initial homeowner shares correlate with subsequent regulatory changes in each specific regulatory dimension. The analysis identifies a significant positive relationship between homeowner share and changes in both the Court Involvement Index (ΔCII) and the Density Restriction Index (ΔDRI). These results are intuitive: areas with higher homeowner shares likely favor enhanced state and local court involvement in regulating residential construction and managing growth. Similarly, increases in minimum lot size requirements, captured by ΔDRI, align with homeowners' incentives to restrict housing supply and thereby protect property values.

Less straightforward, however, are the negative relationships between homeowner share and changes in the Local Political Pressure Index ($\Delta LPPI$) and Local Project Approval Index ($\Delta LPAI$). The LPAI indicates the groups required to approve new projects that do not need rezoning, as well as the necessary voting thresholds. The negative association may reflect that communities with higher homeowner shares already possess detailed comprehensive plans, enabling faster approvals for projects fitting existing guidelines, thereby reducing procedural stringency over time.

The negative correlation with $\Delta LPPI$, which measures local political involvement in development decisions, poses a more nuanced interpretation. One possibility is that homeowners became less politically active following substantial home-value declines during the Great

Recession, thus reducing their incentive to maintain or increase local regulatory pressures. This interpretation aligns with the observed positive correlation (0.1637) between homeowner share and the initial 2006 LPPI, suggesting that homeowner-dominated municipalities initially exhibited higher levels of political involvement. Similar to the broader WRLURI trends, municipalities with initially high homeowner shares and higher baseline political involvement may have faced limited scope or reduced incentives for further increases, resulting in a relative decline between 2006 and 2018.

Table 8: Relationship Between Initial Homeowner Share and Changes in WRLURI Subindexes.

Change in Subindex	*2006 %Owner*	$\Delta WRLURI^{adjusted}$	*Constant*	*Observations*	*R-squared*
$\Delta LPPI$	-0.012** (0.006)	0.941*** (0.092)	0.207 (0.417)	388	0.220
ΔCII	0.011** (0.005)	1.199*** (0.084)	-1.076*** (0.360)	388	0.418
ΔLAI	0.002 (0.002)	0.013 (0.025)	0.270** (0.123)	384	0.003
ΔSRI	-0.003 (0.002)	0.052 (0.046)	0.124 (0.148)	388	0.008
ΔDRI	0.009* (0.005)	0.236*** (0.080)	-0.245 (0.347)	388	0.025
ΔOSI	-0.000 (0.002)	0.117*** (0.029)	0.050 (0.125)	388	0.045
ΔEI	0.002 (0.002)	0.183*** (0.029)	-0.412*** (0.143)	388	0.101
ΔADI	-0.012 (0.015)	0.759*** (0.227)	0.942 (0.967)	388	0.035
ΔAHI	-0.001 (0.001)	0.129*** (0.021)	0.023 (0.080)	388	0.103
$\Delta LPAI$	-0.034*** (0.010)	-0.124 (0.125)	15.683*** (0.638)	388	0.033
$\Delta LZAI$	-0.002 (0.004)	0.454*** (0.065)	0.381 (0.273)	388	0.125
$\Delta SPII$	0.002 (0.004)	0.782*** (0.052)	-0.193 (0.256)	388	0.339

Robust standard errors.
* p<0.10, ** p<0.05, *** p<0.01

Table 8 and the regression analysis (Table 9) reveal an intriguing pattern regarding homeowner preferences and regulatory impacts. Homeowners initially favored certain policies, such as greater local political involvement (LPPI correlation of 0.1637) and local project approvals (LPAI correlation of 0.1160). However, between 2006 and 2018, homeowner-dominated municipalities generally experienced reductions in these specific regulatory dimensions (negative $\Delta LPPI$ and $\Delta LPAI$). Interestingly, these declining regulatory dimensions ($\Delta LPPI$ and $\Delta LPAI$) exhibit significant and positive associations with housing price growth, as shown in Table 9. Regulatory aspects that homeowners increasingly preferred or sustained, such as density restrictions (DRI, correlation 0.1380) and court involvement (CII, correlation -0.0338), show insignificant effects on housing prices. A plausible explanation for this result is that policies in which homeowners had already established high baselines left little room for impactful further increases. Thus, reductions in previously elevated regulatory areas appear to significantly affect prices.

Table 9: Regression of Housing Price Growth on Adjusted WRLURI Subindex Changes

Variables	*(1)* $\%\Delta \boldsymbol{HPI}^{\boldsymbol{county}}$
$\Delta \boldsymbol{LPPI}$	**0.647*** **(0.368)**
$\Delta \boldsymbol{CII}$	**-0.294** **(0.441)**
$\Delta \boldsymbol{LAI}$	**2.406** **(2.005)**
$\Delta \boldsymbol{SRI}$	**1.283** **(0.260)**
$\Delta \boldsymbol{DRI}$	**-0.234** **(0.472)**
$\Delta \boldsymbol{OSI}$	**2.868**** **(1.262)**
$\Delta \boldsymbol{EI}$	**-1.643** **(1.483)**
$\Delta \boldsymbol{ADI}$	**-0.051** **(0.200)**
$\Delta \boldsymbol{AHI}$	**1.029** **(1.908)**
$\Delta \boldsymbol{LPAI}$	**0.881***** **(.310)**
$\Delta \boldsymbol{LZAI}$	**-0.148** **(0.582)**
$\Delta \boldsymbol{SPII}$	**0.032** **(0.662)**
Controls	**X**
Constant	**264.187*** **(142.224)**
Observations	**470**
R-squared	**0.261**

Standard errors clustered at county level.
X = model includes base controls
* p<0.10, ** p<0.05, *** p<0.01

The Open Space Index (OSI) measures regulatory requirements that mandate developers to provide dedicated open spaces or fees in lieu of dedication when constructing new residential developments. Results from Table 9 indicate that changes in OSI have a significant and large positive impact on housing price growth (coefficient of 2.868, significant at the 5% level). This suggests that municipalities increasing their open-space requirements saw notably higher housing price appreciation, likely because mandated open spaces enhance local amenities and neighborhood attractiveness, thereby boosting property values. Homeowner share had a weak positive correlation with the 2006 OSI (0.1484) but had an insignificant correlation with ΔOSI.

In summary, among the WRLURI subindexes, changes in Open-Space Requirements (OSI), Local Project Approval Index (LPAI), and Local Political Pressure Index (LPPI) exhibit the largest and most statistically significant impacts on housing price growth. Notably, homeowner-dominated communities recently implemented relatively smaller increases in these impactful regulatory dimensions, likely due to their already high baseline levels of stringency. This high baseline limited the potential scope and incentives for further tightening, explaining why recent regulatory changes appear less pronounced despite strong homeowner preferences for such regulations.

7. Conclusion

This paper investigates the relationship between changes in local land-use regulations, measured by the Wharton Residential Land Use Regulatory Index (WRLURI), and housing price growth from 2006 to 2018, emphasizing the role of local homeowner composition. The analysis provides clear evidence supporting the Homevoter Hypothesis: municipalities with higher initial homeowner shares experience significantly greater housing price appreciation in response to increased regulatory stringency. Specifically, each additional percentage point increase in homeowner share amplifies the impact of regulatory tightening by 0.087 percentage points on housing prices. Further granularity reveals that this effect is most pronounced in communities within the highest homeowner-share quartile, underscoring the strong alignment of homeowner interests with stringent land-use policies aimed at preserving or enhancing property values.

An intriguing complexity emerges from examining homeowner preferences for specific types of regulatory changes. Homeowners initially preferred stringent regulations related to local political involvement and local project approvals but reduced these dimensions over time, likely due to already high baseline levels. Paradoxically, reductions in these regulatory areas, rather than increases, were associated with significant positive impacts on housing prices. Whereas regulations that homeowners continued to favor, such as court involvement and density restrictions, showed no statistically significant effect on price growth, possibly due to limited additional marginal impacts from already high initial baselines.

The Open Space Index (OSI), capturing mandatory open space dedications from developers, emerges as particularly impactful. Municipalities increasing OSI saw substantial price appreciation, likely reflecting the enhanced local amenities and perceived neighborhood quality stemming from mandated open spaces.

Although the empirical framework and robustness checks strengthen confidence in the associations identified, this paper acknowledges inherent limitations, including potential endogeneity and reverse causality. Future research leveraging instrumental variables or experimental designs could provide more definitive causal insights.

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8. Appendix

8.1 Construction of adjusted 2006 and 2018 WRLURI

I have attached the Stata code. If one downloads the WRLURI data for Wharton,[4] merge the data sets together using the FIPS place codes and then runs the code, they will have the adjusted subindexes, which I used to do my analysis on which land-use regulations homeowners prefer. From there, they use principal component analysis to get the raw adjusted WRLURI for 2006 and 2018, and from there it is standardized by subtracting the mean and dividing by the standard deviation. Then subtract the 2006 standardized score form the 2018 standardized score and the final result will be the $\Delta WRLURI^{adjusted}$.

```
***Create new Index
*LPPI
gen LPPI06_new = local + pressure + totinitiatives
gen LPPI18_new = q3a18 + q3b18 + totinitiatives18
*CII
gen CII06_new = localcourts + statecourts
gen CII18_new = q3d18 + q3e18
*LAI
gen LAI06_new = zonvote
gen LAI18_new = LAI18
*SRI
gen SRI06_new = SRI
gen SRI18_new = SRI18
*DRI
gen DRI06_new = .
replace DRI06_new = 0 if minlotsize==0
replace DRI06_new = 1 if minlotsize_lhalfacre==1
replace DRI06_new = 2 if minlotsize_mhalfacre==1
replace DRI06_new = 3 if minlotsize_oneacre==1
replace DRI06_new = 4 if minlotsize_twoacre==1
gen DRI18_new = DRI18
*OSI
gen OSI06_new = OSI
gen OSI18_new = OSI18
*EI
gen EI06_new = EI
gen EI18_new = EI18
*AHI
gen AHI06_new = affordable
gen AHI18_new = AHI18
```

[4] https://real-faculty.wharton.upenn.edu/gyourko/land-use-survey/

```
*ADI
gen ADI06_new = ADI
gen time_weighted = ((0.75*(q16a118 + q16b118)/2) + (0.25*(q17a118 + q17b118)/2))
gen ADI18_new =  (time_weighted + ((q20a18 + q20b18 + q20c18)/3) + ((q22a18 + q22b18 + q22c18)/3))/3
*LPAI
gen LPAI06_new = LPAI
gen LPAI18_new = q4_1a18 + q4_1c18 + q4_1d18 + q4_1f18 + q4_1h18 + q4_1i18
*LZAI
gen LZAI06_new = commission + loczoning + council + cntyboard + cntyzoning + envboard
gen q4_2k18D = .
replace q4_2k18D = 1 if q4_2k18 == 1 | q4_2k18 == 2
replace q4_2k18D = 0 if q4_2k18 == 3
gen q4_2l18D = .
replace q4_2l18D = 1 if q4_2l18 == 1 | q4_2l18 == 2
replace q4_2l18D = 0 if q4_2l18 == 3
gen q4_2m18D = .
replace q4_2m18D = 1 if q4_2m18 == 1 | q4_2m18 == 2
replace q4_2m18D = 0 if q4_2m18 == 3
gen q4_2n18D = .
replace q4_2n18D = 1 if q4_2n18 == 1 | q4_2n18 == 2
replace q4_2n18D = 0 if q4_2n18 == 3
gen q4_2o18D = .
replace q4_2o18D = 1 if q4_2o18 == 1 | q4_2o18 == 2
replace q4_2o18D = 0 if q4_2o18 == 3
gen q4_2p18D = .
replace q4_2p18D = 1 if q4_2p18 == 1 | q4_2p18 == 2
replace q4_2p18D = 0 if q4_2p18 == 3
gen LZAI18_new = q4_2k18D + q4_2l18D + q4_2m18D + q4_2n18D + q4_2o18D + q4_2p18D
*SPII
gen SPII06_new = stateleg
gen SPII18_new = SPII
```

```
***Making the adjusted index
pca LPPI_new SPII_new CII_new SRI_new DRI_new OSI_new EI_new AHI_new ADI_new LPAI_new LZAI_new, components
(1)
predict WRLURI_raw
egen WRLURI_std = std(WRLURI_raw)
summarize WRLURI_std
pwcorr WRLURI_std WRLURI18, sig

misstable summarize LPPI_new SPII_new CII_new SRI_new DRI_new OSI_new EI_new AHI_new ADI_new LPAI_new
LZAI_new

***Merge
rename WRLURI_raw WRLURI_raw_2006
rename WRLURI_std WRLURI_std_2006
rename WRLURI_raw WRLURI_raw_2018
rename WRLURI_std WRLURI_std_2018
```

The following sections show the questions that I matched together. One can appreciated very quickly that these surveys are very different. Beyond just bias associated with non-response rates, one could imagine that an answer could be affected by the other questions asked. For example, if you are asked to rate the impact of something relative to others, the others asked would certainly affect your answer.

Comparing the Local Political Pressure Index (LPPI) and Court Involvement Index (CII):
2006 Question:

1. In your community, how involved are the following organizations in affecting residential building activities and/or growth management procedures? Please rate the importance of each on a scale of 1 to 5 by circling the appropiate number (1 = not at all involved; 5 = very involved).

- Local Council, Managers, Commissioners	1	2	3	4	5
- Community pressure	1	2	3	4	5
- County legislature	1	2	3	4	5
- State legislature	1	2	3	4	5
- Local courts	1	2	3	4	5
- State courts	1	2	3	4	5

2018 Question:

3. In your community, how involved are the following in affecting residential building activities and/or growth management procedures?

Organization	No involvement	Less involvement	Moderate involvement	More involved	Very involved
a. Local Council, Managers, Commissioners	❒ 1	❒ 2	❒ 3	❒ 4	❒ 5
b. Community pressure	❒ 1	❒ 2	❒ 3	❒ 4	❒ 5
c. State legislature	❒ 1	❒ 2	❒ 3	❒ 4	❒ 5
d. Local courts	❒ 1	❒ 2	❒ 3	❒ 4	❒ 5
e. State courts	❒ 1	❒ 2	❒ 3	❒ 4	❒ 5
f. Other	❒ 1	❒ 2	❒ 3	❒ 4	❒ 5

3A. If you chose "Other" above, please specify:

____

The questions are worded the same but include different options. For comparison, we only include options that appears in both surveys: Local Council, Managers, Commissioners, Community Pressure, State legislature, Local courts, and State courts.

We constructed the Local Political Pressure Index as follows:

$$LPPI_{i,2006} = local_i + pressure_i + totinitiatives_i$$

$$LPPI_{i,2018} = LocalCouncil_i + CommunityPressure_i + BallotInitiatives_i$$

where

Year	Component	Variable Long Name	Definition	Code	Source
2006	local	Local Council, Managers, Commissioners Involvement	The degree of involvement of the local council, managers, and commissioners in affecting the residential building activities and/or growth management procedures of a jurisdiction.	1 = not at all involved; 5 = very involved	Line item 1 of survey question 1
2006	pressure	Community Pressure Involvement	The degree of involvement of community pressure in affecting the residential building activities and/or growth management procedures of a jurisdiction.	1 = not at all involved; 5 = very involved	Line item 2 of survey question 1
2006	totinitiatives	Total # of Conservation Initiatives Approved	Number of ballot initiative passed by the jurisdiction from 1996 to 2005.		Trust for the Public Land, Landvote database http://www.tpl.org/tier2_kad.cfm?content_item_id=0&folder_id=2607 Accessed on July 26, 2005
2018	LocalCouncil	Local Council, Managers, Commissioners Involvement	The degree of involvement of the local council, managers, and commissioners in affecting the residential building activities and/or growth management procedures of a jurisdiction.	1 = not at all involved; 5 = very involved	Question 3a of survey
2018	CommunityPressure	Community Pressure Involvement	The degree of involvement of community pressure in affecting the residential building activities and/or growth management procedures of a jurisdiction.	1 = not at all involved; 5 = very involved	Question 3b of survey
2018	BallotInitiatives	Total # of Conservation Initiatives Approved	Number of ballot initiatives passed by the jurisdiction from 2008 to 2018.	# of initiatives	Trust for the Public Land, Landvote database https://tpl.quickbase.com/db/bbqna2qct?a=dbpage&pageID=8

This allows direct comparison. We constructed the Court Involvement Index as follows:

$$CII_{i,2006} = \text{localcourts}_i + \text{statecourts}_i$$

$$CII_{i,2018} = \text{LocalCourt}_i + \text{StateCourt}_i$$

where

Year	Component	Variable Long Name	Definition	Code	Source
2006	localcourts	Local Court Involvement	Local courts involvement in regulation.	1 = not at all involved; 5 = very involved	Line item 5 of survey question 1
2006	statecourts	State Court Involvement	State courts involvement in regulation.	1 = not at all involved; 5 = very involved	Line item 6 of survey question 1
2018	LocalCourt	Local Court Involvement	The degree of involvement of local court in affecting the residential building activities and/or growth management procedures of a jurisdiction.	1 = not at all involved; 5 = very involved	Question 3d of survey
2018	StateCourt	State Court Involvement	The degree of involvement of state court in affecting the residential building activities and/or growth management procedures of a jurisdiction.	1 = not at all involved; 5 = very involved	Question 3e of survey

Comparing the Local Assembly Index (LAI):
2006 Question:

This subindex was not in the 2006 survey. It values comes from survey response write-ins from question 2 in the 2006 survey. Clearly, comparing this over time is questionable due to it being explicitly asked in one survey and not in the other.

2018 Question: (specifically part q)

4. Which of the following are required to approve residential land-use changes?

Required: Organization is used for any residential land-use changes.
Not Required: If it is not used for that purpose OR does not exist in your community.
Supermajority Required: Any circumstance exists where approval requires more than a simple majority.

For projects that do require rezoning (i.e., rezoning or a variance): ***(Check one per row)***

	Required	Supermajority Required	Not Required
k. Local Planning Commission	❒ 1	❒ 2	❒ 3
l. Local Zoning Board	❒ 1	❒ 2	❒ 3
m. Local Council, Managers, Commissioners	❒ 1	❒ 2	❒ 3
n. County Board of Commissioners	❒ 1	❒ 2	❒ 3
o. County Zoning Board	❒ 1	❒ 2	❒ 3
p. Environmental Review Board	❒ 1	❒ 2	❒ 3
q. Town Meeting	❒ 1	❒ 2	❒ 3
r. Public Health Office	❒ 1	❒ 2	❒ 3
s. Design Review Board	❒ 1	❒ 2	❒ 3
t. Other	❒ 1	❒ 2	❒ 3

4B: If you checked "Other" above, please specify:

____

Comparing the Supply Restrictions Index (SRI):

2006 Question:

5. Does your community place annual limits on the total allowable:

	Yes	No
- No. of building permits – single family?		
- No. of building permits – multi-family?		
- No. of residential units authorized for construction – single family?		
- No. of residential units authorized for construction – multi-family?		
- No. of multi-family dwellings?		
- No. of units in multi-family dwellings?		

2018 Question:

8. Does your community place annual limits on the total allowable number of permits or dwellings

	Yes	No
a. Building permits for single-family homes	❒ 1	❒ 2
b. Building permits for multi-family homes	❒ 1	❒ 2
c. Number of single-family residential units authorized for construction	❒ 1	❒ 2
d. Number of multi-family residential units authorized for construction	❒ 1	❒ 2
e. Number of multi-family dwellings	❒ 1	❒ 2
f. Number of units in multi-family dwellings	❒ 1	❒ 2

These questions are identical. Therefore, no adjustments need to be made.

Comparing the Density Restriction Index (DRI):
2006 Question:

6. To build, do developers have to meet these requirements?

	Yes	No
- Meet the minimum lot size requirement? If yes: ½ acre or more________ ½ acre or less ________ 1 acre or more________ 2 acres or more ________		
- Include "affordable housing" (however defined)?		
- Supply mandatory dedication of space or open space (or fee in lieu of dedication)?		
- Pay allocable share of costs of infrastructure improvement?		

2018 Question:

7. Do you have a minimum lot size requirement? ❒ a. Yes 1 ❒ b. No 2 *(If "No," skip to question 8.)*

7A. If "Yes," do you have the same minimum lot size requirement across the entire jurisdiction?

❒ a. Yes 1 ❒ b. No 2

7B. If you have any minimum size requirement, what is the largest minimum requirement? (*Check only one.)*

❒ Less than ½ acre 1 ❒ ½ to 1 acre 2 ❒ 1 to under 2 acres 3 ❒ 2 acres or more 4

We redefine the 2006 DRI to be in the same terms as the 2018 DRI, which is listed below. We can do this due to the similarity of the questions. We constructed the new Density Restriction Index as follows:

DRI_i=0 if there is no minimum lot size regulation anywhere in the jurisdiction
DRI_i=1 if there is a minimum, but it is no larger than 0.5 acres
DRI_i= 2 if there is a minimum, and the largest one is from 0.5-1.0 acre
DRI_i= 3 if there is a minimum, and the largest one is from 1.0-2.0 acres
DRI_i= 4, if there is a minimum, and the largest one is for more than 2 acres

Comparing the Open Space Index (OSI), Exactions Index (EI), and Affordable Housing Index (AHI):

2006 Question:

6. To build, do developers have to meet these requirements?

	Yes	No
- Meet the minimum lot size requirement? If yes: ½ acre or more________ ½ acre or less ________ 1 acre or more________ 2 acres or more _______		
- Include "affordable housing" (however defined)?		
- Supply mandatory dedication of space or open space (or fee in lieu of dedication)?		
- Pay allocable share of costs of infrastructure improvement?		

2018 Question:

9. Do developers have to comply with any of the following requirements to build in your jurisdiction?

	Yes	No
a. Include affordable housing, however defined, in their projects	❐ 1	❐ 2
b. Supply mandatory dedication of space or open space (or fee in lieu of dedication)	❐ 1	❐ 2
c. Pay impact fees (allocable share of costs of infrastructure improvement)	❐ 1	❐ 2

Year	Component	Variable Long Name	Definition	Code	Source
2006/2018	OSI	Supply Open Space	Response indicating that developers are required to supply mandatory dedication of open space, or open space, or a fee in lieu of dedication in order to build.	Recoded as: 0= no, 1 = yes	Question 6 / Question 9b of survey
2006/2018	EI	Pay Costs of Improvement	Response indicating that developers are required to pay allocable share of costs of infrastructure improvement in order to build.	Recoded as: 0= no, 1 = yes	Question 6 / Question 9c of survey
2006	affordable	Affordable housing requirement		Recoded as: 0= no, 1 = yes	Question 6
2018	AHI	Affordable Housing	Response indicating that developers are required to include affordable housing, however defined, in their projects in order to build.	Recoded as: 0= no, 1 = yes	Question 9a of survey

Comparing the Approval Delay Index (ADI):

2006 Question:

10. What is the current length of time required to complete the review of residential projects in your community?

For single-family units:________months For multi-family units:________months

12. What is the typical amount of time between application for rezoning and issuance of a building permit for development of:

	Less than 3 mos.	3 to 6 mos.	7 to 12 mos.	13 to 24 mos.	If above 24, How long?
- Less than 50 single family units					
- 50 or more single family units					
- Multi-family units					

13. What is the typical amount of time between application for subdivision approval and the issuance of a building permit (assume proper zoning is already in place) for the development of:

	Less than 3 mos.	3 to 6 mos.	7 to 12 mos.	13 to 24 mos.	If above 24, How long?
- Less than 50 single family units					
- 50 or more single family units					
- Multi-family units					

2018 Question:

16. What is the current length of time required to complete the review of a "by-right" (permitted under current rules) residential project? *(For both rows, enter a number OR check the box on the right.)*

	1 Length of time in months	2 We do not have this type of unit
a. Single-family units		❐ 1
b. Multi-family units		❐ 1

17. What is the current length of time required to complete the review of a "not by-right" (i.e., would require an exemption to current rules) residential project? (For both rows, enter a number OR check the box on the right.)

	1 Length of time in months	2 We do not have this type of unit
a. Single-family units		❐ 1
b. Multi-family units		❐ 1

20. What is the typical amount of time between application for rezoning and issuance of a building permit for development of:

Unit Type	We do NOT have this unit	Less than 3 months	3 to 6 months	7 to 12 months	1 to 2 years	2 to 3 years	Over 3 years
a. Less than 50 single-family units	❐ 1	❐ 2	❐ 3	❐ 4	❐ 5	❐ 6	❐ 7
b. 50 or more single-family units	❐ 1	❐ 2	❐ 3	❐ 4	❐ 5	❐ 6	❐ 7
c. Multi-family units	❐ 1	❐ 2	❐ 3	❐ 4	❐ 5	❐ 6	❐ 7

22. What is the typical amount of time between application for <u>subdivision approval</u> and issuance of a building permit for development of:

Unit Type	We do NOT have this unit	Less than 3 months	3 to 6 months	7 to 12 months	1 to 2 years	2 to 3 years	Over 3 years
a. Less than 50 single-family units	❒ 1	❒ 2	❒ 3	❒ 4	❒ 5	❒ 6	❒ 7
b. 50 or more single-family units	❒ 1	❒ 2	❒ 3	❒ 4	❒ 5	❒ 6	❒ 7
c. Multi-family units	❒ 1	❒ 2	❒ 3	❒ 4	❒ 5	❒ 6	❒ 7

We constructed the new Approval Delay Index as follows:

$$ADI_{i,2006} = [(\text{time\_sfu} + \text{time\_mfu})/2 + (\text{time1\_l50sfu} + \text{time1\_m50sfu} + \text{time1\_mfu})/3 + (\text{time2\_l50sfu} + \text{time2\_m50sfu} + \text{time2\_mfu})/3]/3$$

$$\text{ADI} = \{((\text{sfprojrev} + \text{mfprojrev})/2) + ((\text{nsfprojrev} + \text{nmfprojrev})/2) + ((\text{sfl50} + \text{sfm50} + \text{mf})/3) + ((\text{subsfl50} + \text{subsfm50} + \text{submf})/3)\}/4$$

Comparing the Local Project Approval Index (LPAI):

2006 Question:

3. Which of the following are required to approve a new project that does not need rezoning, and by what vote?

	Yes	Yes, by simple majority	Yes, by more than simple majority	No
- Planning Commission				
- Local Council, Managers, Commissioners				
- County Board				
- Environmental Review Board				
- Public Health Office				
- Design Review Board				

2018 Question:

4. Which of the following are required to approve residential land-use changes?

Required: Organization is used for any residential land-use changes.
Not Required: If it is not used for that purpose OR does not exist in your community.
Supermajority Required: Any circumstance exists where approval requires more than a simple majority.

For projects that do not require rezoning, i.e., allowed "by-right": *(Check one per row)*

	Required	Supermajority Required	Not Required
a. Local Planning Commission	❐ 1	❐ 2	❐ 3
b. Local Zoning Board	❐ 1	❐ 2	❐ 3
c. Local Council, Managers, Commissioners	❐ 1	❐ 2	❐ 3
d. County Board of Commissioners	❐ 1	❐ 2	❐ 3
e. County Zoning Board	❐ 1	❐ 2	❐ 3
f. Environmental Review Board	❐ 1	❐ 2	❐ 3
g. Town Meeting	❐ 1	❐ 2	❐ 3
h. Public Health Office	❐ 1	❐ 2	❐ 3
i. Design Review Board	❐ 1	❐ 2	❐ 3
j. Other	❐ 1	❐ 2	❐ 3

4A: If you checked "Other" above, please specify: ____

$$LPAI \ does \ not \ change \ for \ 2006$$

$$LPAI_{i,2018} = LocalPlan_i + LocCouncil_i + CountyComm_i + Environ_i + PubHealth_i + Design_i$$

Comparing the Local Zoning Approval Index (LZAI):

2006 Question:

2. Which of the following are required to approve zoning changes, and by what vote?

	Yes	Yes, by simple majority	Yes, by more than simple majority	No
- Local Planning commission				
- Local Zoning Board				
- Local Council, Managers, Commissioners				
- County Board of Commissioners				
- County Zoning Board				
- Environmental Review Board				

2018 Question:

For projects that do require rezoning (i.e., rezoning or a variance): ***(Check one per row)***

	Required	Supermajority Required	Not Required
k. Local Planning Commission	❒ 1	❒ 2	❒ 3
l. Local Zoning Board	❒ 1	❒ 2	❒ 3
m. Local Council, Managers, Commissioners	❒ 1	❒ 2	❒ 3
n. County Board of Commissioners	❒ 1	❒ 2	❒ 3
o. County Zoning Board	❒ 1	❒ 2	❒ 3
p. Environmental Review Board	❒ 1	❒ 2	❒ 3
q. Town Meeting	❒ 1	❒ 2	❒ 3
r. Public Health Office	❒ 1	❒ 2	❒ 3
s. Design Review Board	❒ 1	❒ 2	❒ 3
t. Other	❒ 1	❒ 2	❒ 3

4B: If you checked “Other” above, please specify:

____

8.2 Additional Specifications

8.2.1 Shows that the interaction term between the change in the WRLURI and the homeowner share is insignificant, when using the percentage change in the HPI that is aggregated from census tract data with the housing stock as a weight.

```
Linear regression                               Number of obs     =        625
                                                F(18, 406)        =      15.44
                                                Prob > F          =     0.0000
                                                R-squared         =     0.2681
                                                Root MSE          =     15.572

                             (Std. err. adjusted for 407 clusters in fips_county)
```

delta_HPI	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
delta_WRLURI	-1.156246	3.772773	-0.31	0.759	-8.572855	6.260363
pop_total_2006	6.18e-06	9.30e-06	0.66	0.507	-.0000121	.0000245
delta_pop	.6797012	.094334	7.21	0.000	.4942572	.8651452
median_hh~2006	-.00015	.0000664	-2.26	0.024	-.0002806	-.0000194
delta_income	.2688832	.0633285	4.25	0.000	.1443906	.3933758
median_ye~2006	-.1746073	.0625152	-2.79	0.005	-.2975012	-.0517133
pct_nonwh~2006	-.0191044	.0674177	-0.28	0.777	-.1516357	.1134269
pct_colle~2006	.0739534	.0762409	0.97	0.333	-.0759228	.2238297
unemploym~2006	-1.412537	.2382299	-5.93	0.000	-1.880855	-.9442186
pct_owner~2006	-.0925925	.0954249	-0.97	0.332	-.2801811	.0949962
pct_hou~t_2006	-.4118502	.0915247	-4.50	0.000	-.5917717	-.2319286
pct_urban~2000	.0349455	.0667551	0.52	0.601	-.0962833	.1661744
c.delta_WRLURI#c.pct_owner~2006	.0380574	.0545747	0.70	0.486	-.069227	.1453417
ARS_place_ro~d						
2	.089894	1.834224	0.05	0.961	-3.515868	3.695656
3	.476785	2.889367	0.17	0.869	-5.203203	6.156773
4	7.171359	3.299334	2.17	0.030	.6854482	13.65727
5	1.813001	4.027318	0.45	0.653	-6.103998	9.73
6	4.721449	5.605747	0.84	0.400	-6.298463	15.74136
_cons	355.572	121.5182	2.93	0.004	116.6886	594.4554

8.2.2 Shows that the interaction term between the change in the WRLURI and the vacancy rate is insignificant, when using the percentage change in the HPI that is aggregated from census tract data with the housing stock as a weight.

```
Linear regression                                   Number of obs     =        624
                                                    F(18, 405)        =      14.88
                                                    Prob > F          =     0.0000
                                                    R-squared         =     0.2676
                                                    Root MSE          =     15.589

                                         (Std. err. adjusted for 406 clusters in fips_county)
```

delta_HPI	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
delta_WRLURI	1.257589	1.187693	1.06	0.290	-1.077224	3.592401
pop_total_2006	6.09e-06	9.24e-06	0.66	0.510	-.0000121	.0000243
delta_pop	.6832488	.0941978	7.25	0.000	.498071	.8684266
median_hh_income_2006	-.0001509	.0000662	-2.28	0.023	-.000281	-.0000208
delta_income	.2679666	.0631849	4.24	0.000	.1437553	.3921779
median_year_built_2006	-.1771513	.0626793	-2.83	0.005	-.3003686	-.053934
pct_nonwhite_2006	-.0204575	.0670804	-0.30	0.761	-.1523267	.1114116
pct_college_degree_2006	.0736377	.0761755	0.97	0.334	-.0761111	.2233865
unemployment_rate_2006	-1.414187	.2376326	-5.95	0.000	-1.881334	-.9470395
pct_owner_occ_2006	-.0919007	.0953679	-0.96	0.336	-.2793786	.0955773
pct_housing_vacant_2006	-.415983	.0910678	-4.57	0.000	-.5950077	-.2369583
pct_urban_pop_2000	.0457048	.0693678	0.66	0.510	-.0906611	.1820706
c.delta_WRLURI#c.pct_housing_vacant_2006	.0111959	.0808049	0.14	0.890	-.1476534	.1700452
ARS_place_round						
2	.0487694	1.847786	0.03	0.979	-3.58368	3.681219
3	.495167	2.935236	0.17	0.866	-5.275033	6.265367
4	7.211604	3.316221	2.17	0.030	.6924489	13.73076
5	1.870875	4.016061	0.47	0.642	-6.024053	9.765802
6	4.880419	5.588468	0.87	0.383	-6.105607	15.86645
_cons	359.5617	121.8771	2.95	0.003	119.971	599.1525

8.2.3 Shows that the interaction term between the change in the WRLURI and the vacancy rate is insignificant, when using the percentage change in the HPI that is county-level data match to municipality-level data.

```
Linear regression                               Number of obs     =        633
                                                F(18, 410)        =      15.26
                                                Prob > F          =     0.0000
                                                R-squared         =     0.2501
                                                Root MSE          =     14.748

                                      (Std. err. adjusted for 411 clusters in fips_county)
```

delta_HPI_county	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
delta_WRLURI	1.528314	1.167825	1.31	0.191	-.7673579	3.823985
pop_total_2006	3.64e-06	9.40e-06	0.39	0.699	-.0000148	.0000221
delta_pop	.6162222	.0775343	7.95	0.000	.4638079	.7686365
median_hh_income_2006	-.0001022	.000094	-1.09	0.278	-.000287	.0000826
delta_income	.2178282	.0601084	3.62	0.000	.099669	.3359874
median_year_built_2006	-.1289506	.0591462	-2.18	0.030	-.2452183	-.0126829
pct_nonwhite_2006	-.0351489	.058668	-0.60	0.549	-.1504766	.0801787
pct_college_degree_2006	-.1027986	.0789706	-1.30	0.194	-.2580365	.0524393
unemployment_rate_2006	-1.340902	.2339583	-5.73	0.000	-1.800809	-.8809942
pct_owner_occ_2006	-.0995452	.0869553	-1.14	0.253	-.2704789	.0713886
pct_housing_vacant_2006	-.385436	.0964184	-4.00	0.000	-.5749721	-.1959
pct_urban_pop_2000	.005038	.0628566	0.08	0.936	-.1185234	.1285994
c.delta_WRLURI#c.pct_housing_vacant_2006	-.0104002	.0821333	-0.13	0.899	-.1718551	.1510546
ARS_place_round						
2	-.1712205	1.858539	-0.09	0.927	-3.824674	3.482233
3	1.108401	2.979827	0.37	0.710	-4.749243	6.966045
4	5.425568	3.387073	1.60	0.110	-1.232628	12.08376
5	2.864475	4.774737	0.60	0.549	-6.521545	12.2505
6	11.30346	8.115674	1.39	0.164	-4.650063	27.25698
_cons	269.9397	115.3154	2.34	0.020	43.25654	496.6228

8.2.4 Shows that the adjusted change in WRLURI was not significant using percentage change in the HPI that is aggregated from census tract data with the housing stock as a weight.

```
Linear regression                               Number of obs     =        382
                                                F(17, 285)        =       8.96
                                                Prob > F          =     0.0000
                                                R-squared         =     0.2095
                                                Root MSE          =      15.34

                                   (Std. err. adjusted for 286 clusters in fips_county)
```

delta_HPI	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
adjusted_delta_WRLURI	.6029098	1.013634	0.59	0.552	-1.392249	2.598069
pop_total_2006	-6.54e-06	4.85e-06	-1.35	0.179	-.0000161	3.01e-06
delta_pop	.5104815	.1003285	5.09	0.000	.3130027	.7079603
median_hh_income_2006	-.0001177	.0000959	-1.23	0.221	-.0003064	.0000711
delta_income	.2220384	.0724571	3.06	0.002	.0794193	.3646574
median_year_built_2006	-.1965883	.0841116	-2.34	0.020	-.3621471	-.0310296
pct_nonwhite_2006	-.0128579	.0837706	-0.15	0.878	-.1777455	.1520298
pct_college_degree_2006	.0255691	.0883194	0.29	0.772	-.1482719	.1994102
unemployment_rate_2006	-1.497456	.2921001	-5.13	0.000	-2.072403	-.9225087
pct_owner_occ_2006	-.1137918	.1184353	-0.96	0.337	-.3469106	.1193271
pct_housing_vacant_2006	-.4309848	.1147538	-3.76	0.000	-.6568574	-.2051122
pct_urban_pop_2000	.0628435	.1042201	0.60	0.547	-.1422953	.2679822
ARS_place_round						
2	-.084534	2.290864	-0.04	0.971	-4.593693	4.424625
3	3.551622	3.777011	0.94	0.348	-3.882755	10.986
4	4.561376	4.570171	1.00	0.319	-4.434195	13.55695
5	6.45541	3.914108	1.65	0.100	-1.248817	14.15964
6	-1.272969	5.578991	-0.23	0.820	-12.25422	9.708285
_cons	398.3269	164.0317	2.43	0.016	75.45963	721.1942

8.2.5 Shows that the adjusted change in WRLURI was not significant using percentage change in the HPI that is county-level data match to municipality-level data.

```
Linear regression                               Number of obs     =        387
                                                F(17, 288)        =       9.06
                                                Prob > F          =     0.0000
                                                R-squared         =     0.2124
                                                Root MSE          =     14.761

                                   (Std. err. adjusted for 289 clusters in fips_county)
```

delta_HPI_county	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
adjusted_delta_WRLURI	.6183291	.8523765	0.73	0.469	-1.059348	2.296007
pop_total_2006	-7.77e-06	5.38e-06	-1.45	0.149	-.0000184	2.81e-06
delta_pop	.534347	.0985782	5.42	0.000	.3403219	.7283721
median_hh_income_2006	-.0000956	.0001422	-0.67	0.502	-.0003754	.0001842
delta_income	.1696974	.0656944	2.58	0.010	.0403954	.2989994
median_year_built_2006	-.1894447	.0765936	-2.47	0.014	-.3401988	-.0386905
pct_nonwhite_2006	-.0215568	.0776625	-0.28	0.782	-.1744147	.1313012
pct_college_degree_2006	-.1189765	.0926754	-1.28	0.200	-.3013835	.0634305
unemployment_rate_2006	-1.574782	.2914668	-5.40	0.000	-2.148457	-1.001106
pct_owner_occ_2006	-.1125943	.1222316	-0.92	0.358	-.3531749	.1279863
pct_housing_vacant_2006	-.4092996	.1233855	-3.32	0.001	-.6521513	-.166448
pct_urban_pop_2000	-.0088779	.0862734	-0.10	0.918	-.1786844	.1609285
ARS_place_round						
2	-.0978041	2.219635	-0.04	0.965	-4.466568	4.27096
3	3.082138	3.734059	0.83	0.410	-4.26737	10.43164
4	4.679815	4.742406	0.99	0.325	-4.654356	14.01399
5	8.401135	5.671055	1.48	0.140	-2.760835	19.5631
6	1.613933	6.573882	0.25	0.806	-11.32501	14.55288
_cons	393.3641	149.5006	2.63	0.009	99.11182	687.6164

8.3 The Shrubman

Early on a bitter February morning in 2001, John Thoburn stirred from his fitful sleep as guards shouted for breakfast. The economics graduate and business owner found himself sharing a cramped day room with nine other inmates – mostly drug dealers and fathers who had failed to pay child support. They couldn't believe this clean-cut golf range owner had landed in their midst. But there he sat in Fairfax County Jail facing more time behind bars than many of his cellmates, separated from his wife and three young sons who had fled to Texas to avoid prosecution. His fellow inmates called him "Shrubman," a reference to the landscaping dispute that had landed the man behind bars.

In 1984, the Thoburn family tried to develop 115 and a half acres of land between Tysons Corner and Dulles International Airport from residential to commercial use. They hoped to build an office park that would eventually be connected to a future metro station. The land is located north of the Dulles Toll Road and separated down the middle by Hunter Mill Road, placing it at a strategic intersection. Many in the neighborhood wanted to preserve the rural feel of Fairfax County and were fearful of any commercial development near their neo-colonial homes on large lots, leading to the Thoburns' proposal being rejected. Some of the most vocal critiques were from members of the Hunter Mill Defense League, a group that aimed to "maintain Hunter Mill Road as a tranquil, residential byway."[5] In 1989, John Thoburn's father relocated his private Christian school to Hunter Mill Road, sparking more skepticism from neighbors who suspected the school was not merely about education but rather a tactical step toward eventual commercial development.

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[5] "Home." *Historical Marker Database Locator*, hmdl.site/. Accessed 28 Apr. 2025.

In 1992, John Thoburn made what appeared to be a community-minded choice for his property on Hunter Mill Road. Although he possessed the legal right to develop residential housing on the land, he instead proposed a 46 acre lower-impact recreational facility featuring a nine-hole golf course, batting cages, and a driving range. This decision, however, faced opposition from local groups, particularly the Hunter Mill Defense League, who expressed concerns that the development might set a precedent for future commercial zoning in the area. Despite these objections, Thoburn succeeded in opening his facility in 1997, though with limited approval that permitted only the driving range portion of his planned development. The facility was situated across the street from his father's school. Figure 8.3.1 shows the property.

The opening of the facility marked the beginning of Thoburn's troubles. The restrictions Thoburn encountered seemed to defy common sense and practical business operations. For instance, while modern stereo systems were permitted, jukeboxes were explicitly prohibited. He was allowed to have a "snack food concession," which, according to the county, meant he was allowed to sell pre-packaged roast beef sandwiches but forbidden from warming up a hot dog. He could sell a Coca-Cola if it came in a bottle or can but pour that same beverage into a cup and suddenly, he was violating county ordinances. Thoburn believed these seemingly arbitrary restrictions were motivated by anti-competitive practices, noting that the county's own golf facilities operated free from these same regulations.[6]

[6] https://web.archive.org/web/20010720012232/http://freejohnthoburn.com/

Figure 8.3.1: Map of the property.[7]

In 1994, as part of the agreement to open his golf facility, John Thoburn invested approximately $125,000 to plant more than 700 trees, which the county initially approved.[8] However, the county later demanded additional landscaping changes, including the replanting of 98 previously approved trees – some requiring moves of just three feet. The dispute extended to a constructed berm at 365 feet, which faced contradictory county assessments: first deemed too

[7] *Google Earth.* Google, https://earth.google.com/web/@38.9506921,-77.30925154,101.95389794a,1034.49645392d,35y,1.1552385h,0t,0r/data=ChYqEAgBEgoyMDAyLTA0LTMwGAFCAggBOgMKATBCAggASg0I____________ARAA. Accessed 28 Apr. 2025.

[8] https://www.deseret.com/2001/5/25/19588063/man-who-balked-at-tree-planting-is-freed-from-jail/

low, then too high, before finally being declared acceptable without any actual modifications. Despite no changes being made, the county imposed $24,500 in fines.[9]

The conflict reached its peak on February 16, 2001, when John Thoburn faced a critical choice: either comply with the tree and shrub requirements or cease operations. When Thoburn maintained that he lacked the financial means to implement these changes and argued against the wasteful nature of replanting, the county's response was severe. He was found in contempt of court and incarcerated – a remarkable outcome for a dispute centered around 270 trees and shrubs. His wife fled to Texas along with their three children to avoid joining her husband.

During Thoburn's incarceration, his family continued operating the driving range while launching a nationwide campaign for his release. Support poured in from across the country, with donors contributing to his legal defense and thousands sending emails to county officials demanding his freedom - some messages carrying threatening overtones. Speaking to Fox News, Thoburn declared, "I'm here in jail for the right to operate my business on my property. . . It's private property. I'm defending property rights."[10]

The county ultimately released Thoburn after 97 days, opting to plant the trees themselves and bill him for the work. While the judge maintained the case was "simply about obeying the law," he concluded that further punishment would serve no purpose. Thoburn viewed the outcome differently: "It's a victory; they didn't succeed in closing my business. Nothing's different except Fairfax County's attorneys asked me to be released, where before they asked I be sent to jail. I think they were too embarrassed to keep me another day." The county charged him $500 for each day of his imprisonment, resulting in a $48,500 bill.[11]

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[9] https://www.foxnews.com/story/zoning-board-gives-golf-range-owner-the-birdie
[10] Ibid.
[11] https://www.deseret.com/2001/5/25/19588063/man-who-balked-at-tree-planting-is-freed-from-jail/

When the county came around to plant the trees, they brought a state trooper with a shotgun. Despite all of the grandstanding about “following the law,” the county failed to follow their own zoning requirements, using shorter trees and placing them in positions that Thoburn claimed deliberately interfered with his business operations. When he pointed out this discrepancy, the county dismissed the concern, stating that “exact precision” wasn’t necessary and that the height difference wasn’t “materially significant,” a stark contrast to their strict enforcement against Thoburn himself.[12]

The story of the Thoburn properties ended with the Great Recession, which ultimately forced the driving range to shut its doors in 2015. The family dispersed with John Thoburn relocated to Wisconsin while the private Christian school moved to Loudoun County. Members of the Hunter Mill Defense League, their longtime adversaries, expressed regret at seeing them depart, fearing the inevitable redevelopment in the future by the new owners. Much of the contested land now lies abandoned and overgrown. The family’s original vision of commercial development never materialized. Instead, the office park and metro station they had envisioned were constructed two miles down the Dulles Toll Road, leaving behind empty lots as a silent testimony to what could have been. [13]

The case of John Thoburn illustrates the human impact of land-use regulations. While empirical analysis, such as that conducted throughout this paper, often abstracts regulatory impacts into coefficients and statistical relationships, Thoburn’s experiences highlight the real-world consequences that stringent and sometimes arbitrary land-use policies can impose on property owners. It exemplifies how local political dynamics and homeowner-driven interests,

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[12] https://heartland.org/opinion/shrub-man-out-of-jail/
[13] Source: My family.

captured theoretically by the Homevoter Hypothesis, manifests itself through organizations such as the Hunter Mill Defense League, sometimes resulting in severe personal and economic costs.