Zone Defense: Why Liberal Cities Build Fewer Houses

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Abstract

In this paper, I investigate a puzzling feature of American urban politics: cities with more liberal residents tend to permit fewer new housing units each year than similar conservative cities. Empirically, I show that this relationship is not attributable to differences in income, demographics, geography, or characteristics of the housing stock. To help explain this puzzle, I develop a formal model of municipal zoning policy. In this model, liberal cities are characterized by generous levels of public goods spending. This, in turn, attracts new households, who have an incentive to construct inexpensive housing. If permitted to do so, the added property tax revenue from these new households would be insufficient to cover their share of public spending. In a spatial sorting equilibrium, any city that offers generous public goods spending must also enact restrictive zoning to defend it.

1 Introduction

This paper is motivated by a puzzling feature of contemporary American urban politics. In the decade since the Great Recession, home prices have once again reached record highs in cities across the United States. But the cities with the most acute housing affordability problems are overwhelming liberal, while conservative cities remain quite affordable by comparison. Figure 1 illustrates this stylized fact: cities that voted for Obama in 2008 tend to have more expensive housing relative to their median income. The average home in Mesa, Arizona costs three years of the median household's income, while in San Francisco, that figure is closer to ten years.

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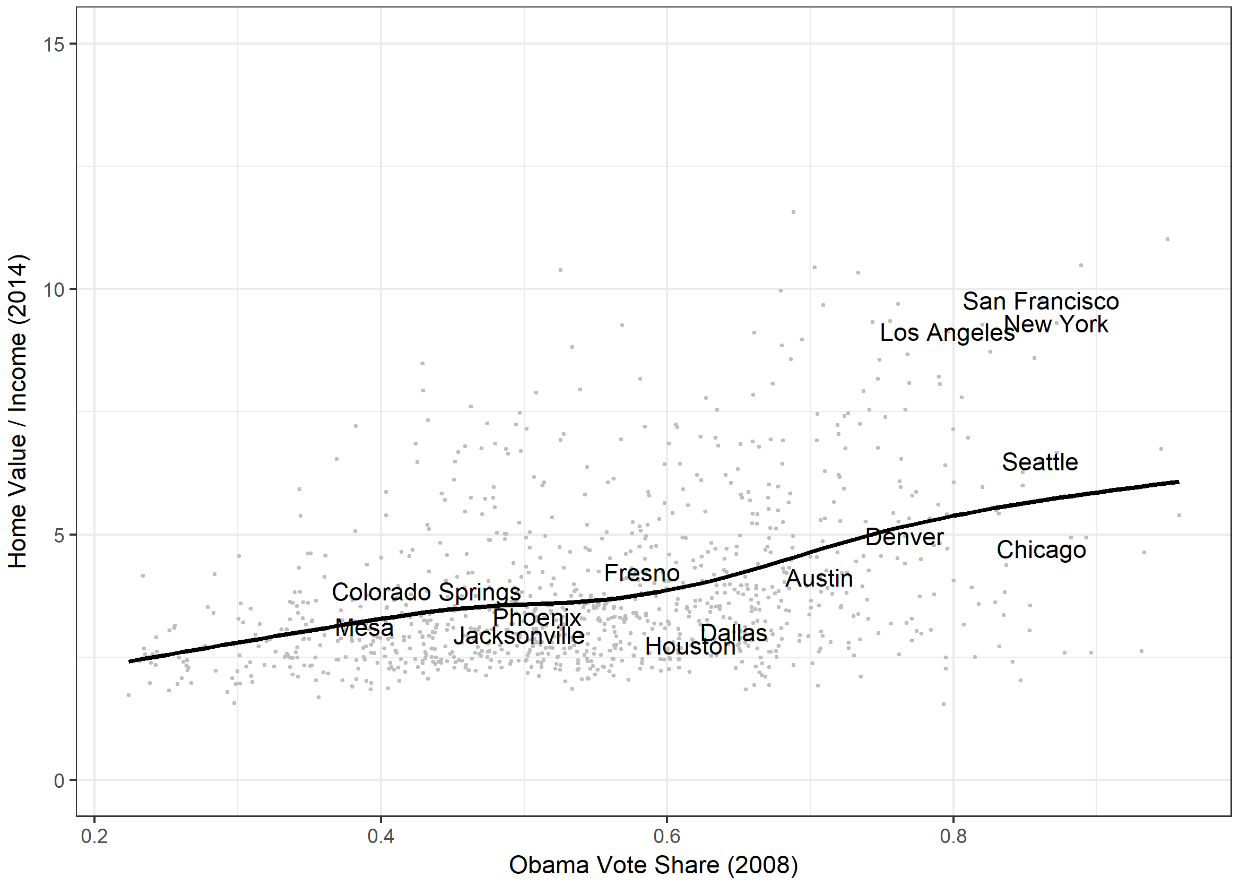

Figure 1: Median home value, as a fraction of median income, is higher on average in liberal cities. Sample consists of all US cities with a population greater than 10,000 (shrinking cities excluded). Solid line is a moving average, with select cities labeled.

There are, of course, a large set of confounding factors that might explain this pattern: liberal cities tend to be coastal, more historic, have higher incomes, have more educated residents, and less available land for housing development, all of which tend to increase home prices. But in this paper's empirical analysis, I show that these confounding factors alone cannot fully explain the home price difference between liberal and conservative cities. Instead, this effect appears attributable to differences in housing supply elasticity: liberal city governments permit fewer new housing units when faced with increasing demand, and they impose more stringent zoning regulations on new residential development.

The ill effects of such regulations are, at this point, well-documented. Because home prices must rise when increasing demand for housing is not met by increasing supply, the most regulated US cities tend to have higher rents than we would expect from construction costs and wages alone (Glaeser & Gyourko 2003, Quigley & Raphael 2005). In turn, these excess housing costs can have profound effects on the broader economy. For one, they slow economic growth by pricing workers out of cities where they would be most productive. One estimate suggests that easing housing restrictions in the three most productive US cities alone would increase GDP by roughly 9.5% (Hsieh & Moretti 2015). Second, by pricing poorer households out of more affluent areas, growth control policies exacerbate residential segregation, both by race (Rothwell & Massey 2009) and by income (Rothwell & Massey 2010). Such segregation has been shown to affect civic participation (Oliver 1999), public goods provision (Alesina et al. 1999, Trounstine 2015), and even life expectancy (Chetty et al. 2016). Third, density restrictions in central cities promote suburban sprawl, which increases both commuting costs and carbon emissions (Glaeser & Kahn 2010). Finally, such restrictions may contribute to widening income inequality. Rognlie (2015) finds that the increase in capital's share of income since 1948 can be attributed *entirely* to an increase in the return to housing, something that could not have occurred if the housing supply were more flexible over that period.

Why then, do liberal cities implement more restrictive zoning than their conservative counterparts? On its face, the fact seems paradoxical, given American liberalism's emphasis on raising wages, combating segregation, reducing carbon emissions, and promoting public transit.

To help explain this puzzle, I develop a formal model of municipal zoning. Agents in the model consume three types of goods: public goods, housing, and non-housing private goods. City governments tax housing and supply public goods. Liberal agents place a higher value on public goods relative to private consumption, and seek out municipalities that tax and spend generously. However, in a world with free migration, cities with generous public spending tend to attract low-income households. If these new migrants are permitted to construct inexpensive housing, then the property tax revenue they contribute would be insufficient to cover their share of public services. This provides liberal cities with an incentive to impose restrictive zoning policies, mandating that newcomers consume some minimum amount of housing in order to live in the jurisdiction.

The paper proceeds in five parts. In the next section, I provide a brief introduction to municipal zoning policies, and review the existing explanations in the literature for their existence. In section three, I develop the formal model, and in section four I present my empirical analysis, demonstrating that liberal cities issue fewer new building permits, have more expensive housing, and score higher on a survey-based measure of land use regulation. Section five concludes.

2 Municipal Zoning: Background

Residential construction in the United States is heavily regulated by municipal governments. Zoning authority, upheld as constitutional by the landmark 1926 Supreme Court case *Euclid v. Ambler*, grants municipal governments broad discretion to regulate land use within their boundaries. This zoning power takes many forms. The most common is Euclidean zoning, which divides the entire municipality into zones, within which there is a single permitted land use (e.g. residential, commercial, industrial).[1] This separation of uses, de rigeur among mid-century urban planners, has largely fallen out of fashion of late, but nearly all US municipal governments maintain some form of Euclidean zoning.

Even cities without explicit Euclidean zoning codes retain many of its features. Other forms of land use regulation include permit limits, open space requirements, minimum lot sizes, setback requirements, parking minimums, and building height restrictions. Houston, for example, is notable for being the only major American city without a Euclidean zoning code. Nevertheless, the city strictly regulates residential land use, requiring minimum lot sizes, setbacks, and off-street parking for all new residential developments. These regulations have promoted a sprawling, auto-dependent pattern of residential development (Lewyn 2005).

Why do municipal governments enact these policies restricting new housing growth? This question is itself puzzling, especially in light of much of the foundational work in American urban politics. Molotch (1976) famously describes the city as a "growth machine", a political entity whose principal aim is to promote business interests through population growth. Broadly speaking, there are three prominent explanations in the literature for the widespread prevalence of municipal zoning.

In the urban economics literature, zoning regulations are often depicted as a form of benevolent urban planning. Euclidean zoning can separate polluting industries from residential areas, improving public health. Unplanned urban growth produces negative externalities like traffic congestion, environmental degradation, loss of historic buildings, and crowding of natural amenities. Given these externalities, a local government can increase social welfare within its boundaries by limiting the rate of population growth (Cooley & LaCivita 1982, Brueckner 1990).

[1] A common misconception is that the name "Euclidean zoning" is an homage to Euclid the ancient Greek geometrician. It is actually a reference to the town of Euclid, Ohio, whose pioneering zoning code was the subject of the aforementioned Supreme Court case. In a twist on the twist, however, the town of Euclid was itself named for Euclid the mathematician after it was settled by Case Western Reserve cartographers in the 1700s. So the original misconception is, in a way, partly correct (Wolf 2008).

The most prominent political economy explanation for restrictive zoning policies is the "Homevoter Hypothesis" (Fischel 2001), which views zoning as a means through which homeowners can insure the value of their property. For many Americans, a house is the single most valuable item in their investment portfolio, it is financed heavily by debt, and its value is strongly tied to local economic shocks. Given this precarious financial situation, homeowners are likely to support public policies that protect the value of their greatest asset (Scheve & Slaughter 2001). Empirically, American homeowners are much more likely to be involved in municipal politics than renters, for whom financial security is not as closely tied to the health of the local real estate market (Dipasquale & Glaeser 1999). Although the evidence for this hypothesis is compelling, the Homevoter Hypothesis itself does not explain why liberal cities would zone more strictly than conservative cities, particularly given that conservative cities tend to have a larger share of homeowners.

Finally, there is the literature on "fiscal zoning", which motivates this paper's model. According to this theory, restrictive zoning policies arise as a response to the fiscal constraints faced by local governments. As Peterson (1981) notes, cities are inherently limited in their choice of public spending policies. Due to labor and capital mobility, redistributive transfers are particularly difficult to enact at the local level, except when there are relatively few jurisdictions (Epple & Romer 1991) or substantial sources of intergovernmental revenue (Craw 2010). Hamilton (1975) proposes a solution to this problem: if cities restrict housing development, they can increase the cost of housing in their jurisdictions, deterring entry by poor households. This allows residents to enact their preferred package of taxes and spending without concern that it will spark new migration.

Subsequent political economists have developed this hypothesis further. Brueckner (1997) argues that exactions – up-front fees paid by developers to finance local public services – are an efficient way to finance the fixed costs of new infrastructure. Ding et al. (1999) suggest that if local public goods are congestible, then instituting an urban growth boundary, a boundary beyond which development must be low-density, can increase aggregate welfare. In many municipalities, planning documents explicitly cite strains on public service provision as the reason for enacting growth controls (Molotch 1976). Empirical studies suggest that this proposed link between growth controls and citizens' preferences for public goods has merit. Gerber & Phillips (2003) find that San Diego residents are more likely to support pro-growth ballot initiatives if they result in increased local public goods provision, and that developers are more likely to finance new public goods in cities with direct democracy requirements for new housing development (Gerber & Phillips 2004). The formal model I develop in the next section proceeds from this insight.

3 The Model

3.1 Setup

The model consists of n agents and m cities. Agents are free to migrate between cities, and each agent seeks to maximize a utility function of the following form:

$$U_i = g_i^{\alpha_i} H_i^{\beta_i} c_i^{1-\alpha_i-\beta_i} \tag{1}$$

where g_i denotes public goods consumption, H_i is housing consumption, and c_i is consumption of non-housing private goods.[2] The parameters β_i and α_i denote agent i's ideal share of spending on housing and public goods, respectively. We can think of the α_i parameter as an agent's "liberalism": agents with higher α are more willing to forego private consumption in exchange for public goods.

Each city taxes housing consumption and supplies public goods, the value of which is divided equally among city residents. Rewriting equation 1 yields the following utility for agent i living in city j:

$$U_{ij} = \left(t_j \bar{H}_j\right)^{\alpha_i} H_i^{\beta_i} \left(y_i - t_j H_i - H_i\right)^{1-\alpha_i-\beta_i} \tag{2}$$

where t_j is the tax rate in city j, $\bar{H}_j$ is average housing consumption of residents in city j, and y_i is agent i's pre-tax income.

Upon moving to a new jurisdiction, agent i chooses its optimal level of housing consumption, taking the city's current tax and spending policies as fixed. Solving the first order condition yields this optimal H_i^*.

$$\begin{aligned}\frac{\partial U_i}{\partial H_i} = &\left(t_j \bar{H}_j\right)^{\alpha_i} \beta_i H_i^{\beta_i - 1} \left(y_i - t_j H_i - H_i\right)^{1-\alpha_i-\beta_i} \\ &+ \left(t_j \bar{H}_j\right)^{\alpha_i} H_i^{\beta_i} (1-\alpha_i-\beta_i)(-1-t_j) \left(y_i - t_j H_i - H_i\right)^{-\alpha_i-\beta_i} = 0\end{aligned}$$

$$\left(1+t_j\right)\left(1-\alpha_i-\beta_i\right) H_i = \beta_i \left(y_i - t_j H_i - H_i\right)$$

$$H_i^* = \frac{\beta_i y_i}{(1-\alpha_i)(1+t_j)} \tag{3}$$

[2]For the purpose of this model, housing consumption can represent either rented housing or mortgage payments by a homeowner.

Each city's tax and spending policy is determined by majority vote, setting t_j to the median voter's ideal tax rate (equation 4).

$$\frac{\partial U_i}{\partial t_j} = \alpha_i \bar{H}_j \left(t_j \bar{H}_j\right)^{\alpha_i - 1} H_i^{\beta_i} \left(y_i - t_j H_i - H_i\right)^{1-\alpha_i-\beta_i}$$
$$+ \left(t_j \bar{H}_j\right)^{\alpha_i} H_i^{\beta_i} (1-\alpha_i-\beta_i)(-H_i)\left(y_i - t_j H_i - H_i\right)^{-\alpha_i-\beta_i} = 0$$

$$(1-\alpha_i-\beta_i) t_j H_i = \alpha_i \left(y_i - t_j H_i - H_i\right)$$

$$t_i^* = \frac{\alpha_i (y_i - H_i)}{(1-\beta_i) H_i} \tag{4}$$

All else equal, citizens with higher α_i prefer higher taxes, as do citizens with greater disposable income $(y_i - H_i)$.

Finally, citizens also vote on whether to enact a zoning policy, represented in the model by a housing consumption floor, requiring new residents to consume some minimum amount of housing. This is the model's analogue to policies like minimum lot sizes, parking requirements, or other density restrictions that increase the amount of housing a person must consume in order to live in a jurisdiction.

3.2 An Analytic Solution

I will solve the full model with heterogeneous income and preferences computationally. But to first grasp the intuition for why liberal jurisdictions may be more willing to enact restrictive zoning policies, let us solve a simplified version of the model analytically. Suppose that every agent has identical income and preferences ($y_i = y$, $\alpha_i = \alpha$, $\beta_i = \beta$ for all i). Using this simplified model we can prove a series of propositions.

Proposition 1 *There exists a Pareto efficient outcome in which each citizen consumes* $\frac{(\alpha+\beta)y}{1+t}$ *units of housing.*

Proof of Proposition 1. When each citizen has identical income and preferences, a Benevolent Urban Planner would set a uniform H_i to maximize utility (equation 2).

$$\frac{\partial U}{\partial H} = \alpha t (tH)^{\alpha-1} H^{\beta} (y - tH - H)^{1-\alpha-\beta}$$
$$+ (tH)^{\alpha} \beta H^{\beta-1} (y - tH - H)^{1-\alpha-\beta}$$
$$+ (tH)^{\alpha} H^{\beta} (1-\alpha-\beta)(-1-t)(y - tH - H)^{-\alpha-\beta} = 0$$

$$(1+t)(1-\alpha-\beta)H = (\alpha+\beta)(y-tH-H)$$

$$H^* = \frac{(\alpha+\beta)y}{1+t} \tag{5}$$

Note that, substituting the preferred tax rate from (4) into (5) yields $H^* = \beta y$, $t^* = \frac{\alpha}{\beta}$, and $t^*H^* = \alpha y$, which is precisely the allocation of income that maximizes the Cobb-Douglas utility function. No agent can increase its utility by consuming more than H^*. And if any agent consumed less than H^*, it would harm every other agent by reducing $\bar{H}$. Therefore, this is a Pareto efficient outcome.

Proposition 2 *The social optimum is not a stable equilibrium. Agents have an incentive to consume less than the Pareto efficient quantity of housing (i.e. $H_i^* < H^*$).*

Proof of Proposition 2. We have already shown that an agent selecting its optimal housing consumption (taking $\bar{H}_j$ as fixed) will select H_i^* from equation 3. To see that this quantity is strictly less than the Pareto efficient quantity, note that $H_i^* < H^*$ is equivalent to:

$$\begin{aligned}
\frac{\beta y}{(1-\alpha)(1+t)} &< \frac{(\alpha+\beta)y}{1+t} \\
\frac{\beta}{1-\alpha} &< \alpha+\beta \\
\alpha+\beta &< 1
\end{aligned}$$

which is true by construction.

Proposition 2 implies that the Pareto efficient outcome is unattainable in equilibrium without zoning controls. New migrants (even those with identical income and preferences to incumbent households!) have an incentive to spend less than incumbent residents on housing consumption, thereby receiving proportionally more in public goods than they contribute in taxes.

The next proposition demonstrates that incumbent residents are harmed by a reduction in $\bar{H}$, and therefore have an incentive to implement a housing consumption floor. This incentive is strongest in cities with high α, where residents place a higher value on public goods consumption.

Proposition 3 *Decreasing $\bar{H}$ below H^* harms incumbent households (i.e. $\frac{\partial U}{\partial \bar{H}} > 0$), and this disutility is larger for communities with higher α (i.e. $\frac{\partial^2 U}{\partial \bar{H} \partial \alpha} > 0$).*

Proof of Proposition 3. Taking the first order condition of (2) with respect to $\bar{H}$ yields:

$$\frac{\partial U}{\partial \bar{H}} = \alpha t (t\bar{H})^{\alpha-1} H^{\beta} (y - tH - H)^{1-\alpha-\beta}$$

Substituting the values of H^* and t^* from the Pareto efficient outcome reduces this equation to:

$$\begin{aligned}\frac{\partial U}{\partial \bar{H}} &= \alpha \frac{\alpha}{\beta} (\alpha y)^{\alpha-1} (\beta y)^{\beta} \left((1-\alpha-\beta)y\right)^{1-\alpha-\beta} \\ &= \alpha^{\alpha+1}(1-\alpha-\beta)^{1-\alpha-\beta}\beta^{\beta-1}\end{aligned}$$

This expression is strictly greater than zero, implying that incumbent households would be willing to incur some cost to ensure that newcomers do not consume less than H^* units of housing. The magnitude of this marginal disutility, in turn, depends on the value of α.

$$\frac{\partial^2 U}{\partial \bar{H} \partial \alpha} = \left[\alpha^{\alpha}(\alpha + \alpha \ln \alpha + 1)(1-\alpha-\beta)^{1-\alpha-\beta} - \alpha^{\alpha+1}(1-\alpha-\beta)^{1-\alpha-\beta}(\ln(1-\alpha-\beta)+1)\right] \beta^{\beta-1}$$

This expression is positive if:

$$\begin{aligned}\alpha + \alpha \ln \alpha + 1 &> \alpha(\ln(1-\alpha-\beta)+1) \\ \ln \alpha + \frac{1}{\alpha} &> \ln(1 - 1\alpha - \beta) \\ \alpha e^{\frac{1}{\alpha}} &> 1 - \alpha - \beta\end{aligned}$$

The left hand side of this expression is strictly greater than 1 for positive values of α, and the right hand side is strictly less than 1 by construction, completing the proof.

Putting this all together, we have demonstrated two important results. First, even in a model with homogeneous income and preferences, new migrants to a city have an incentive to consume less than the Pareto efficient quantity of housing. This suggests that there is some level of "optimal zoning", which raises average housing consumption and produces a Pareto improvement relative to the noncooperative equilibrium. Second, the disutility from a decrease in average housing consumption is strongest in liberal jurisdictions, where residents place a greater value on public goods consumption. This suggests that liberal cities will be more willing to impose zoning restrictions than conservative cities, all else equal.

Experiment	y	α	β	z	n	m
1	100	0.25	0.5	Large	10,000	50
2	100	0.25	0.5	0	10,000	50
3	100	$\sim$ Uniform $(0, 0.5)$	0.5	0.15	10,000	50
4	$\sim$ Uniform $(0, 200)$	$\sim$ Uniform $(0, 0.5)$	0.5	0.15	10,000	50

Table 1: Parameter combinations for computational model experiments.

3.3 A Computational Solution

What if income and preferences are heterogeneous? Do the results we've proven above still hold? To address this question, we will solve a heterogeneous preferences version of the model computationally. The behavior of agents and city governments is identical to that described above, and the computational model proceeds as follows:

Setup.

1. Create n agents with random values of y_i, α_i, and β_i, subject to the condition that $\alpha_i + \beta_i < 1$. These parameters are uncorrelated.

2. Assign m agents to m cities. These agents are the "founders", and they set each city's initial policy to their personal optimum: $H_i = \beta_i y_i$, $t_j = \frac{\alpha_i}{\beta_i}$.

3. Let the exogenous parameter z denote the cost of implementing a zoning restriction. Each resident in the jurisdiction compares this cost against their marginal disutility from a reduction in $\bar{H}_j$. If $\frac{\partial U_i}{\partial \bar{H}_j} > z$, they vote to impose a housing consumption floor at $\bar{H}_j$. Majority rules.

Main Loop.

1. One agent is randomly selected to move.

2. The agent moves to the jurisdiction where it would receive the highest utility (taking $\bar{H}_j$ and t_j as fixed). The agent consumes housing equal to H_i^* or the minimum housing consumption floor set by that jurisdiction, whichever is largest.

3. All agents vote for their preferred tax rate and zoning policy. Each city implements the median policy preference of its residents.

The main loop executes until no agent can improve its utility by moving to a new city. To explore the behavior of the model, I conduct four computational experiments, summarized in Table 1.

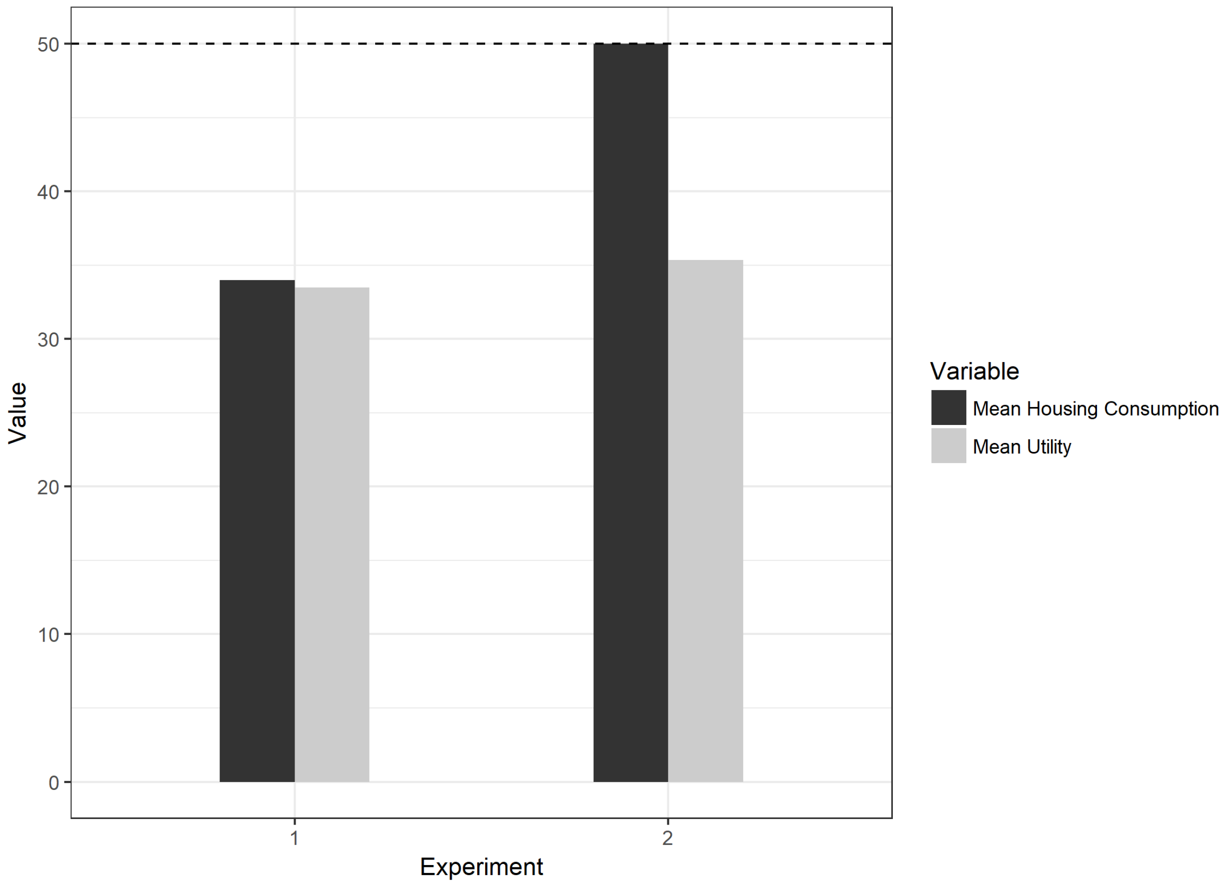

Figure 2: With homogeneous income and preferences, the computational model performs as predicted by the analytic solution. When zoning is prohibitively costly (Experiment 1), housing consumption falls below the Pareto optimum. When zoning is costless (Experiment 2), cities attain the Pareto efficient outcome. The dashed line marks the Pareto efficient level of housing consumption $H^* = \beta y$.

Experiments 1 and 2 replicate the conditions of our simplified analytic model, and it produces the expected outcomes. In Experiment 1, zoning is prohibitively costly, so no jurisdiction implements it. As a result, agents consume a quantity of housing below the Pareto optimum ($\beta y = 50$). In Experiment 2, zoning is costless, so every city implements it. This yields a Pareto improvement, as illustrated in Figure 2.

In Experiment 3, agents have heterogeneous values of α_i. As in Tiebout (1956), agents sort themselves into communities with similar values of α, seeking their preferred mix of taxation and public spending. Zoning is costly, but not prohibitively so. As a result, the cities with higher average values of α_i are more willing to bear the cost of zoning, and are therefore more likely to impose zoning restrictions. Figure 3 plots this relationship.

The relationship between mean α_i and zoning restrictions is even more pronounced when

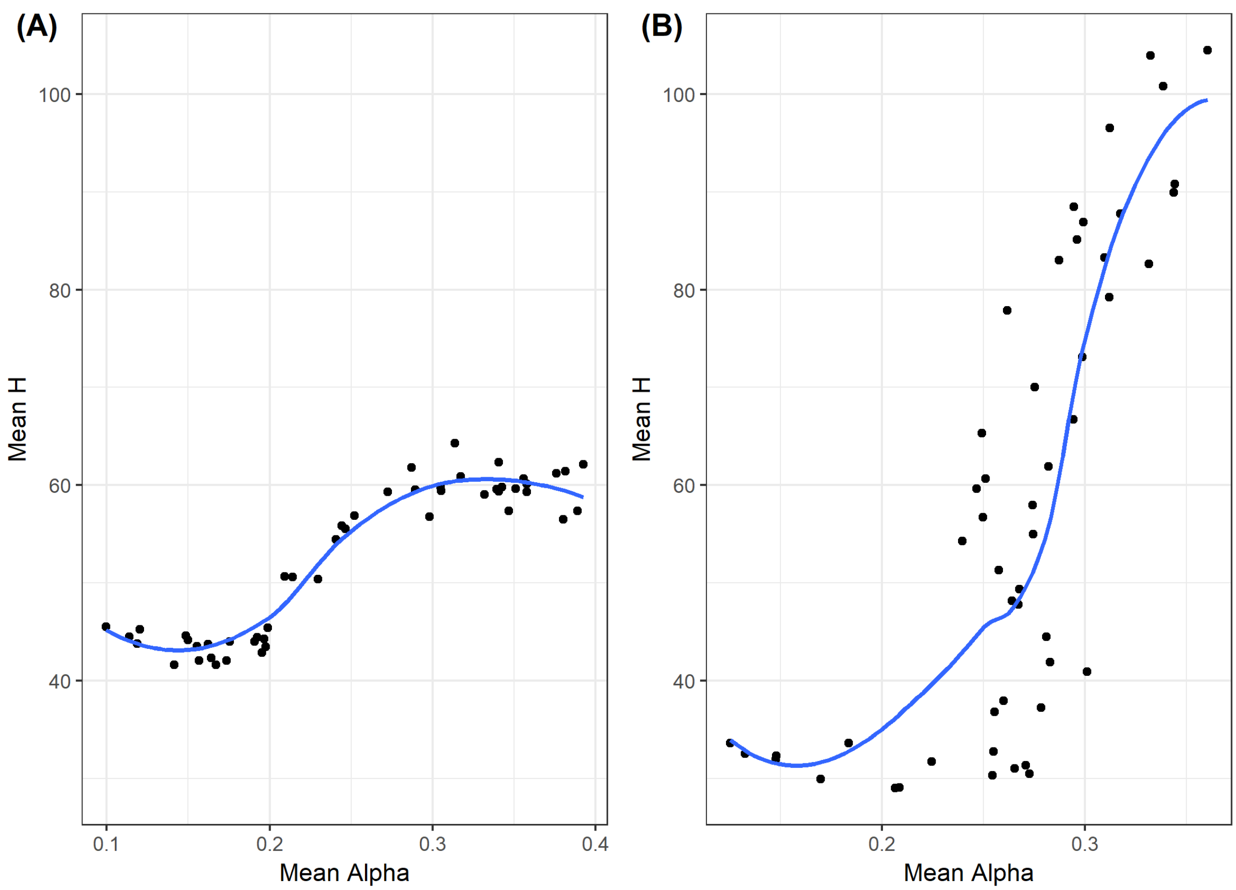

Figure 3: With heterogeneous preferences (Panel A) and income (Panel B), agents sort into municipalities by ideology, and more liberal cities are more likely to enact restrictive zoning than conservative cities. As a result, average housing consumption is higher in liberal cities.

we introduce heterogeneous income in Experiment 4 (Panel B). All else equal, lower income agents are more attracted to wealthy, liberal cities that offer generous public goods provision. This comes at a greater cost for liberal households than it does in comparatively wealthy conservative cities. And so the model generates the relationship we observe in the empirical analysis, described in the following section.

4 Empirical Analysis

My empirical analysis proceeds in three parts. First, I explore whether home values are higher than we would expect (given income, demographic characteristics, and amenities) in liberal cities. Due to endogeneity concerns, I also measure policy outcomes directly: do more liberal cities issue fewer building permits than similar conservative cities? Finally, I test my predictions against an extensive survey-based measure of urban land use regulation. Throughout this analysis, I restrict my attention to cities with a population greater than 10,000.

4.1 Data Sources

4.1.1 Outcome Variables

My outcome variables come from three sources. For my survey-based measure of land use policy, I use the Wharton Residential Land Use Regulation Index (WRLURI) (Gyourko et al. 2008). In 2004, Gyourko, Saiz, and Summers conducted an extensive survey of US municipal governments regarding local land use regulation. City planning officials from 2,649 municipalities (out of 6,896 in the International City Managers Association database) supplied data on: (1) the number of veto players in the zoning approval process, (2) existing rules restricting supply or density of housing, and (3) the length of time required for building permit approval. The authors then use factor analysis to construct their summary measure of the stringency of local housing regulation (WRLURI).

In the analysis that follows, I slightly modify this measure. The original WRLURI is generated in part using survey questions on state-level variables (e.g. state court involvement) and institutional variables (e.g. number of veto players whose approval is required to permit new development). To generate a dependent variable that measures city-level regulations alone – and allows me to include veto players as an explanatory variable – I remove those subcomponents. I generate this new regulatory measure using principal component analysis,

Table 2: Selected Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Max
Population (2010)	3,907	47,719	174,603	10,001	8,175,133
Housing Units (2010)	3,907	19,860	72,399	1,362	3,371,062
Mean Jan. Temperature	3,907	36.7	14.0	−11.5	76.4
Mean Jul. Temperature	3,907	75.5	5.5	50	95
Median Home Value (2010-2014)	3,819	221,660	147,841	34,200	999,100
Median Household Income (2010-2014)	3,858	60,195	26,665	13,608	241,453
MRP Ideology	3,840	−0.032	0.202	−0.988	0.691
MRP Ideology (Tausanovitch & Warshaw)	1,545	−0.044	0.263	−1.019	0.669
Pct. White (2010)	3,878	0.640	0.251	0.007	0.983
Pct. Black (2010)	3,878	0.121	0.171	0.001	0.980
Pct. Hispanic (2010)	3,878	0.164	0.195	0.004	0.987
Pct. Over 65 (2010)	3,878	0.131	0.058	0.000	0.836
Pct. College Graduates (2010)	3,878	0.295	0.159	0.006	0.898
Pct. Housing Constructed before 1959	3,709	0.330	0.230	0.000	0.930
Pct. Developable Land within 20km (2011)	3,332	44.723	27.607	0.012	96.8
Building Permits (2000-2016)	2,696	4,115	12,383	0	368,111
WRLURI	1,276	−0.077	0.874	−2.091	3.759
Modified WRLURI	1,276	0.032	0.960	−1.998	4.740
Zoning Veto Players	1,275	1.496	1.029	0.000	6.000

as in the original study. In Appendix 1, I show that my results do not depend on this choice, and that the results go through using the original WRLURI measure as well.

Because the regulatory measure is constructed from multiple factors, it is somewhat difficult to interpret. However, the following benchmarks can serve as a rough guide. The index ranges from roughly -2 to $+4$, and 85% of the distribution lies between -2 and $+1$. An exemplar town in the -2 range is Lake Arthur, LA. There there are no formal restrictions on density or housing supply in Lake Arthur, and there is no planning commission or environmental review required to approve new construction. On average, new housing stock is approved by the local government within one month. Contrast this with Charleston, SC, which scores a 0. Charleston has a Euclidean zoning code, including stringent height restrictions in the downtown core. Changes to the zoning plan must be approved by the city council. However, there are no statutory limits on new construction, and on average it takes 3 months to approve new single family units.

On the higher end of the regulatory index we find Los Angeles, CA (+2) and Mashpee, MA (+3.5). Los Angeles has a formal zoning code, and any rezoning requires the approval of the planning commission, a city council majority, and an environmental board. There are no formal construction or permit limits, but the city government reports that it takes 6 months on average to approve new single family housing. Mashpee, meanwhile, has among the most restrictive land use policies in the nation. There is a statutory limit on new building permits each year, a minimum lot size of 1 acre for residential development, and any change in the zoning code requires a majority vote at an all-citizen town meeting.

For my measure of new building permits by city, I consult the US Census Building Permits Survey, merging annual counts of new building permits by Census Designated Place between 2000 and 2016. My measure of median home price comes from the 2016 five-year American Community Survey.

4.1.2 Ideology

For data on city-level ideology, I rely on the invaluable dataset compiled by Tausanovitch & Warshaw (2013). Combining public opinion data from the Cooperative Congressional Election Study, they create a city-level measure of conservatism using multilevel regression and poststratification for over 1600 US cities. The ideology measure ranges from roughly -1 (Berkeley, CA liberal) to about 0.5 (Amarillo, TX conservative). As Tausanovitch & Warshaw (2014) document in a subsequent paper , this measure of conservatism is a significant predictor of city-level taxes and expenditures per capita. For this reason, I believe it is a reasonable measure of the population's preference for local public spending – the model's α_i parameter. The original Tausanovitch & Warshaw measure was constructed only for cities with population greater than 20,000, so I extend their procedure to create ideology measures for each city in my sample.[3]

4.1.3 Other Covariates

Many large US cities are "built out", and have little available land for residential development. In such cities, constructing new housing stock is relatively more difficult, and we would expect to observe fewer new building permits and more expensive land prices. Because these cities tend to be older, coastal, and more liberal, excluding this covariate is likely to bias our

[3] To replicate the city-level estimates, I first construct an individual-level ideology measure by taking the first component from a principal component analysis of twenty-two policy questions in the 2010 Cooperative Congressional Election Study. I then estimate city-level ideology measures using multilevel regression and poststratification (MRP), as in Tausanovitch & Warshaw (2013). I verify that the final measure is capturing average city-level ideology by regressing it against the Democrat's presidential vote share in 2008. The correlation between presidential vote share and Tausanovitch and Warshaw's original measure is -0.76, and with the replicated measure is -0.77. This and all other replication materials will be made available at the author's website.

estimates. So I compute a measure of developable land for each city. Combining the USGS Digitial Elevation Model[4] and National Land Cover Dataset (NLCD), I identify the percentage of land area within a 20km radius of each city center that is (1) undeveloped, and (2) not geographically inhospitable to residential development, e.g. a wetland or steep terrain with greater than 15% grade (Saiz 2010). Using this information, I generate a measure for each city (`pct.developable`), denoting the percentage of nearby land that is available for development.

For demographic and housing data, I consult the 2000 and 2010 Decennial Census (U.S. Census Bureau, Summary File 3). Finally, I compute the mean January and July temperatures in each municipality using the WorldClim dataset (Hijmans et al. 2005). Table 2 reports selected summary statistics for these variables.

4.2 Results

4.2.1 Home Prices

Table 3 reports the coefficient estimates from a set of linear regressions predicting median home values by city. As Glaeser & Gyourko (2005) document, a two-factor linear model including median income and average temperature explains a large share of the variation in median home values (R^2 roughly 0.6). The results from Table 3 suggest that liberal cities tend to be more expensive than income and climate alone would predict. This relationship holds if we include state fixed effects (column 3), additional demographic/geographic covariates (column 4), and CBSA-level fixed effects. On average, the median home value in a moderately liberal city (Ideology Score: -0.15) is about $25,000 to $50,000 higher than in a similar conservative city (Ideology Score: 0.15).

4.2.2 Building Permits

For my second measure of local growth controls, I investigate the number of new housing units approved in each city from 2000 to 2016. I adopt the empirical estimation strategy from (Kahn 2011), regressing log(new units + 1) on log(units), median home value, and state fixed effects. Table 4 reports the coefficient and standard error estimates from these regressions. Liberal cities issue fewer building permits than we would expect given their size, housing costs, and demographic variables. Depending on how we specify the model, a

[4] Data available from the US Geological Survey, accessed through the `elevatr` package in `R` (Hollister & Tarak Shah 2017).

Table 3: Median Home Value Regressions

	Dependent variable:				
	Median Home Value (2010-2014)				
	(1)	(2)	(3)	(4)	(5)
MRP Ideology	$-132{,}855^{***}$	$-106{,}816^{***}$	$-77{,}737^{***}$	$-136{,}259^{***}$	$-170{,}893^{***}$
	(11,712)	(6,428)	(7,703)	(14,274)	(19,621)
Median Household Income		4.35^{***}	4.05^{***}	3.03^{***}	2.97^{***}
		(0.05)	(0.05)	(0.08)	(0.12)
Mean Jan. Temperature		$3{,}612^{***}$	$5{,}544^{***}$	$4{,}082^{***}$	$7{,}646^{***}$
		(105.4)	(331.6)	(317.1)	(1,154.7)
Mean Jul. Temperature		$-8{,}374^{***}$	$-9{,}042^{***}$	$-6{,}016^{***}$	$-5{,}680^{***}$
		(277.6)	(396.8)	(373.0)	(890.8)
Log Population (2010)				$-2{,}289^{**}$	$-3{,}056^{***}$
				(890)	(1,107)
Pct. White				$-92{,}982^{***}$	$-26{,}092$
				(17,269)	(22,562)
Pct. Black				$-186{,}766^{***}$	$-145{,}109^{***}$
				(19,429)	(25,470)
Pct. Hispanic				$-79{,}536^{***}$	$-41{,}630^{*}$
				(17,191)	(22,614)
Pct. Over 65				$258{,}796^{***}$	$412{,}081^{***}$
				(22,440)	(39,423)
Pct. College Grad				$238{,}907^{***}$	$253{,}350^{***}$
				(12,065)	(16,749)
Pct. Housing Built Pre-1959				$77{,}227^{***}$	$72{,}563^{***}$
				(5,753)	(8,221)
Pct. Developable (20km)				-288.11^{***}	-45.97
				(53.03)	(101.21)
Constant	$217{,}525^{***}$	$460{,}945^{***}$	$396{,}519^{***}$	$382{,}879^{***}$	92,915
	(2,399)	(20,156)	(40,144)	(34,472)	(100,259)
State Fixed Effects	No	No	Yes	Yes	No
CBSA Fixed Effects	No	No	No	No	Yes
Observations	3,782	3,782	3,782	3,259	2,017
R^2	0.03	0.74	0.80	0.86	0.90
Note:					*p<0.1; **p<0.05; ***p<0.01

moderately conservative city (+0.15) issued on average 13% to 38% more building permits than a moderately liberal city (−0.15) during the period in question.

4.2.3 Wharton Residential Land Use Regulation Index

Finally, I use the Wharton regulatory measure as my outcome variable. Table 5 reports the coefficient estimates and standard errors from five OLS models. As expected, liberal cities have more restrictive housing regulations than one would predict given their income, demographics, and geography. A one-unit increase in the conservatism measure is associated with a 0.55 unit decrease in the regulatory index. These results are not, however, robust to adding additional state-level fixed effects (Column 4) or CBSA-level fixed effects (Column 5).

5 Concluding Thoughts

In this paper, I have investigated the systematic difference in home prices and zoning policies between liberal and conservative US cities. I develop a theory to explain the puzzle: if cities with liberal residents place a greater value on public goods provision, then restrictive zoning policy can enable generous public expenditures by ensuring that newcomers pay their fair share of property taxes. In an empirical analysis, I show that the observed relationship between city-level ideology and zoning policy is robust to conditioning on a number of confounding factors. All else equal, liberal cities are more expensive, issue fewer new building permits, and score higher on the survey-based measure of land use regulatory stringency.

The current study faces several limitations that I hope to address in future work. Firstly, the empirical analysis is purely cross-sectional, and while I have done what I can to control for likely confounding factors, a time series analysis of some sort may be more convincing from a causal inference perspective. Unfortunately, our current survey-based measures of zoning policy are solely cross-sectional. In future work, I plan to develop new and improved measures of zoning stringency, based on GIS remote sensing or text analysis of zoning code changes over time.

Second, the current analysis focuses entirely on US cities. A useful test of the theory would be to compare conservative and liberal cities in countries where zoning authority is devolved to municipal authorities, but *taxation* is collected at the national level. If zoning restrictions are in part a response to the fiscal incentives outlined in this paper's model, then we should expect to see a weaker relationship between ideology and zoning in these

Table 4: Building Permit Regressions

	Dependent variable:					
	Log Building Permits (2000-2016)			Log Building Permits (2010-2016)		
	(1)	(2)	(3)	(4)	(5)	(6)
MRP Ideology	3.25***	0.60*	1.41***	4.24***	0.77*	1.56***
	(0.19)	(0.33)	(0.41)	(0.20)	(0.44)	(0.55)
Log Housing Units (Initial)	0.91***	0.99***	1.01***	1.30***	1.23***	1.25***
	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Median Home Value	0.38***	0.88***	0.93***	0.71***	0.94***	1.21***
	(0.05)	(0.08)	(0.13)	(0.05)	(0.10)	(0.16)
Mean Jan. Temperature		0.01	0.02		0.03***	0.01
		(0.01)	(0.03)		(0.01)	(0.03)
Mean Jul. Temperature		0.05***	0.05**		0.03**	0.04
		(0.01)	(0.02)		(0.01)	(0.03)
Pct. White		1.07**	−0.45		1.39**	0.18
		(0.54)	(0.62)		(0.56)	(0.67)
Pct. Black		0.49	−0.08		−0.02	−0.24
		(0.58)	(0.66)		(0.64)	(0.75)
Pct. Hispanic		0.74	−0.14		0.77	0.44
		(0.54)	(0.62)		(0.56)	(0.67)
Pct. Over 65		−0.07***	−0.07***		−8.92***	−9.66***
		(0.01)	(0.01)		(0.87)	(1.10)
Pct. College Grad		−1.30***	−1.07**		0.79*	0.44
		(0.33)	(0.44)		(0.43)	(0.57)
Pct. Housing Built Pre-1959		−3.34***	−2.29***		−2.21***	−1.62***
		(0.17)	(0.21)		(0.20)	(0.24)
Pct. Developable (20km)		0.02***	0.04***		0.03***	0.03***
		(0.001)	(0.002)		(0.002)	(0.003)
Constant	−8.12***	−21.20***	−23.68***	−21.61***	−28.90***	−33.44***
	(0.86)	(1.75)	(3.12)	(0.89)	(2.07)	(3.87)
State Fixed Effects	No	Yes	No	No	Yes	No
CBSA Fixed Effects	No	No	Yes	No	No	Yes
Observations	2,670	2,438	2,034	2,648	2,421	2,017
R^2	0.31	0.70	0.76	0.45	0.69	0.74
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 5: Regulatory Index Regressions

	Dependent variable:				
	Modified Wharton Residential Land Use Index (2004)				
	(1)	(2)	(3)	(4)	(5)
MRP Ideology	−0.31**	−0.53***	−1.24***	−0.33	−0.09
	(0.14)	(0.13)	(0.20)	(0.35)	(0.48)
Log Median Income (2000)		1.04***	0.82***	0.64***	0.30
		(0.07)	(0.12)	(0.14)	(0.23)
Log Population (2000)			0.07**	0.10***	0.17***
			(0.03)	(0.03)	(0.04)
Mean Jan. Temperature			0.02***	0.02**	0.03
			(0.003)	(0.01)	(0.03)
Mean Jul. Temperature			−0.02***	−0.03***	−0.02
			(0.01)	(0.01)	(0.02)
Pct. White			2.30***	2.50***	2.27***
			(0.57)	(0.66)	(0.86)
Pct. Black			1.36**	2.12***	1.89**
			(0.58)	(0.69)	(0.90)
Pct. Hispanic			2.44***	2.64***	1.71**
			(0.59)	(0.65)	(0.86)
Pct. Over 65			−0.004	−0.02**	−0.01
			(0.01)	(0.01)	(0.01)
Pct. College Grad			0.14	0.47*	0.56
			(0.24)	(0.27)	(0.40)
Pct. Housing Built Pre-1959			−1.05***	−0.93***	−0.64***
			(0.16)	(0.18)	(0.23)
Pct. Developable (20km)			0.004***	0.004**	0.01***
			(0.001)	(0.002)	(0.003)
Veto Players			0.21***	0.20***	0.19***
			(0.02)	(0.02)	(0.03)
Constant	0.02	−11.06***	−10.38***	−8.92***	−7.70**
	(0.03)	(0.77)	(1.56)	(1.74)	(3.39)
State Fixed Effects	No	No	No	Yes	No
CBSA Fixed Effects	No	No	No	No	Yes
Observations	1,271	1,269	1,141	1,141	924
R^2	0.004	0.14	0.30	0.35	0.49
Note:	*p<0.1; **p<0.05; ***p<0.01				

countries.

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Appendix 1: Robustness Tests

To ensure the robustness of my empirical results, I re-estimate each regression using different measures for my key variables. Appendix Tables 6-8 report the results from this reanalysis using (a) the original Tausanovitch & Warshaw measure of ideology, and (b) the original WRLURI measure from Gyourko et al. (2008). The main results reported above hold, with a few exceptions. Notably, the original Tausanovitch & Warshaw ideology measure is *not* a statistically significant predictor of median home price or new building permits when CBSA-level fixed effects are included. Note that using the original ideology measure requires us to drop roughly 1,500 cities from the sample, which could explain the discrepancy.

Table 8 reports the results of the reanalysis using both the original measure of ideology *and* the original Wharton Residential Land Use Regulation Index. In all specifications, ideologically liberal cities score higher on WRLURI, even when including state-level and CBSA-level fixed effects.

Table 6: Median Home Value Regressions (Robustness Test)

	Dependent variable:				
	Median Home Value (2010-2014)				
	(1)	(2)	(3)	(4)	(5)
MRP Ideology (T&W)	−148,925***	−119,681***	−109,722***	−32,821***	−15,727
	(14,211)	(7,611)	(8,407)	(10,401)	(13,170)
Median Household Income		4.79***	4.53***	2.95***	2.71***
		(0.09)	(0.09)	(0.13)	(0.18)
Mean Jan. Temperature		4,260***	5,342***	4,938***	8,503***
		(150.9)	(515.6)	(496.2)	(1,464.8)
Mean Jul. Temperature		−8,814***	−8,506***	−6,527***	−7,085***
		(399.2)	(560.7)	(547.3)	(1,081.6)
Log Population (2010)				−2,255.33	−44.30
				(1,422.32)	(1,649.13)
Pct. White				−137,168***	−69,495***
				(23,179)	(25,736)
Pct. Black				−149,781***	−86,294***
				(25,432)	(28,345)
Pct. Hispanic				−107,981***	−94,447***
				(23,519)	(26,971)
Pct. Over 65				293,370***	248,323***
				(43,445)	(57,917)
Pct. College Grad				310,202***	302,616***
				(18,982)	(25,578)
Pct. Housing Built Pre-1959				98,359***	91,905***
				(9,846)	(12,005)
Pct. Developable (20km)				−204.41**	−114.10
				(83.86)	(153.79)
Constant	214,252***	459,193***	360,403***	353,142***	151,376
	(3,777)	(29,792)	(48,769)	(51,043)	(120,903)
State Fixed Effects	No	No	Yes	Yes	No
CBSA Fixed Effects	No	No	No	No	Yes
Observations	1,530	1,530	1,530	1,376	1,202
R^2	0.07	0.77	0.83	0.88	0.92
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 7: Building Permit Regressions (Robustness Test)

	Dependent variable:					
	Log Building Permits (2000-2016)			Log Building Permits (2010-2016)		
	(1)	(2)	(3)	(4)	(5)	(6)
MRP Ideology (T&W)	2.85***	0.02	−0.13	3.10***	0.01	−0.42
	(0.17)	(0.21)	(0.27)	(0.19)	(0.27)	(0.35)
Log Housing Units (Initial)	1.18***	1.14***	1.13***	1.52***	1.36***	1.32***
	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Median Home Value	0.35***	0.69***	0.84***	0.71***	0.89***	1.06***
	(0.06)	(0.11)	(0.17)	(0.06)	(0.14)	(0.23)
Mean Jan. Temperature		0.01	−0.01		0.04***	−0.02
		(0.01)	(0.03)		(0.01)	(0.04)
Mean Jul. Temperature		0.06***	0.07***		0.03**	0.07**
		(0.01)	(0.02)		(0.02)	(0.03)
Pct. White		0.66	−0.44		0.80	0.15
		(0.56)	(0.62)		(0.63)	(0.73)
Pct. Black		−0.27	−1.10*		−1.11	−1.60*
		(0.60)	(0.67)		(0.70)	(0.82)
Pct. Hispanic		0.46	−0.38		−0.15	−0.20
		(0.57)	(0.66)		(0.64)	(0.77)
Pct. Over 65		−0.05***	−0.05***		−7.23***	−6.70***
		(0.01)	(0.01)		(1.17)	(1.57)
Pct. College Grad		−0.53	−0.63		0.61	0.32
		(0.43)	(0.60)		(0.60)	(0.86)
Pct. Housing Built Pre-1959		−2.88***	−1.97***		−1.91***	−1.62***
		(0.22)	(0.27)		(0.27)	(0.34)
Pct. Developable (20km)		0.02***	0.04***		0.03***	0.03***
		(0.002)	(0.003)		(0.002)	(0.004)
Constant	−11.50***	−21.20***	−24.72***	−25.18***	−29.70***	−32.52***
	(1.13)	(2.32)	(3.76)	(1.22)	(2.95)	(5.11)
State Fixed Effects	No	Yes	No	No	Yes	No
CBSA Fixed Effects	No	No	Yes	No	No	Yes
Observations	1,459	1,316	1,213	1,446	1,305	1,202
R^2	0.43	0.74	0.81	0.49	0.73	0.78

Note: *p<0.1; **p<0.05; ***p<0.01

Table 8: Regulatory Index Regressions (Robustness Tests)

	Dependent variable:				
	Wharton Residential Land Use Regulation Index (2004)				
	(1)	(2)	(3)	(4)	(5)
MRP Ideology (T&W)	−0.74***	−0.91***	−1.08***	−0.65***	−0.59**
	(0.12)	(0.12)	(0.17)	(0.19)	(0.27)
Log Median Income (2000)		1.02***	0.77***	0.67***	0.73***
		(0.09)	(0.14)	(0.15)	(0.27)
Log Population (2000)			0.07*	0.06*	0.10**
			(0.04)	(0.04)	(0.04)
Mean Jan. Temperature			0.02***	0.01	0.01
			(0.003)	(0.01)	(0.03)
Mean Jul. Temperature			−0.05***	−0.03**	−0.03
			(0.01)	(0.01)	(0.02)
Pct. White			2.00***	2.18***	1.17
			(0.65)	(0.71)	(0.86)
Pct. Black			1.18*	1.80**	1.03
			(0.66)	(0.73)	(0.86)
Pct. Hispanic			2.29***	2.54***	1.21
			(0.69)	(0.71)	(0.85)
Pct. Over 65			−0.004	−0.01	−0.004
			(0.01)	(0.01)	(0.01)
Pct. College Grad			0.19	0.84***	0.60
			(0.29)	(0.30)	(0.45)
Pct. Housing Built Pre-1959			−0.63***	−0.63***	−0.49*
			(0.19)	(0.21)	(0.27)
Pct. Developable (20km)			0.002	0.003	0.01**
			(0.002)	(0.002)	(0.003)
Constant	−0.03	−10.95***	−8.00***	−8.78***	−8.24**
	(0.03)	(0.96)	(1.88)	(2.04)	(3.79)
State Fixed Effects	No	No	No	Yes	No
CBSA Fixed Effects	No	No	No	No	Yes
Observations	735	735	653	653	588
R^2	0.05	0.19	0.34	0.49	0.65
Note:					*p<0.1; **p<0.05; ***p<0.01