THE MAIN SOCIOECONOMIC DETERMINANTS of EXCLUSIONARY ZONING IN U.S. JURISDICTIONS

by

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Exclusionary zoning policies impose restrictions on the development of housing with the intention or effect of excluding certain groups or classes of people. By favoring certain demographics, such policies can disproportionately affect lower income individuals and minorities by restricting their access to affordable housing. This, in turn, exacerbates income segregation and perpetuates racial discrimination, which widens the socioeconomic gap between affluent and disadvantaged communities. This paper examines the main socioeconomic determinants of exclusionary zoning in American Jurisdictions. Using a comprehensive dataset that combines socioeconomic variables with specific regulation indexes that are intended to proxy for exclusionary zoning, this research employs multiple regression analysis to examine the main predictors of regulatory restrictiveness. The findings indicate that income, race, age, and poverty levels, all play an important role in determining the regulatory restrictiveness of U.S. jurisdictions. Specifically, the results suggest that older and wealthier areas tend to implement stricter regulations to preserve property values, while poorer areas with a higher proportion of people working in manufacturing exhibit lighter regulatory controls. The results also reveal that regulatory restrictiveness decreases in areas with a higher proportion of white residents. The discussion addresses the limitations of this study and emphasizes the need for further research to better understand the complex dynamics between socioeconomic factors and exclusionary zoning.

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Introduction

Zoning is a prominent regulatory practice that was introduced in the U.S. in the early 20th century. It involves the division of land within a political jurisdiction into different zones or areas, each with specific restrictions and permitted land uses. Zoning generally has several purposes, including the promotion of economic development, the protection of public health, and the preservation of community aesthetics. However, as Economist William A. Fischel describes, one of the primary reasons that prompted the introduction of zoning policies in the U.S. is the need for predictability and protection for single-family residences. Zoning provided safety and security to homeowners by giving them clarity on land use regulations and assuring them that neighboring areas and districts will not be utilized in a way that would conflict with their residential desires. Public records became a crucial resource that homeowners could consult to assess what land uses were permitted in specific zones, which helped them make informed decisions.

Homes represented the largest financial asset for numerous homeowners in America, and thus, safeguarding their value was crucial. As the public became increasingly aware of the importance and value of homeownership, concerns about housing values began to rise. This, in turn, led to the emergence of oppositional social movements, which sought to restrict new development projects that potentially threatened property values. One of the most recent and prominent of such movements is NIMBY, or Not in my Backyard. NIMBY is a term that describes the attitudes and behaviors of vocal and connected residents who oppose and strive to restrict the potential development of projects and facilities in their vicinity, even if they believe that such developments might have a favorable overall impact on their region. NIMBY

proponents are usually interested in preserving class status, maintaining community aesthetics, and ultimately, protecting home values.

NIMBYism carries powerful racial and class connotations, especially in the United States, where it tends to be predominantly perpetuated by the white middle and upper classes. These groups generally possess greater socioeconomic power and wield stronger political influence, which enables them to take institutionalized action against development proposals and encourage political institutions to enforce regulatory barriers to housing construction. As a consequence, exclusionary zoning policies have become more prevalent, excluding multifamily developments directly, or indirectly through measures like growth boundaries, strict environmental controls, and low-density development. Unfortunately, these exclusionary zoning policies disproportionately harm minority communities, who typically do not possess the political power or the socioeconomic standing of their white counterparts.

Additionally, the complex dynamics of housing regulation and entrenched interests pose great challenges to those who aim to reduce obstacles to development. Land developers and potential new homeowners, for instance, often face an uphill battle when attempting to influence established regulatory frameworks. Specifically, the established power structures and resistance from NIMBY proponents often obstruct these constituents' ability to shape policies in favor of more inclusive and affordable housing. Due to the hostility and exclusionary attitude that is often associated with NIMBY initiatives, the movement has faced tremendous criticism from academic circles and pro-development advocates.

Let us take a step back and define exclusionary zoning, which is essential for the purpose of this paper. Exclusionary zoning refers to the deliberate implementation of zoning ordinances to restrict specific land uses or the development of certain types of houses with the aim or effect

of excluding a certain group or class of people. Among the various negative consequences of exclusionary zoning is the increased costs of building new structures, the exacerbation of income segregation and racial discrimination, and the restriction of opportunities for economic growth. While these consequences need to be addressed and mitigated, this paper is primarily concerned with the main socioeconomic determinants of exclusionary zoning. Specifically, it seeks to investigate the key factors that predict the intensity of exclusionary zoning policies in political jurisdictions in America.

A wealth of existing literature highlights the relationship between land use regulations and a range of regional characteristics including income, racial composition, and political affiliation. This paper seeks to contribute to this body of knowledge by examining the key socioeconomic variables that predict the intensity of exclusionary zoning policies in U.S. Jurisdictions. By gaining insight into the intricate relationships between socioeconomic variables and exclusionary zoning, this paper can help inform policymakers and urban planners about the dynamics that shape exclusionary housing practices. Consequently, this knowledge can guide efforts into creating a more equitable and sustainable system of housing practices that takes into consideration the diverse needs and interests of existing communities.

Political Theory

In this section, we will introduce some relevant political theory, which will provide insight into the mechanisms through which regulations are set. By exploring theoretical frameworks and concepts, we can shed light on the factors and processes that shape local policy and regulatory environments. This theoretical explanation will help us generate testable hypotheses, which will be empirically examined through regression analysis in subsequent sections.

Median Voter Theorem

The median voter theorem is a concept in political science and economics that was popularized and developed by economists Anthony Downs (1957) and Duncan Black. The theorem proposes that in a majority rule voting system, the outcome of a policy decision tends to reflect the preferences of the median voter. The median voter is the individual whose preference falls in the middle of a spectrum when all voters are arranged in the order of their preferences on a particular matter. The theorem suggests that candidates or parties strategically position themselves closer to the preferences of the median voter in order to capture a higher share of the votes.

It is important to note that the median voter theorem rests on several core assumptions. For instance, it assumes that voters' preferences are single-peaked. This means that voters have a unique point along a policy position preference curve at which they would obtain the highest utility and that their utility diminishes as policy moves further away from that optimal point. Additionally, the theorem assumes that voters' preferences are one-dimensional, meaning that preferences can be adequately captured along a single political spectrum. The theorem also assumes that there are two parties or candidates that are competing for voters. In other words,

voters have to pick between two policy positions, and will ultimately vote for the one closest to their ideal point.

Due to these simple assumptions, the median voter theorem may not accurately capture real-world preferences, which are complex and multidimensional in nature. However, the model does offer a valuable framework for analyzing and understanding the dynamics that shape policy and regulations. If voters cast their vote for the party or candidate whose political stance is most closely aligned with theirs, then the candidate who is closest to the median voter will always win. In the context of this paper, the median voter theorem suggests that the regulatory environment is ultimately shaped according to the preferences of the median voter. That is, if the median voter in a given political jurisdiction prefers tighter regulation controls, then local policy will reflect that, and vice versa.

Tiebout Equilibrium

The Tiebout model originated from a 1956 article by prominent economist Charles Tiebout, entitled *A Pure Theory of Local Expenditures*. Tiebout (1956) suggested that competition between local political jurisdictions places competitive pressures for them to offer local public goods, resulting in an optimal provision of such goods. The model suggests that if municipalities offer varying "baskets" of goods (government services) at a variety of prices (tax rates), then people will move from one local community to another that maximizes their personal utility. In other words, the model implies that people will geographically sort themselves according to their preferences for local public goods and services, as well as taxes. The Tiebout equilibrium refers to the theoretical outcome of the Tiebout model, where individuals are assumed to have sorted themselves optimally across jurisdictions, meaning that everyone resides in the jurisdiction that offers their desired bundle of benefits and taxes.

Like the median voter theorem, The Tiebout model rests on several core assumptions. For example, it assumes that people have full mobility and will move to the community where their preference patterns, which are already established, are best satisfied. It also assumes that people have perfect information about the local public sector. Specifically, individuals are assumed to have full knowledge of the variations among the local government's revenue and expenditure patterns. Additionally, the model assumes the existence of a vast number of communities in which individuals may opt to reside. These assumptions limit the model's ability to capture the full complexity and intricacies of real-world dynamics. In reality, there are costs to moving between jurisdictions, and people may not always be well-informed about the revenue and expenditure patterns of local jurisdictions.

Nonetheless, the model does offer a useful theoretical framework that provides insight into the dynamics of individual behavior and choice. In the context of this research, the Tiebout model suggests that people will relocate based on their preferences for exclusionary zoning policies. Specifically, individuals and families that prefer restrictive residential regulations will seek to live in areas that have such regulations established. Conversely, people who prefer more inclusionary housing laws, will move to jurisdictions that have lighter residential land use regulations and more inclusionary housing environments. Thus, we can hypothesize, based on the Tiebout model, that high-income individuals who own homes will end up living in areas with tighter regulation controls as they tend to care more about community aesthetics and property values. On the other hand, low-income individuals who do not own homes, and thus may be less concerned with such matters, will locate in areas with lighter regulatory regimes.

It is worth noting that the median voter theorem and the Tiebout model allow us to look at the issue of exclusionary zoning from different angles. In particular, the median voter theorem

suggests that the intensity of exclusionary zoning will be determined by the preferences of the median voter in a given political jurisdiction. In that sense, the socioeconomic attributes of the jurisdiction determine the restrictiveness of its residential land use regulations. On the other hand, the Tiebout model implies that individuals will choose to reside in jurisdictions whose residential land use regulations match their preferences. In that sense, the regulatory restrictiveness of a jurisdiction's residential environment determines the socioeconomic attributes of the individuals who reside in it. This suggests that the direction of the effect is unclear.

Thus, it is important to keep in mind that socioeconomic factors such as income and race have a complex and multifaceted relationship with exclusionary zoning. Recall that the purpose of this paper is to investigate the key socioeconomic variables that predict the intensity of exclusionary zoning policies in American jurisdictions. In other words, the paper seeks to identify the factors that have the strongest and most meaningful associations with exclusionary zoning. However, no causal relation between regulation and any of the socioeconomic variables that will be used in the analysis is implied. The Tiebout model and the median voter theorem provide insights into the different ways in which preferences, regulations, and socioeconomic attributes interact and shape the outcomes of land use policies. Thus, understanding these concepts can help us make sense of the results that will be discussed in subsequent sections.

Literature Review

This section examines existing studies and research papers that contribute to our understanding of exclusionary zoning and its determinants. The sources explored will not only help us understand the historical development of zoning and how it eventually evolved to be exclusionary, they will also point us to several socioeconomic variables that ought to be used in our analysis. The primary objective of this section is to enhance our understanding of the existing body of literature on residential land use regulations, and its various causes and effects.

The Local Residential Land Use Regulatory Environment Across U.S. Housing Markets: Evidence from a New Wharton Index

This is an influential study conducted by economists Joseph Gyourko, Jonathan Hartley, and Jacob Krimmel. It reports results from a survey on residential land use regulatory regimes of approximately 2,500 suburban communities in the United States. Using a variety of regulation variables, Gyourko et al. (2019) construct a comprehensive measure of regulatory restrictiveness, which they call the Wharton Residential Land Use Regulatory Index, or WRLURI for short. This index is standardized to have a mean of 0 and standard deviation of 1, with a higher value indicating a more stringent regulatory environment.

The WRLURI index is considered to be the aggregate index since it is computed using 12 regulation subindexes, each of which is designed to measure and capture a unique regulatory dimension. These subindexes, which are computed based on the various questions that were asked in the Wharton survey, include the Density Restriction Index (DRI), the Local Political Pressure Index (LPPI), the State Political Involvement Index (SPII), and the Local Assembly Index (LAI).

Although the WRLURI is used to rank suburban communities based on their regulatory restrictiveness, it does not indicate what rules and regulations exist in the community. To offer this translation, the authors group communities by their position in the overall distribution of WRLURI values. Those in the bottom quartile of the distribution are considered to be lightly regulated. These communities have a WRLURI value that is greater than 0.64 standard deviations below the mean. Similarly, communities in the top quartile of the distribution are deemed to be highly regulated and have a WRLURI value that is greater than 0.64 standard deviations above the mean. Those that are considered moderately regulated have a WRLURI that falls somewhere in between.

The authors report market-wide regulatory index values for the 44 metropolitan areas, in which there were at least ten communities that responded to their survey. Based on their results, San Francisco and New York are the most highly regulated core-based statistical areas (CBSAs) in the nation, each exhibiting an aggregate index that is greater than one standard deviation above the mean. On the other hand, Detroit and Saint Louis were the least regulated by the same metric.

The authors demonstrate a few interesting patterns in their paper. One particularly insightful pattern is shown in a table that highlights variations across WRLURI distributions. Specifically, the table displays census information from 2010 on income, home values, race, education and other factors for three distinct categories: lightly regulated communities, moderately regulated communities, and highly regulated communities. The table indicates that regulation is increasing in local income, home value, educational attainment, and population density, whereas it is decreasing in the percentage of the population that is white. Note that while these results are interesting, they are merely descriptive statistics and thus do not provide a

comprehensive analysis of the causal effects and predictive power of the variables. Additionally, the paper doesn't convey the relationship of these variables with the various regulation subindexes used to construct the aggregate index (WRLURI).

This paper will utilize the Wharton dataset and leverage a few of the indexes it contains, including the aggregate index, to analyze the main socioeconomic determinants of exclusionary zoning. Note that while the dataset is one of the most comprehensive regulation datasets that are publicly available, the calculation of the indexes relies on self-reported data from a survey of communities, which may result in potential biases and inaccuracies.

An Economic History of Zoning and a Cure for its Exclusionary Effects

Written by William A. Fischel, this scholarly article details the historical development of zoning in America and highlights the causes of its implementation and evolution throughout the nation. Fischel (2004) argues that the appeal of city-wide zoning in the early 20th century was a product of the security that it gave homebuilders and owners. Prior to the adoption of zoning, such groups were largely uncertain about the ways in which neighboring areas of undeveloped land would be used. However, zoning helped dissipate this uncertainty by assuring homeowners and builders that nearby tracts will not be used in ways that are incompatible with their residential preferences.

Fischel claims that an owner-occupied home is the single largest financial asset that most Americans own, which explains why the risk of its devaluation presents a significant threat to their financial security. Given its importance, homeowners have a strong financial incentive to protect and enhance the value of their homes by paying close attention to government land-use policies and actively participating in policymaking decisions.

Fischel argues that job decentralization was one of the key factors that led to the emergence of zoning in America. The advent of transportation technologies such as automobiles, highways, and buses gave workers the luxury of separating their place of work from their area of residence. As jobs moved away from central cities and transportation became more readily affordable and accessible, it became feasible for people, including the poor, to move to the suburbs. This rapid movement raised major concerns among suburban homeowners who had a vested interest in preserving their property values. As such, they were usually apprehensive about the impact of new developments in their residential areas on their home values.

Although zoning initially served as a tool to regulate land use patterns and separate incompatible land uses, it naturally became exclusionary as homeowners relentlessly strived to protect their most valuable asset. This self-interested desire served as the driving force for the NIMBY movement, which involved opposing certain kinds of housing developments, such as affordable housing and multifamily dwellings in primarily single-family residential districts. The enactment of regulatory barriers, such as minimum lot sizes, gradually unfolded, and their nature was clearly exclusionary as they had the effect of pushing away the poor, who simply could not keep up with the rising housing costs.

To mask these exclusionary intentions, suburban homeowners began to enlist environmental protection as a primary incentive for opposing new developments. This is because claiming that new developments damaged property values was an insufficient rationale in public discourse. Thus, economic advantage, which was usually the main private motivator was masked by an apparently less selfish justification, which is the desire to protect the natural environment. This served to perpetuate the exclusion of lower-income households from the suburbs.

Fischel's article is relevant to this research paper because it provides context on the dynamics that led to the introduction of zoning in America. It also points to several variables that could explain or predict the intensity of exclusionary zoning in American political jurisdictions. These variables include homeownership rates, income and race. Based on Fischel's arguments, these variables could predict a more stringent regulatory environment, and thus would be interesting to explore in this paper.

Handbook of Regional and Urban Economics: Regulation and Housing Supply

Written by Joseph Gyourko and Raven Molloy, "Regulation and Housing Supply" is a chapter within a book entitled *Handbook of Regional and Urban Economics*. The chapter discusses the underlying causes and implications of restrictive land use regulations. Gyourko and Molloy (2015) cite a variety of interesting studies that attempt to explore the causes and effects of residential land use regulations in America, which will be discussed in this subsection. According to the authors, Dublin et. al reported that electoral districts with a higher share of homeowners had a higher proportion of votes cast in favor of growth controls in a 1988 San Diego Election. This supports the notion that homeowners are strong advocates of regulation and are a crucial factor driving the implementation of exclusionary zoning laws, as Fischel (2004) alludes to.

Gyourko and Molloy also note that McDonald investigated the demographic and economic forces driving the voting patterns of a proposed zoning ordinance in Houston, Texas. He found that middle-income precincts were more likely to support a proposed zoning ordinance than their lower-income counterparts. In particular, zoning was decisively opposed in low-income black and Anglo precincts and strongly favored in middle-income precincts. Although the author doesn't examine homeownership directly, it is safe to assume that middle-income

districts generally have a higher proportion of homeowners than low-income ones. It is important to note that high-income Anglo precincts were not as supportive towards zoning compared to their middle-income counterparts, which is somewhat surprising.

As Gyourko and Molloy indicate, if homeowners prefer tighter regulation, then we should expect a more stringent regulatory environment in areas where these constituents have a stronger political influence. However, evidence for this theory is challenging to find. The authors state that a study conducted by Logan and Zhou in 1990 utilized a national sample of suburban municipalities in 1973 and found that only a weak correlation existed between homeownership and a variety of growth controls. Other studies have yielded consistent and comparable findings for growth control measures in cities around San Jose and municipalities in California. Thus, as Gyourko and Molloy claim, the presence of homeowners alone may not accurately indicate the degree of influence that these individuals have on local policy. A more precise reflection of their influence could be represented by demographic or socioeconomic factors that are correlated with their capacity to engage in local policymaking.

Numerous studies have found a positive correlation between regulation and variables like income, education, the fraction of professional workers, and other socioeconomic characteristics that are likely to be correlated with the political influence of homeowners. It is important to note, however, that the cross-sectional nature of these studies make it difficult to rule out the possibility that the correlations are driven by omitted variables. An additional issue that was pointed out by Ortalo-Magne and Prat (Cited in Gyourko and Molloy), is that because regulation increases housing prices, the intensity of regulatory barriers could disincentivize individuals from owning homes. This introduces the issue of reverse causality, which further obscures the relationship between homeownership and regulation.

Relatively few papers have attempted to account for potential endogeneity problems when exploring the role of homeownership in restricting housing supply. To address this issue, a study conducted by Hilber and Robert-Nicoud used the fraction of households that are married couples without children as an instrument for homeownership rates to examine its relationship with housing supply regulation (Cited in Gyourko and Molloy). The idea is that married couples without children tend to have relatively higher and more stable income levels that single adults or households with children. Married couples also generally have more stable relationships compared to unmarried couples, which increases the likelihood of them settling in an area and thus gives them more time to recoup the transaction costs of purchasing a home. Note that the underlying assumption behind proxying for homeownership rate in this manner is that the only avenue through which the share of married couple without children could impact housing supply regulation is through homeownership rates.

Although the study found a positive correlation between homeownership rates and housing regulation, the result was statistically insignificant. That is, there was some indication that areas with higher homeownership rates have stricter housing regulation ordinances, but the relationship was not strong enough to reach statistical significance. Additionally, the observed effect of homeownership rates on housing regulation was modest. A one standard deviation increase in a metropolitan area's homeownership rate is associated with a one-third of a standard deviation increase in regulatory constraints. However, it is important to note that using the proportion of married couples without children as a proxy for homeownership rates can be problematic, as there may be other variables that are correlated with both the proxy and regulation that are not accounted for in the analysis. This can lead to omitted variable bias and thus hinder the validity of the findings.

Glaeser and Ward (2009) employed a different approach to address and circumvent the endogeneity of homeownership and regulation (Cited in Gyourko and Molloy). The authors specifically focus on Greater Boston and examine recent patterns in housing regulation as a function of historical homeownership rates in the region. By doing so, they establish a temporal ordering where homeownership rates are measured prior to housing supply regulation. This helps mitigate the issue of reverse causality as homeownership rates in the past are less likely to be influenced by the current regulatory environment. However, it is important to note that such an approach does not account for the issue of omitted variable bias. That is, historical homeownership rates may be correlated with unobserved attributes that could impact housing supply regulation.

Glaeser and Ward (2009) were able to detect some correlation between minimum lot sizes, a common regulatory barrier that has an exclusionary effect, with historical housing density. In fact, their findings indicate that historical housing density is the most important determinant of minimum lot size. They also found that the percentage of the population that was white in 1940 is associated with slightly more stringent minimum lot sizes. One of their most fascinating results is that the there is a modest negative correlation between the share of the population that worked in manufacturing in 1940 and the restrictiveness of minimum lot sizes. There are a few plausible explanations for this phenomenon. First, manufacturing may proxy for working class residents who were not as concerned about restricting housing options for the poor. Second, manufacturing may proxy for the prevalence of businesses that have a vested interest in promoting greater residential construction. This is to keep housing prices low and thereby preclude the need to make wage adjustments to compensate workers for rising housing costs.

Hypotheses

In this section, I propose several hypotheses regarding the relationship between socioeconomic factors and exclusionary zoning. Based on the literature review, I hypothesize that some of the most important socioeconomic determinants of exclusionary zoning are income, race, age, poverty levels, homeownership rates, the proportion of the population working in manufacturing, the proportion of single-family homes, and population density. Although not explicitly referred to by the literature explored, I think the proportion of housing units that are vacant may also be an important predictor of exclusionary zoning policies. Higher vacancy rates could suggest an excess of housing relative to demand. This oversupply may be an indication of less restrictive zoning policies.

I hypothesize that median household income is positively associated with regulatory restrictiveness. That is, I predict that wealthier political jurisdictions are more likely to implement exclusionary zoning policies as a means of safeguarding property values and maintaining community aesthetics. Conversely, I expect jurisdictions with higher poverty levels to have less stringent exclusionary zoning measures as lower income individuals may be less concerned about property value preservation.

I also hypothesize that the degree of regulation in U.S. jurisdictions is increasing in educational attainment and population density. These hypotheses are supported by the findings of Gyourko et. al (2019). I also anticipate that jurisdictions with a higher proportion of homeowners and single-family homes will have a higher degree of regulatory restrictiveness. This prediction is supported by Fischel (2004), who suggests that American zoning heavily prioritized the protection of single-family homeowners in the early 20th century.

While Gyourko et. al (2019) demonstrate that regulatory restrictiveness in jurisdictions is decreasing in their level of whiteness, I hypothesize that exclusionary zoning policies will be more prevalent in areas with a higher proportion of white residents. This is because historical patterns suggest that predominantly white jurisdictions typically sought to maintain racial discrimination by excluding certain minorities, such as African Americans. This hypothesis is also supported by Glaeser and Ward (2009), who suggest a potential association between the proportion of white residents and more stringent minimum lot sizes. Additionally, I hypothesize that regulatory restrictiveness is decreasing in areas with a higher proportion of people working in the manufacturing industry. This is also supported by Glaeser and Ward (2009), who found that the share of the population working in manufacturing in 1940 is associated with less restrictive minimum lot sizes.

I predict that regulatory restrictiveness is increasing in median age, as older residents, who are generally more likely to own homes, may favor tighter regulations. Older communities may also prioritize stability and predictability and thus oppose new developments that could potentially introduce uncertainty and damage property values. This hypothesis is supported by the findings of Keith Ihlandfeldt, (as cited in Gyourko and Molloy, 2015), who instrumented for land use restrictions by utilizing past community characteristics. He argued that these characteristics, which include the fraction of residents older than 55, as well as other variables such as average income, homeownership, educational attainment, and race, are correlated with a homeowner's ability to influence local policy. He found that all these variables are strong predictors of regulation.

Data

Wharton Survey

The regulation data that is utilized in this paper comes from the Wharton survey, which asks a series of questions to numerous suburban communities in the U.S. that are focused on the process of local regulation. The survey, which was conducted in 2018, includes inquiries about various rules and requirements, each of which highlights a specific regulatory aspect. Based on the responses, the authors construct 12 separate indexes that capture different components of the local regulatory environment. Indexes include the Local Political Pressure Index (LPPI), which measures the degree to which various agents participate in the local residential development process, the Density Restriction Index (DRI), which refers to the restrictiveness of minimum lot sizes, and the Approval Delay Index, which measures the length of time it takes for permit approvals for development projects. These indexes, along with nine others are collectively used to construct the aggregate index, the WRLURI, which provides a comprehensive overview of the stringency of the local regulatory environment.

The dataset contains information on 2,844 suburban communities in the United States, 2,472 of which have complete information. I filter the data so that it only contains those 2,472 communities. This is to ensure that all the communities in the dataset have an observation for the aggregate index (WRLURI), since it cannot be constructed if any of the subindexes is missing. Filtering the data in this way also ensures consistency in the analysis, as it is based on a homogeneous set of communities with complete information, which can help maintain the validity of the results.

Note that although this dataset may be the most comprehensive one available on residential land use regulation, it has several limitations. As mentioned earlier, one of those

limitations is that it relies on self-reported data from suburban communities in America, which may introduce the possibility of inaccurate responses. Additionally, the dataset does not include complete information for a modest number of communities that have responded to the survey. There are also numerous communities in the United States that are not included in this dataset, which may blur the diversity of housing regulations across suburban areas in the nation.

PolicyMap

To examine the main determinants of exclusionary zoning, various socioeconomic variables will be used. As mentioned in the hypotheses section, these variables include income, race, age, population density, poverty rates and homeownership rates. Data from 2020 on these variables were sourced from PolicyMap, which is a cloud-based Geographic Information System (GIS) that allows users to explore and visualize data on various demographic, socioeconomic, and housing variables.

PolicyMap gathers its data from multiple reputable sources, including the U.S. Census Bureau, the Bureau of Labor Statistics, and the Federal Housing Finance Agency. The platform allows users to select their desired dataset, pick a location, and then specify at which granular level they want the data at, such as state, county, or city. There was no comprehensive dataset that existed for all location levels. Thus, to get information for the suburban communities that are contained in the Wharton dataset, I had to download data at both the county subdivision and city levels, and then combine them in a single data frame before merging it with the Wharton dataset. This process, though hectic, ensured that we obtained the desired data on most communities for which there was regulation information. Just less than 15 communities in the Wharton dataset were omitted due to the merging process, since there was no data for them on PolicyMap.

It is important to note that the platform lacks data on a variety of political variables that may help predict the level of exclusionary policies in American political jurisdictions. The existing literature suggests that the political power of homeowners may be a strong predictor of exclusionary zoning. Thus, obtaining data that sheds light on the degree of political influence wielded by homeowners in American jurisdictions would be interesting. However, such information is not available in the PolicyMap database, which poses a significant limitation.

Methodology

According to the existing literature on the determinants of housing supply regulation, some of which have been listed in the literature review section, there are various variables that might predict the level and intensity of exclusionary zoning in a given jurisdiction in the United States. The variables we will investigate are income, race, age, population density, homeownership rates, housing vacancy rates, employment in the manufacturing industry, and housing types. We will use specific regulation indexes provided in the Wharton dataset to proxy for exclusionary zoning, and we will regress those indexes on all the demographic variables we have data for. The specific variables I will use in the analysis to predict the level of exclusionary zoning in an American jurisdiction are shown in table 1.

Variable	Explanation
MedianIncome	Estimated median income of a household in 2020
PercentWhite	Percentage of all people who were white in 2020
HomeownershipPercentage	Estimated percentage of all households that own a home in 2020
MedianAge	Estimated median age of all people in 2020
PercentManufacturing	Percentage of people aged 16 years or older employed in the manufacturing industry in 2020
PercentBachelorDegree	Percentage of people with at least a bachelor's degree in 2020
PercentVacant	Percentage of housing units that were vacant in 2020
PercentSFH	Percentage of housing units that were single-family homes in 2020
PercentPoverty	Percentage of all people living in poverty in 2020
PopulationDensity	Number of people per square mile in 2020

Table 1: Socioeconomic Variables to be Analyzed and their Explanation

It is worth mentioning that PolicyMap does not have population density information for a considerable number of suburban communities that responded to the Wharton survey. Therefore, calculating population density for these specific communities was an issue that I had to address.

To solve this problem, I obtained data on the total population and total area of these communities and performed the necessary calculations to determine population density. Specifically, I divided the total population by the total area to obtain the number of people per square mile, which is a commonly used measure of population density.

Although there are 13 regulation indexes that could proxy for exclusionary zoning, only the few most pertinent ones will be used. Given the comprehensiveness of the Wharton Residential Land Use Regulation Index (WRLURI) and the fact that its construction relies on subindexes that capture different regulatory aspects, it will be one of the indexes that are used to proxy for exclusionary zoning. As Gyourko and Molloy (2015) indicate, minimum lot size regulations can have exclusionary intentions and effects because they tend to restrict access to potential minority residents and potential low-income residents. Thus, the Density Restriction Index (DRI) might be an interesting subindex to explore given that it directly captures the restrictiveness of minimum lot sizes in U.S. jurisdictions. To find another subindex that proxies for exclusionary zoning, a correlation matrix is created. This matrix captures the correlations between the various regulation indexes that are created from the Wharton survey. The subindex that is most highly correlated with the DRI will be chosen.

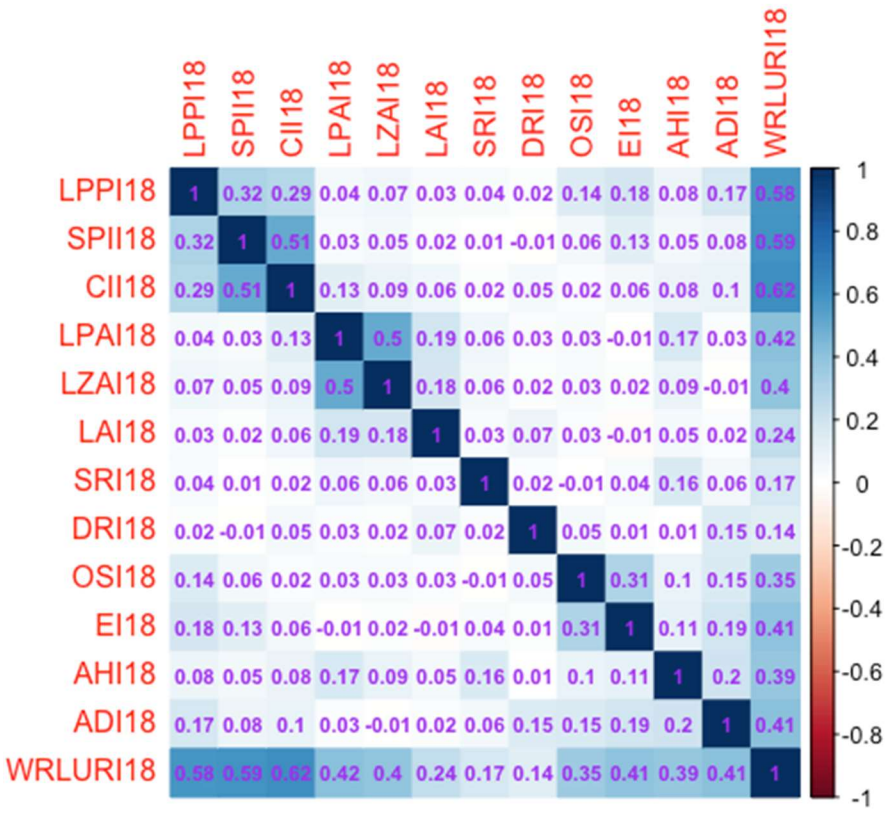

Figure 1: Correlation Matrix of Regulation Indexes

This is a correlation matrix that demonstrates the relationship between the various regulation indexes that are included in the Wharton dataset. It will help us choose a third regulation index to proxy for exclusionary zoning.

Figure 1 shows that the Approval Delay Index (ADI), which measures the length of time it takes for development projects to receive approval, is the most highly correlated index with the DRI. The matrix also reveals that ADI is one of the top five most highly correlated subindexes with the aggregate index, the WRLURI. Exclusionary zoning often entails the deliberate delay or obstruction of the approval process of certain development projects, such as multi-family housing. This is typically done to discourage or limit the construction of developments that may be attractive and affordable to specific populations. Thus, ADI can be considered a relevant

proxy for exclusionary zoning as it gives an indication of the administrative barriers or red tape that are put in place to deter certain subgroups from moving into an area.

Now that we have identified and selected the indexes that will be used to proxy for exclusionary zoning, we will create a matrix that demonstrates the correlations between these indexes and the various socioeconomic variables we will test. This will give us an overview of the relationships between the regressors and predictors of concern. We will then proceed with regression analysis, which will involve different types of models that vary in their degree of depth and complexity.

We will utilize a basic model that contains all of the socioeconomic variables as the predictors, and the selected regulation indexes (DRI, ADI, and WRLURI) as the regressors. Then, we will use another model that includes dummy variables, which may help us identify and capture non-linear relationships. A third and final model that includes interaction terms will be utilized to account for moderating effects. The interaction terms will assist us in investigating how the relationship between the socioeconomic variables and exclusionary zoning may be moderated by other factors. Because the inclusion of interaction terms and dummy variables allows us to identify more nuanced relationships and intricate patterns that might not be captured or reflected by the basic model, we will consider those models advanced. Thus, to clarify, there will be two different advanced models, one that contains dummy variables, and another that includes interactions.

The dummy variables will be made for two predictors: MedianIncome, which represents median household income, and PercentWhite, representing the percentage of the population that is white. This is because according to McDonald's study, which was referenced earlier, middle-income black and Anglo precincts in Houston, Texas, were stronger supporters of a proposed

zoning ordinance compared to both their low-income, and high-income counterparts. Thus, there may be a non-linear relationship that exists between exclusionary zoning and those two demographic variables, which will be explored through the incorporation of dummy variables.

For income, three categorical variables will be created depending on the estimated median household income in a community. Communities with a median household income level that is below the first quartile value will be classified as low-income, whereas those with a value above the third quartile will be considered high-income. Communities with a median household income that is in between those two values will be classified as medium-income. The same process will be done for the race variable. Table 2 shows the descriptive statistics of both the MedianIncome and PercentWhite variables, which will be necessary for determining the quartile values and thus creating the desired categorical variables.

The interaction terms will involve three variables: MedianIncome, PercentWhite, and HomeownershipPercentage, which represents the percentage of households that own a home. Interacting the homeownership and income variables will allow us to investigate how the impact of income on exclusionary zoning varies depending on homeownership rates. An interactive term between income and race can help shed light on how the impact of exclusionary zoning varies depending on the racial composition of a jurisdiction. Finally, interacting the homeownership rate and race variables can give us an insight into how the influence of homeownership rates on exclusionary zoning varies across different racial groups.

Variable	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
MedianIncome	20476	53262	68912	76651	91454	250001
PercentWhite	2.67	64.46	81.82	74.73	90.28	97.98

Table 2: Descriptive Statistics of MedianIncome and PercentWhite

Based on these regression specifications, the regressions will look as follows:

Basic Models

$$\begin{aligned}\text{WRLURI} = \beta_0 &+ \beta_1 \text{MedianIncome} + \beta_2 \text{PercentWhite} \\ &+ \beta_3 \text{HomeownershipPercentage} + \beta_4 \text{MedianAge} \\ &+ \beta_5 \text{PercentManufacturing} + \beta_6 \text{PercentBachelorDegree} \\ &+ \beta_7 \text{PercentVacant} + \beta_8 \text{PercentSFH} \\ &+ \beta_9 \text{PercentPoverty} + \beta_{10} \text{PopulationDensity} + u_i\end{aligned}$$

$$\begin{aligned}\text{DRI} = \beta_0 &+ \beta_1 \text{MedianIncome} + \beta_2 \text{PercentWhite} \\ &+ \beta_3 \text{HomeownershipPercentage} + \beta_4 \text{MedianAge} \\ &+ \beta_5 \text{PercentManufacturing} + \beta_6 \text{PercentBachelorDegree} \\ &+ \beta_7 \text{PercentVacant} + \beta_8 \text{PercentSFH} \\ &+ \beta_9 \text{PercentPoverty} + \beta_{10} \text{PopulationDensity} + u_i\end{aligned}$$

$$\begin{aligned}\text{ADI} = \beta_0 &+ \beta_1 \text{MedianIncome} + \beta_2 \text{PercentWhite} \\ &+ \beta_3 \text{HomeownershipPercentage} + \beta_4 \text{MedianAge} \\ &+ \beta_5 \text{PercentManufacturing} + \beta_6 \text{PercentBachelorDegree} \\ &+ \beta_7 \text{PercentVacant} + \beta_8 \text{PercentSFH} \\ &+ \beta_9 \text{PercentPoverty} + \beta_{10} \text{PopulationDensity} + u_i\end{aligned}$$

Advanced Models (Dummy Variables)

$$\begin{aligned}\text{DRI} = \beta_0 &+ \beta_1 \text{MediumIncome} + \beta_2 \text{HighIncome} + \beta_3 \text{MediumWhite} \\ &+ \beta_4 \text{HighWhite} + \beta_5 \text{HomeownershipPercentage} + \beta_6 \text{MedianAge} \\ &+ \beta_7 \text{PercentManufacturing} + \beta_8 \text{PercentBachelorDegree} \\ &+ \beta_9 \text{PercentVacant} + \beta_{10} \text{PercentSFH} \\ &+ \beta_{11} \text{PercentPoverty} + \beta_{12} \text{PopulationDensity} + u_i\end{aligned}$$

$$\begin{aligned}\text{ADI} = \beta_0 &+ \beta_1 \text{MediumIncome} + \beta_2 \text{HighIncome} + \beta_3 \text{MediumWhite} \\ &+ \beta_4 \text{HighWhite} + \beta_5 \text{HomeownershipPercentage} + \beta_6 \text{MedianAge} \\ &+ \beta_7 \text{PercentManufacturing} + \beta_8 \text{PercentBachelorDegree} \\ &+ \beta_9 \text{PercentVacant} + \beta_{10} \text{PercentSFH} \\ &+ \beta_{11} \text{PercentPoverty} + \beta_{12} \text{PopulationDensity} + u_i\end{aligned}$$

Advanced Models (Interaction Terms)

$$\begin{aligned}\text{WRLURI} = \beta_0 &+ \beta_1 \text{MedianIncome} + \beta_2 \text{PercentWhite} \\ &+ \beta_3 \text{HomeownershipPercentage} + \beta_4 \text{MedianAge} \\ &+ \beta_5 \text{PercentManufacturing} + \beta_6 \text{PercentBachelorDegree} \\ &+ \beta_7 \text{PercentVacant} + \beta_8 \text{PercentSFH} \\ &+ \beta_9 \text{PercentPoverty} + \beta_{10} \text{PopulationDensity} \\ &+ \beta_{11} \text{MedianIncome} \cdot \text{HomeownershipPercentage} \\ &+ \beta_{12} \text{MedianIncome} \cdot \text{PercentWhite} \\ &+ \beta_{13} \text{HomeownershipPercentage} \cdot \text{PercentWhite} + u_i\end{aligned}$$

$$\begin{aligned}\text{DRI} = {} & \beta_0 + \beta_1 \text{MedianIncome} + \beta_2 \text{PercentWhite} \\ & + \beta_3 \text{HomeownershipPercentage} + \beta_4 \text{MedianAge} \\ & + \beta_5 \text{PercentManufacturing} + \beta_6 \text{PercentBachelorDegree} \\ & + \beta_7 \text{PercentVacant} + \beta_8 \text{PercentSFH} \\ & + \beta_9 \text{PercentPoverty} + \beta_{10} \text{PopulationDensity} \\ & + \beta_{11} \text{MedianIncome} \cdot \text{HomeownershipPercentage} \\ & + \beta_{12} \text{MedianIncome} \cdot \text{PercentWhite} \\ & + \beta_{13} \text{HomeownershipPercentage} \cdot \text{PercentWhite} + u_i\end{aligned}$$

$$\begin{aligned}\text{ADI} = {} & \beta_0 + \beta_1 \text{MedianIncome} + \beta_2 \text{PercentWhite} \\ & + \beta_3 \text{HomeownershipPercentage} + \beta_4 \text{MedianAge} \\ & + \beta_5 \text{PercentManufacturing} + \beta_6 \text{PercentBachelorDegree} \\ & + \beta_7 \text{PercentVacant} + \beta_8 \text{PercentSFH} \\ & + \beta_9 \text{PercentPoverty} + \beta_{10} \text{PopulationDensity} \\ & + \beta_{11} \text{MedianIncome} \cdot \text{HomeownershipPercentage} \\ & + \beta_{12} \text{MedianIncome} \cdot \text{PercentWhite} \\ & + \beta_{13} \text{HomeownershipPercentage} \cdot \text{PercentWhite} + u_i\end{aligned}$$

Note that interpreting the coefficients of the interaction terms can be challenging. Thus, an example might help. To find the marginal effect of income on the aggregate index, we can take the partial derivative of MedianIncome with respect to the WRLURI, which yields:

$$\frac{\partial \text{MedianIncome}}{\partial \text{WRLURI}} = \beta_1 + \beta_{11} \text{HomeownershipPercentage} + \beta_{12} \text{PercentWhite}$$

If we assume that β_1 and β_{11} are both positive and significant, then higher homeownership rates increase the positive effect of income on the aggregate index. If, on the other hand, we assume that β_1 is positive but β_{11} is negative, then a higher homeownership rate decreases the positive effect of income on WRLURI.

Results and Analysis

A correlation matrix that demonstrates the relationships between the regulation indexes and our socioeconomic variables is shown in figure 2. Based on the correlations, the regulation indexes that seem to exhibit the strongest associations with the variables of concern are the indexes that have been selected to proxy for exclusionary zoning: the Density Restriction Index (DRI), the Approval Delay Index (ADI), and the Wharton Residential Land Use Regulation Index (WRLURI). However, it is important to note that while these correlations offer valuable insights, they offer a limited depth of analysis compared to regression models.

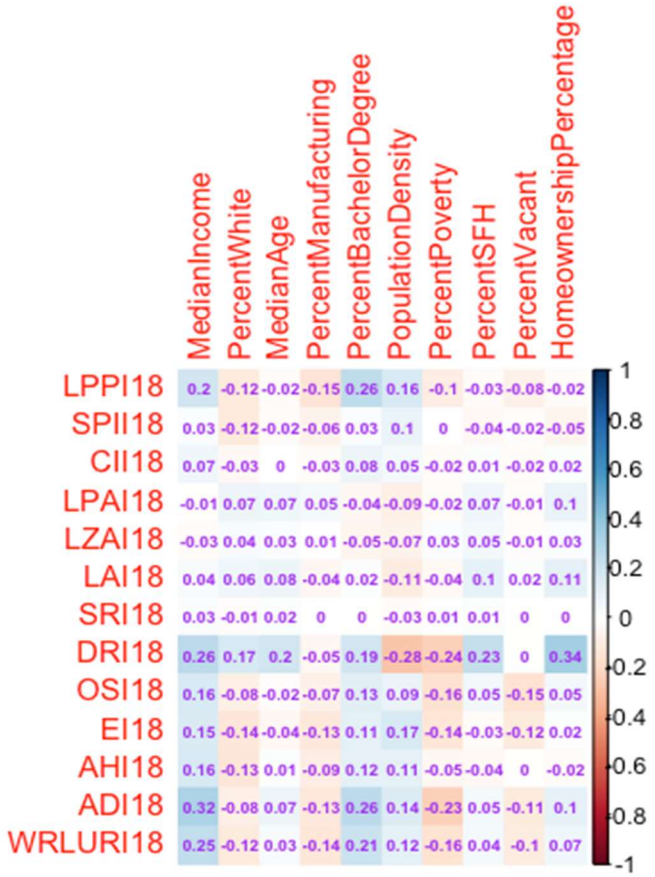

Figure 2: Correlation Matrix of Regulation Indexes and Socioeconomic Variables

Moving forward, we will delve into the results of the regression models. A subsection will be devoted to reporting and analyzing the results of the basic models. Another subsection will cover the results of the advanced models with dummy variables, and a third subsection will focus on the advanced models with interaction terms.

Basic models

Table 3 in the following page displays the results of the basic regression models. We will begin with the basic WRLURI model. There is a statistically significant positive relationship between MedianIncome and WRLURI, which is expected as higher income areas typically have stronger support for regulatory barriers to preserve property values. This positive relationship is in line with the findings of Gyourko, Hartley, and Krimmel (2019), who demonstrated that regulation was increasing in local income. Table 3 shows that a one thousand dollar increase in median household income is associated with a 0.005237 increase in WRLURI, holding all other variables constant.

We may get a more insightful interpretation by comparing standard deviations instead. In this case, a one standard deviation increase in MedianIncome (33847.78) is associated with approximately a 1/5 standard deviation increase in WRLURI (0.177), which is a relatively modest effect. Another variable that had a statistically significant positive effect on WRLURI is MedianAge. However, its effect on the aggregate index was much smaller compared to that of median household income. In particular, a one standard deviation increase in the estimated median age of a population (6.85) is associated with approximately a 1/15 standard deviation increase in the aggregate index (0.063).

The remaining statistically significant variables all have a negative effect on the aggregate index. For instance, the table indicates that Percent Manufacturing had a statistically

significant negative effect on WRLURI, supporting the findings cited in the literature review (Glaeser &Ward, 2009). Again, this may be because that the proportion of the population working in manufacturing proxies for working class residents who are not as concerned about implementing zoning ordinances to restrict access to affordable housing. PercentWhite also had a statistically significant negative effect on the aggregate index, meaning that as the percentage of the population that is white increases, the WRLURI tends to decrease, corroborating the findings reported in the literature review (Gyourko et. al, 2019).

Regressor	Estimate	Std. Error	t value	Pr(> |t|)
WRLURI				
(Intercept)	1.687e-01	2.401e-01	0.702	0.482441
MedianIncome (in 000s)	5.237e-03	1.231e-03	4.255	2.17e-05 ***
PercentWhite	-7.858e-03	1.322e-03	-5.942	3.21e-09 ***
MedianAge	9.191e-03	3.579e-03	2.568	0.010295 *
PercentManufacturing	-1.100e-02	3.078e-03	-3.573	0.000359 ***
PopulationDensity	4.398e-06	1.272e-05	0.346	0.729526
PercentSFH	-1.254e-03	2.270e-03	-0.552	0.580689
PercentVacant	-7.535e-03	2.525e-03	-2.984	0.002869 **
PercentPoverty	-7.487e-03	4.145e-03	-1.806	0.071027 .
PercentBachelorDegree	1.223e-03	2.039e-03	0.600	0.548606
HomeownershipPercentage	-2.525e-04	2.683e-03	-0.094	0.925021
Adjusted R^2: 0.09134				
Residual standard error: 0.9542				
DRI				
(Intercept)	1.594e+00	2.996e-01	5.321	1.13e-07 ***
MedianIncome (in 000s)	5.081e-03	1.536e-06	3.309	0.000951 ***
PercentWhite	-6.061e-03	1.650e-03	-3.673	0.000245 ***
MedianAge	8.416e-03	4.466e-03	1.884	0.059620 .
PercentManufacturing	-1.068e-02	3.841e-03	-2.780	0.005478 **
PopulationDensity	-2.007e-04	1.587e-05	-12.645	¡ 2e-16 ***
PercentSFH	-9.867e-03	2.832e-03	-3.484	0.000503 ***
PercentVacant	-2.787e-03	3.150e-03	-0.885	0.376443
PercentPoverty	-3.977e-03	5.172e-03	-0.769	0.441985
PercentBachelorDegree	4.396e-03	2.544e-03	1.728	0.084146 .
HomeownershipPercentage	2.012e-02	3.347e-03	6.011	2.12e-09 ***
Adjusted R^2: 0.1804				
Residual standard error: 1.191				
ADI				
(Intercept)	5.757e+00	1.077e+00	5.348	9.73e-08 ***
MedianIncome (in 000s)	3.591e-02	5.518e-06	6.508	9.20e-11 ***
PercentWhite	-2.899e-02	5.929e-03	-4.889	1.08e-06 ***
MedianAge	5.415e-02	1.605e-02	3.374	0.000752 ***
PercentManufacturing	-3.072e-02	1.380e-02	-2.226	0.026115 *
PopulationDensity	8.025e-05	5.702e-05	1.407	0.159473
PercentSFH	-1.226e-02	1.018e-02	-1.204	0.228587
PercentVacant	-2.442e-02	1.132e-02	-2.157	0.031098 *
PercentPoverty	-6.779e-02	1.859e-02	-3.647	0.000270 ***
PercentBachelorDegree	-1.665e-03	9.142e-03	-0.182	0.855491
HomeownershipPercentage	-1.455e-02	1.203e-02	-1.210	0.226520
Adjusted R^2: 0.1305				
Residual standard error: 4.278				

Table 3: Regression Results of the Basic Models

Additionally, PercentVacant had a statistically significant negative effect on the WRLURI, indicating that a higher proportion of housing units that are vacant is associated with a lower degree of regulation. Another variable that had a negative effect on the aggregate index is HomeownershipPercentage. This is unexpected since it contradicts the logical idea that a higher proportion of homeowners would result in a more stringent regulatory environment due to their shared interest in protecting their property values. However, it is important to note that the result is statistically insignificant. It is also worth mentioning that this model's adjusted R-squared is only 0.09134, which indicates that the predictors only explain 9.134% of the variation in the aggregate index. Thus, it is important to keep in mind that the selected socioeconomic factors only account for a small portion of the variation observed in the WRLURI.

For the basic DRI model, the MedianIncome variable had a statistically significant positive effect on the DRI, just as it did on the aggregate index. In this case, a one standard deviation increase in MedianIncome is associated with nearly a 1/5 standard deviation increase in the DRI, holding all other variables constant. This income effect is similar in the WRLURI model as well. Estimated median age seems to have a relatively higher impact on the Density Restriction Index than it has on the aggregate index. A one standard deviation increase in the estimated median age of a jurisdiction's population is associated with approximately a 1/17 standard deviation increase in the DRI. This estimate can be considered marginally significant although the p-value (0.06) is slightly higher than the conventional significance level of 0.05. As is the case with the WRLURI, PercentWhite had a negative and statistically significant effect on the DRI. The proportion of the population that is 16 years old or higher working in manufacturing had a relatively similar negative effect on the DRI as it did on the WRLURI.

The population density and single-family home variables both have a statistically significant negative effect on the DRI. This may be counterintuitive since one would logically expect a higher population density to be associated with a higher need for regulation. Similarly, a higher proportion of single-family homes would typically be associated with higher regulatory restrictiveness, since American zoning was primarily introduced to protect single-family homeowners (Fischel, 2004). Although the impact is modest, it is worth mentioning that the percentage of people living in poverty also had a statistically significant negative effect on the DRI, which is aligned with the findings mentioned in the literature review (Gyourko et. al, 2019). The adjusted R-squared of this model is 0.1804, which indicates that the predictors explain 18.04% of the variation in the DRI. Therefore, the predictors explain a larger proportion of the variation observed in the DRI than they do for the aggregate index.

According to the regression results of the basic ADI model, the effect of median household income on the ADI is positive and significant, similar to its effects on the DRI and WRLURI. Similarly, the estimated median age variable, MedianAge, had a statistically significant positive effect on the ADI, as it did for the other two indexes. Meanwhile, the poverty, vacancy, and manufacturing variables all had a statistically significant, yet modest negative effect on the ADI. The adjusted R-squared of the model is 0.1305, which is higher than the basic WRLURI model, but lower than the basic DRI model.

Advanced Models (Dummy Variables)

Now, we turn to the advanced models, which include interaction terms and dummy variables. First, I will discuss the results of the advanced models that incorporate dummy variables. The results are shown in table 4. For the advanced WRLURI model, the median age variable had a statistically significant positive effect on the WRLURI, whereas both the

PercentManufacturing and PercentVacant variables had a statistically significant negative effect on the aggregate index. These results are consistent with the findings in the basic WRLURI model.

Regressor	Estimate	Std. Error	t value	Pr(> |t|)
WRLURI				
(Intercept)	-6.857e-02	2.442e-01	-0.281	0.77893
medium_income	1.595e-01	6.456e-02	2.470	0.01358*
high_income	5.483e-01	9.993e-02	5.487	4.51e-08***
medium_white	-2.426e-01	5.346e-02	-4.538	5.95e-06***
high_white	-2.998e-01	6.944e-02	-4.317	1.65e-05***
MedianAge	8.758e-03	3.616e-03	2.422	0.01551*
PercentManufacturing	-1.208e-02	3.077e-03	-3.924	8.95e-05***
PopulationDensity	1.783e-05	1.222e-05	1.459	0.14458
PercentSFH	2.454e-04	2.260e-03	0.109	0.91353
PercentVacant	-7.222e-03	2.529e-03	-2.856	0.00433**
PercentPoverty	-4.471e-03	4.500e-03	-0.994	0.32049
PercentBachelorDegree	1.431e-03	1.734e-03	0.826	0.40912
HomeownershipPercentage	-1.939e-03	2.694e-03	-0.720	0.47179
Adjusted R^2: 0.09121				
Residual standard error: 0.9543				
DRI				
(Intercept)	1.341e+00	3.040e-01	4.410	1.08e-05***
medium_income	2.393e-01	8.037e-02	2.978	0.002931**
high_income	4.573e-01	1.244e-01	3.676	0.000242***
medium_white	-3.289e-01	6.655e-02	-4.942	8.25e-07***
high_white	-1.845e-01	8.645e-02	-2.135	0.032877*
MedianAge	7.801e-03	4.502e-03	1.733	0.083239.
PercentManufacturing	-1.150e-02	3.831e-03	-3.003	0.002701**
PopulationDensity	-1.924e-04	1.521e-05	-12.651	¡ 2e-16***
PercentSFH	-7.584e-03	2.813e-03	-2.696	0.007063**
PercentVacant	-3.526e-03	3.148e-03	-1.120	0.262774
PercentPoverty	8.792e-04	5.602e-03	0.157	0.875290
PercentBachelorDegree	7.921e-03	2.158e-03	3.670	0.000247***
HomeownershipPercentage	1.799e-02	3.354e-03	5.364	8.89e-08***
Adjusted R^2: 0.1841				
Residual standard error: 1.188				
ADI				
(Intercept)	4.748e+00	1.098e+00	4.323	1.60e-05***
medium_income	7.063e-01	2.903e-01	2.433	0.015058*
high_income	2.229e+00	4.494e-01	4.960	7.54e-07***
medium_white	-1.163e+00	2.404e-01	-4.840	1.38e-06***
high_white	-1.697e+00	3.123e-01	-5.435	6.01e-08***
MedianAge	5.560e-02	1.626e-02	3.419	0.000639***
PercentManufacturing	-3.106e-02	1.384e-02	-2.244	0.024913*
PopulationDensity	1.267e-04	5.495e-05	2.305	0.021229*
PercentSFH	-3.293e-03	1.016e-02	-0.324	0.745948
PercentVacant	-2.590e-02	1.137e-02	-2.277	0.022854*
PercentPoverty	-6.983e-02	2.024e-02	-3.451	0.000569***
PercentBachelorDegree	1.646e-02	7.796e-03	2.111	0.034863*
HomeownershipPercentage	-9.977e-03	1.212e-02	-0.823	0.410385
Adjusted R^2: 0.1251				
Residual standard error: 4.291				

Table 4: Regression Results of the Advanced Models (Dummy Variables)

The coefficient of medium_income is approximately 0.16, indicating that U.S. jurisdictions with moderate income levels have an expected WRLURI that is 0.16 higher compared to their low-income counterparts. The coefficient of high_income is nearly 0.55, which suggests that the expected WRLURI is approximately 0.55 higher in high-income areas compared to low-income ones. These coefficients, which are statistically significant, indicate that higher income areas tend to implement stricter regulatory barriers, which can have exclusionary effects. Although this result somewhat deviates from McDonald's findings (Cited in Gyourko and Molloy, 2015), it makes intuitive sense. It is logical to expect stringent regulatory barriers to be increasing in income, as wealthier areas tend to prioritize the preservation of property values.

The coefficients of the medium_white and high_white categorical variables are approximately -0.243 and -0.3 respectively, which indicates that the expected WRLURI of U.S. jurisdictions is decreasing in their level of whiteness. Both estimates are statistically significant. This is in line with the findings of Gyourko et. al (2019) who showed that regulation was decreasing in the proportion of the population that is white. The results reveal a reasonably linear relationship between both median household income and the proportion of the population that is white with regulatory restrictiveness.

For the advanced DRI model, the PercentManufacturing, PopulationDensity, and Percent SFH variables all have a statistically significant negative effect on the DRI, whereas PercentBachelorDegree and HomeownershipPercentage were the only two continuous variables that have a statistically significant positive coefficient. The medium_income and high_income variables both had positive coefficients, which is in line with the findings in the advanced WRLURI model. In particular, areas with a moderate (medium) income level have an expected WRLURI that is approximately 0.24 higher than low-income areas, and areas with a high income

level have an expected WRLURI that is about 0.46 higher than low-income areas. These results, which are statistically significant, indicate a fairly linear relationship between median household income and regulatory restrictiveness. The medium_white and high_white variables both have statistically significant negative coefficients. However, the negative impact of medium_white is greater than that of high_white. Specifically, jurisdictions with a moderate proportion of white residents have an expected DRI value that is nearly 0.33 lower than jurisdictions with a low proportion of white residents. On the other hand, jurisdictions with a high proportion of white residents display an expected DRI value that is approximately 0.185 lower than jurisdictions with a low proportion of white residents

The advanced ADI model indicates that the variables that have a significant and positive effect on the ADI are MedianAge, PercentBachelorDegree and PopulationDensity variables, whereas the variables that have a significant negative effect are PercentManufacturing, PercentVacant, and PercentPoverty. These results are expected and in line with previous results. The model indicates that jurisdictions with a moderate income level have an expected ADI of around 0.706 higher than low-income ones. It also shows that jurisdictions with higher income levels have an expected ADI of 2.23 higher than their low-income counterparts. Both results are statistically significant. The medium_white and high_white variables are both negative and significant. Compared to jurisdictions with a low proportion of white residents, areas with a moderate proportion of white residents have an ADI that is nearly 1.2 lower, whereas jurisdictions with a high proportion of white residents have an expected ADI that is approximately 1.7 lower.

Note that the results obtained thus far indicate a reasonably linear relationship between both median household income and the level of whiteness in a population with regulatory

restrictiveness. Thus, it may be more appropriate to just include continuous variables in the advanced models that incorporate interaction terms. This will streamline the analysis process and enhance its clarity and coherence.

Advanced Models (Interaction Terms)

Now, I will focus on the advanced models that include interaction terms. The results are shown in table 5 in the following page. Looking at the WRLURI model, the continuous variables that have a positive and significant effect on the WRLURI are MedianIncome, MedianAge, and HomeownershipPercentage, whereas those that have a significant negative effect on it are PercentWhite, PercentManufacturing, and PercentVacant. These results are similar to those in other models.

When it comes to the interaction terms, the only one that is statistically significant is the one between MedianIncome and HomeownershipPercentage, though the effect is very small and negative. It indicates that the impact of median household income on the aggregate index varies according to the homeownership rate. Specifically, a higher homeownership rate tends to decrease the positive effect of median household income on the aggregate index. This is evident from the positive coefficient of the MedianIncome variable (2.557e-05) and the negative coefficient of the interaction term (-2.68e-07). These numbers collectively suggest that as the percentage of households that own a home increases by 1, the impact of median household income on the aggregate index decreases by 0.000000268, indicating a relatively small effect.

For the DRI model, the only continuous variables that had a significant and positive effect on the index are MedianIncome and PercentBachelorDegree. The rest of the continuous variables that were statistically significant, such as PercentWhite, PercentManufacturing, PopulationDensity, and PercentSFH, all had a negative effect on the DRI. The only interaction

term that had a significant coefficient is the one between PercentWhite and HomeownershipPercentage. The estimate indicates that the higher the percentage of households that own a home, the lower the negative impact of PercentWhite on the DRI. This is illustrated

Regressor	Estimate	Std. Error	t value	Pr(> |t|)
WRLURI Interaction				
(Intercept)	-1.376e+00	4.954e-01	-2.778	0.005519**
MedianIncome	2.557e-05	4.399e-06	5.811	7.01e-09***
PercentWhite	-1.043e-02	4.576e-03	-2.279	0.022748*
MedianAge	1.013e-02	3.588e-03	2.822	0.004808**
PercentManufacturing	-1.070e-02	3.074e-03	-3.480	0.000511***
PopulationDensity	-3.183e-06	1.292e-05	-0.246	0.805467
PercentSFH	5.544e-04	2.282e-03	0.243	0.808089
PercentVacant	-8.128e-03	2.518e-03	-3.228	0.001264**
PercentPoverty	4.104e-03	4.648e-03	0.883	0.377320
PercentBachelorDegree	8.796e-04	2.051e-03	0.429	0.667986
HomeownershipPercentage	1.599e-02	7.266e-03	2.201	0.027807*
MedianIncome:HomeownershipPercentage	-2.680e-07	5.098e-08	-5.257	1.59e-07***
MedianIncome:PercentWhite	3.207e-08	4.226e-08	0.759	0.447991
PercentWhite:HomeownershipPercentage	1.684e-05	7.871e-05	0.214	0.830586
Adjusted R^2: 0.1011				
Residual standard error: 0.949				
DRI Interaction				
(Intercept)	3.705e+00	6.170e-01	6.005	2.20e-09***
MedianIncome	1.211e-05	5.479e-06	2.209	0.027243*
PercentWhite	-3.943e-02	5.700e-03	-6.919	5.80e-12***
MedianAge	6.224e-03	4.468e-03	1.393	0.163777
PercentManufacturing	-1.229e-02	3.829e-03	-3.210	0.001343**
PopulationDensity	-2.124e-04	1.610e-05	-13.194	¡ 2e-16***
PercentSFH	-9.590e-03	2.842e-03	-3.374	0.000753***
PercentVacant	-4.054e-03	3.136e-03	-1.293	0.196293
PercentPoverty	-2.018e-03	5.789e-03	-0.349	0.727439
PercentBachelorDegree	5.657e-03	2.554e-03	2.215	0.026861*
HomeownershipPercentage	-1.590e-02	9.050e-03	-1.757	0.078961.
MedianIncome:HomeownershipPercentage	-7.612e-08	6.349e-08	-1.199	0.230674
MedianIncome:PercentWhite	-1.740e-08	5.264e-08	-0.331	0.740985
PercentWhite:HomeownershipPercentage	5.497e-04	9.803e-05	5.607	2.29e-08***
Adjusted R^2: 0.1921				
Residual standard error: 1.182				
ADI Interaction				
(Intercept)	-4.268e+00	2.208e+00	-1.933	0.053364.
MedianIncome	1.772e-04	1.961e-05	9.034	¡ 2e-16***
PercentWhite	-1.053e-02	2.040e-02	-0.516	0.605760
MedianAge	5.685e-02	1.599e-02	3.555	0.000385***
PercentManufacturing	-3.051e-02	1.370e-02	-2.226	0.026090*
PopulationDensity	1.606e-05	5.761e-05	0.279	0.780462
PercentSFH	-2.157e-03	1.017e-02	-0.212	0.832070
PercentVacant	-2.738e-02	1.122e-02	-2.439	0.014787**
PercentPoverty	1.234e-04	2.072e-02	0.006	0.995247
PercentBachelorDegree	-7.042e-04	9.140e-03	-0.077	0.938596
HomeownershipPercentage	5.414e-02	3.239e-02	1.672	0.094722.
MedianIncome:HomeownershipPercentage	-1.262e-06	2.272e-07	-5.556	3.06e-08***
MedianIncome:PercentWhite	-4.614e-07	1.884e-07	-2.449	0.014390*
PercentWhite:HomeownershipPercentage	2.412e-04	3.508e-04	0.687	0.491845
Adjusted R^2: 0.1499				
Residual standard error: 4.23				

Table 5: Regression Results of the Advanced Models (Interaction Terms)

by the negative coefficient of PercentWhite (-0.03943) and the positive coefficient of the interaction term (0.00055).

According to the regression results of the ADI model, the only continuous variables with a significant and positive coefficient are MedianIncome and MedianAge, whereas the only ones with a significant and negative coefficient are PercentManufacturing and PercentVacant. When it comes to the interactions, the term between MedianIncome and HomeownershipPercentage is negative, as it was in the WRLURI model. This indicates that a higher homeownership rate decreases the positive effect of median household income on the ADI. The interaction between MedianIncome and PercentWhite is also negative, suggesting that a higher proportion of white residents decreases the positive effect of income on the ADI. Note that the adjusted R-squared values of all the advanced models that have interaction terms are slightly higher than their corresponding basic models which indicates that the advanced models do a better job of capturing the observed variations in the selected regulation indexes.

Discussion

When analyzing the basic models, the most pertinent predictors based on statistical significance seemed to be MedianIncome, MedianAge, HomeownershipPercentage, PercentWhite, PercentManufacturing, and PercentPoverty. Median household income and median age both had a positive effect on the selected regulations indexes across all the basic models, which is in line with what I hypothesized. This suggests that a higher income level in a U.S. jurisdiction is associated with more stringent regulation, which is reasonable since higher income areas are usually more concerned about maintaining property values and more financially capable of enforcing regulatory barriers that suit their interests.

It also suggests that older communities are more likely to adopt regulatory barriers, which makes sense as higher age may proxy for older residents who prioritize stability, property values, and maintaining existing neighborhood characteristics. Also, older populations generally have more influence on local policy and have a higher degree of civic and political engagement which positively impacts their ability to restrict developments that may be incompatible with their desires. In this case, age may be correlated with homeowners' ability to influence policymaking decisions.

The PercentManufacturing and PercentPoverty variables, which capture the proportion of the population working in manufacturing, and the percentage of the population living in poverty respectively, each had a negative effect on the selected indexes across the basic models. Those results, which are consistent with the literature review and in line with my hypothesis, are sensible since poorer jurisdictions may prioritize economic development over strict regulation. They may also lack the financial resources and political influence to advocate for regulatory barriers, which contributes to the leniency of their regulatory climate.

The models consistently display a negative relationship between PercentWhite and the regressors of concern, contrary to my hypothesis. It may seem implausible that jurisdictions with a smaller proportion of white residents have stricter development controls, since existing literature suggests that white residents have historically prioritized maintaining racial segregation. However, this result can also make sense as a higher proportion of white residents may be linked with a lesser need to impose regulatory barriers. Additionally, the models show that PercentVacant had a significant and negative relationship with the WRLURI and the ADI, which indicates higher proportions of vacant housing units may be linked with lower levels of exclusionary zoning, as hypothesized.

In all the models where HomeownershipPercentage had a statistically significant coefficient, the estimate was positive, which aligns with my hypothesis. This implies a positive relationship between homeownership and housing regulation, which makes sense as a higher homeownership rate may be associated with a stronger collective desire to enforce regulatory barriers. However, it is important to note that the relationship between homeownership and regulation is likely to be much more complex than that, especially considering the fact that homeowners are not a homogeneous group and their attitudes and preferences toward regulation may differ significantly.

Based on the results, PercentSFH, which represents the percentage of housing units that are single-family homes, was usually statistically insignificant in capturing the observed variations in the aggregate index and the ADI. This may suggest that this variable does not have a pertinent impact on exclusionary zoning policies. However, it can also imply that the effect of housing composition on exclusionary zoning is indirect and mediated through the more pertinent socioeconomic factors such as income and race. Nonetheless, it is worth mentioning that the

coefficient of PercentSFH was statistically significant and negative in all the DRI models, suggesting a negative relationship between the variable and minimum lot sizes, which goes against my hypothesis.

Although PopulationDensity and PercentBachelorDegree did not have a statistically significant effect on the aggregate index and the ADI, they did have a positive and significant effect on the DRI. This suggests that higher population density and educational attainment are linked with more restrictive minimum lot sizes. This supports my hypothesis, which posited that those socioeconomic variables are positively associated with regulatory restrictiveness and exclusionary zoning measures.

The advanced models that include categorical variables suggested that a higher level of income is associated with a higher degree of regulation. This result was consistent across all models, which gives us more certainty that areas with higher income exhibit a higher tendency to implement restrictive zoning laws. The models also suggested that the degree of regulation is decreasing in the level of whiteness. This was consistent in all the models except for the DRI model, which shows that the medium_white variable has more of a negative effect on the DRI than high_white.

The advanced models with interaction terms suggest that income impacts regulation differently depending on the homeownership rate and racial composition of a jurisdiction. In general, the effects of income, race, and homeownership rates on the selected regulation indexes are not independent of each other. That is, the model suggests that their combined effects and interactions play a role in determining the level of regulation in a U.S. jurisdiction. Observing the results of these interactions provides a more nuanced glimpse on the impact of the socioeconomic variables on the regulatory intensity of an environment.

It is important to note that there are many limitations to this study. For example, the analysis does not include political variables due to issues regarding data availability and collection. These variables could very well be pertinent in predicting the intensity of exclusionary zoning policies in U.S. jurisdictions. As the literature review suggests, the presence of homeowners alone in a community does not accurately predict the intensity of its exclusionary zoning laws (Gyourko and Molloy, 2015). Rather, it is the political influence that these homeowners have that could be a much more accurate predictor. Additionally, adding variables that capture the political affiliation of American jurisdictions can help shed light on how differing beliefs and ideologies can impact the regulatory climate. Thus, the inclusion of political variables in the models would be of paramount importance for further research.

It is also worth mentioning that the regulation indexes were calculated based on a survey that was conducted in 2018, whereas data on the socioeconomic variables of concern were sourced from 2020. Although there is a time lag between the data sources, it should not be a major issue as socioeconomic patterns generally exhibit relative stability over short timeframes. Additionally, due to the lack of regulation data, the analysis does not capture the dynamic relationship of the predictors on the regulation indexes over time, which further limits the study.

One more point that might be worth mentioning is that although a reasonable rationale backed by quantitative measures was used to select the regulation indexes, they may not necessarily be the best measures of exclusionary zoning. That is, although the chosen indexes do capture regulatory dimensions that have historically been linked with exclusionary practices, they might not be the most accurate and comprehensive measures of exclusionary zoning.

Conclusion

The results of the analysis, coupled with other literature on this topic lead us to conclude that the intensity of exclusionary zoning can be partially predicted by socioeconomic factors such as income, race, age, poverty, and homeownership. Older and wealthier areas usually implement stricter development controls to maintain neighborhood characteristics and preserve property values. On the other hand, poorer areas where a higher proportion of residents work in the manufacturing industry are typically less concerned with imposing strict regulation, and generally have a weaker ability to do so.

The regressions also reveal that exclusionary zoning is increasing in the percentage of households that own a home, which is aligned with the findings mentioned in the literature review (Gyourko and Molloy, 2015). The results also reveal that regulatory restrictiveness is decreasing in the proportion of housing units that are vacant and the proportion of the population that is white. Based on existing literature, it may be unexpected that exclusionary zoning policies are relatively less intense in areas with a higher proportion of white residents. However, there are a few plausible explanations for this result. For instance, there might be a relatively smaller need in areas with higher proportion of white residents to impose regulatory barriers due to the presence of established power structures that may already favor the interests of these residents.

Considering the complexity of exclusionary zoning and its underlying factors, it is crucial to address the issue of endogeneity in our analysis. In this regard, the Tiebout model and median voter theorem provide valuable insights into the role of local preferences and political dynamics in shaping regulatory outcomes. The median voter theorem suggests that the socioeconomic characteristics of the residents in a jurisdiction influence its level of exclusionary zoning. For instance, if a jurisdiction is populated by a substantial number of wealthy homeowners who

prioritize preserving property values, it increases the likelihood that the median voter will advocate for stricter regulations. Consequently, the regulatory environment reflects the preferences of these residents.

On the other hand, the Tiebout model suggests that the level of exclusionary zoning in a jurisdiction can contribute to the socioeconomic traits of its residents. For instance, jurisdictions with tighter regulation controls may attract older and wealthier individuals. This bidirectional relationship between socioeconomic factors and exclusionary zoning highlights the need for further research to comprehensively understand the intricate dynamics at play. In general, the Tiebout model and the median voter theorem allow us to gain a deeper understanding of how socioeconomic factors and exclusionary zoning mutually influence each other.

The findings in this research can provide valuable insights for policymakers in understanding the socioeconomic factors that are contributing to exclusionary zoning. As the conversation around zoning and its impact continues, further research and collaborative efforts are crucial in addressing the potential solutions that could promote fair and sustainable urban environments. By observing the patterns and determinants that are strongly associated with exclusionary zoning, policymakers will be better able to identify ways to mitigate their potential exclusionary effects.

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