Do Strict Land Use Regulations Make Metropolitan Areas more Segregated by Income?

Abstract

Problem, Research Strategy, and Findings: Income segregation has risen in each of the last four decades in U.S. metropolitan areas. The spatial separation of different income groups is important for many reasons; neighborhood social mix has been shown to have lifelong impacts on health, economic productivity, and behaviors such as propensity to commit crime. Although it is widely assumed that local land use regulations – such as minimum lot sizes and growth controls – exclude low-income households from wealthier neighborhoods, the empirical research is surprisingly limited. Existing studies do not take advantage of recent advances in the measurement of income segregation or nuanced survey data on different types of land use regulation.

Using these new measures for the 95 biggest cities in the US, we examine the relationship between land use regulation and segregation by income. Two findings stand out. First, density restrictions are associated with the segregation of the wealthy and middle-income, but not the poor. Second, more local pressure to regulate land use is linked to higher rates of segregation but more state control is connected to lower segregation. Further, we argue that comprehensive data on local land use regulations need to be collected on a consistent basis to inform future research and planning practice.

Takeaway for Practice: The results have important implications for planners. First, density restrictions are again found to be a driver of urban segregation and should be removed. Second, we confirm that the local nature of planning creates problems that regional and state efforts can ameliorate to some extent. Finally, efforts to force wealthier parts of city to build housing for low-income households, i.e. inclusionary housing, have a greater potential to reduce segregation than bringing higher-income households into lower-income parts of the city.

Keywords: Segregation, land use regulations, exclusionary zoning

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1. Introduction

In spite of recent data showing that racial segregation in the U.S. is on the decline (Glaeser & Vigdor, 2012; Logan & Stults, 2011) segregation by income[1] increased in every decade from 1970 to 2010. The share of households living in poor or affluent neighborhoods doubled during this time period (Bischoff & Reardon, 2013). A steady and substantial rise income inequality contributed to this trend but does not fully explain it (Reardon & Bischoff, 2011). What else accounts for the increasing separation of high and low-income households? One common explanation is that local land use regulations – such as minimum lot sizes and growth controls – make jurisdictions more socioeconomically homogeneous and metropolitan areas more segregated. This hypothesis is often put forward by both scholars (Mills & Hamilton, 1997; R. Pendall, 2000) and the popular press (Applebaum, 2012; Thompson, 2014), yet there is a surprising dearth of empirical research on this relationship.

It is important that planners and policymakers better understand how land-use regulations and housing market dynamics shape patterns of income segregation in cities. Local governments have little control over income inequality. In contrast, land-use regulation is one of the major powers of local governments in the United States. Local land use regulations have been shown to have an impact on key urban housing market dynamics such as prices and volatility (Huang & Tang, 2012; Kok, Monkkonen, & Quigley, 2014; Saiz, 2010). However, we can identify only one existing study that tests the hypothesis that more restrictive land use regulations lead to higher levels of income segregation (Rothwell & Massey, 2010). That study lays groundwork for this one, but focuses on only one of many dimensions of land use regulations (minimum lot size),

[1] In this paper we use income segregation and economic segregation interchangeably, although we recognize the difference and the limitations that using income as a proxy for a household's entire economic status is not completely precise.

uses a slightly unconventional and less comprehensive measure of economic segregation, and is limited to the 50 largest cities in the U.S.

In this paper, we take advantage of recent advances in the tools to measure economic segregation (Reardon, 2009; Reardon & Bischoff, 2011; Reardon & O'Sullivan, 2004) as well as a survey data of land use regulations from 2005 (Gyourko, Saiz, & Summers, 2008) that has been used in a number of recent housing market studies. We use these and other data to estimate a set of regression models for the 95 largest Metropolitan Statistical Areas (MSAs) in the U.S. The results of these models show that the relationship between land use regulations and income segregation is more complex than previously documented. Density restrictions, previously shown to impact overall levels of segregation, are shown to be associated with the segregation of the wealthy and middle-income, but not the poor. The number of approvals local governments require for new housing developments – often the measure of regulation most strongly associated with housing market outcomes – is strongly related to the segregation of low-income households. Finally, more local pressure to regulate land use is linked to higher rates of segregation, whereas stronger state-level control is correlated with lower levels of segregation.

Although we can conclude from this research that planners and policymakers interested in reducing economic segregation should pay attention to local land use regulations as a contributing factor, an additional conclusion is that we need more and better data in order to understand this phenomenon. Given the widespread agreement that regulatory barriers adversely affect housing affordability (Been, 2005; Glaeser & Ward, 2009; Saiz, 2010; Schill, 2005) and the perverse incentives of local governments to exclude low-income households through these barriers, frequent and comprehensive data on land use regulations should be gathered. The way in which local regulations shape metropolitan segregation is complex and the cross-sectional data

available to scholars are not sufficient to draw strong causal conclusions on this topic. Planners should advocate for a national database on local regulations in order that we can identify problems and solutions in this area.

The paper proceeds as follows: first, we discuss the mechanisms through which land use regulations are thought to shape income segregation and summarizes relevant empirical research on the topic. We then describe the data and methods used, and report the results of the econometric analysis. The final section describes the implications of these findings for planning practice.

2. How do Land Use Regulations Affect Income Segregation?

One way to understand income segregation is as a process through which households self-sort into neighborhoods with the best combination of housing and local amenities that they can afford (Oates, 1981; Tiebout, 1956). Urban economic theory has concentrated on factors such as city size, urban form, and the spatial organization of governance and public services in order to understand a city's socioeconomic layout. Because larger cities feature longer commuting distances, there is greater heterogeneity in land values and neighborhoods, which increases the self-selection into homogenous communities (Mills & Hamilton, 1997). Yet, segregation is also understood to occur due to structural forces including policies and collective efforts to exclude certain groups. Although this is well documented in regards to racial segregation (Massey & Denton, 1993; R. Pendall, 2000), there are fewer empirical studies on economic segregation.

The planning community widely assumes a connection between land use regulation and income segregation, in spite of the limited empirical evidence. The American Planning

Association (APA) adopted its most recent policy guide on housing in 2006. One of the central positions is to reduce barriers to housing opportunity, which include, "large lot zoning, restrictive single family definitions, minimum square footage for single family homes, housing location policies, expensive subdivision design standards, prohibitions against manufactured housing, [and] time-consuming permitting and approval processes" (American Planning Association, 2006: 5). The underlying assumption is that cumbersome permitting processes make some cities and neighborhoods unaffordable to lower and middle-income households, leading to greater neighborhood homogeneity and higher metropolitan income segregation. The popular media also often cites the affordability impacts of housing regulations and by extension their role in economic segregation (Applebaum, 2012; Thompson, 2014).

Of course, many factors shape a metropolitan area's overall level of income segregation, such as inequality, population size, growth rates, density, and political fragmentation. Income inequality is a necessary but not sufficient cause of economic segregation, but a number of studies have shown that inequality is positively associated with income segregation across cities (Reardon & Bischoff, 2011; Watson, 2009; Watson, Carlino, & Ellen, 2006). Interestingly, income inequality at the upper end of the distribution seems to play a bigger role in explaining economic segregation than that at the lower end. (Reardon & Bischoff, 2011) find that the rise in economic inequality seems to have increased the segregation of affluence while having little effect on the segregation of poverty.

The size and growth rate of a metropolitan area also help explain the extent to which economic segregation occurs. There is less segregation by income in smaller metropolitan areas (Reardon & Bischoff, 2011), likely because households have fewer residential choices and neighborhoods are less differentiated. The relationship between population growth and economic

segregation has been found to have a U-shape, with fast-growing and stagnant metropolitan areas experiences growing economic segregation (Watson et al., 2006).

The relationship between urban form and segregation is complex. Although higher population densities could lead to greater integration if neighborhoods include more multifamily and smaller housing units, density is also associated with larger cities and more competitive land and housing markets (Pendall & Carruthers, 2003; Yang & Jargowsky, 2006). (Pendall & Carruthers, 2003) find that higher density is associated with greater levels of income segregation, although this does not hold in the highest density metropolitan areas. Economic segregation seems to peak at about 14 persons or jobs per acre based on the dissimilarity index or 12.5 persons or jobs per acre based on the isolation index (Pendall & Carruthers, 2003). Decentralized development patterns and sprawl are thus shown to encourage economic segregation (Yang & Jargowsky, 2006). Urban containment policies such as growth boundaries have been shown to be associated with a decrease in segregation between white and black households (Nelson, Sanchez, & Dawkins, 2004). It is unclear if this is also true for income segregation.

Metropolitan fragmentation also contributes to economic segregation. The U.S. system of incorporated cities, most of whom have the power to regulate land use within their borders, is somewhat unique. Metropolitan areas with more than a million residents in the U.S. can have dozens or even hundreds of separate jurisdictions, each of which have control over their land use. The social stratification-government inequality thesis posits that fragmentation increases racial and economic inequality and segregation within metropolitan areas (Jimenez & Hendrick, 2010), thus metropolitan areas with a greater number of jurisdictions, are expected to have greater levels of segregation. Yang & Jargowsky (2006) use metropolitan fragmentation as a proxy for zoning stringency to identify the relationship between zoning stringency and economic segregation.

They find that the number of governments per 100,000 persons in a metropolitan area is positively associated with economic segregation.

Land use regulation is a broad concept; the rules that govern the use of land can include anything from building safety requirements to urban growth boundaries to actual control over use. We operationalize these regulations through survey data that covers several domains of regulation. Low-density zoning is the most heavily studied dimension in this area and argued to be the most exclusionary regulation (Ihlanfeldt, 2004). For example, Pendall (2000, 130) finds that low-density only zoning is a "potent exclusionary land use control and that building permit caps warrant caution," but he finds little evidence connecting other types of land use regulations with exclusion. He connects low-density zoning to economic and racial exclusion through a multi-part chain. The first and second links are the low-density zoning reduction in overall housing growth and multifamily housing. The third and fourth links are a reduction in rental units and affordability. This, finally, leads to "dampened growth in the minority population" (Pendall 2000, 138). He then finds empirical evidence that low-density zoning significantly reduces the amount of rental housing in a city and increases racial segregation in a metropolitan area.

In a review of the literature on the impact of land use regulations, Ihlanfeldt (2004) concludes that regulations that exclude development of lower-cost housing types often lead to increased racial and economic segregation if "higher-income jurisdictions or jurisdictions with higher percentages of Whites adopt more restrictive land use regulations" (Ihlanfeldt, 2004: 269). However, he raises the argument that the tendency for higher income jurisdictions to enact such regulations means that simple empirical tests of the relationship are limited in value. That is to say, it is not clear whether exclusionary zoning causes jurisdictions to be more homogenous in

terms of race and/or income or if predominantly White and high-income jurisdictions tend to enact these regulations.

One study has attempted to tackle the issue of endogeneity between regulations and segregation head-on using a two-stage least square (2SLS) models with instrumental variables. Rothwell and Massey (2010), in an analysis of 50 metropolitan areas, use year of statehood and population density in 1910 as instrumental variables in a 2SLS model that tests the hypothesis that maximum allowable densities impacts economic segregation. They use the survey data developed by Pendall, Puentes, & Martin (2006) to measure land use regulation, and measures of segregation based on the Gini coefficient and the exposure index. They find a positive relationship between zoning stringency and inequality between jurisdictions, "accounting for two standard deviations in the Gini coefficient for neighborhood income inequality and one standard deviation in the exposure of the poor to the affluent in the year 2000" (Rothwell & Massey, 2010: 1140).

3. Data and Methods

This paper takes the work by Rothwell and Massey (2010) as a point of departure, using updated data and new methods to measure both land use regulation and income segregation across more cities in the years 2000 and 2010. Crucially, the new segregation measures disaggregate across the income distribution. This type of disaggregation has been used to show, for example, that the increase in overall income segregation in U.S. metropolitan areas has been largely caused by the segregation of affluent households (Reardon and Bischoff, 2011). It is thus possible to analyze whether more stringent regulation of urban development contributes to the segregation of higher- or lower-income households, or both.

Further, we now know much more about the nature of land use regulations in the United States. The survey of Pendall et al (2006) on zoning rules in 50 MSAs in 2003 focused on the extent to which MSAs control the maximum allowable density through the zoning process. Additionally, Gyourko and colleagues (2006) developed the Wharton Residential Land Use Regulation Index (WRLURI) from surveys in nearly 2,000 municipalities across the country in 11 sub-categories of regulation (see Appendix A for details); which range from measures of the number approvals needed for a project approval to open space requirements to the duration of approvals. These data have been used in various studies of housing markets and found to have important impacts on prices and volatility (Huang & Tang, 2012; Saiz, 2010).

One of the central challenges in measuring the impacts of land use regulations on segregation is that segregation is a phenomenon measured at the scale of the urban (or metropolitan) area, whereas regulations are enacted and implemented by much smaller jurisdictions; incorporated cities or townships. We acknowledge that the right way to study this relationship is using a multi-level framework that includes city-level observations as well as those at the metropolitan level. However, the available data do not allow for this, as there are not sufficient surveys of regulation within metropolitan areas to measure variation in a valid way (in the typical MSA, only about a quarter of that MSA's incorporated cities have data in the WRLURI). This problem can and should be addressed through more comprehensive data collection efforts.

Therefore, in this paper we follow other researchers and make the assumption that collectively, highly regulated cities make highly regulated metropolitan areas, and aggregate the city-level data on regulations to MSAs using population weights (Gyourko et al, 2008). Additionally, we begin to address the more complex nature of the phenomenon by running

models where the independent variable is the ratio between central city and MSA land use regulation stringency, in order to identify whether segregation is driven by stringent rules in suburban areas relative to less regulated central cities.

The dependent variables in our models are segregation indexes based on the rank-order information theory index. This index depends first on creating cumulative income groups and calculating an entropy measure of segregation for each. The index is essentially a comparison of the percent difference between the city's overall income diversity and the population-weighted sum of each census block group's income diversity. In this case there are data on 15 income groups in each city. Each of these groups is at a slightly different percentile on the income distribution in each city due to differences in absolute levels of income. However, it is straightforward to estimate segregation for the 10^{th}, 50^{th}, and 90^{th} percentile of the income distribution, and these can then be compared across cities. See Reardon (2009) and Reardon & Bischoff (2011b) for details.

<<Insert Table 1 here>>

Table 1 provides summary statistics for the 95 MSAs in our sample. In order to test the hypothesis that more tightly regulated housing markets are associated with elevated levels of economic segregation at the MSA level, we combine the above data on regulation and index on economic segregation with a number of control variables taken from the U.S. Census. Then we run an OLS regression model that estimates the effect that housing market regulation stringency measured in 2005 has on economic segregation in 2010. The model can be represented as follows:

$$\mathrm{ES}_i = \alpha + \beta_1 \mathrm{WRLURI}_i + \beta_2 X'_i + e_i$$

Where WRLURI_i and ES_i, are the Wharton Residential Land Use Regulation Index and the Economic Segregation index, respectively. *X'* is a set of MSA-level covariates, following Rothwell & Massey (2010): ln population , household income Gini , affluence rate , poverty rate , percent non-white , number of jurisdictions (in hundreds), all measured in 2010.

We do not take the instrumental variable approach to addressing the possible threat of endogeneity, as others have done, for two reasons. First, in studies of urban phenomena, it is difficult to create convincingly causal two stage models. The instruments that have been used are usually not strong and often there are theoretical problems with their exogeneity to outcome variables. Moreover, even if regulations are more likely to be adopted by certain types of jurisdictions, we believe we capture the most important characteristics in our control variables, and therefore the coefficients on regulation still have meaning. Evidence of this is found in studies that, when controlling for the most important socioeconomic and demographic features of cities, find regulation variables to be insignificant predictors of expected impacts (Glaeser & Ward, 2009; Monkkonen & Quigley, 2008).

Another issue that is often of concern when examining potential impacts of land use regulations is timing. Again, this is a problem that results from a lack of a systematic effort to collect data on land use regulation in the United States in a longitudinal fashion. This means that measures of the regulatory environment are almost always cross sectional, depending as they do on the resources of scholars and not the census bureau. Although a detailed study of the Boston metropolitan area over several decades (Glaeser & Ward, 2009) revealed that regulations are amended relatively frequently, substantial changes to the regulatory environment is a heroically difficult and politically contested undertaking. In fact, (Pendall et al., 2006) report that fewer

than 20 percent of jurisdictions that they surveyed reported significant changes to maximum permitted density between 1994 and 2003.

As mentioned, we begin our analysis by replicating the model of Rothwell and Massey (2010) and then vary the measures of income segregation and land use regulations. Rothwell and Massey (2010) use a segregation index based on a neighborhood Gini coefficient. This measure uses the median income of each tract to estimate inequality between census tracts across the MSA, which is effectively a clustering or larger-scale measure of segregation. The rank-order information index, which we utilize, estimates a measure of income diversity for each tract and then compares the population weighted sum of these measures to the diversity of the city overall. Although this is an evenness measure in this form and does not consider large-scale variations in spatial scale, it is preferable because it measures neighborhood diversity and is a more conventional method of measuring segregation. We also introduce a more diverse measure of land use regulation and cover a larger sample of cities. Rothwell and Massey (2010) only use a measure of maximum allowable density (Pendall et al., 2006) for 50 MSAs. In contrast, we use all 11 sub-indexes of the WRLURI and almost twice as many MSAs (95 MSAs).

4. Results

Measures of income segregation and land use regulation utilized by Rothwell and Massey (2010) were found to be strongly linked. However, our preferred measures of these phenomena present a more nuanced picture of the relationship. Tables 2 and 3 display results from regression models that replicate those employed by Rothwell and Massey (2010) as well as models that vary the key independent and dependent variables with our preferred measures. The WRLURI – a much more broad measure of the regulatory environment – is found to be associated with the

neighborhood Gini measure of segregation but not with the rank-order index. The permitted density zoning measure of regulation used by Rothwell and Massey (2010), though strongly connected to the neighborhood Gini, is also not significantly associated with the rank-order index. The explanation for this discrepancy lies chiefly with differences in the measures of segregation, which have been outlined previously. The neighborhood Gini measures income segregation in a rougher manner than the rank-order measure and at a larger geographic scale. It is only moderately correlated with the rank-order measure (0.4).

<<Insert Table 2 & 3 here>>

The goal of this analysis is not to contest the work of Rothwell and Massey (2010), rather we seek to take advantage of the ability to assess nuanced aspects of segregation and regulation; i.e., for different income groups and different types of regulations. To do this, we regress different measures of segregation – in the year 2010 – on the 11 components of the WRLURI, and a set of control variables. Table 4 displays the condensed results of a large number of models, only reporting the coefficients for the regulation measures. It is in these models that a more nuanced picture of the relationship between regulation and segregation emerges. Importantly, several aspects of regulation – the omnibus WRLURI, state court involvement (SCII), local assembly (LAI), exactions (EI), open space requirements (OSI), supply restrictions (SRI), and approval delay (ADI) – are not significantly associated with higher levels of segregation.

<<Insert Table 4 here>>

Similar to previous research, we find that density restrictions are strongly associated with elevated levels of economic segregation overall, and the segregation of middle-income and affluent households specifically. However, density restrictions did not affect the segregation of the lowest-income households. This finding provides an important nuance to the widely accepted notion that exclusionary zoning techniques such as density restrictions are largely responsible for the isolation of the poor. We do not find that density restrictions directly lead to the concentration of poverty. Rather, they appear to lead to the concentration of affluence, which is associated with overall higher levels of segregation.

Four other sub-indices of the WRLURI have a significant relationship with levels of economic segregation. Three measures of local involvement in the regulatory process are associated with higher levels of segregation (local political pressure (LPPI), local zoning approval (LZAI), and local project approval (LPAI)). The latter two indexes measure the number of independent reviews needed for project and zoning change approval and are in other work are associated with a more inelastic housing supply and higher housing prices (Saiz, 2010). Places where cities have more separate oversight mechanisms are more segregated. In contrast, the measure of state political involvement (SPII) is associated with lower levels of economic segregation. This is an important finding, as it suggests that where regulatory power is more concentrated in the hands of local decision makers, segregation is higher, but where higher levels of government have greater influence it is lower.

The question of geographic scale is central to this analysis. Regulation occurs at the level of the incorporated city or township (there are from dozens to hundreds in one metropolitan area) and segregation occurs at the level of the metropolitan area. To date, scholars have only used aggregated measures of regulation at the metropolitan level. Variation in the stringency of land

use regulation within MSAs should also matter. An MSA with high average levels of land use regulation might have consistently high regulations across its component cities, or some jurisdictions with very high levels and some with low levels. The MSA with greater variation is likely to have greater levels of segregation. Unfortunately, the most comprehensive source of data on local land use regulations – the WRLURI – do not cover enough cities within most MSAs to get a statistically valid read on the importance of variation within MSAs.

Nonetheless, the WRLURI data do allow us to approximate a test of a common hypothesis about the role of regulation in segregation. That is, the idea that suburban jurisdictions implement density restrictions to exclude lower income households, and those households are restricted to higher density (and lower cost) central cities. We assess whether differences in regulatory stringency between central cities and the surrounding suburbs has any relationship metropolitan levels of segregation.

<<Insert Table 5 here>>

Table 5 displays the results of four regression models where the independent variable is the ratio between the WRLURI in the central city to the WRLURI of other jurisdictions in the MSA. The coefficients on these models are weakly significant (at the 10 percent level) in two models, i.e. the overall segregation level and the segregation of the poor. Surprisingly, however, these coefficients are positive, suggesting that MSAs with more stringent central cities relative to the surrounding suburbs have *more* segregation. We would expect that if the suburban exclusionary zoning story were driving MSA segregation, that these coefficients would be negative (and statistically significant). These results lead to more questions than answers. Importantly, it should be noted that only 88 of the 95 largest cities have data on land use

regulation in their central city, thus the model is not as complete as those presented before. Similarly, the fact that there are data missing on regulation from the suburban districts – the typical MSA only has information for 25% of their incorporated cities – means that these results are not conclusive, and motivates further work on this topic.

5. Conclusions and implications for practice

In this paper, we demonstrate that the relationship between land use regulation and economic segregation is more complex than often assumed. When controlling for a range of characteristics of metropolitan areas, we find that some types of regulation (e.g. density restrictions, the number of independent reviews for project approval and zoning changes) are significantly associated with some measures of segregation (segregation of the middle-income and affluent) in the 95 largest MSAs in the USA in the year 2010. The results have important implications for planners interested in reducing economic segregation in America's cities. First and foremost, density restrictions are again found to be a major culprit in the fragmentation of cities. Secondly, we confirm that the local nature of planning creates problems that regional and state efforts can ameliorate to some extent. Finally, the disaggregated findings imply that efforts to force wealthier parts of city to build housing for low-income households, i.e. inclusionary housing, have a greater potential to reduce segregation than bringing higher-income households into lower-income parts of the city.

However, throughout the paper we emphasize that this extremely important area of research is burdened by a dearth of data. Thus, not only do we conclude by presenting a number of clear extensions to the research presented here, but also with a call for data collection. Extensions to this research are necessary to deepen the understanding of how land use regulation

shapes economic segregation and housing affordability in U.S. cities as well as to develop concrete implications for practice. We do not consider the role of regulations that seek to integrate the residences of different income groups. Recent work on inclusionary zoning ordinances (Mukhija, Regus, Slovin, & Das, 2010; Schuetz, Meltzer, & Been, 2009) has begun to yield evidence on the nature of these regulations and their impacts on affordability, but not their impact on segregation. These studies also suffer from a lack of data. Additionally, though this study begins to pinpoint which regulations matter more, research on the impact of relaxing regulations would begin to provide concrete steps for practicing planners seeking to reduce segregation in their cities.

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Table 1: Summary Statistics (2010 values, unless otherwise noted)

Variable	Obs	Mean	Std. Dev.	Min	Max
Ordinal income segregation	95	0.108	0.020	0.057	0.154
Segregation of poor	95	0.100	0.021	0.051	0.146
Segregation of middle-income	95	0.103	0.021	0.051	0.155
Segregation of affluent	95	0.155	0.031	0.088	0.241
Population (thousands)	95	1910.028	1861.496	141.244	9758.256
Population per square mile	95	822.305	1586.638	54.300	13468.490
Median household income	95	54791.660	9499.677	31879.000	86850.000
Percent bachelor's degree or more	95	0.295	0.065	0.147	0.489
Percent non-white	95	0.271	0.105	0.062	0.520
Percent owner-occupied	95	0.659	0.067	0.343	0.766
Poverty rate	95	0.099	0.035	0.049	0.305
Percent detached single-family housing	95	0.611	0.108	0.100	0.756
Municipalities in metro (2005)	95	53.295	58.388	5.000	365.000
Percent population change (2000-2010)	95	0.091	0.188	-0.871	0.746
Average January temperature	95	38.440	12.684	13.100	68.100
Percent voting Democrat (2008)	95	0.545	0.094	0.342	0.792
Percent manufacturing jobs	95	0.106	0.040	0.034	0.222
Wharton Regulatory Index	95	0.110	0.697	-1.239	1.936
Local political pressure index (LPPI)	95	0.126	0.447	-0.878	1.253
State political involvement index (SPII)	95	-0.012	1.014	-1.976	2.416
State court involvement index (SCII)	95	2.173	0.660	1.000	3.000
Local zoning approval index (LZAI)	95	2.009	0.381	1.268	3.685
Local project approval index (LPAI)	95	1.571	0.514	0.000	3.630
Local assembly index (LAI)	95	0.012	0.078	0.000	0.658
Density restrictions index (DRI)	95	0.231	0.228	0.000	1.000
Open space index (OSI)	95	0.649	0.227	0.000	1.000
Exactions index (EI)	95	0.805	0.208	0.216	1.000
Supply restrictions index (SRI)	95	0.280	0.524	0.000	3.525
Approval delay index (ADI)	95	6.075	2.266	2.417	14.794

Table 2: OLS Model Results (2000): Rothwell and Massey Replication Plus WRI

	Neighborhood income Gini	Neighborhood income Gini	Ordinal income segregation	Ordinal income segregation
Permitted density zoning	-0.0433***		-0.00259	
	(0.0123)		(0.00409)	
Wharton Regulatory Index (WRI)		-0.0245*		-0.00325
		(0.0144)		(0.00437)
Household income Gini	0.238	0.353	0.00711	0.0121
	(0.315)	(0.343)	(0.104)	(0.105)
Affluence rate	-0.0341	0.184	0.0962*	0.119**
	(0.159)	(0.189)	(0.0528)	(0.0574)
Poverty rate	0.405	0.977*	-0.00773	0.0320
	(0.456)	(0.487)	(0.151)	(0.148)
Percent black or Latino	0.0392	-0.0937	0.0783***	0.0706***
	(0.0817)	(0.0812)	(0.0271)	(0.0247)
Number of jurisdictions (00s)	0.0121	0.0197**	0.00463	0.00495*
	(0.00871)	(0.00920)	(0.00289)	(0.00280)
Constant	0.253*	-0.0579	0.0556	0.0338
	(0.139)	(0.131)	(0.0462)	(0.0398)
Observations	50	49	50	49
Adjusted R-squared	0.365	0.238	0.295	0.292

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: 2SLS Model Results (2000): Rothwell and Massey Replication Plus WRI

	Neighborhood income Gini	Neighborhood income Gini	Ordinal income segregation	Ordinal income segregation
Permitted density zoning	-0.0479***		0.00138	
	(0.0175)		(0.00585)	
Wharton Regulatory Index (WRI)		0.335		0.0218
		(0.355)		(0.128)
Household income Gini	0.222	0.406	0.0208	0.000331
	(0.296)	(0.436)	(0.0990)	(0.157)
Affluence rate	-0.0419	1.010**	0.103**	0.0142
	(0.150)	(0.505)	(0.0501)	(0.182)
Poverty rate	0.356	-0.0701	0.0350	0.0580*
	(0.447)	(0.0932)	(0.150)	(0.0336)
Percent black or Latino	0.0530	0.0184*	0.0662**	0.00563
	(0.0858)	(0.00972)	(0.0287)	(0.00350)
Number of jurisdictions (00s)	0.0110	-0.0695	0.00553*	0.0209
	(0.00863)	(0.0806)	(0.00289)	(0.0290)
Constant	0.281*	-0.136	0.0312	0.0754
	(0.153)	(0.192)	(0.0511)	(0.0690)
Observations	50	49	50	49
Adjusted R-squared	0.441	0.177	0.368	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: WRLURI and Sub-Indices with Segregation of the Poor, Middle-Income, and Affluent (2010)
Note: Each row provides a set of coefficients from a different model

	Ordinal income segregation (2010)	Segregation of poor (2010)	Segregation of middle-income (2010)	Segregation of affluent (2010)
Wharton Regulatory Index (WRI)	0.000499	-0.00117	0.00146	-0.00281
	(0.00289)	(0.00318)	(0.00307)	(0.00430)
Local political pressure index (LPPI)	0.0111***	0.00505	0.0111**	0.0124*
	(0.00413)	(0.00469)	(0.00439)	(0.00625)
State political involvement index (SPII)	-0.00504***	-0.00660***	-0.00394*	-0.00670**
	(0.00184)	(0.00199)	(0.00199)	(0.00277)
State court involvement index (SCII)	-0.000467	-0.00504	0.00128	-0.00155
	(0.00303)	(0.00330)	(0.00322)	(0.00451)
Local zoning approval index (LZAI)	0.00935*	0.00189	0.00795	0.0182**
	(0.00493)	(0.00553)	(0.00527)	(0.00724)
Local project approval index (LPAI)	0.0102***	0.0103***	0.00974***	0.00937*
	(0.00345)	(0.00382)	(0.00369)	(0.00529)
Local assembly index (LAI)	-0.0291	-0.00888	-0.0316	-0.0538
	(0.0239)	(0.0265)	(0.0253)	(0.0354)
Density restrictions index (DRI)	0.0222***	0.0111	0.0229***	0.0279**
	(0.00773)	(0.00881)	(0.00822)	(0.0117)
Open space index (OSI)	0.00735	0.00147	0.00969	0.00277
	(0.00838)	(0.00926)	(0.00887)	(0.0125)
Exactions index (EI)	0.00878	-0.00304	0.0118	0.0146
	(0.00917)	(0.0101)	(0.00969)	(0.0136)
Supply restrictions index (SRI)	0.00139	0.00510	0.000985	-0.00388
	(0.00355)	(0.00387)	(0.00376)	(0.00527)
Approval delay index (ADI)	-0.000423	-0.000252	-0.000180	-0.00164
	(0.000860)	(0.000947)	(0.000913)	(0.00127)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All models include: ln population (2010), household income Gini (2010), affluence rate (2010), poverty rate (2010), percent non-white (2010), number of jurisdictions (in hundreds).

Table 5: Central-City to MSA WRLURI Ratio (2010)

	Ordinal income segregation (2010)	Segregation of poor (2010)	Segregation of middle-income (2010)	Segregation of affluent (2010)
Ratio of central city to metro WRLURI	0.0003*	0.0003*	0.0002	0.0003
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Population ln (2010)	0.0069*	-0.0012	0.0081**	0.0154***
	(0.0037)	(0.0039)	(0.0038)	(0.0052)
Household income Gini (2010)	-0.0844	-0.122	-0.143	0.323*
	(0.126)	(0.133)	(0.132)	(0.177)
Affluence rate (2010)	0.0505	0.0362	0.0658	0.131*
	(0.0522)	(0.0554)	(0.0548)	(0.0737)
Poverty rate (2010)	0.106	-0.0295	0.128	0.153
	(0.0861)	(0.0913)	(0.0904)	(0.122)
Percent non-white (2010)	0.0192	-0.0075	0.0296	0.0263
	(0.0235)	(0.0250)	(0.0247)	(0.0332)
Number of jurisdictions (00s)	0.00636	0.0127**	0.00376	0.0089
	(0.0046)	(0.0049)	(0.0048)	(0.0065)
Constant	0.0118	0.154**	0.00394	-0.262***
	(0.0656)	(0.0696)	(0.0689)	(0.0926)
Observations	88	88	88	88
Adjusted R-squared	0.142	0.092	0.156	0.319

Appendix A: Wharton Residential Land Use Regulatory Index (WRLURI) Sub-Indices

Local assembly (LAI): Whether there are community meetings or assemblies prior to rezoning requests

Supply restrictions (SRI): Explicit caps on new units

Density restrictions (DRI): Minimum lot size (yes/no)

Open space (OSI): Are there open space requirements?

Exactions (EI): Whether municipalities require developers to pay their share of costs of infrastructure improvement

Approval delay (ADI): What is the average duration of the approval process?

Local political pressure (LPPI): Involvement by local actors in the development process

State political involvement (SPII): Degree to which state facilitates land use restrictions

State court involvement (SCII): tendency of courts to uphold impact fees, fairshare development requirements, building moratoria and exclusionary zoning (low score is more restrictive court)

Local zoning approval (LZAI): How many groups have to approve zoning changes?

Local project approval (LPAI): How many groups have to approve projects that do not require zoning changes?

Source: Gyourko et al., 2008