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THE EFFECT OF DENSITY ZONING ON RACIAL SEGREGATION IN U.S. URBAN AREAS

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Abstract

We argue that anti-density zoning increases black residential segregation in U.S. metropolitan areas by reducing the quantity of affordable housing in white jurisdictions. Drawing on census data and local regulation indicators compiled by Pendall, we estimate a series of regression models to measure the effect of maximum density zoning on black segregation. Results estimated using ordinary least squares indicate a strong and significant cross-sectional relationship between low-density zoning and racial segregation, even after controlling for other zoning policies and a variety of metropolitan characteristics, a relationship that persists under two-stage least squares estimation. Both estimation strategies also suggest that anti-density zoning inhibits desegregation over time.

INTRODUCTION

Racial segregation persists at high levels in U.S. urban areas (Wilkes and Iceland 2004). Nearly half of all urban African Americans live under conditions of hypersegregation and 30% live under conditions that can still be described as high (Massey 2004). Research into the causes of segregation has focused on intergroup differences in buying power; white prejudices; black preferences; discrimination in housing and lending; and federal housing policies (Hirsch 1983; Jackson 1985; Massey and Denton 1993; Charles 2003). Little attention has been paid to local land use zoning, however, despite strong circumstantial evidence of its importance in segmenting the urban geography with respect to race and class (Orfield 2002).

Throughout the 20th century, affluent Whites have taken political actions to separate themselves spatially from perceived out-groups---first southern and eastern European immigrants, then African Americans, and most recently Hispanics, but always the lower classes. Although Fischel (2004) sees class exclusion as the primary motive for zoning, Fogelson (2005) points to obvious racist motivations in the history of U.S. housing policy. Over the years, as one set of discriminatory barriers was eliminated by civil rights legislation and court decisions, new barriers were erected, yielding what Massey (2005) calls a “moving target” of discriminatory mechanisms.

Despite this history, some continue to view segregation is nothing more than an apolitical outcome of aggregated choices. Bajari and Kahn (2005) suggest that black migrants simply are not willing to pay as much as Whites to live outside the central city or to inhabit privileged neighborhoods. Likewise, Ihlanfeldt and Scafidi (2002) uncover a weak but significant relationship between black preferences and segregation. In contrast, Emerson, Chai, and Yancey 2002, document a clear reluctance of Whites to live among Blacks even if other neighborhood conditions are quite favorable, especially if they have children under 18.

Accounting for segregation as preferences revealed through neutral housing markets would be reasonable if housing markets were perfectly competitive and preferences truly exogenous, but housing markets are, in fact, highly regulated and preferences are unlikely to be exogenous. Research by Cutler, Glaeser, and Vigdor (1999) suggests that political actions taken by Whites were primarily responsible for segregation through 1970. Although they explain contemporary segregation in terms of decentralized white racism---defined as the willingness of Whites to pay a premium to live in white neighborhoods---this explanation does not account for the considerable variation in segregation levels between otherwise similar metropolitan areas, which suggests that preferences may be realized under regulatory constraints that are themselves racially motivated.

HOW ZONING AFFECTS SEGREGATION

That macro-level zoning regulations play a role in sustaining segregation is suggested by the work of Pendall (2000), who showed that jurisdictions with low-density zoning were less likely to have black residents than those without such regulations. Not only did low-density jurisdictions experience 5% slower housing growth from 1980 to 1990, but the share of multifamily housing decreased by 0.6 percentage points and the share of African Americans by 0.8 points. Pendall, Puentes, and Martin (2006) applied an updated version of Pendall's data to metropolitan areas and found that anti-density zoning was also associated with a higher concentration of Blacks in the central city. Work by Nelson, Sanchez, and Dawkins (2004) also found that containment regulation, a form of pro-density land use policy, was associated with accelerated desegregation from 1990 to 2000.

Our conceptual model builds on the work of Glaeser, Gyourko, and Saks (2005), who argue that homeowners and homeowner organizations work to limit local development in order to foster the appreciation of home values. Yet, following Pendall's (2000) finding that metropolitan prices dominate local markets, we consider other motivations, emphasizing the importance of density, business interests, and taxation in local decision-making.

We argue that density regulations emerge out of a political economy with two key players, homeowners and business interests, yielding two contrasting policy positions: one in favor of development and the other opposed. On the one hand, in areas with a large number of rural jurisdictions ---places where rural housing units cover the existing landscape, as in older states--- it is in the narrow interests of homeowners to block development because tax rates are lower in rural areas (see Appendix Table D) and taxation is more likely to fall on the median homeowner (as ownership rates are well above 50% and 10% greater than in urban areas).[1] Business interests are also weaker in small towns where rural dwellers mostly commute to work outside their jurisdictions (implying that business ownership is rare or controlled by outsiders who lack a vote on land use regulation).[2]

On the other hand, in areas where there are fewer rural settlements--places where urban housing dominates the landscape, as in younger states---it is to the advantage of homeowners and business interests to promote development. Taxation is unlikely to be greatly affected by new development because urban areas have scale economies. That is to say, the fixed costs of schools and infrastructure have largely been accounted for and variable costs per person are small because of high population density. Retail businesses are also more common in high-density areas, and they view growth as beneficial, increasing demand for services and products.

In addition to density, taxation, and the prevalence of home ownership, enacting a low- versus high-density regime depends on one other factor: governmental fragmentation. If central cities can readily annex surrounding jurisdictions then the ability of homeowners to block development is constrained. The segmentation of metropolitan areas into a patchwork of small local governments is an important condition for anti-density zoning to emerge. Fragmentation is not neutral with respect to racial composition, however. Alesina, Baqir, and Hoxby (2004) find that the annexation of jurisdictions within counties is strongly affected by the presence of black residents, suggesting that anti-black motivations play a role in fragmentation and zoning.

In recent work, Rothwell (2009a) found that anti-density regulations limited the metropolitan supply of housing from 1980 to 2000, and Pendall (20002) shows that they limit the local supply of multi-family units. We hypothesize that zoning exacerbates racial segregation through these channels. For Blacks, who have lower than average incomes, the probability of finding housing outside of historically segregated neighborhoods is greatly diminished when surrounding white jurisdictions are torpid and expensive.

EMPIRICAL MODEL AND DATA

Our analytic model connects black-white segregation in a metropolitan area to the average maximum density permitted in its constituent municipalities while controlling for other market-relevant factors. Our model is summarized by equation (1):

$$S_{mt}=\alpha+\beta_1 Z_m+\beta_2 D_{mt}+\beta_3 G_{mt}+\beta_4 X_{mt}+\mu_t, \quad (1)$$

where S_{mt} indicates the level of segregation in metropolitan region m at time t; Z_m indicates the zoning regime for the metropolis aggregated from local jurisdictions D_{mt} is the area's population density; G_{mt} is a vector for geographic amenities, and X_{mt} is a vector of metropolitan social, political, and economic controls that potentially affect housing market conditions and which may also be correlated with an area's racial composition.

[1]We have evidence of this from the Census Bureau's 2000 survey shown in Appendix D. The effective property tax was calculated by economists at the National Association of Home Builders, and is available here: http://www.nahb.org/generic.aspx?genericContentID=35450. Using a sample of every county in the U.S., we found that rural counties pay an effective property tax rate that is about 2.5 percentage points lower than urban counties. In an OLS regression, this effect is robust (i.e. the coefficient falls to −2.0 and has a t-stat of −9.7) after controlling for race, public school enrollment, median income, average property values, unobserved state effects, and the home ownership rate. The homeownership rate also significantly predicts lower property taxes in such a model.

[2]2000 census data shows that only 30% of U.S. residents living in rural places work in that place, whereas 43% of urban residents work in their place of residence. In places with less than 2,500 residents, just 26% work where they live, and the average zoning score is 1.85 (less than eight units per acre) in the Pendall sample.

Since there are many aspects to land regulation besides density restrictions, our model allows for other significant forms of zoning. In some cases, when we expect that density zoning will have an interactive effect, we also include interaction terms between density zoning and other regulations. We take Z_m as a broad measure of the regulatory regime in the following way:

$$\mathrm{Z_m}=(\alpha_1\delta_m+\alpha_2\delta_m*\mathrm{A_m})+\alpha_3 A_m, \quad (2)$$

where δ_m is maximum density zoning, and A_m is a vector of alternative land use regulations that will be explained below in detail. In these models, we are most interested in assessing the marginal effect of a change in δ_m, which is: $\alpha_1 + \alpha_2 A_m$.

Beyond cross sectional relationships, we seek to estimate a dynamic model of contemporary segregation. Obviously density zoning cannot explain segregation before 1970 as density restrictions were rarely used before then and were irrelevant in the face of other more direct barriers to integration (Fogelson 2005 and Ben-Joseph 2002). Conditional on segregation in 1980, however, we believe that segregation by the year 2000 has come to be strongly affected by density-zoning practices. To test this hypothesis, we estimate a model similar to that of equation (2), but move the log of segregation at time *t* to the right hand side while inserting the log of segregation at time *t+10* or *t+20* as a new dependent variable.

We measure segregation using indices of black-white residential dissimilarity and black-black residential isolation developed by Iceland, Weinberg, and Steinmetz (2002). Our measure of density zoning comes from the 2003 survey conducted by Pendall and colleagues (see Pendall, Puentes, and Martin 2006 for more detail) in 49 of the nation's largest metropolitan areas. Together these areas contained 1,677 local governments reporting zoning ordinances covering maximum allowable density. The MSAs in our sample contain 56% of the U.S. population in 2000, and 58% of the African-American population. We discarded jurisdictions that did not have an answer to the survey question on maximum density. Overall, the response rate was 64%, which we computed as the total number of jurisdictions in the MSA divided by the number in the survey. The response rate was slightly higher in western and southern metropolitan areas, which have fewer jurisdictions. Yet, it was still 57% in the Midwest and over 60% in the Northeast.

Our key zoning measure comes from a survey question on the maximum allowable density for new residential construction. The choices ranged from less than four units per acre, which earned a score of 1, to more than 30 units per acre, which earned a score of 5. A score of 2 allowed 4–7 units per acre; a score of 3 allowed 8–15 units per acre; and a score of 4 corresponded to 16–30 units per acre. Within each metropolitan area we computed the average zoning density score across jurisdictions. A list of the 49 metropolitan areas and their density zoning scores are reported in Appendix Table A.

The Pendall et al (2006) survey also contained information on other kinds of land use regulations. Rothwell (2009a) found that most of these alternative regulations did not significantly predict metropolitan housing supply growth, but two, in particular, had significant effects in some models. We thus included these zoning measures as controls and modeled their interactions with maximum density zoning. The first is school regulation in the metropolitan area, measured as the percentage of jurisdictions that use ordinances or impact fees to restrict new development unless the developer pays for school infrastructure. The second measures the prevalence of growth control statutes, as indicated by the percentage of jurisdictions imposing growth moratoriums or building permit caps.

In addition to these two indicators, we also measure the percentage of jurisdictions that offer pro-development incentives such as affordable housing bonuses, density bonuses, and expedited permitting for affordable housing production. Finally, although it did not predict housing supply growth, we also used containment regulations as a control because of Nelson et al.'s (2004) finding that they promoted desegregation from 1990 to 2000. Containment regulations create growth boundaries that delimit development within a specified urban ring in order to reduce sprawl.

In our models, we combine these zoning indicators with a more comprehensive index developed by Gyourko, Saiz, and Sommers (2007). In a widely cited paper, Malpezzi (1996) uses a similar index from a Wharton School survey of real estate experts originally conducted by Linneman et al (1990). We used the newer index from Gyourko et al (2007) both practical and theoretical reasons. Practically, the Malpezzi index only covers 35 of our MSAs, but the Gyourko et al (2007) index covers all 49. Empirically, Rothwell (2009a) found the Malpezzi (1996) index to be insignificant in predicting housing growth under a variety of specifications, whereas maximum density zoning robustly predicted growth even after controlling for the Malpezzi's index and state regulations. Finally, Malpezzi (1996) himself rejected the hypothesis that his index affected segregation.

Both Wharton surveys combine a broad range of issues that are of theoretical interest but are not necessarily relevant to urban development policy. Indeed many of them are outcomes and not policies per se. For example, the Malpezzi (1996) index includes respondent estimates of approval times and approval likelihood, as well as a broad question on the adequacy of land availability. The Gyourko et al (2007) index includes information about local political pressure, approval authority, degree of local democracy, permit delays, development fees, open space criteria, state regulations, and supply restrictions. Although these data may lead to many important insights, strict approval authority and voting on zoning may be irrelevant for multi-family developers if the project is precluded by known anti-density regulation.

Many of our control variables derive from the urban economics literature. Rappaport and Sachs (2003) find that coastal proximity and access to water contribute significantly to regional development in the United States, so we include a dummy variable for coastal proximity and the ratio of water to land area. Glaeser and Saiz (2003) found the percentage of people with a college education to be a robust predictor of housing and population growth across metropolitan areas, so we also included it in our equations. The metropolitan share of industry in agriculture, has obvious implications for land use; and the share of industry in manufacturing is included because older manufacturing regions generally offer fewer economic opportunities for inner city Blacks (Wilson 1987). Following Tiebout (1956) and Cutler and Glaeser (1997), we include political variables associated with sorting, such as the number of local governments and the share of local revenue from local taxes. Summary statistics for all variables are presented in Table 1.

Racial segregation was still quite high in 1980, with an average black-white dissimilarity index of 0.717 and an average black isolation index of 0.596; but as others have noted (Farley and Frey 1994; Charles 2003), segregation generally declined over the ensuing decades to reach an average dissimilarity of 0.622 and an average isolation index of 0.523 in the year 2000. Across all metropolitan areas for which we have complete information, the average region had 165.5 units of general government and among these we observed zoning regulations in an average of 32 municipalities. On our 1–5 scale of density regulation, the average metropolitan area evinced a score of 3.40 with a range from 2.16 to 4.67 and a standard deviation of 0.66.

THE ENDOGENEITY OF ZONING

If there were no significant unobserved variation and no reverse causation between segregation and zoning, then the model's residual error would be randomly distributed with an expected value of zero; but we consider this outcome doubtful, as there are many ways in which Z could be correlated with μ_t. In areas where the races are more integrated, for example, homeowners may be politically unable or less willing to impose exclusionary zoning laws. Conversely, if most Whites live in suburbs and most African Americans live in central cities, then Whites may not only be able but quite eager to impose zoning restrictions to preserve that arrangement. In other words, Whites may react to earlier shifts toward or away from segregation by strengthening or relaxing local zoning regimes, thereby violating the assumptions underlying ordinary least squares estimation.

To control for the possibility of reverse causality, we employ a two-stage least squares (2SLS) framework that uses year of statehood as an instrumental variable. It is strongly correlated with permissive density zoning, and a regression of zoning on statehood yields an r-squared of 0.41 and an F-statistic of 35. Olson (1982) argues that political institutions stagnate over time because interest groups with a stake in those institutions form factions that choke off change. In the present case, older metropolitan areas are more likely to stagnate because previously unpopulated areas have had a longer time to establish rural settlements, in which anti-development coalitions are likely to form. Indeed, year of statehood is highly correlated (−0.68) with the density of rural housing units in 1990 (the number of rural units in a MSA divided by its land mass). We are also motivated by Hilber and Mayer's (2009) finding that areas with less residential development exhibit lower spending on public schools.[3]

Our instrumental variable is valid so long as year of statehood does not affect segregation except through zoning or other observed correlates in our model, such as the black population share, which is higher in older states. We control for a number of correlates to try to guard against this possibility, such as percentage living in rural areas and the farming

[3]Hilber and Mayer (2009) attribute this finding to a lower elasticity of housing price appreciation in rural towns, but as we argue above, we believe the more important explanation involves the absence of scale economies in rural areas, which dissuades those communities from public goods with high fixed costs up until a certain threshold.

share of the workforce. We also control directly for the local share of revenue in local government spending and the number of local governments. Both are proxies for taxpayer incentives to sort their preferences by jurisdiction as posited by Tiebout (1956). To provide additional evidence that statehood really is exogenous to segregation, we regressed 1920 black-white dissimilarity on year of statehood along with controls for the black percentage and population density in 1910 (see Appendix Table E).[4] The p-value for statehood was unquestionably insignificant (p=0.56), which only makes sense as density zoning was not prevalent in the 1920s (Ben-Joseph 2002).

THE STABILITY OF ZONING REGULATIONS

One final methodological issue is the stability of zoning over time. Since we seek to model changes from 1980 to 2000 but only have a cross-sectional measure of zoning policies, the stability of those policies is important methodologically. Of the 1,677 jurisdictions, 60 said they had not changed their zoning laws since 2000 and 133 hand not changed since 1990; and when respondents were asked "compared to your jurisdiction's current level of regulation on land use and residential development, how would you describe your jurisdiction" over the last three decades, 738 reported that zoning regulations were "about the same."

Pendall shared with us his 1994 survey, which had data on density zoning in that year and how it related to previous years (see Pendall 2000). These data revealed that from 1988 to 1994, only 6% of jurisdictions increased allowable density by ten percent or more and 7% decreased it by ten percent or more. During 1994–2003, the respective percentages were both 8%. Meanwhile, the share reporting identical regulations in both years was very high---80% from 1988 to 1994 and 75% from 1994 to 2003 (see Appendix Table B). A question pertaining to regulation more broadly also revealed a high degree of stability.[5] The Pendall 2003 data also included a dummy variable indicating which jurisdictions were present in the previous survey. We matched unique jurisdiction names for all observations in both surveys and discarded those with the same name, yielding 560 observations where zoning data was reported for both 1994 and 2003. Of these jurisdictions, 60% had exactly the same density zoning score at both dates, and 91% of the 2003 scores fell within plus or minus 50% of the 1994 zoning score (see Figure 1 in Appendix). A regression of 2003 on 1994 scores yielded a coefficient of .75 and a t-statistic of 20. Moreover, the regional pattern in zoning did not change from 1994 to 2003 and regional averages were almost identical.

These facts make it extremely unlikely that measurement error in attributing 2003 density regulations to earlier zoning regimes bias our results. Still, it is possible that those jurisdictions that liberalized zoning between 1994 and 2003 had significantly more restrictive zoning in the 1990s and that we are falsely crediting zoning for desegregation. There are a number of ways we can test this. One is to create a dummy variable that equals 1

[4]As Appendix Table E shows, the effect remains insignificant with regional effects, or using the change in the percentage black from 1910 to 1920. The 1920 segregation data on 32 MSAs is provided by Jacob Vigdor, from a collaborative project with David Cutler and Edward Glaeser, with data available here: http://trinity.aas.duke.edu/~jvigdor/segregation/

[5]We suspect that the main reason that this question shows less continuity is because it includes every kind of regulation, including the trendy use of inclusionary zoning, which has not demonstrated any effect on housing markets in recent studies (e.g. Rothwell 2009a; Shuetz, Been, and Meltzer 2008).

if the 2003 survey respondent said that permitted density regulation in 1994 was the within 10% of current regulations and 0 otherwise. We can then use this dummy variable as the dependent variable in a regression with 1994 zoning on the right hand side and regional dummies. If the coefficient for 1994 zoning is significant, we know that previous zoning is correlated with the likelihood of changing, making our measurement error potentially problematic. Similarly, if regional dummies are significant, we might infer that regional characteristics are affecting the likelihood of density zoning changes.

In performing these tests, however, none of the variables was significant, and variance explained was virtually zero (Appendix Table C). We also examined this potential bias using the 1994 survey, which asked respondents to report density changes from 1988 to 1994. Using similar procedures, neither regional dummies nor 1994 zoning either alone or in combination explained whether or not a jurisdiction changed its density regulation from 1988 to 1994 (Appendix Table C). We thus conclude that metropolitan density zoning regimes were quite stable from 1988 to 2003 and that no region is more or less stable than any other.

THE EFFECT OF ZONING ON SEGREGATION: 1990 AND 2000

We estimated ordinary least squares regressions to assess the effect of maximum density zoning on segregation in 1990 and 2000, controlling for a wide array of possible confounding variables and alternative land use regulations. In both years, we estimate two sets of equations---one showing the effect of density zoning by itself, and one including five indices of other land regulations as control variables. As shown in Table 2, across all specifications, the coefficient for maximum density is highly significant statistically and in the expected direction, with more permissive zoning regulations (indicated by a higher allowable density) yielding lower levels of segregation. These results are not driven by metropolitan characteristics that foster or deter growth, such as median income, human capital, industrial structure, which are held constant in the model, and they are not a product of suburban versus central city prices or housing supply.

The relationship also holds in the presence of alternative indicators of the regulatory regime. For example, Gyourko's Wharton Index has no apparent effect on segregation and does not diminish the effect of density zoning when included in the model. Controlling for containment also has no influence on the size of the density zoning effect. In some specifications, school infrastructure regulations and growth controls are associated with higher segregation, but the results are not robust across the different models and their inclusion does not alter the effect of density zoning.

In the full model predicting black-white dissimilarity, each point increase in maximum density zoning lowers the black-white dissimilarity index by 0.10 points in 1990 and by 0.09 points in 2000. Given that the observed range in density zoning is 2.2 to 4.7, we estimate that moving a metropolitan area from the most restrictive to the most liberal density regime would reduce segregation by 0.25 points in 1990 and 0.23 points in 2000, both very large effects on a 0 to 1.0 scale.[6] The right-hand columns report essentially the same results using the isolation index, though the coefficients are slightly higher; and once again the effect holds in the presence of other regulatory indicators.[7]

THE EFFECT OF ZONING DESEGREGATION: 1980–2000

We are also interested in measuring how zoning could affect trends in segregation over time as there have been significant changes in recent decades. According to Iceland, Weinberg, and Steinmetz (2002), between 1980 and 2000 average black-white dissimilarity fell from 0.73 to 0.64 in U.S. metropolitan areas while average black isolation fell from 0.66 to 0.59. Behind these average trends, however, lies a great deal of geographic variation. In general, desegregation was greatest in the South and West and least in the Northeast and Midwest. On average, the former regions had much more liberal density zoning regulations than the latter, leading us to hypothesize that interregional differences in desegregation are explained, at least in part, by interregional differences in zoning policies.

A simple way to test this hypothesis is to regress the log of segregation in 2000 on the log of segregation in 1980 or 1990 including zoning variables and baseline controls as covariates. In this case, the coefficient associated with the density regime captures the percentage change in segregation associated with density zoning and the coefficient on baseline segregation measures the persistence of segregation over time. Our models differ somewhat from those previously used to model segregation trends. We have added two more control variables associated with economic growth---average January temperature and the rate of union membership in the initial decade[8]---and because zoning did change in some jurisdictions, we included controls for the percentage of jurisdictions that reported overall zoning changes and changes specific to density zoning. Finally, following Rothwell (2009a) we added interactions between school infrastructure regulation and growth controls with density zoning.

We also excluded two variables used in earlier studies. First, we omit Gyourko's regulatory index, as it becomes redundant with the addition of the Pendall survey question on overall regulation in 1990 and 1980. Second, we drop a measure of affordable housing incentives because it was either insignificant or had the wrong sign (i.e. it was associated with greater segregation, suggesting it has been a response to social conditions, not a cause). Moreover, since most affordable housing incentives were not adopted until the late 1990s or early 21st century, it is unlikely that they affected segregation in the 1980s and 1990s (Tombari 2005).

[6]Similar results are obtained when we create a dummy variable for liberal density zoning, where liberal=1 if the zoning score is above the mean and liberal=0 otherwise. Using the full set of controls in 2000, the marginal effect on liberal is −17.6 for the dissimilarity index and −17.2 for the isolation index, both with t-stats over 3.8 (see Appendix Table F).

[7]Since our zoning indicator relies on averages of observations from jurisdictions within each metropolitan area, we replicated our results after giving greater weight to those regions for which we have more observations to guard against the possibility that a few unrepresentative local observations might bias our measure of the regulatory environment. Specifically, we ran a weighted OLS regression using the number of observations per MSA as weights. In general, this re-specification of the model increased the significance of the maximum density zoning variable and slightly inflated the size of its effect. These results are shown in Appendix Table F.

[8]The National Climatic Data Center provided data on temperature. We used the average from 1971 to 2000. Glaeser and Tobio (2007) found this to predict growth in the US in recent decades. The union data is borrowed from Barry Hirsh and David McPherson, available at http://unionstats.gsu.edu/. Olson (1982) found evidence that economic growth was slower in the U.S. where union density was higher from the 1940s to the 1970s.

Table 3 summarizes the results of OLS regressions predicting desegregation from zoning measures and controls. Once again, whether measured in terms of dissimilarity or isolation, density zoning appears to have a strong influence on the pace of racial desegregation in U.S. metropolitan areas from 1980 to 2000. The larger the density score—the more liberal the zoning policy—the larger the percentage decline in black-white dissimilarity and black spatial isolation, holding constant other features of the local zoning regime. This effect is robust to the omission of variables that measure regulatory changes, or any combination of those variables, including a measure of the jurisdictions in each MSA that maintained the same density zoning score since 1994 or the same overall level of regulation since 1980.

In MSAs with no observed school regulations or growth controls (17 out of 49 MSAs), the marginal effect of a one unit change in zoning is simply the point estimate, which is a very large effect: −0.13 for the dissimilarity index and −0.18 for the isolation index. For the others, there is a marginal interacted effect between density zoning, school infrastructure regulation and growth controls, which somewhat dampens the impact of density zoning. For the 1980–2000 models, the interacted marginal effect for the dissimilarity index is −0.06 and −0.02 for the isolation index, which amounts to a change of 15 points and 4 points, respectively, if the most restrictive MSA in 1980 had replaced its zoning with the least restrictive MSA's regulations.

The point effect of density zoning from 1990–2000 is less robust than the 1980–2000 model and statistically insignificant in the specifications shown here. More parsimonious specifications over this period yield significant results, but only if the interactions with alternative regulations are included, which probably reflects the fact that the degree and variation in desegregation were much lower in the latter than the former period. Indeed, the standard deviation of desegregation was almost twice as large in the 1980s compared with the 1990s, and the mean was roughly three times as large. Nonetheless, our measure of the percentage of jurisdictions that reported density liberalization since 1994 was negative and highly significant in its effect on 2000 segregation, conditional on 1990 segregation. In other words, whatever the 2003 density zoning regime, those metropolitan areas that most liberalized density zoning rules since 1994 saw the largest drops in segregation from 1990 to 2000.[9]

CONTROLLING FOR REVERSE CAUSALITY

Despite the strong observed effect of maximum density zoning on segregation in the presence of numerous controls, the possibility of reverse causality still remains as a threat to internal validity. Table 4 repeats the cross-sectional and trends regressions for dissimilarity and isolation using two-stage least squares (2SLS). The background controls are as before but the interactions between the alternative zoning regulations and density zoning have been eliminated to conserve degrees of freedom in light of inconsistent effects in earlier models.

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[9]The coefficient on density liberalization in the 1980–2000 regression is insignificant and has a positive sign, as opposed to the 1990 to 2000 regression. This is not a contradiction, however, because if a jurisdiction increased its density score from 1994 to 2003 that means it must have had a lower score sometime between 1980 and 1994, so the results are still consistent with the idea that increasing the density score (i.e. moving toward a more liberal land use policy) is associated with less segregation. The most important result is clearly the coefficient on the level of density regulation, given what we know about its stability over time.

These results confirm the significant effect of low density zoning in bolstering segregation and suggest the relationship is indeed casual. Across all specifications, the more liberal the density zoning regime, the lower the level of segregation controlling for school regulation, growth controls, containment, and the likelihood of having more or less regulation. Our instrument easily passes the test of relevance, with first stage F-statistics well above 10 in every model (see Appendix Table H).

We would expect the instrumented density zoning effect to be larger than the OLS effect if the residual of equation (1) is positively correlated with both density zoning and segregation. This would be the case, if high segregation puts political pressure on jurisdictions to liberalize zoning regimes. Certainly, the supreme court of New Jersey has done this its decision against the town of Mt. Laurel, as did the Massachusetts Legislature when it passed General Law Chapter 40B. Consistent with this reasoning, the effects of density zoning are indeed stronger once they have been purged of biases stemming from reverse causality. In the 2000 cross-sectional models, for example, the OLS coefficient was 0.09 for both segregation indices whereas the 2SLS coefficient was 0.12 in both cases, a 25% increase. In the 1980–2000 model predicting trends in dissimilarity, whereas OLS predicted a decline of 13% over the two decades, 2SLS predicted a 14% drop. Likewise, in predicting 1980–2000 trends in isolation, OLS predicted an 18% decline but the predicted decline was 21% with 2SLS.

UNOBSERVED REGIONAL CHARACTERISTICS

We undertake one final robustness check motivated by the striking regional differences in density zoning. Although there are no regional differences in terms of change in density zoning, there are large absolute differences in the level at any point in time. The West is by far the most liberal region with respect to density regulation, followed by the South, the Midwest and the Northeast. The West-South average is almost an entire unit more permissive on the density score than the Midwest-Northeast average.[10] Consistent with our argument, the regional pattern in housing supply and desegregation precisely mirrors the regional pattern in density zoning. In the preceding analysis, we argued that this is no coincidence; but critics might argue that it reflects unobserved regional characteristics not captured by our lengthy list of control variables. Estimating the model one region at a time does not change the results, and we don't know of any other explanation why the South and West experience should greater desegregation, but in response to reviewer comments we nonetheless add a full set of regional controls to our regressions, and report the results in Table 5.

The first two columns show cross-sectional results for 2000. Not surprisingly, the coefficients are smaller as the regional dummies now pick up some of the variance in segregation and isolation, showing significantly greater levels in the Northeast and Midwest. Although the effect of zoning on black-white dissimilarity is no longer significant, zoning

[10]This contradicts the depiction of the West as highly regulated (Gyourko et al 2007), but we want to be clear which regulations we are talking about. From Pendall's data, our measure of school infrastructure regulations, growth controls, and containment are significantly more common in the West and California in particular. The Gyourko et al (2007) survey includes an indicator of density regulation, which also depicts the West as the most open to density and the Northeast as the most hostile to it.

continues to predict black isolation at the 10% significance level with a two tailed test, and at a 5% level with a one tailed test (p<.032). As for the change in segregation from1980 to 2000, the point estimates continue to be large and statically robust for both indices when regional controls are added to the models. The one caveat is that interactions now absorb more of the variation, so that liberal density zoning is associated with higher segregation in areas where growth controls are especially prevalent. Though not shown here, the 2SLS results also remain highly significant in the cross-sectional results and significant at the 10% level in the dynamic model. We conclude that the effect of density zoning on segregation is not driven by unobserved regional characteristics. Even within regions, MSAs with more favorable regulations towards density see more racial integration.

OTHER ZONING REGULATIONS

Although density zoning stands out here, we are not prepared to draw confident conclusions about the effects of other regulations on segregation, since many of them have not been used long enough to affect segregation significantly.[11] Like Nelson, Sanchez, and Dawkins (2004), we find that containment regulations predict desegregation from 1990 to 2000 when we omit controls for changes in density regulation, though this is not the case in the cross-sections or from 1980 to 2000 or 1980 to 1990. These regulations are essentially pro-density, as opposed to the anti-density regulations of large lot zoning. Yet, unlike Nelson, Sanchez, and Dawkins (2004), we argue that anti-density zoning is a more fundamental cause of segregation because containment without high-density zoning would condemn an area to housing scarcity. We also have empirical evidence that density zoning is more fundamental to desegregation than containment. Density zoning in 1994 significantly predicts the 2003 level of containment as well as the change in containment regulations from 1994 to 2003, but the reverse is not true (see Appendix Table G).[12]

Aside from containment, we suspect that growth controls probably contribute to segregation by preventing housing growth in white jurisdictions. School infrastructure regulations also act like anti-density zoning by raising the costs of multi-family developments. In both cases, inconsistent estimates may be due to their infrequent use and association with otherwise liberal areas. Finally, inclusionary zoning measures seem to be driven more by political efforts to appear favorable to affordable housing, but do not appear to offer a robust tool to promote density (Meltzer and Shuetz 2008).

SUMMARY AND DISCUSSION

The foregoing analysis suggests that patterns and processes of racial segregation in the post-civil rights American city are strongly affected by density zoning. At any point in time from

[11]First, of the jurisdictions with containment regulations measured in 2003, 74% had at least one in place before 1994 (70% before 1990). This is similar to density zoning, in that 75% of jurisdictions had roughly the same density regulations in 1994 as they had in 2003, and 80% had the same density regulation in 1988 as they had in 1994. By contrast, our school infrastructure regulation variable included AFPOs (Adequate Public Finance Ordinances), but only 1% of these were implemented before 1995.Only 5% of our moratoria on growth, which were included under growth controls, were said to be in place before 1995, and the oldest started in 1992. We do not know how long building caps and impact fees have been in use.

[12]As shown in Appendix Table G, the relationship holds in unconditional specifications, and with the inclusion of controls for segregation in 1990, the number of general governments, housing supply growth from 1990–2000, the black share of the population in 1990, local government reliance on property taxes, and regional effects.

1990 to 2000, inter-metropolitan variation in black-white segregation and black isolation was strongly predicted by a metropolitan area's relative openness to housing construction as embodied in maximum zoning rules---the greater the allowable density, the lower the level of racial segregation. Moreover, our instrumental variable analysis suggests that the causal arrow runs from regulation to segregation, even if the reverse is also true.

In keeping with these cross-sectional findings, we also found that the prospects for desegregation are greater in areas with more liberal density regulations. From 1980 to 2000, metropolitan areas that allowed higher density development moved more rapidly toward racial integration than their counterparts with strict density limitations, even after controlling for a battery of social, geographic, and economic characteristics and for potential reverse causality between segregation and zoning. Our confidence that anti-density zoning is a true source of segregation is increased by a recent working paper by Rothwell (2009b) that uses the same data and finds the essentially the same results for levels of Asian and Hispanic segregation; and consistent with Pendall's analysis (2000) we do not find any consistent pattern emerging for other land use regulations.

In terms of underlying mechanisms, we argue that restrictive density zoning produces higher housing prices in white areas and limits opportunities for people with modest incomes to leave segregated areas, a perspective in accordance with a great deal of research showing that zoning increases housing prices (Rothwell 2009a; Glaeser and Gyourko 2002; Glaeser, Gyourko, and Saks 2005; Fischel 1985).

In their analysis, Cutler and Glaeser (1997) found evidence that decentralized white racism, as revealed in housing preferences, perpetuated contemporary segregation in U.S. metropolitan areas. Our results suggest that, whatever their racial motivations, homeowners reveal their political preferences to exclude households of modest means through low density zoning under certain predictable conditions. These conditions are found in metropolitan areas where local governments are relatively fragmented, rural settlements are prevalent, jurisdictions rely heavily on property taxation, and the percentage of African-Americans is high. We believe federal policy should be brought to bear on local land regulations, prohibiting the most severe.

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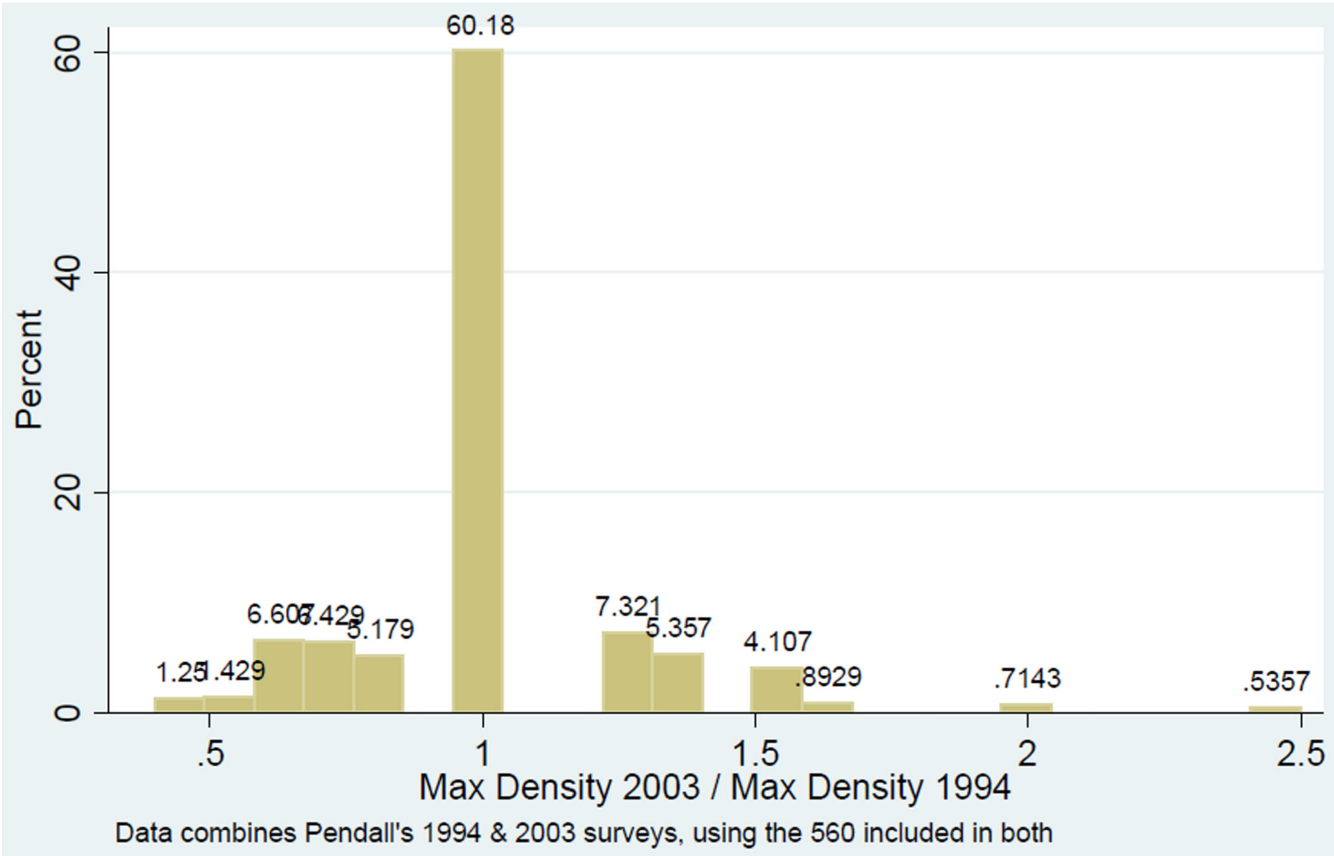

Fig 1.
The Stability of Density Zoning

Table 1

Summary Statistics of all Variables with sources

	Mean	Std. Dev.	Min	Max
Black-White Segregation Indices (from U.S. Bureau of the Census)				
	Mean	Std. Dev.	Min	Max
Dissimilarity 2000	0.62	0.11	0.36	0.85
Dissimilarity 1990	0.66	0.10	0.45	0.87
Dissimilarity 1980	0.72	0.09	0.48	0.88
Isolation 2000	0.52	0.17	0.05	0.83
Isolation 1990	0.55	0.16	0.06	0.82
Isolation 1980	0.60	0.15	0.12	0.86
Regulatory Data (from Rolf Pendall, unless noted)				
	Mean	Std. Dev.	Min	Max
Maximum Density Score	3.37	0.66	2.17	4.67
Affordable Housing Index	0.23	0.27	0.00	1.00
Containment Index	0.27	0.24	1.00	0.94
Containment Index (if in place since 1994 or earlier)	0.21	0.23	0.00	0.89
School Infrastructure Regulation Index	0.18	0.24	0.00	0.86
Growth Control Index	0.08	0.09	0.00	0.38
% with Less Regulation in 1980	0.42	0.15	0.09	0.83
% with More Regulation in 1980	0.18	0.08	0.00	0.36
% with Less Regulation in 1990	0.38	0.14	0.15	0.83
% with More Regulation in 1990	0.28	0.11	0.00	0.50
Density Zoning was Higher (more liberal) in 1994	0.10	0.08	0.00	0.29
Density Zoning Score was Lower (more restrictive) in 1994	0.08	0.07	0.00	0.33
Wharton Land Use Regulation Index (from Gyourko et al 2007)	0.06	0.55	−1.35	1.16
Constant Data				
General Governments in 1962, Cutler and Glaeser 1995	81.73	88.78	4.00	339.00
Water to Land Ratio 2000, Census	0.19	0.31	0.00	1.29
Coastal Proximity Dummy, Google Maps	0.41	0.50	0.00	1.00
Year of Statehood, U.S. Mint	1825.45	35.70	1788	1912
Average Jan. Temperature, National Climate Center	37.58	13.76	11.80	68.10
Full Set of Dynamic Controls				

	2000		1990		1980	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Black Share of MSA Population, Census	0.16	0.09	0.15	0.09	0.14	0.09
Pop. Density, Census	514	245	536	353	403	230
Share of Adults Over 25 with BA (or higher), Census	0.28	0.05	0.23	0.04	0.18	0.04
Share of Workers in Manufacturing Sector, Census	0.13	0.05	0.16	0.05	0.21	0.08
Median Household Income, Census	45918	5294	32646	4426	17694	1881
Share of Workforce in Agriculture, Census	0.01	0.01	0.02	0.01	0.02	0.01
Share of Commuters with Commute time over 35 Minutes, Census	0.21	0.06	0.17	0.06		
ln(Number of residents who moved into MSA during previous decade), Census	14.26	0.77	12.74	0.80	12.07	0.84
Suburan Housing Units/Central City Housing Units, HUD	3.92	5.34	3.36	4.94		
Median Gross Rent, HUD	723	112	470	84	250	25
Suburban Median Rent/Central City Median Rent, HUD	1.12	0.12	1.14	0.13		
Share of Units without Plumbing, Census	0.01	0.00	0.00	0.00		
Single Detached Units, Census	0.60	0.08	0.57	0.08		
Rural Share of Housing Units, Census	0.11	0.07	0.14	0.12		
State Average of Local Govt Revenue from Own Source, Census of Governments	0.53	0.07	0.55	0.07		
Average State Taxation per Capita, Census of Governments	1900	427	1352	267		
Union Membership Rate, Hirsh and McPherson (unionstats.gsu.edu)			14.43	6.69	15.89	7.26
Percent of Occupations in Farming, HUD					0.01	0.01

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Table 2

OLS regression of density regulation on black-white residential dissimilarity and isolation indices in 49 U.S. metropolitan areas during 1990 and 2000.

	dissimilarity index				isolation index			
	1990	**1990**	**2000**	**2000**	**1990**	**1990**	**2000**	**2000**
Density Zoning Score	–0.06***	–0.10***	–0.06**	–0.09***	–0.09***	–0.11***	–0.07***	–0.09**
	(0.020)	(0.0239)	(0.0238)	(0.0316)	(0.0237)	(0.034)	(0.0258)	(0.037)
Affordable Housing Regulation		0.129**		0.0792		0.141		0.0930
		(0.0535)		(0.120)		(0.0965)		(0.127)
Containment		0.0750		–0.0171		0.0248		–0.0948
		(0.0530)		(0.0790)		(0.0724)		(0.091)
School Infrastructure Regulation		0.0641		0.139*		0.104		0.182**
		(0.0556)		(0.0773)		(0.0725)		(0.07)
Growth Control Regulation		0.207*		0.334		0.117		0.208
		(0.108)		(0.270)		(0.170)		(0.277)
Wharton Land Use Regulation Index		–0.0375		–0.0333		–0.06**		–0.050*
		(0.0239)		(0.0254)		(0.027)		(0.028)
Constant	0.455	0.445	0.329	0.293	0.0167	–0.0389	–0.741	–0.563
	(0.530)	(0.532)	(0.696)	(0.645)	(0.761)	(0.799)	(0.786)	(0.579)
Adjusted R-squared	0.611	0.658	0.500	0.563	0.744	0.766	0.727	0.807

Controls not shown: the number of general governments in 1962, the black share of the population, population density, the share of adults over 25 with a BA, the manufacturing share of industry, the median household income, the water-to-land ratio, a dummy for coastal proximity, the agricultural share of industry, the share of commuters with commute times over 35 minutes, population growth in the previous 10 years, the ratio of suburban to central city housing units, the median rent, the suburban to central city rent ratio, the share of homes with no plumbing, the rural share of housing units, the average local jurisdictions' reliance on own revenue (for each state), state taxation per capita.

*** p<0.01,

** p<0.05,

* p<0.1, standard errors are in parentheses and are robust to heteroskedastcity and clustering.

Table 3

OLS regression of density regulation on changes in black-white residential dissimilarity and isolation in 49 U.S. metropolitan areas from 1980 to 2000.

	1990–2000		1980–2000	
	Dissimilarity	**Isolation**	**Dissimilarity**	**Isolation**
Density Zoning Score	–0.00347	–0.0195	–0.127***	–0.180**
	(0.0265)	(0.0470)	(0.0439)	(0.0789)
Increased Allowable Density Since 1994	–0.254**	–0.398*	0.0212	0.149
	(0.114)	(0.226)	(0.126)	(0.316)
Decreased Allowable Density Since 1994	0.0984	–0.0531	–0.227	–0.180
	(0.166)	(0.261)	(0.212)	(0.380)
Less Overall Regulation in Previous Decade	–0.2***	–0.215	–0.301***	–0.714***
	(0.0773)	(0.139)	(0.0974)	(0.243)
More Overall Regulation in Previous Decade	–0.00685	0.102	–0.309**	–0.782**
	(0.0864)	(0.166)	(0.146)	(0.380)
Containment (1994 or older)	–0.0643	–0.151	–0.0451	–0.190*
	(0.0457)	(0.0945)	(0.0613)	(0.102)
School Infrastructure Regulations	–0.125	–0.128	0.0617	–1.135*
	(0.374)	(0.639)	(0.396)	(0.673)
Growth controls	–0.558	–0.546	–2.717**	–3.963*
	(0.648)	(1.198)	(1.121)	(2.189)
Density zoning*School Regulation	0.0432	0.0566	–0.0379	0.280
	(0.106)	(0.177)	(0.113)	(0.190)
Density zoning*Growth Controls	0.225	0.241	0.951***	1.428**
	(0.179)	(0.315)	(0.337)	(0.642)
Constant	0.329	0.293	0.0180	0.372
	(0.696)	(0.645)	(0.365)	(0.576)
Adjusted R-squared	0.500	0.563	0.889	0.945

Controls not shown: the number of general governments in 1962, the black share of the population, population density, the share of adults over 25 with a BA, the manufacturing share of industry, the median household income, the water-to-land ratio, a dummy for coastal proximity, the agricultural share of industry, the share of commuters with commute times over 35 minutes, population growth in the previous 10 years, the ratio of suburban to central city housing units, the median rent, the suburban to central city rent ratio, the share of homes with no plumbing, the rural share of housing units, the average local jurisdictions' reliance on own revenue (for each state), state taxation per capita. Additionally, average January temperature and union membership rates were added.

1980 regressions omitted controls for suburban ratios, commute times, the share with no plumbing, and substituted the share of farming units instead of rural housing.

*** $p<0.01$,

** $p<0.05$,

* $p<0.1$, standard errors are in parentheses and are robust to heteroskedasticity and clustering.

Table 4

2SLS regression of density regulation on decennial changes and 2000 levels of black-white residential dissimilarity and isolation in 49 U.S. metropolitan areas

	2000		1990–2000		1980–2000	
	Dissimilarity	**Isolation**	**Dissimilarity**	**Isolation**	**Dissimilarity**	**Isolation**
Density Zoning Score	–0.123***	–0.119***	0.0222	–0.00512	–0.135***	–0.212**
	(0.0357)	(0.0300)	(0.0397)	(0.0567)	(0.0437)	(0.0937)
Increased Allowable Density Since 1994			–0.297***	–0.452***	–0.0948	–0.218
			(0.0729)	(0.123)	(0.132)	(0.269)
Decreased Allowable Density Since 1994			0.105	–0.0999	–0.449**	–0.709*
			(0.140)	(0.212)	(0.181)	(0.376)
Less Overall Regulation in Previous Decade			–0.230***	–0.191*	–0.106	–0.393**
			(0.0752)	(0.107)	(0.0906)	(0.163)
More Overall Regulation in Previous Decade			–0.0141	0.100	–0.161	–0.521*
			(0.0575)	(0.108)	(0.132)	(0.311)
Containment	–0.0644	0.00845	–0.0619*	–0.134*	0.0412	–0.0196
	(0.0643)	(0.0591)	(0.0373)	(0.0753)	(0.0507)	(0.0917)
School Infrastructure Regulations	0.170***	0.129**	0.0517**	0.0924**	–0.00718	0.00133
	(0.0473)	(0.0529)	(0.0258)	(0.0408)	(0.0433)	(0.0941)
Growth controls	0.296	0.409**	0.282***	0.372***	0.644***	1.277***
	(0.189)	(0.182)	(0.102)	(0.119)	(0.189)	(0.383)
Constant	–0.663	0.209	–0.0306	–0.509	–0.369	–0.550
	(0.407)	(0.465)	(0.246)	(0.422)	(0.263)	(0.424)
Adjusted R-squared	0.801	0.551	0.950	0.979	0.825	0.902

Controls not shown: the number of general governments in 1962, the black share of the population, population density, the share of adults over 25 with a BA, the manufacturing share of industry, the median household income, the water-to-land ratio, a dummy for coastal proximity, the agricultural share of industry, the share of commuters with commute times over 35 minutes, population growth in the previous 10 years, the ratio of suburban to central city housing units, the median rent, the suburban to central city rent ratio, the share of homes with no plumbing, the rural share of housing units, the average local jurisdictions' reliance on own revenue (for each state), state taxation per capita.

For the 1990–2000 and 1980–2000 regressions, average January temperature and union membership rates were added, and the Wharton Index and affordable housing index were only used in the 2000 regression.

1980–2000 regressions were identical to 1990–2000 regressions, except they omitted controls for suburban ratios, commute times, the share with no plumbing, state taxation, local reliance on own revenues, and they substituted the share of farming units for the rural housing share.

*** p<0.01,

** p<0.05,

* p<0.1, standard errors are in parentheses and are robust to heteroskedastcity and clustering.

Table 5

OLS regression of density regulation and regional controls on decennial changes and 2000 levels of black-white residential dissimilarity and isolation in 49 U.S. metropolitan areas

	2000		1980–2000	
	Dissimilarity	**Isolation**	**Dissimilarity**	**Isolation**
Density Zoning Score	–0.0537	–0.0764*	–0.107**	–0.206***
	(0.0422)	(0.0404)	(0.0477)	(0.0755)
Containment	0.00380	–0.0611	0.0107	–0.0828
	(0.0622)	(0.0778)	(0.0681)	(0.104)
School Infrastructure Regulations	0.154***	0.191***	–0.00550	0.315
	(0.0568)	(0.0642)	(0.114)	(0.194)
Growth controls	0.553*	0.517*	1.089***	1.904***
	(0.278)	(0.291)	(0.346)	(0.554)
Density Zoning*School Regulation			0.00508	–1.166*
			(0.421)	(0.675)
Density Zoning*Growth controls			–3.280***	–5.572***
			(1.166)	(1.752)
Mid-West	0.271***	0.254**	0.177*	0.332**
	(0.100)	(0.117)	(0.0976)	(0.146)
North East	0.231**	0.185	0.159	0.279**
	(0.101)	(0.113)	(0.0983)	(0.137)
South	0.119	0.148*	0.0430	0.224
	(0.0723)	(0.0836)	(0.0753)	(0.138)
Constant	–0.0290	–0.797	–0.163	–0.319
	(0.614)	(0.523)	(0.438)	(0.674)
Adjusted R-squared	0.676	0.843	0.905	0.949

Controls not shown: the number of general governments in 1962, the black share of the population, population density, the share of adults over 25 with a BA, the manufacturing share of industry, the median household income, the water-to-land ratio, a dummy for coastal proximity, the agricultural share of industry, the share of commuters with commute times over 35 minutes, population growth in the previous 10 years, the ratio of suburban to central city housing units, the median rent, the suburban to central city rent ratio, the share of homes with no plumbing, the rural share of housing units, the average local jurisdictions' reliance on own revenue (for each state), state taxation per capita. The regional dummy variables are with respect to the West.

For the 1980–2000 regression, average January temperature and union membership rates in 1986 were added, but controls were omitted for suburban ratios, commute times, the share with no plumbing, and they substituted the share of farming units for the rural housing share. The Wharton Index and affordable housing index were only used in the 2000 regression.

*** p<0.01,

** p<0.05,

* p<0.10, standard errors are in parentheses and are robust to heteroskedastcity and clustering.

Appendix Table A

Metropolitan areas included in analysis of zoning and segregation with indices of black-white dissimilarity and maximum zoning density.

Metropolitan areas	Black-White Dissimilarity 2000	Maximum Density Zoning Score
Salt Lake City-Ogden UT MSA	0.36	3.95
Phoenix-Mesa AZ MSA	0.43	4.08
Las Vegas NV-AZ MSA	0.43	4
Raleigh-Durham-Chapel Hill NC MSA	0.45	2.85
Portland-Salem OR-WA CMSA	0.46	4.12
Norfolk-Virginia Beach-Newport News VA-NC MSA	0.46	3.63
Seattle-Tacoma-Bremerton WA CMSA	0.49	4.29
Austin-San Marcos TX MSA	0.51	4.29
Oklahoma City OK MSA	0.53	3.5
Jacksonville FL MSA	0.54	3.83
San Diego CA MSA	0.54	4.67
Orlando FL MSA	0.54	3.72
Charlotte-Gastonia-Rock Hill NC-SC MSA	0.54	3.14
Sacramento-Yolo CA CMSA	0.56	4.18
Richmond-Petersburg VA MSA	0.56	2.75
Nashville TN MSA	0.57	3.95
Greensboro--Winston-Salem--High Point NC MSA	0.57	3.5
Minneapolis-St. Paul MN-WI MSA	0.58	3.61
Dallas-Fort Worth TX CMSA	0.59	3.79
San Francisco-Oakland-San Jose CA CMSA	0.6	4.45
Denver-Boulder-Greeley CO CMSA	0.61	4.17
Columbus OH MSA	0.62	2.66
Tampa-St. Petersburg-Clearwater FL MSA	0.63	4.1
Washington-Baltimore DC-MD-VA-WV CMSA	0.63	3.8
Hartford CT NECMA	0.64	2.42
Louisville KY-IN MSA	0.64	3
West Palm Beach-Boca Raton FL MSA	0.65	3.55
Atlanta GA MSA	0.65	2.94
Los Angeles-Riverside-Orange County CA CMSA	0.66	4.22
Houston-Galveston-Brazoria TX CMSA	0.66	2.78
Rochester NY MSA	0.66	2.46
Boston-Worcester-Lawrence-Lowell-Brockton MA-NH NECMA	0.66	2.37
Grand Rapids-Muskegon-Holland MI MSA	0.67	2.67
Pittsburgh PA MSA	0.67	2.62
Memphis TN-AR-MS MSA	0.68	3
New Orleans LA MSA	0.68	4.14
Kansas City MO-KS MSA	0.69	3.32

Metropolitan areas	Black-White Dissimilarity 2000	Maximum Density Zoning Score
New Haven-Bridgeport-Stamford-Waterbury-Danbury CT NEC	0.69	3.26
Miami-Fort Lauderdale FL CMSA	0.69	4.41
Indianapolis IN MSA	0.7	3
Philadelphia-Wilmington-Atlantic City PA-NJ-DE-MD CMSA	0.72	2.86
St. Louis MO-IL MSA	0.73	3.06
Cincinnati-Hamilton OH-KY-IN CMSA	0.74	3.11
Cleveland-Akron OH CMSA	0.77	2.79
Buffalo-Niagara Falls NY MSA	0.77	2.16
Chicago-Gary-Kenosha IL-IN-WI CMSA	0.8	3.28
New York-Northern New Jersey-Long Island NY-NJ-CT-PA C	0.81	2.81
Milwaukee-Racine WI CMSA	0.82	2.86
Detroit-Ann Arbor-Flint MI CMSA	0.85	2.85

Appendix Table B

Percentage of Jurisdictions that Reported Change (or lack thereof) in Maximum Density Zoning

	Did not change	Increased Allowable Density by 10% or More	Decreased Allowable Density by 10% or More	observations
From 1994 to 2003	76.5%	8.4%	8.4%	1677
From 1988 to 1994	80.7%	6.1%	7.2%	1168

Appendix Table C

The Relationship Between Density Zoning Stability, Regions, and Previous Zoning

	Same 1988–1994	Same 1988–1994	Same 1994–2003	Same 1994–2003	Zoning 2003/Zoning 1994
Midwest	0.0649	0.0501	0.0597	0.0275	–0.00778
	(0.0471)	(0.0427)	(0.0553)	(0.0503)	(0.0309)
Northeast	2.37e-05	–0.00775	0.00835	–0.00861	–0.00619
	(0.0406)	(0.0392)	(0.0477)	(0.0461)	(0.0284)
South	–0.0192	–0.0244	–0.0466	–0.0579	–0.00345
	(0.0485)	(0.0479)	(0.0570)	(0.0564)	(0.0347)
Density Zoning in 1994	0.0124		0.0270		
	(0.0166)		(0.0195)		
Constant	0.791***	0.845***	0.659***	0.777***	1.018***
	(0.0781)	(0.0294)	(0.0918)	(0.0346)	(0.0213)
Observations	560	560	560	560	560
Adjusted R-squared	–0.001	–0.000	0.000	–0.001	–0.005

Standard errors in parentheses,

*** p<0.01,

** p<0.05,

* p<0.1. Columns 1–4 use Probit regressions, with marginal effects shown. Column 5 uses OLS on a continuous dependent variable.

Appendix Table D

Population and Property Tax Burden for U.S. Counties in 2000

	Dependent Variable=Effective Property Tax Rate			
% Rural	−2.516***		−2.014***	
	(0.275)		(0.197)	
Population in Millions		3.788***		1.248***
		(0.555)		(0.471)
(Population in Millions)^2		−4.69e-07***		−1.55e-07***
		(8.00e-08)		(5.91e-08)
Percent of Population Enrolled in School			0.0659	−2.840
			(2.219)	(2.387)
Home Owner Rate			−3.320***	−7.339***
			(1.003)	(0.743)
Median Household Income			0.000101***	0.000136***
			(1.02e-05)	(1.15e-05)
Average Property Value			−2.34e-05***	−2.66e-05***
			(2.40e-06)	(2.58e-06)
Percent Black			1.446***	1.053*
			(0.555)	(0.563)
Percent Non-white & Non-black			0.432	0.866
			(0.557)	(0.548)
Constant	11.33***	9.509***	12.06***	13.31***
	(0.186)	(0.0882)	(0.650)	(0.568)
Observations	3060	3137	3060	3137
Adjusted R-squared	0.029	0.021	0.860	0.858

Robust standard errors in parentheses.

*** p<0.01,

** p<0.05,

* p<0.1.

Note: The effective property tax was calculated by economists at the National Association of Home Builders, http://www.nahb.org/generic.aspx?genericContentID=35450, using 2000 Census data on self-reported property taxes and home values.

Appendix Table E

The Exogeneity of Statehood: Testing if Year of Statehood is Correlated with Segregation Before Zoning was Used

	Black-white Dissimilarity 1920				
Year of Statehood		0.000484	0.000787	0.000787	0.000934
		(0.000814)	(0.000738)	(0.000738)	(0.000773)
Population Density in 1910	0.000255**	0.000301*	0.000292**	0.000292**	0.000293**
	(0.000115)	(0.000148)	(0.000142)	(0.000142)	(0.000138)
% Black 1910	–0.402***	–0.373**	–0.367**	–0.367**	–0.109
	(0.145)	(0.150)	(0.158)	(0.158)	(0.201)
% Black 1920-% black 1910			0.000278		0.000523
			(0.000471)		(0.000317)
% Black 1920				0.000278	
				(0.000471)	
Midwest					0.178**
					(0.0851)
Northeast					0.0911
					(0.104)
South					0.0347
					(0.0955)
Constant	0.476***	–0.414	–0.966	–0.966	–1.365
	(0.0360)	(1.490)	(1.362)	(1.362)	(1.428)
Observations	32	32	31	31	31
Adjusted R-squared	0.360	0.344	0.390	0.390	0.464

Robust standard errors in parentheses, clustered on MSAs.

*** p<0.01,

** p<0.05,

* p<0.1.

Note: The 1920 segregation data on 32 MSAs is provided by Jacob Vigdor, from a collaborative project with David Cutler and Edward Glaeser, with data available here: http://trinity.aas.duke.edu/~jvigdor/segregation/. 1910 data was downloaded from Social Explorer.

Appendix Table F

Robustness Check of Alternative Specifications: Regression of density regulation on black-white residential dissimilarity indices in 49 U.S. metropolitan areas during 1990 and 2000, using a binary-zoning measure and continuous zoning with weighted least squares.

Specification Change:	Binary Measure of Zoning (=1 if Max Density>3.37, =0 otherwise)				Weighted Least Squares (weight=1/number of observed local governments with zoning)			
	dissimilarity index				dissimilarity index			
	1990	1990	2000	2000	1990	1990	2000	2000
Density Zoning Score	−0.099***	−0.12***	−0.13***	−0.18***	−0.074***	−0.11***	−0.05**	−0.088***
	(0.0359)	(0.0400)	(0.0392)	(0.0409)	(0.0166)	(0.0257)	(0.0192)	(0.0274)
Affordable Housing Regulation		0.0989		0.0836		0.117		0.0886
		(0.0656)		(0.0926)		(0.0722)		(0.114)
Containment		0.0345		−0.0418		0.0874		0.0265
		(0.0444)		(0.0476)		(0.0668)		(0.0642)
School Infrastructure Regulation		0.0554		0.129**		0.0607		0.143*
		(0.0508)		(0.0486)		(0.0488)		(0.0789)
Growth Control Regulation		0.175		0.532**		0.0739		0.126
		(0.145)		(0.224)		(0.176)		(0.240)
Wharton Land Use Regulation Index		−0.0292		−0.0149		−0.0337		−0.0341
		(0.0227)		(0.0193)		(0.0247)		(0.0261)
Constant	−0.0461	−0.178	−0.00311	−0.181	0.338	0.257	0.221	0.134
	(0.496)	(0.496)	(0.564)	(0.489)	(0.431)	(0.557)	(0.697)	(0.573)
Adjusted R-squared	0.634	0.646	0.603	0.717	0.744	0.755	0.665	0.721

Controls not shown: the number of general governments in 1962, the black share of the population, population density, the share of adults over 25 with a BA, the manufacturing share of industry, the median household income, the water-to-land ratio, a dummy for coastal proximity, the agricultural share of industry, the share of commuters with commute times over 35 minutes, population growth in the previous 10 years, the ratio of suburban to central city housing units, the median rent, the suburban to central city rent ratio, the share of homes with no plumbing, the rural share of housing units, the average local jurisdictions' reliance on own revenue (for each state), state taxation per capita.

*** p<0.01,

** p<0.05,

* p<0.1, standard errors are in parentheses and are robust to heteroskedastcity and clustering.

Appendix Table G

Regressions of Regulation on Previous Regulation

	Containment 2003			Density Zoning 2003		
Density Zoning Score 1994	0.0590***	0.0741***	0.0352	1.656***	1.190***	0.625*
	(0.0179)	(0.0200)	(0.0302)	(0.334)	(0.264)	(0.351)
Containment in 1994	0.961***	0.946***	0.945***	0.766	0.245	0.00228
	(0.0692)	(0.0593)	(0.0601)	(0.592)	(0.559)	(0.482)
% Black 1990	–0.299	0.0868	0.306	–2.662	–1.388	–0.510
	(0.203)	(0.370)	(0.410)	(2.273)	(3.424)	(2.908)
Pop Density 1990	1.90e-05	5.54e-05	6.71e-05*	0.000780*	0.000991**	0.00113**
	(2.18e-05)	(3.69e-05)	(3.56e-05)	(0.000394)	(0.000398)	(0.000419)
No. of General Govt Jurisdictions in 1962		0.000221**	0.000194**		–0.00233*	0.000868
		(8.17e-05)	(8.64e-05)		(0.00127)	(0.00115)
Housing Supply Growth 1990–2000		0.0591	-0.0750		0.635	–1.185
		(0.147)	(0.212)		(1.430)	(1.428)
black-white isolation index in 1990		–0.261*	–0.411**		–1.306	–1.858
		(0.140)	(0.175)		(1.710)	(1.442)
Property Tax Share of Local Revenue in 1991		0.0503	0.0291		–1.991	–0.344
		(0.0783)	(0.0767)		(1.319)	(1.379)
Midwest			0.00637			–1.437***
			(0.0437)			(0.505)
Northeast			–0.0641			–2.023***
			(0.0649)			(0.640)
South			–0.0117			–0.548
			(0.0319)			(0.400)
Constant	–0.144*	–0.186	0.0658	–6.594***	–3.137*	–0.648
	(0.0733)	(0.120)	(0.208)	(1.190)	(1.671)	(1.909)
MSA Observations	25	25	25	25	25	25
Adjusted R-squared	0.965	0.974	0.976	0.711	0.763	0.811

Appendix Table H

The sources of Density Zoning in 49 MSAs

	Density Zoning Score 2003 Measure				
Year of Statehood	0.0120***			0.00489	0.0101***
	(0.00202)			(0.00382)	(0.00351)
No. of Rural Housing Units in 1990/Land Area		-0.0365***	−0.0279***	−0.0193*	−0.0158***
		(0.00580)	(0.00698)	(0.0101)	(0.00570)
% Black 1990			−1.709**	−0.718	0.0122
			(0.728)	(0.966)	(1.342)
no. of General Govts in 1962			−0.00213***	−0.00200***	−0.000276
			(0.000674)	(0.000611)	(0.000764)
% of Local Government's Revenue from Own Source 1992					0.987
					(1.340)
State Taxation Per Capita					−0.000641**
					(0.000254)
Share of Local Revenue from Own Source (State average)					0.99
					(1.34)
Property Tax Share of Local Revenue (state average)			−0.903	−0.877	
			(0.606)	(0.585)	
Constant	−18.54***	4.133***	4.797***	−4.486	−16.38**
	(3.669)	(0.123)	(0.289)	(7.159)	(6.696)
F-statistic	35	39	19	15	41
Observations	49	49	49	49	49
Adjusted R-squared	0.407	0.461	0.560	0.573	0.840

Robust standard errors in parentheses, clustered on MSAs.

*** p<0.01,

** p<0.05,

* p<0.1.

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Column 5 was used as the first stage of the 2SLS regressions from Table 4. It contains the following controls: population density, the share of adults over 25 with a BA, the manufacturing share of industry, the median household income, the water-to-land ratio, a dummy for coastal proximity, the agricultural share of industry, the share of commuters with commute times over 35 minutes, population growth in the previous 10 years, the ratio of suburban to central city housing units, the median rent, the suburban to central city rent ratio, the share of homes with no plumbing, the rural share of housing units.