Regulation and the Rise of Housing Prices in Greater Boston

A study based on new data from 187 communities in eastern Massachusetts

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This paper is part of the Initiative on Local Housing Regulation, a joint effort of the Pioneer Institute for Public Policy Research and Harvard University's Rappaport Institute for Greater Boston. As part of this initiative, researchers at the Pioneer Institute and the Rappaport Institute have assembled and coded a database on zoning codes, subdivision requirements, and environmental regulations that as of 2004 governed land use in 187 communities in eastern and central Massachusetts. The searchable database is available at www.pioneerinstitute.org/municipalregs/. The site also houses summary reports, analyses of the data, and a downloadable version of the database in formats that can be used for econometric analyses. In coming months, the Pioneer Institute and the Rappaport Institute will also be issuing papers and policy briefs, some jointly and some individually, on land-use regulation in greater Boston.

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Institutions

The **Pioneer Institute for Public Policy Research,** founded in 1988, is an independent, non-profit, public policy research institute based in Boston that generates and markets new and practical public policy ideas and peer-reviewed scholarship. Pioneer Institute research explores the application of market principles to state and local policy to advance the core values of an open society—individual freedom and responsibility, economic opportunity, social mobility, and limited government.

The Rappaport Institute for Greater Boston at Harvard University strives to improve region's governance by attracting young people to serve the region, working with scholars to produce new ideas about important issues, and stimulating informed discussions that bring together scholars, policymakers, and civic leaders. The Rappaport Institute was founded and funded by the Jerome Lyle Rappaport Charitable Foundation, which promotes emerging leaders in Greater Boston.

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Executive Summary

In well-functioning markets, when prices rise, supply increases, and then prices stop rising and sometimes even fall. By this definition, the housing market in the greater Boston area is not working.

The market is sending clear signals about the demand:

- Between 1980 and 2004, housing prices in three of the Census Bureau's divisions of the Boston metropolitan area grew by between 179 and 210 percent (adjusted for inflation), which made these areas—Boston-Quincy, Cambridge-Newton, and Essex County—second through fourth in the nation behind only the New York area's Nassau-Suffolk Division.

- According to data from the National Association of Realtors in the third quarter of 2005, the median sales price for existing single-family homes in the Boston metropolitan area was $430,900, more than any other region in the continental United States except for portions of California, greater New York City, and the Washington, D.C. metropolitan area.

Supply, however, is not keeping up:

- In the 1960s, there were 172,459 units permitted in the Boston metropolitan area; in the 1980s, 141,347. However, despite the sharp rise in prices in the 1990s, only 84,105, units were permitted in that decade.

- The decline in permits has been particularly striking for units in multi-family buildings. In the 1960s, less than 50 percent of all permits in the Boston metropolitan area were for single-family homes. In the 1990s, over 80 percent of all permits were for single-family homes.

Some of the price increase can be explained by the region's dramatic economic renaissance in the past three decades. However, other regions have boomed without experiencing dramatic increases in house prices. Until the last quarter, for example, median housing prices in the Phoenix area were less than $200,000 and in the Houston area the current median sales price is $142,000. Local governments in Phoenix area handed out 57,273 permits for single-family homes during 2004, Las Vegas area localities 35,579—local governments in the greater Boston area only 5,001.

Is Greater Boston Running Out of Land?

There are two theories about why so little new housing is being built in Greater Boston. It may simply be that the area has run out of land. After all, the Boston metropolitan area is one of the country's most dense metropolitan areas. Alternatively, the shortfalls in supply may be the result of restrictive land use regulations.

There is little evidence to support the view that greater Boston simply lacks the land to build new homes. Within the urban core, it would be quite feasible technically to build taller buildings. In fact, with strong support from the city, a host of new high-rise residential housing has been built or is being built in the heart of Boston. While densities outside of the core are high relative to the United States as a whole, they are still quite low, averaging 1.4 acres per home for communities within 50 miles of Boston. Moreover, if land were just scarce, then the price of a quarter acre of land would be the same whether it extends an existing lot or if it sits under a new home. However, Glaeser and Gyourko (2002) find that a quarter-acre is worth 20 times more

in greater Boston if it sits under a new house than if it extends the lot of an existing house, suggesting that surviving the regulatory process adds enormous value.

Greater Boston's Regulatory Web

Such data suggest that regulation, not density, has caused low levels of new construction and high housing prices in Greater Boston. To help test this claim, over the past two years the Pioneer Institute for Public Policy Research and Harvard's Rappaport Institute for Greater Boston developed a unique new dataset on land-use regulation in 187 cities and towns in eastern and central Massachusetts. Working under the direction of Pioneer's Amy Dain, researchers answered more than 100 questions about each community's land-use regulations by reviewing official documents and interviewing local officials, who were subsequently given the opportunity to review the data about their community.

The most striking fact that emerges from the data is that developers face an incredibly heterogeneous set of local regulatory regimes. This heterogeneity begins with minimum lot size, which remains the most important restraint on the use of land. The 22 municipalities in the region with average minimum lot sizes of less than a quarter of an acre contain more than 25 percent of the region's population. In contrast, the 14 municipalities where minimum lot size is greater than 70,000 square feet (1.625 acres) cover ten percent of the region's land but hold only four percent of its population.

Communities have at their disposal a number of other regulations that they can use to limit new construction.

- **Growth caps and phasing schedules.** Communities can use growth caps to limit the number of new units that can be built during a given year, or phasing schedules to limit the number of units per year that can be built within a single subdivision. We identified 54 communities that made use of growth limitations, the vast majority having adopted them in the last ten years.

- **The prohibition of irregularly shaped lots.** More than half of the communities with the largest minimum lot sizes make it even harder to meet their standards by requiring that those lots be sufficiently compact.

- **Wetland regulations.** More two-thirds of the 187 communities also have wetlands bylaws or ordinances that are stricter than state wetland regulations. Only a handful of these bylaws or ordinances were adopted before 1980. More than 50 communities adopted them in the 1980s, and more than 50 have adopted them since 1990.

- **Septic-system regulations.** We counted 109 communities with septic-system regulations stricter than the state's standards, which is two-thirds of municipalities that are not entirely served by public sewer systems.

- **Subdivision rules.** All but six communities have rules for subdivisions. Some adopted the regulations before 1950 and most did so by 1980. More than 70 amended their bylaws after 2000.

While communities in the greater Boston area have also adopted measures that relax minimum lot size requirements, they often find ways to discourage their use.

- **Cluster provisions** allow developers to build at higher densities if they set aside some amount of open space. The lot size reductions due to cluster zoning are quite dramatic. In communities with large minimum lot sizes,

cluster zoning typically allows almost a two-thirds reduction in the minimum lot size requirement for each home. At the same time, however, many of the communities allow no more units in a development built under cluster zoning than would have been allowed under a conventional zoning plan.

- **Inclusionary zoning** provisions often allow builders to construct at higher densities if they include some housing units designated as affordable to low- or moderate-income households. Ninety-nine of the municipalities in our sample have adopted some type of inclusionary zoning provision and nearly half of those have adopted the provision since 2000. Seventy-seven of these communities offer a density bonus for including the affordable units. However, the provisions have never been used in at least 43 of the 99 communities.

- **Age-restricted zoning** is often used to allow smaller minimum lot sizes if the development is open only to older adults. Almost 60 percent of those communities with more than 20,000 square foot minimum lot sizes have some form of provision for such age-restricted housing. More than 40 percent of those communities with minimum lot sizes that are greater than 35,000 square feet have provisions that allow for age-restricted multi-family housing.

Impacts on Permits: Do Regulations Matter?

While these regulations are striking and diverse, it is less clear which of them actually matter. To answer this question, we connected the new dataset with data on permits by locality going back to 1980, *Banker and Tradesmen* data on house sales in the greater Boston area, U.S. Census data going back to 1910, and the Massachusetts GIS system, which collected data on minimum lot size requirements across the state in 1999–2000.

The evidence linking minimum lot size to development is persuasive. On average, as average minimum lot size increases by one-quarter of an acre, there were approximately ten percent fewer houses in 1970, nine percent fewer houses in 2000, and ten percent fewer houses permitted between 1980 and 2002. These results are, perhaps, unsurprising, but they do confirm the important role that zoning has on new development. Perhaps, more surprisingly, the connection between minimum lot size and development is declining over time, as even places with smaller minimum lot sizes radically reduce the amount of new construction they allow.

It is less clear which of three broad areas of additional regulation have had the greatest impact on new construction: wetland regulations, septic rules, or subdivision policies. We found that when localities impose wetlands regulations stricter than those imposed by the state, new construction appears to fall by about ten percent. When localities impose rules for septic systems that are stricter than state standards, new construction falls by about four percent. Adoption of subdivision rules, finally, is associated with about a twelve percent drop in new construction. The estimated effects of each form of regulation individually are inconclusive; the magnitude of the effects is imprecisely estimated, and we cannot be certain that the effects are statistically different from zero. However, combining all three forms of regulations into one index, we obtain statistically robust results indicating that each additional form of regulation is associated with a ten percent decline in annual permits. The degree of correlation across these three kinds of regulation, however, prevent us from coming to a reliable conclusion about the degree to which each individually contributes to the shortfall in new construction permits.

What about features that alleviate the burdens of zoning? Adoption of cluster zoning is correlated with an increase in the amount of new development, but we were not able to discern an impact of inclusionary zoning. We also were unable to assess the impact of Chapter 40B, the Massachusetts Anti-Snob Zoning Act, which allows the state to overrule local land-use decisions for projects, because it impacts most municipalities. Nonetheless, we can say that the more than 30,000 units constructed under Chapter 40B have accounted for a significant part of new development in many areas.

Housing Prices

The reduction in permits caused by the regulations has had a significant effect on *regional* housing prices. Since 1990, for example, the housing stock in greater Boston increased by only 9 percent. Published estimates of housing demand elasticities (Ermisch, Findlay, and Gibb 1996), suggest that if the housing stock had instead increased by 27 percent, as it did from 1960 to 1975, housing prices would be 23 to 36 percent lower. That is, the median house price, which is now $431,900, would have been as low as $276,100.

While we can show that regulations reduce new construction permits, and connect that lack of supply to high housing prices in the greater Boston area, it is more difficult to estimate the price of housing directly from the degree of regulation. Housing markets are regional not local: more restrictions in Wellesley will not only raise prices in Wellesley, but also in neighboring Needham, even if Needham has less stringent land-use restrictions. Because we lack the kind of clear comparisons we had with the effect on permits, we have to make do with less precision and certainty.

Nevertheless, land-use regulations do seem to have an impact on locality-specific prices: an additional acre in minimum lot size raised the median sales prices of homes in the locality in question by 15.8 percent in 1987, 11.3 percent in 1995 and 19.5 percent in 2001. That impacts were higher in 1987 and 2001 than in 1995 suggests that more restrictive land-use regulations are more potent at high points of the real estate cycle.

Median sales price, however, does not control for differences in housing characteristics or the land area under the median home that is being sold. Housing units in areas with larger lots may be more expensive because they are larger and have more land. When we control for housing characteristics such as the number of rooms, age of the home, internal square footage, and total acreage of the lot, one additional acre in the minimum lot size is associated with between an 11.5 and 13.8 percent increase in housing prices, depending on what other factors we control for. This is less than the effect when we do not take into account actual acreage under the housing unit, but is still significant.

Land-use regulation has also reduced the amount of affordable housing in the greater Boston area. To assess this impact, we calculated the share of sales in the community where an average resident of the region could pay for the interest on the purchase price of the home with 30 percent of his or her income. We find that as minimum lot size increases by one acre, the share of homes that qualify as affordable by this definition drops by 8-to-20 percent.

Addressing the Problems

The current system has four structural features that must be addressed if proposals for change are likely to be effective.

1. While individual communities have every incentive to impede new construction with land-use regulations, those who have yet to buy, and those who reside in surrounding communities, whether individuals or businesses, suffer.

2. Localities have demonstrated remarkable resilience and creativity in keeping the supply of housing low. If the state tries to limit the restrictions along any one dimension, communities will increase them on one or more other dimensions.

3. The high degree of ambiguity in regulations and uncertainty in the permitting process increases costs for developers and encourages frivolous court challenges. It is both hard and expensive for developers to raise money, and difficult for developers, local officials, and abutters to negotiate binding agreements.

4. With only limited procedures for allowing developers to compensate current residents and communities for the negative impact of new development, the current system is economically inefficient.

Four policy approaches could address the problems created by these features.

1. The state could alter local incentives by using state aid to reward localities that encourage new construction and punish those who discourage it. While the recently passed Chapters 40R and 40S, which are designed to eliminate fiscal problems created by new development, are small steps in the right direction, the state needs to use the bulk of its local aid to successfully encourage new construction.

2. The state could, more intrusively, follow the lead of Chapter 40B and give state or regional entities the power to overrule local land-use decisions in communities with low density levels, high prices, and few permits. Such an override, moreover, should be linked with impact fees at a level set by the state. Overriding local control is sure to be unpopular, but it is also the surest way of breaking local bottlenecks on new construction.

3. The state could take policy actions that clarify rights and limit the potential for litigation while simultaneously increasing protections for current homeowners, thus improving the lot of both developers and local homeowners. Such measures might include requiring plaintiffs who unsuccessfully challenge a project in court to pay a fee or to pay the developers' legal costs.

4. The state could substitute existing regulations with a well-designed impact-fee system that would reduce uncertainty, promote new construction, and enhance the welfare of developers, abutters, and communities. We want to emphasize, however, that impact fees could only increase new construction and housing affordability if they replace existing barriers to new construction.

If the residents and businesses in greater Boston are seriously interested in making affordable housing a reality, they must lower the barriers against new construction. However, since there is no reason to expect that localities will act against the self-interest of homeowners, it is up to the state to take action to change the schedule of incentives and relieve the externalities burdening those who have yet to buy a home and businesses. Because the only way to reduce the price of something is to produce more of it, it is logically incoherent to be both an advocate of affordable housing and an opponent of new construction.

I. Introduction

Between 1980 and 2000, according to the U.S. Census, four of the five cities in the United States with the fastest growing housing prices were in the Boston metropolitan areas (Cambridge, Boston, Somerville, and Newton). Repeat sales price indices from the Office of Federal Housing Enterprise Oversight (OFHEO, various dates) confirm this (See Table 1). Housing prices in the Census Bureau's subdivisions of the Boston metropolitan area grew by between 179 and 210 percent between 1980 and 2004 (adjusted for inflation), which made Boston areas second through fourth in the nation behind only the Nassau-Suffolk Division of New York City.

Table 1. Percent Change in Housing Prices, 1980–2004, Top 20 Metropolitan Areas

Metropolitan Area	Percent Change in OFHEO Repeat Sales Index, 1980-2004
Nassau-Suffolk, NY Metropolitan Division	251%
Boston-Quincy, MA Metropolitan Division	210%
Cambridge-Newton-Framingham, MA Metropolitan Division	180%
Essex County, MA Metropolitan Division	179%
Salinas, CA Metropolitan Statistical Area	162%
New York-Wayne-White Plains, NY-NJ Metropolitan Division	158%
Napa, CA Metropolitan Statistical Area	156%
Santa Cruz-Watsonville, CA Metropolitan Statistical Area	156%
Worcester, MA Metropolitan Statistical Area	149%
San Luis Obispo-Paso Robles, CA Metropolitan Statistical Area	146%
San Francisco-San Mateo-Redwood City, CA Metropolitan Division	138%
San Jose-Sunnyvale-Santa Clara, CA Metropolitan Statistical Area	137%
Santa Rosa-Petaluma, CA Metropolitan Statistical Area	131%
Santa Barbara-Santa Maria-Goleta, CA Metropolitan Statistical Area	129%
Providence-New Bedford-Fall River, RI-MA Metropolitan Statistical Area	129%
Oakland-Fremont-Hayward, CA Metropolitan Division	116%
Edison, NJ Metropolitan Division	114%
Newark-Union, NJ-PA Metropolitan Division	112%
Oxnard-Thousand Oaks-Ventura, CA Metropolitan Statistical Area	109%
San Diego-Carlsbad-San Marcos, CA Metropolitan Statistical Area	109%

Source: OFHEO repeat sales index, raw index is adjusted for inflation using CPI minus shelter

According to data from the National Association of Realtors (NAR), the median housing value in greater Boston was $430,900 in the third quarter of 2005.[1] Until this last quarter, the only regions in the continental United States that were more expensive than greater Boston are in California or greater New York (and in the last quarter, the Washington, D.C. metropolitan area). Housing affordability is not only a problem for the poor; housing prices are so high that all but the richest individuals find the region extremely expensive. Moreover, because high housing prices mean that businesses need to pay higher wages, firms too are caught in the housing affordability crisis.

The rise in greater Boston's housing prices is not all bad news. After all, the region would not be expensive if people did not want to live here. The region's rising housing prices are the natural result of its remarkable post-1980 renaissance. As the region has reinvented itself around new technologies, wages and productivity have risen, and people have increasingly been willing to pay to live in this particularly productive region.

Still high housing prices can only come about if rising demand runs up against inelastic supply. In places like the southwest, where land is plentiful and land-use

regulation is more lenient, economic upturns barely affect housing prices. The Houston, Phoenix, and Las Vegas metropolitan areas have boomed over the last 40 years, but their housing prices have not risen dramatically. Until the last quarter, NAR data shows that median housing prices in the Phoenix metropolitan area were less than $200,000. In Houston, the current median sales price is $142,000. These differences in price are accompanied by a very different level of supply. In 2004, there were 57,273 single-family house permits issued in the Phoenix metropolitan area and 35,579 in Las Vegas, but only 5,001 in the greater Boston area.[2] When supply is plentiful, affordability is ensured. More bluntly, you cannot both make greater Boston affordable and limit new construction. The law of supply and demand dictates that the only real path to affordability is through more supply.

In this paper, we explore the determinants of housing supply and the impact of housing supply on housing prices within the greater Boston area. This work builds on several important studies of the local housing market done in the last few years. In 2000, "A New Housing Paradigm for Boston," a report commissioned by the Boston Archdiocese and the Greater Boston Chamber of Commerce, warned that high housing costs and inadequate supply were threatening the region's economic competitiveness (Bluestone, Euchner, Weisman, 2000). In 2002, the Governor's Special Commission on Barriers to Housing Development concluded that land-use regulations were an important obstacle to meeting the region's housing challenges, a theme that was echoed in a 2003 study by Charles Euchner prepared for the Pioneer Institute and the Rappaport Institute (Gumble and Ruping, 2002; Euchner, 2003). Building on this work, the Commonwealth Housing Task Force in 2004 issued a report proposing that the state encourage communities to build dense housing in community centers and that it also hold communities harmless from financial losses attributable to increased school costs generated by that housing, proposals that became the basis for the state's Chapter 40R (2004) and Chapter 40S (2005), respectively (Carman, Bluestone, and White, 2003; Carman, Bluestone, and White, 2005). While many of these studies contended that regulatory obstacles were a major factor behind the sharp increase in Boston's housing prices, they generally presented only anecdotal evidence in support of this assertion.

This paper attempts to fill this void and in doing so offer both scholars and policymakers insights into whether and how land-use regulation affects the supply and cost of housing in greater Boston. We begin in Section II by reviewing the basic facts about prices and construction within this area. Perhaps the most striking single fact is that as prices have soared over the last 15 years, new construction has dropped below what it was in the 1980s or earlier. In the 1960s, there were 172,459 units permitted in the Boston metropolitan area, in the 1980s, 141,347 units. However, in the 1990s, total permits fell to 84,105. This decline has been particularly striking for multi-family housing. In the 1960s, less than 50 percent of all the permits in the Boston metropolitan area were for single-family homes; however, during the 1990s, single-family homes made up more than 80 percent of all permits.

There are two fundamentally different theories about why supply appears to have become so constrained in greater Boston. First, it may simply be that the area has run out of land. The Boston metropolitan area is after all one of the denser metropolitan areas in the country. The second view is that the shortfalls in supply are the result of land use regulations imposed primarily by local governments and other governmental actions (such as environmental regulation) that have made it impossible to develop greater Boston further.

In Section II of this paper, we find little evidence to support the view that greater Boston simply lacks the land to build new homes. Within the urban core, it is technically feasible to build taller buildings. While densities outside of the core are high relative to the United States as a whole, they are still quite low, averaging 1.4 acres per home for communities within 50 miles of Boston. Three other pieces of evidence support the view that regulation not land availability is responsible for the slowdown in prices. First, if land were just scarce, then the price of a quarter acre of land would be the same if it extended an existing lot or if it sat under a house. Glaeser and Gyourko (2002) find that a quarter-acre is worth 20 times more in greater Boston if it sits under a new house than if it extends the lot of an existing house, suggesting that having a lot that meets minimum regulatory requirements adds enormous value. Second, Glaeser, Gyourko, and Saks (2006a, forthcoming) find that little of the decline in permits can be explained by density levels. Third, Boston ranked quite high in both the oldest and newest Wharton land-use surveys of regulatory obstacles to building new housing (Linneman, Summers, Brooks and Henry Buist, 1990; Malpezzi, 1996, Foster and Summers, 2005).

Section III introduces a unique new data set containing information on land-use regulations[3] for 187 cities and towns in the greater Boston area, jointly assembled by the Pioneer Institute for Public Policy Research and the Rappaport Institute for Greater Boston. We use this data set in concert with data on permits by locality going back to 1980, *Banker and Tradesman* data on house sales,[4] U.S. Census data going back to 1910, and information on minimum lot sizes from the MassGIS, a statewide database developed and maintained by the Massachusetts Executive Office of Environmental Affairs (MassGIS 2000).

The most striking fact about Massachusetts' land-use controls is their heterogeneity across space. Far from facing a single unified regulatory regime, developers face an incredibly heterogeneous set of communities. This heterogeneity begins with minimum lot size, which remains the most important form of land-use control. In 22 of the municipalities, which contain more than 25 percent of the region's population, minimum lot sizes are less than one-quarter acre. In 14 municipalities, the minimum lot size is greater than 70,000 square feet (1.625 acres), and they, not surprisingly, comprise more than ten percent of the region's land but only four percent of its population. These are the extremes: the modal locality has a minimum lot size of slightly less than one acre.

If the heterogeneity in minimum lot size is striking, the diversity of other forms of regulation is even greater. In our empirical work, we focus first on zoning and then on measures concerning wetlands, septic systems, and subdivision rules, but these are just a small but important subset of the regulations with which communities control new development. Communities also, for example, restrict the shapes of lots, adopt specific growth caps, and require curbs to be made out of granite rather than concrete.

While these regulations are striking and diverse, it is less clear which of them actually matter. In Section IV, we turn to the impact of zoning regulations and housing stock. First, we address the impact of minimum lot size. Given that minimum lot sizes were imposed in the early-to-mid 20th century, and thus many locality characteristics will be endogenous to this form of regulation, our basic approach is to control for characteristics of the locality at the dawn of the zoning era (1915 or 1940) and then look at whether there are differences in subsequent development.

We find that, on average, as average minimum lot size in the locality increases by one-quarter of an acre, there were approximately 10 percent fewer houses in 1970, 9

percent fewer houses in 2000, and 10 percent fewer houses permitted between 1980 and 2002. While these results are unsurprising, they do confirm the important role that zoning has on new development. More surprisingly, the connection between minimum lot size and development seems to be declining over time, as even places with generous zoning radically reduce the amount of new construction they allow.

In Section V, we turn to other rules that make new construction more difficult. When localities impose wetlands regulations stricter than those required by the state, new construction appears to drop about 10 percent. Septic rules appear to have only a negligible effect on permits, and subdivision rules appear to decrease new construction on average by about 12 percent. Combining these regulations into one index, we obtain results that indicate that an additional form of regulation is associated with a 10 percent decline in annual permits. These results all suggest that these added rules are indeed reducing the amount of new construction, the degree of correlation across these three kinds of regulation prevent us from coming to a firm and reliable conclusion about the degree to which each individually contributes to the shortfall in new construction permits.

In Section VI, we turn to measures that might alleviate the burdens of zoning. Since Chapter 40B (also known as the Massachusetts Anti-Snob Zoning Act), which allows the state to overrule local land-use decisions for projects where at least 20–25 percent of the units have long-term restrictions on rents or sales prices, impacts most municipalities, there is no clean way of estimating its impact on the amount of new construction in each of those communities. Nonetheless, while the state's data on 40B is incomplete, the law has been used to build at least 30,000 units of new housing, which means that in many areas 40B plays a major role in new development. We also looked for evidence that cluster zoning and inclusionary zoning had an impact on the amount of new development. Since these measures emerged after 1970, we can look at whether the amount of development increases in localities that adopted them. We find that cluster zoning appears to have increased the amount of new development, whereas inclusionary zoning has not.

In Section VII, we turn away from the impact of regulations on permitting to its impact on prices. We begin by using published estimates of housing demand elasticities to make a rough estimate of the effects of regulations on regional housing prices. These crude estimates suggest that, if instead of increasing by 9 percent since 1990, the housing stock in the region had increased by 27 percent (as it did from 1960 to 1975), then prices might be 23 to 36 percent lower than they are now.

We continue by looking at regulations' impacts on local housing prices. Using cross-locality comparisons to assess the localized impacts on regulations on prices is conceptually problematic since a supply constraint in one area will, in theory, raise prices everywhere. Nevertheless, we do find that after controlling for community characteristics, each additional acre in minimum lot size raised the median sales prices of homes by 15.8 percent in 1987, 11.3 percent in 1995, and 19.5 percent in 2001. Median sales price, however, does not control for differences in housing characteristics. Controlling for these characteristics and other important characteristics (including distance to downtown Boston and whether the locality is home to a major college or university,[5] a one-acre increase in minimum lot size is associated with an 11.5 to 13.8 percent increase in housing prices. These results do not hold, however, when you control for housing density in the locality as of 1940, because the high correlation between housing density then and minimum lot size today makes it difficult to disentangle the impact of these two variables.

Much of the concern about land-use regulation is that it may reduce the amount of affordable housing in the greater Boston area. To look at this issue, we calculated the share of sales in the community where an average resident of the region could pay for the interest on the purchase price of the home with 30 percent of his or her income. We find that as minimum lot size increases by one acre, the share of homes that qualify as affordable by this definition drops by 8-to-20 percent. However, as with the previous calculations, these results become much weaker (and statistically insignificant) if we control for historical housing densities.

In Section VIII, we turn to four notable features of the state's current system of land-use regulation and then suggest four general approaches that respond to these features. First, we note that while stringent land-use regulations may have many advantages for an individual community, they clearly impose costs on the rest of the state. Second, we note that localities act in incredibly creative ways to restrict the construction of new housing. This means any effort to rein in localities by setting statewide standards in one dimension, such as wetlands, will not lead to significant new construction because communities that want to restrict new construction will surely find other clever ways of impeding it. Third, we note that the current system has too much uncertainty, which leads to lengthy permitting processes and frequent court challenges. This almost certainly reduces construction because developers often cannot afford the delays created by an ambiguous process and because it makes it difficult for developers to work out binding agreements with local officials and project abutters. Finally, we note the current system is economically inefficient because it has only limited procedures that allow developers to compensate current residents and communities for new development's negative impacts.

We then suggest four general approaches that respond to these features. First, the state could induce local action by using local aid to significantly reward localities that allow new construction and punish those that do not. The recent 40R and 40S legislation, which are designed to eliminate fiscal problems created by new development, are steps in this direction but for such policies to have a significant impact, the rewards and penalties will likely need to be much greater than those in the new laws. A second, more intrusive, intervention would be to follow the lead of Chapter 40B and give state or regional entities the power to overrule local land-use decisions in communities with very low density levels, high prices, and few permits. Overriding local control is a draconian measure that is sure to be wildly unpopular, but it is also the only sure way of allowing new housing. Third, policy actions that clarify rights and that limit the potential for litigation while simultaneously increasing protection for current homeowners can potentially benefit both local homeowners and developers. Such measures might include requiring plaintiffs who unsuccessfully challenge a project in court to pay a fee or to pay the developers' legal costs. Finally, a well-designed impact-fee system could lead to more development in ways that reduce uncertainty and enhance the welfare of developers, abutters, and communities. We want to emphasize, however, that impact fees could only increase new construction and housing affordability if they replace existing barriers to new construction.

In summary, our evidence confirms the view that the supply of housing is limited by regulation, particularly minimum lot size, across cities and towns in greater Boston, and that this regulation is associated with high housing prices. If greater Boston is seriously interested in making affordable housing in the region a reality, then it must change its system so that the barriers facing development decline. Because the best way to reduce the price of something is to produce more of it, it is logically incoherent to be both an advocate of affordable housing and an opponent of new construction.

II. What Is Stifling New Construction?

The Boston region has had exceptional housing price appreciation over the past 25 years. Figure 1 shows the growth of housing prices, using the OFHEO repeat sales index, for greater Boston and the United States as a whole. The Boston region has had faster housing price appreciation than any region other than the New York metropolitan area. This growth reflects two facts. First, greater Boston was a relatively inexpensive place to live in 1980. Second, greater Boston is now a relatively expensive place to live. Indeed, it is striking to recall that as late as 1980, Boston was a declining region with much more in common with the Rochester, NY, or St. Louis, MO regions than with the New York City metropolitan area. During the period of Boston's decline, housing often cost less than the price of new construction (Glaeser and Gyourko, forthcoming).

Figure 1. Housing Price Growth, 1980–2004
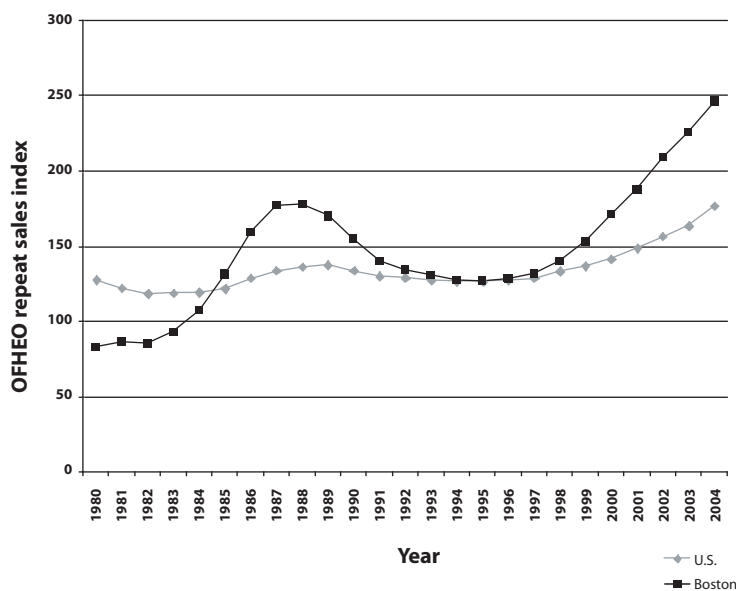
Source: OFHEO repeat sales index

What has caused greater Boston's remarkable housing price explosion? Housing prices result from the interplay of supply and demand. Housing prices can rise if the housing stock suddenly shrinks, as it might in the wake of natural disaster, but in greater Boston's case, there is no doubt that the increase in housing prices reflects an improvement in the demand for housing, which is just another way of saying that more people wanted to live in the region. This increase in demand appears to be mostly the result of a remarkable economic turnaround, as the region reinvented itself, changing from a declining manufacturing area to a capital of the information age.[6] After all, according to U.S. Census Bureau figures, in 1980 Boston was the 43rd richest region in the nation in 1980 but the fifth richest in 2000.

However, even if greater Boston's housing price growth reflects a highly desirable surge in the demand to live in the region, increasing demand does not need to lead to higher housing prices. After all, demand for the Phoenix and Las Vegas regions has also surged over the past 40 years; these two places are among America's most dynamic regional economies. Nevertheless, in these places, rising housing market demand has lead to more units, and has been a very modest impact on housing prices (at least until the last two or three years). Between 1970 and 2000, the housing stock of Phoenix grew by 275 percent and that of Las Vegas grew by nearly 500 percent.

Figure 2. Total Permits in Boston Metro Area, 1961–2002

Source: U.S. Census

Boston-Quincy
Cambridge-Newton-Framingham
Essex County
Boston MSA
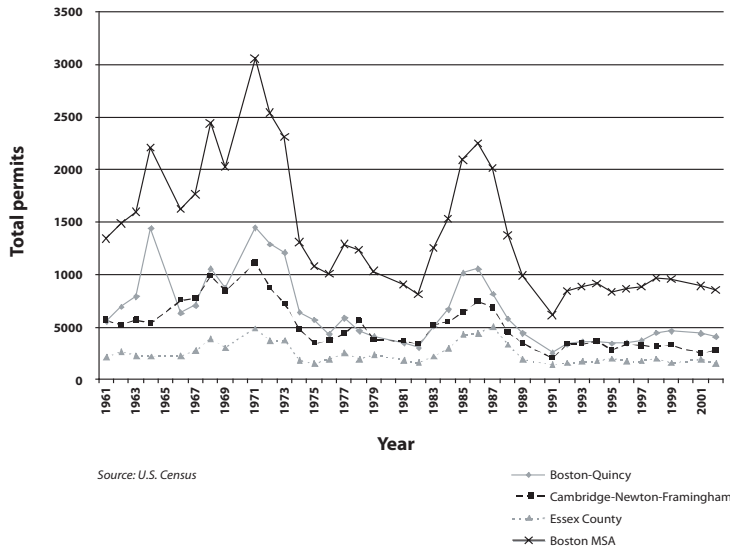
Over the same period, median housing prices in both regions stayed quite close to the median housing price in the nation as a whole.

The economic framework of supply and demand provides us with a clear way of understanding the difference between the experience of the Boston region and the experience of the Phoenix region over the past 25 years. In Phoenix, rising demand has been met with elastic supply. That region has been adding new housing in large quantities, and this new housing has kept housing prices low. In Boston, rising demand has run into a much more inelastic supply, and this inelasticity has meant that greater demand has led to higher prices rather than large quantities of new units. In order to understand housing affordability and to do something about it, it is therefore critical to turn to the causes of housing supply inelasticity.

Perhaps the most striking fact that argues for housing supply in Massachusetts having become more limited is to look at the time series of new permits in greater Boston. Figure 2 shows the time path of permits in the Boston-Quincy, Cambridge-Newton-Framingham, and Essex County Metropolitan Divisions, and in the

Figure 3. Total Permits Divided by Existing Housing Stock in Boston Area, 1980–2002

Source: U.S. Census

25th percentile
Median
75th percentile

**Figure 4a. Relationship between Education and Housing Price Changes
for Texas Communities, 1980–2000**

Source: HUD, State of the Cities Data Systems
Source note: Sample restricted to communities with 1980 population of 15,000 and greater.

metropolitan area as a whole.[7] The graphs show a striking decline over time. In fact, in 1970, 16 percent of Boston-area homes had been built in the previous decade. In 2000, only 5.5 percent of Boston-area homes had been built since 1990.

Figure 3 shows the time path of permits divided by existing units since the 1980s for the sample of communities that are the special focus of this paper: the 187 Massachusetts cities and towns that lie within 50 miles of Boston.[8] All three lines show the ratio of permits in a given year to the number of occupied housing units in the community. The middle line shows the ratio of permits to existing stock for the median locality, i.e., the city or town whose permits to stock ratio is exactly in the middle of our sample in that year. The top line shows that ratio of permits to existing stock for the 75th percentile locality, i.e., the city or town where the permits to stock ratio is greater than exactly three-quarters of the localities in our sample. The bottom line shows the ratio of permits to existing stock for the 25th percentile locality, i.e., the city or town where the permits to stock ratio is greater than exactly one-quarter of the localities in our sample. All three lines show a decline from the late 1980s to today. Even though prices have risen substantially, the supply response to the last boom was much bigger than the supply response to the current boom.

**Figure 4b. Relationship between Education and Housing Price Changes
for Massachusetts Communities, 1980–2000**

Source: HUD, State of the Cities Data Systems
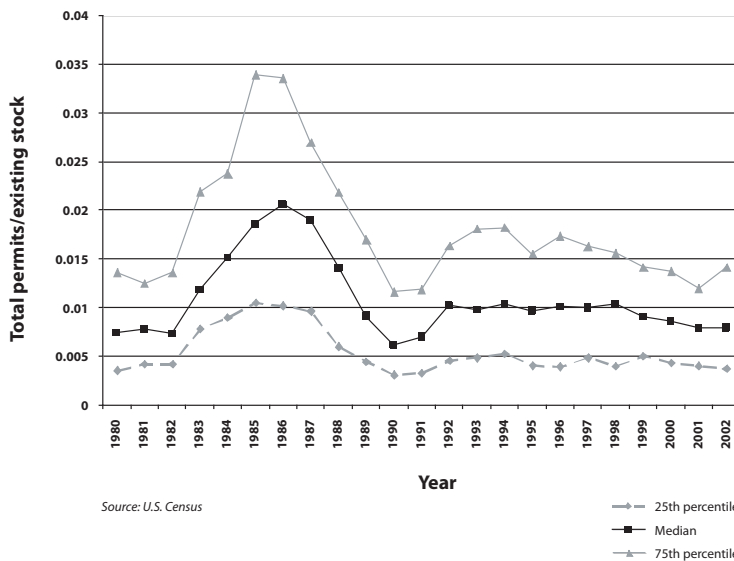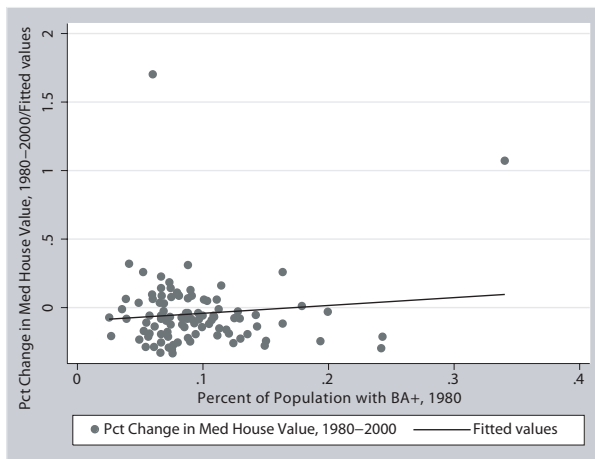Source note: Sample restricted to communities with 1980 population of 15,000 and greater.

**Figure 4c. Relationship between Education and Population Changes
for Texas Communities, 1980–2000**
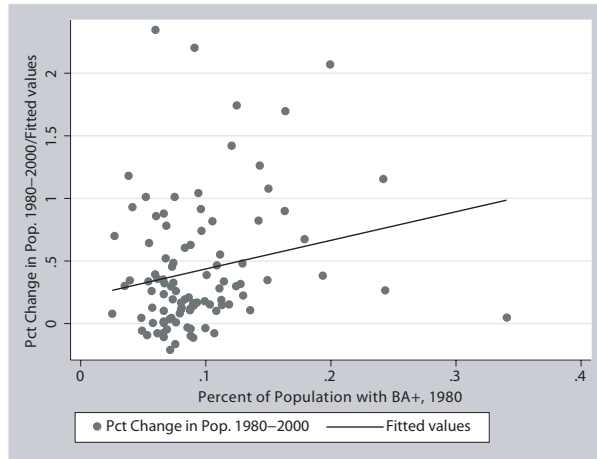
Source: HUD, State of the Cities Data Systems
Source note: Sample restricted to communities with 1980 population of 15,000 and greater.

We can confirm the lack of housing elasticity in the greater Boston area by comparing successful localities in Massachusetts with those in Texas since 1980. In both places, education predicts urban success (Glaeser and Saiz, 2004), and Texas is (at least anecdotally) a place where housing supply is extremely elastic both because of available land and an absence of land-use regulation. Figures 4a and 4b show the correlation between housing price growth and initial years of schooling in communities with more than 15,000 residents in Massachusetts and Texas respectively. Figures 4c and 4d show the correlation between years of schooling and population growth.

Figures 4a and 4b show a clear positive correlation between years of schooling and housing price growth in Massachusetts, but none in Texas. Figure 4c and 4d show a correlation between population growth and schooling in Texas but not in Massachusetts. If schooling is associated with rising demand for these cities and towns, then the differences between Texas and Massachusetts appear to be evidence for the view that Massachusetts has a far less elastic housing supply than Texas. The source of the limitations on supply is less clear. One hypothesis is that as a relatively old region, greater Boston has used up all of its buildable lots. A second hypothesis is

**Figure 4d. Relationship between Education and Population Changes
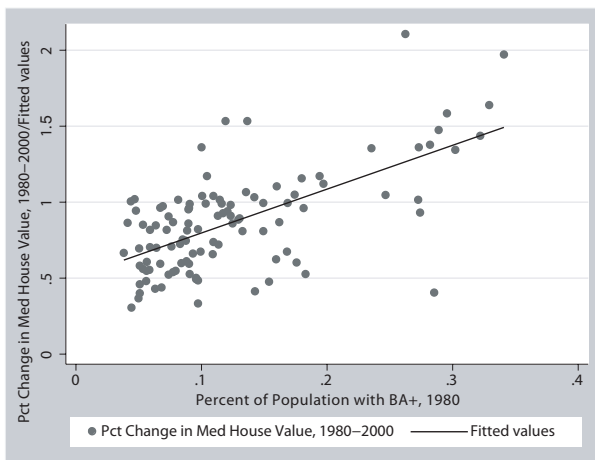for Massachusetts Communities, 1980–2000**

Source: HUD, State of the Cities Data Systems
Source note: Sample restricted to communities with 1980 population of 15,000 and greater.
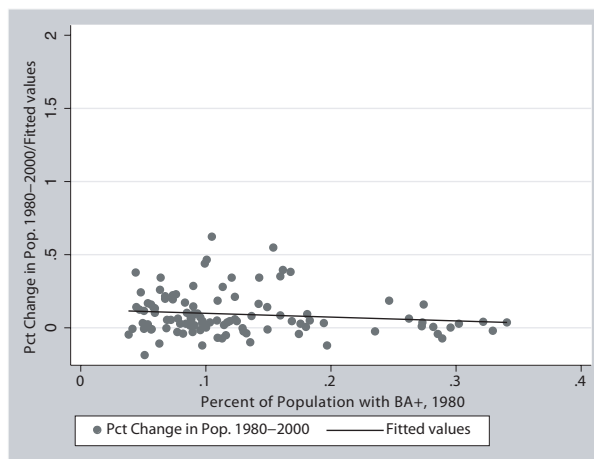
***Figure 5. Relationship between Total Permits Issued between 1980 and 2000
and Housing Density in 1980***
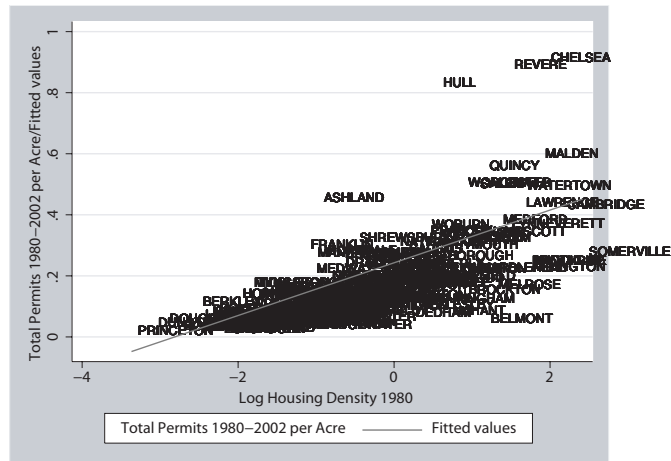
Source: U.S. Census

that the land is still available but local governments have severely limited new construction.

There are four pieces of evidence suggesting that regulation rather than density is responsible for the decrease in permits. First, the basic relationship between density and new permits is positive not negative. Figure 5 shows, by locality, total single-family permits between 1980 and 2002 per acre regressed on the logarithm of housing stock per acre in that locality in 1980. Since 1980, there has been more building per acre in those places that already had more buildings per acre in 1980, a finding that is not compatible with the land scarcity hypothesis.

Second, many low-density communities have had little new construction. For example, Lincoln, Weston, and Concord together include more than 61 square miles or 39,000 acres, and contain only 12,889 homes. Yet in these three places, which currently average more than three acres per home, there were only 1,746 single-family units permitted between 1980 and 2002. Obviously, these are just extreme examples of low-density places with little new construction, but there are another 22 localities within our sample with less than one home for every two acres that allowed less than 600 new units between 1980 and 2002.[9]

Third, density alone does not explain the general decline in housing permits over time (Glaeser, Gyourko and Saks (2006a, forthcoming)). Table 2 looks at permitting by decade in the 1980s and 1990s, and regresses the logarithm of the number of permits in a locality on a locality fixed effect and a dummy variable for the decade of the 1990s. The dummy variable shows that permitting declined by 39.3 percent in the 1990s relative to the 1980s. In the second regression, we control for the logarithm of housing density in the locality at the start of decade. While this coefficient is itself statistically significant, the second column makes it clear that controlling for density does not eliminate the decline in permitting between the 1980s and the 1990s.

Finally, following Glaeser and Gyourko (2002), we compare the value of land under a new house and land that extends an existing lot. In the presence of a free market for land, land should cost the same in either case. Regulation, on the other hand, will drive up the value of the land under a new home. To estimate the value of a piece of land that extends the lot of an existing home, we run a regression of the form:

(1) House Price = a + b* Characteristics + c* Land Area

Table 2. Permitting by Decade, 1980s and 1990s

	(1)	(2)
	ln (total permits)	
1990s	-0.393	-0.6
	(0.074)***	(0.149)***
ln(housing stock)		1.385
		(0.695)**
Constant	6.457	-5.14
	(0.037)***	(5.801)
Town Fixed Effects	Yes	Yes
Observations	372	372
R-squared	0.84	0.85

Notes:
1. Standard errors clustered by town in parentheses
2. * significant at 10%; ** significant at 5%; *** significant at 1%
3. Dependant variable is the log of total permits in the decade.
4. ln(housing stock) is the log of the housing stock at the start of the decade.

Characteristics include the number of rooms, the age of the house, the square footage of the house, and locality fixed effects that control for differences in distance from Boston and the quality of the public schools. Using *Banker and Tradesman* data on sales prices for homes between 2000 and 2005, we calculate a coefficient of .382 on lot size, which means that an extra acre of land is generally associated with paying an extra $16,600 dollars for a home.[10]

To calculate the value of an acre if it sits under a new home, we subtract the construction price of an average home from its sales price. In our sample, in 2004, the average home sales price is $450,000 dollars, the average square footage is 1800 square feet, and average lot size is .7 acres. Using the R.S. Means data on construction costs, Gyourko and Saiz (2004) estimate a $97 dollar per square foot cost for an average home. The construction cost is then approximately $175,000 (1800 x $97) and the land under the house $275,000 ($450,000–$175,000). Since the average home has .7 acres, land under a new home is worth $390,000 dollars per acre. The large gap in costs between the two valuations of an acre reinforces the importance of housing regulation.

Figure 6. Massachusetts Court Decisions Containing Keywords: Zoning, Residential and (Septic or Wetland), 1964–2004
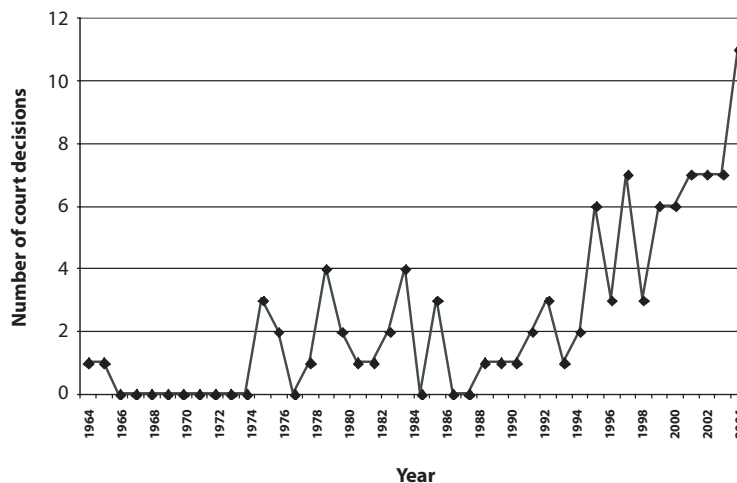
Source: Lexis-Nexis

Having established that regulation not land scarcity is the culprit, we have yet to identify which regulations are most responsible. While it might be minimum lot size, it could also be a maze of other local regulations and laws, such as local regulations for wetlands and septic systems, which seem to be increasingly common. (See Figure 6, which shows the number of Massachusetts court cases reported in the Lexis/Nexis database that include the words "residential," "zoning," and either "wetlands" or "septic.") To help discern which regulations most affect supply, we turn to a new data set that describes the extent of land-use regulations across eastern Massachusetts.

III. The Maze of Housing Regulations in Greater Boston

This paper introduces a new data set that comprehensively surveys the land-use regulations in greater Boston in place as of 2004. This data set has been gathered over the last 24 months by researchers at the Pioneer Institute with assistance from the Rappaport Institute. The research design began with extensive discussions in which local builders and attorneys were asked about the type of regulations that had given them trouble in the process of permitting new residential developments in the greater Boston area. After designing the survey around the major forms of regulation, a team of researchers, managed by Amy Dain (who also played the most significant role in the research design process) collected and coded regulations and ordinances from the 187 cities and towns that fall within 50 miles of the boundaries of the City of Boston. Researchers also interviewed officials from each of these communities and subsequently gave officials from each community the opportunity to review and correct the information about their community (Pioneer Institute for Public Policy Research and Rappaport Institute for Greater Boston, 2005).[11]

The research design focused on eight major areas: (1) general zoning, (2) rules pertaining to multi-family construction, (3) cluster development, (4) inclusionary zoning, (5) growth limits, (6) rules concerning subdivisions, (7) rules concerning wetlands and (8) rules concerning septic systems and sewers. The study underscores what developers already knew: Massachusetts has a dizzying array of local rules that affect every imaginable aspect of construction. For example, 81 communities have a restriction on the shape of a lot. Thirteen require that developers use the pre-construction grade, in some circumstances, to calculate whether the height of the building exceeds the regulatory limit. Thus, if you fill a depression or a slope, the maximum height is calculated as if the building had been built on the original lower grade.

Zoning and Minimum Lot Sizes

Not only does each community have its own rules, but most zoning bylaws also divide communities into districts, each with its own rules. In particular, districts differ in whether they allow single or multi-family housing, whether they allow commercial or industrial uses and in the minimum lot size for new construction. Figure 7 derives from the Massachusetts GIS database the distribution of communities in the Pioneer/Rappaport database by the share of land that they have zoned for single-family housing. More than 80 communities have zoned between 91 and 100 percent of their land for single-family housing and 50 communities have zoned between 81 and 90 percent of their land for single-family housing.

With the same Massachusetts GIS database, we can also calculate the average lot size for each city or town. This average is formed by averaging over districts, which are weighted by their respective quantities of land. Figure 8 shows the distribution of

Figure 7. Share of Land Zoned to Allow Single-Family Residential Development, 2000
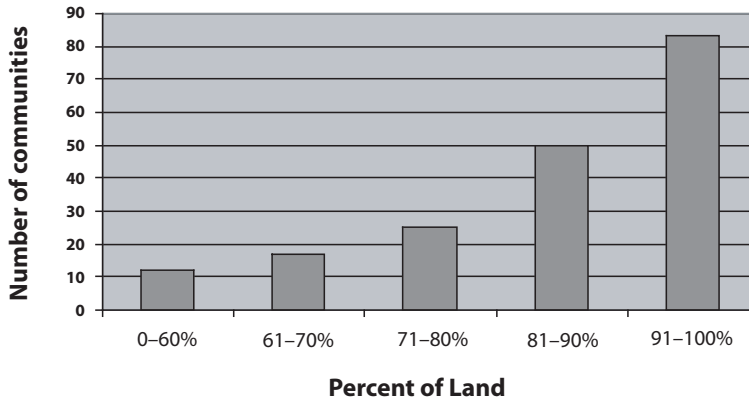
Source: Mass GIS

minimum lot size across the greater Boston area. The middle bars (dark gray) show what share of the region's population lives in cities and towns within a given range of lot sizes. The white bars show what share of the region's land is in communities with lot sizes of a given size. The light-gray bars show what share of the region's communities has lot sizes of a given size. Thus, the first three bars describe the share of the region's municipalities, population, and land that are in communities with minimum lot sizes less than 10,000 square feet. Although less than five percent of the region's land is in these denser areas, and about nine percent of the communities have such small minimum lot sizes, they house more than 20 percent of the region's population.

The second set of bars corresponds to those communities with minimum lot sizes between 10,000 and 20,000 square feet. Twenty percent of the region's population lives in these communities, and almost 15 percent of the communities have this minimum lot size, although they only cover 10 percent of the land. The modal locality lot size is just under an acre (between 30,000 and 40,000 square feet) and almost one-quarter of the communities and one-quarter of the land is zoned in this way. Finally, there are communities where average lot sizes exceed 60,000 square feet. They account for a very small amount of the region's population, but cover almost one-quarter of its land.

There are substantial differences between the communities that have large and small minimum lot size requirements. These differences are shown in Table 3, which gives the average locality characteristics for four groups of communities. In the first group, minimum lot sizes are less than 20,000 square feet. This group includes 42 communities with 42.7 percent of the region's population and 12.7 percent of its

Figure 8. Distribution of Single-Family Minimum Lot Sizes, 2000

Source: Mass GIS

■ Towns
■ Population
□ Land
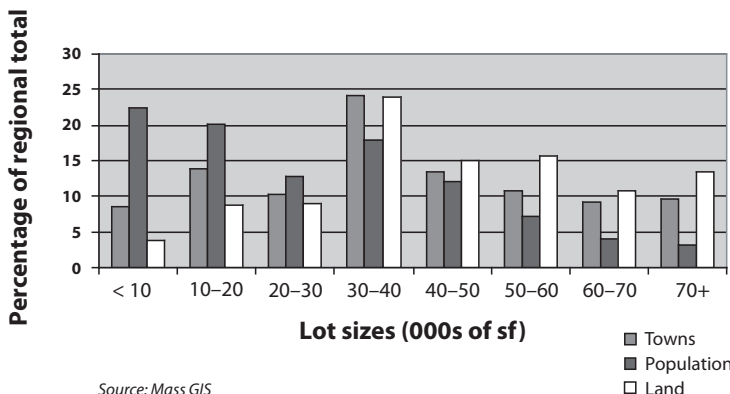
land. The second group includes the 38 communities with average lot sizes between 20,000 and 35,000 square feet. These communities have 18.9 percent of the region's land and 21.7 percent of the region's population. The third group contains those 51 communities with minimum lot sizes between 35,000 and 50,000 square feet. Those communities contain 21.3 percent of the population and 28.8 percent of the land. The final group is the 55 communities with minimum lot sizes that are greater than 50,000 square feet. These communities only contain 14.3 percent of the region's population, but have 39.6 percent of the region's land.

Table 3. Characteristics of Municipalities, by Average Single-Family Minimum Lot Size

	(1)	(2)	(3)	(4)
	< 20,000	**20–35,000**	**35–50,000**	**50,000+**
Share of regional pop	42.7	21.7	21.3	14.3
Share of regional land	12.7	18.9	28.8	39.6
Number of towns	42	38	51	55
Mean population	41,338	23,218	16,987	10,571
	(32,007)	(17,385)	(12,477)	(7,851)
Pct white	84.5	92.1	93.7	94.5
	(15.1)	(7.9)	(3.8)	(4.1)
Pct foreign-born	13.9	7.2	6.2	5.3
	(8.5)	(4.9)	(2.9)	(3.2)
Pct w/ BA +	37.3	35.2	38.8	43.1
	(17.6)	(13.6)	(14.6)	(19.2)
Distance to Boston (miles)	14	22	24	28
	(10)	(8)	(8)	(8)
Land area (acres)	6,551	10,829	12,254	15,642
	(5,240)	(4,651)	(5,218)	(9,742)
Pct housing in SF	49.6	68.3	73.5	79
	(21.9)	(16.5)	(12.4)	(13.5)
Mean hsg price	238,160	217,818	229,635	265,444
	(91,766)	(73,394)	(74,562)	(124,045)
Mean rent	829	732	714	773
	(159)	(166)	(121)	(202)

Notes: standard deviations in parentheses, top rows show means
Source: 2000 Census, Mass GIS

The fourth row of Table 3 shows the populations of these different communities. Unsurprisingly, the communities with the densest zoning are more populous than those with less dense zoning. The average population of the most densely zoned communities is 41,338. The average population of the least densely zoned communities is 10,571. The ninth row shows that the relationships are inverted when the communities are ranked by land area. The most densely zoned communities are the smallest and, on average, they cover 6551 acres (or about 10 square miles). The least densely zoned communities cover, on average, 15,642 acres.

The eighth row looks at distance to downtown Boston. The communities with the largest minimum lot sizes are furthest away from Boston, but beyond a half-acre minimum, the differences in distance dwindle. In fact, localities with large minimum lot sizes are spread throughout the region. The fifth row shows the percent white in the locality. The most densely zoned places are 84.5 percent white; the least densely zoned places are 94.5 percent white. Row 6 demonstrates that communities with smaller minimum lot sizes have a larger share of foreign-born residents. Row 7 shows that localities with larger minimum lot sizes have more highly educated residents.

The final three rows in the table describe the housing market in the different categories of communities. In localities with small minimum lot sizes, the majority of homes

are not detached single-family units. As the minimum lot size increases, so does the proportion of detached single-family homes. Housing prices are higher (according to the 2000 census) in those localities with high minimum lot sizes, but rental costs are lower. We should not place, though, too much weight on these price comparisons since they do not control for the localities with larger minimum lot sizes being further from Boston.

Cluster Zoning, Inclusionary Zoning, and Age Restrictions

Communities have given developers some ways to evade the full power of minimum lot size provisions. For example, cluster zoning allows developers to build at higher densities if they set aside open space. In some cases, cluster zoning allows developers even to build townhouses. Table 4 shows the distribution of cluster zoning provisions across communities with different minimum lot sizes. The second row shows that few communities, especially among those with large minimum lot sizes, lack some form of cluster provision. For example, only 11.8 percent of those communities with lot sizes between 35,000 and 50,000 square feet have not adopted some form of cluster provision. Moreover, in most of these places, developers have actually taken advantage of them.

Table 4. Correlation between Cluster Zoning Provisions and Single-Family Lot Size

	Under 20	20-35	35-50	50+	Total
Observations	42	38	51	55	186
No cluster	35.70%	13.20%	11.80%	20.00%	19.90%
Cluster, never built	40.50%	26.30%	21.60%	29.10%	29.00%
Cluster, built some	23.80%	60.50%	66.70%	50.90%	51.10%
Pct with bonus	48.10%	36.40%	35.60%	59.10%	44.70%
Allow TH or MF in cluster	90.90%	80.00%	76.30%	70.00%	77.10%
Parcel size (acres)	6.4	8.5	9.8	8.5	8.5
Lot size (square feet)	7,863	10,475	15,475	22,252	14,769
Pct reduction in lot size	44%	65%	63%	66%	61%
Open space	28%	29%	34%	37%	32%

Row 6 shows that in most cases, cluster zoning allows some form of multi-family housing or townhouses. The average minimum lot size within cluster provisions ranges from 7,863 to 22,252 square feet across the groups of communities (row 8), and the open space requirement ranges from 28 percent in the densest communities to more than 30 percent in the communities with highest minimum lot sizes (row 10). The lot size reductions due to cluster zoning are quite dramatic. In the less dense communities, cluster zoning typically allows almost a two-thirds reduction in the minimum lot size requirement for each home (row 9). However, many communities allow no more units to be built in a cluster development than under a conventional zoning plan, requiring instead that the land saved be preserved as open space.

A second way in which developers can avoid the full minimum lot size requirement is if the community has adopted some form of inclusionary zoning provision that allows builders to construct at higher densities if they include some housing units designated as affordable to low- or moderate-income households. Just over half of the munici-palities in our sample have adopted some type of inclusionary zoning provision and nearly half of those have adopted the provision since 2000 (shown in Figure 9).[12]

However, few developers are taking advantage of inclusionary zoning. We count 21 localities in which they have been used, and 43 where they have not.[13] The failure to

Figure 9. Adoption of Inclusionary Zoning by Decade

Source: Pioneer/Rappaport database
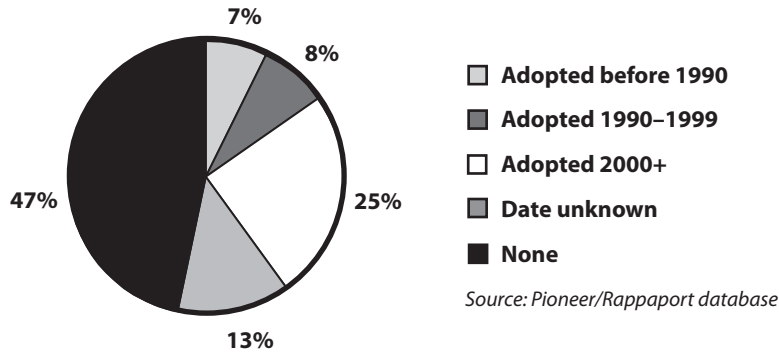
take advantage of these provisions may either mean that they do not provide a density bonus sufficient to attract developers, or, alternatively, reflect that these rules have only been in effect for a few years.

A third way that developers can avoid the minimum lot size requirement in many localities is to restrict the development to the elderly. Figure 10 shows that almost 60 percent of those localities with minimum lot sizes of more than 20,000 square feet have some form of age-restricted housing, and that more than 40 percent of those localities with minimum lot sizes greater than 35,000 square feet have provisions that encourage age-restricted multi-family housing.

Figure 10. Prevalence of Age-Restricted Zoning Provisions by Communities' Minimum Lot Size

Source: Mass GIS, Pioneer/Rappaport database
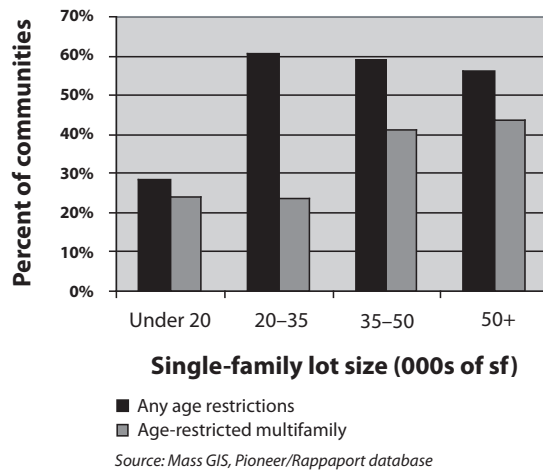
Growth Management, Additional Zoning, and Non-Zoning Regulations

Cities and towns in the greater Boston area have adopted a number of other measures that restrain new construction, for example, growth caps that limit the number of new units that can be built during a given year, and phasing schedules that limit the number of units per year that can be built within a single subdivision. Figure 11 shows the number of localities that have adopted these growth limitation measures. We identified ten localities that adopted such regulations prior to 1994, 28 that adopted them between 1995 and 2000 and nine that adopted them after 2000.[14]

Growth management is much more likely among those communities on the urban fringe that grew substantially during the 1980 to 1994 period. For example, among those localities in our sample that adopted a growth limit (almost always after 1995),

Figure 11. Adoption of Growth Management Decade

☐ Adopted 1979–1994
■ Adopted 1995–2000
☐ Adopted 2001–04
▨ Date unknown
■ None

Source: Pioneer/Rappaport database
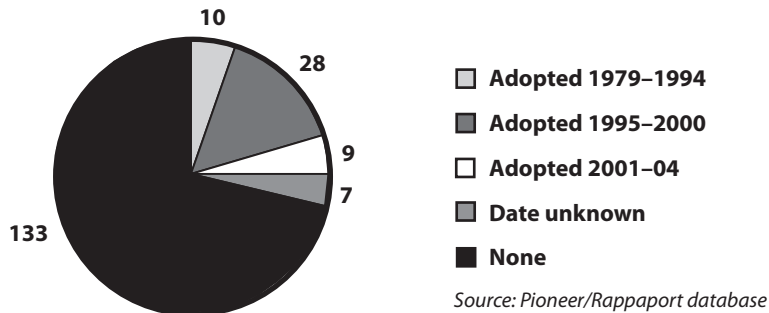
the mean number of single-family permits between 1980 and 1994 was 972. The mean number of permits among the localities that did not adopt growth measures was 755. The communities that adopted growth management policies are, on average, ten miles further from Boston than the communities that did not. Residents of those communities also are less likely to be college graduates and their homes were on average $40,000 less expensive in 2000 than homes in communities without growth management policies.

Minimum lot sizes and growth caps are not the only methods communities use to obstruct development. Figure 12 shows the distribution of other forms of zoning rules. For example, some communities require that in certain zones each new lot have at least 150 feet of frontage. Others prohibit irregularly shaped lots. While almost 30 percent of the towns and cities that have small minimum lot sizes also require lot regularity, more than 50 percent of those with large minimum lot sizes do.

Figure 12. Prevalence of Additional Subdivision Requirements by Communities' Minimum Lot Size

☐ Contiguous upland area
▨ Upland, not contiguous
☐ Enforce lot regularity
■ Frontage 150+ feet
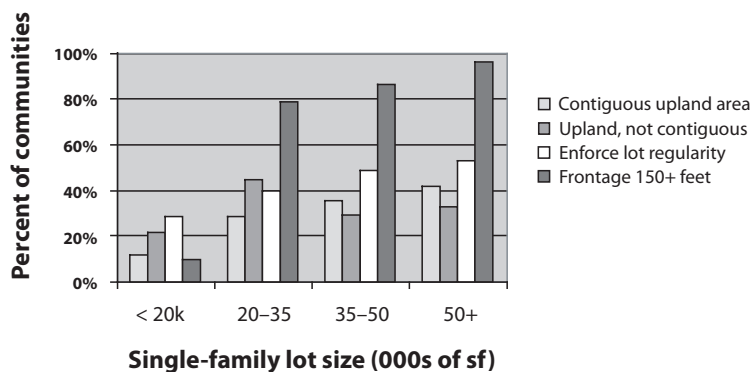
A particularly effective way of making it more difficult to meet minimum lot sizes is to exclude wetlands. Some communities refuse to count land classified as wetlands towards minimum lot size requirements; others require the minimum lot size requirement be met with contiguous non-wetland areas. Figure 12 indicates that these measures are particularly common among areas with larger minimum lot sizes, where nearly three-quarters of the communities only count uplands, i.e., non-wetlands areas, in lot size calculations. About half of them also enforce contiguity; the other half does not.

In addition to zoning rules about use of wetlands, many communities have adopted separate wetlands bylaws that provide greater protection than the state's regulations. Figure 13 describes the content of wetlands bylaws. Among other things, wetlands

Figure 13. Localities with Stricter-than-State Standards for Wetlands
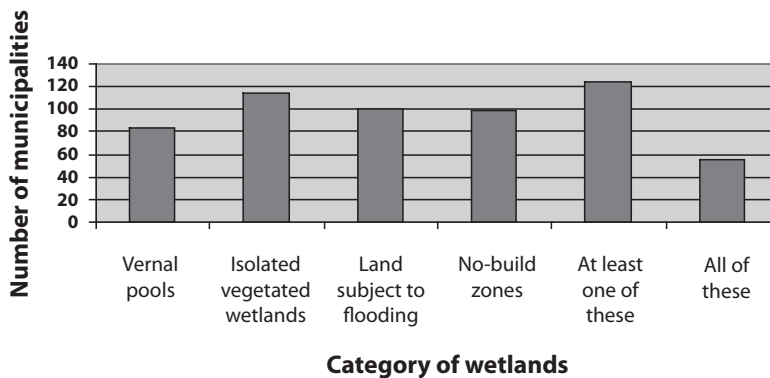
Source: Pioneer/Rappaport database

bylaws protect vernal pools, isolated vegetated wetlands, and land subject to flooding; they also may prohibit building activity within a certain distance of wetlands. Most communities whose bylaws provide wetland protection beyond the state's standards include two or more of these forms of regulation. Six communities in our sample have wetlands bylaws that do not appear to prescribe a higher level of protection than the state on any of the measures that we tracked.

As Figure 14 shows, these rules are generally of recent vintage. Only five communities have wetlands rules that we know were in place before 1980 (there are 13 communities where we could not identify the date of adoption). More than 50 communities adopted their wetlands rules in the 1980s. More than 50 communities have adopted them since 1990. Whether this surge reflects increasing environmentalism or the realization that wetlands rules were a convenient way to stop construction, wetlands rules have exploded over the last 25 years.

Figure 14. Adoption of Local Wetlands Regulations by Decade
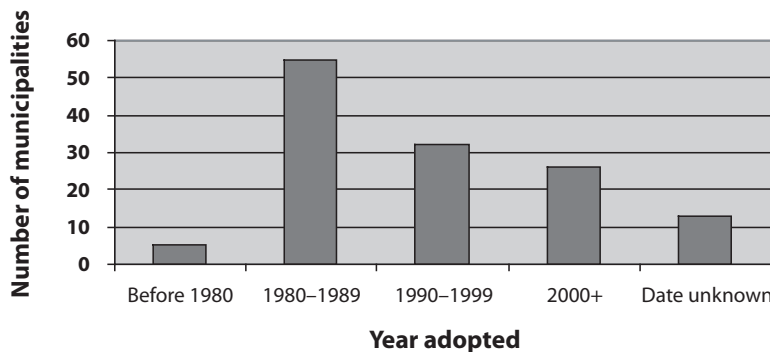
Source: Pioneer/Rappaport database

Currently there are 131 communities in our sample with wetlands rules and 56 without such rules. The wetlands rules are slightly more common in lower density, higher cost areas, but there is little difference in distance from Boston between cities and towns that have and have not adopted them.[15]

Massachusetts' State Environmental Code, known as Title 5, governs septic systems throughout the state; however, many communities have rules that go far beyond the state-level regulations. Figure 15 shows the number of municipalities in our sample that have passed extra restrictions. In total, we count 109 communities with and 78 without extra septic regulations.[16]

Figure 16 shows some of the different forms of these additional restrictions, and their distribution across the communities in our sample. The most common is

Figure 15. Localities with Stricter-than-State Standards for Septic Systems
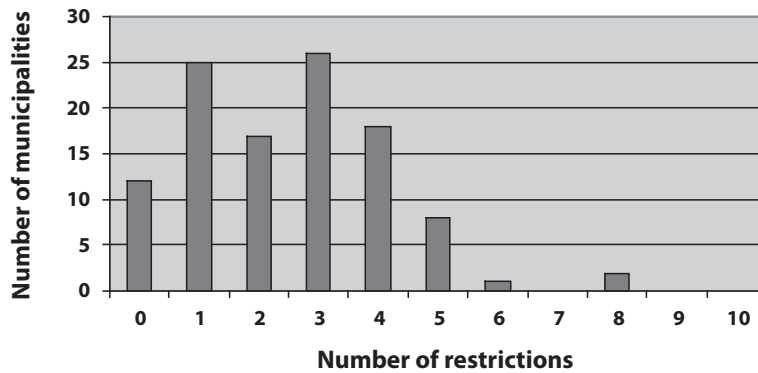
Source: Pioneer/Rappaport database

increasing the setback between septic systems and wetlands. Others include the prohibition of shared septic systems, restricting the time of year for septic installations or percolation tests, raising the minimum size for a leaching field, and reducing the maximum percolation rate.

Finally, we turn to rules concerning subdivisions. All but six of the communities in our sample have subdivision regulations: Arlington, Belmont, Brookline, Cambridge, Somerville, and Watertown are the exceptions.[17] As Figure 17 shows, some of these rules were adopted before 1950 and many between 1950 and 1980. However, there has been a surge of amendments in the last fifteen, especially the last five, years.

The data collection focused mostly on those subdivision requirements relating to the design of new roads. One particularly common form of regulation is to regulate the minimum width of new roads built within subdivisions. Nearly two-thirds of communities require road widths between 22 and 30 feet, with 21 percent requiring more than 30 feet and 14 percent allowing roads narrower than 22 feet. The communities with narrower subdivision roads are generally wealthier communities with higher property values. Somewhat surprisingly, the communities with narrow subdivision roads are somewhat closer to Boston.

Figure 16. Frequency of Local Septic System Rules that Exceed State Standards
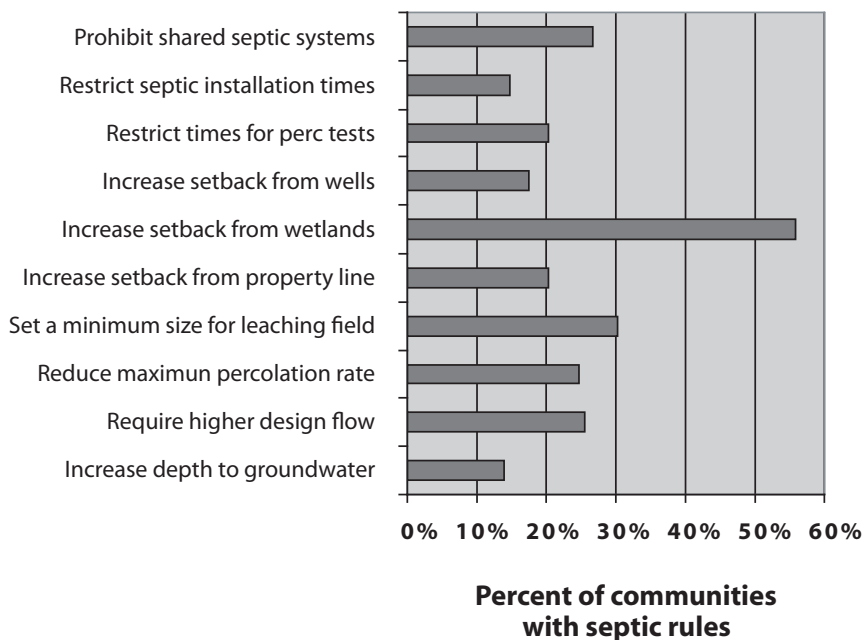
Source: Pioneer/Rappaport database

Figure 17. Adoption and Last Date of Amendment of Subdivision Regulations by Decade

Source: Pioneer/Rappaport database
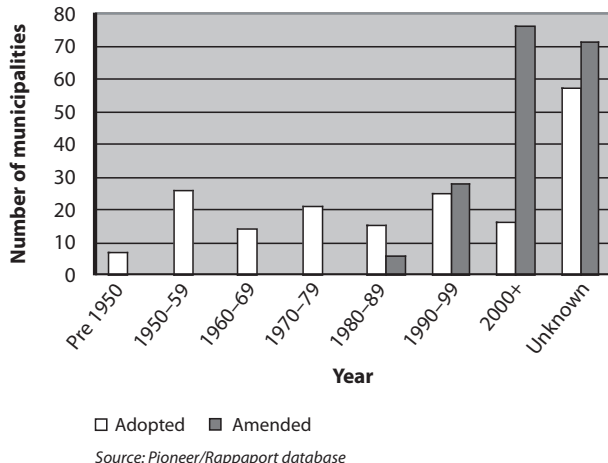
Subdivision road rules not only govern road widths, but also curb materials. As Figure 18 shows, 49 percent of the municipalities in our sample require granite curbs and 48 percent require bituminous curbs. Fifty-three percent of the communities require sidewalks on both sides of the street and 39 percent require sidewalks on only one side of the street. Generally, richer communities have weaker sidewalk requirements.

In this section, we have described a range of ways in which municipalities control new development. In the next sections, we will look at the effect of these regulations on housing permits and prices.

Figure 18. Requirements for Curb Materials Evenly Divided

Source: Pioneer/Rappaport database
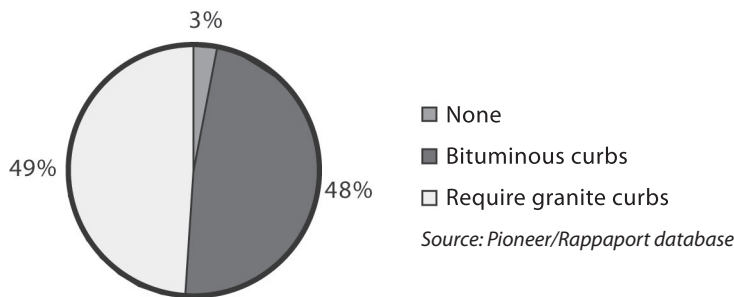
IV. Minimum Lot Sizes and New Permits

While the major contribution of the previous data set was to catalogue the different types of housing regulations, when evaluating the impact on housing market regulation on new construction it continues to make sense to start with minimum lot size. After all, the requirement that a new home sit on a large enough lot remains the primary means in which communities can stop development. Many regulations described in the previous section place additional burdens on top of minimum lot size while other measures, such as cluster zoning, can reduce those burdens.

We employed the Commonwealth of Massachusetts' MassGIS system (www.mass.gov/mgis/massgis.htm) to provide the minimum lot size for each zoning district within each municipality in our sample. In the case of single-family housing, we divide the current acreage of each district by its minimum lot size to calculate the

total number of houses that could be built in each district (Schuetz, 2005). We then combine the figures from the sub-areas to get the total area and total number of houses that could be built (if all the land was empty), and divide the former by the latter to calculate the average lot size per acre in each locality. The formula runs:

(2)

$$\frac{Acre}{Lot} = \frac{\sum_{Areas} Acreage}{\sum_{Areas} \frac{Acreage}{Minimum\ Lot\ Size}}$$

There is a great deal of heterogeneity in this variable across communities in our sample. Some communities, such as Lincoln, Weston, and Carlisle, have more than one acre per lot while other communities, such as Cambridge and Somerville, have less than .2 acres per lot. Of course, the acre/lot calculation misses some of zoning's more interesting aspects. For example, few would dispute that Wellesley or Lexington have used land-use regulations to limit new construction over the past 20 years, yet their acre/lot values are modest: .23 and .48 respectively.

We do not know when these regulations were first imposed, but we do know that most communities had zoning regulations before 1980 and approximately 12 percent had adopted them before World War II. It is therefore safest to ignore year-by-year variation in permitting and examine whether there has been more development in areas that, on average, require greater minimum lot sizes.[18] Before turning to the connection between this variable and new permitting, we ask whether this variable is related to the housing stock across cities and towns.[19]

Our basic procedure is to estimate: (3)

$$Log\ (Housing_t) = \alpha * \frac{Acre}{Lot} + \beta_1 Log\ (Area) + \beta_2 Log\ (Housing_{1940}) + Controls$$

where ($Housing_t$) is the number of homes in the locality at time t, ($Housing_{1940}$) is the number of homes in the locality in 1940 and *Area* is the locality's current land area. We include a variety of controls designed to capture underlying differences in the supply and demand for housing across communities. Specifically, we include controls for the distance to Boston and a set of controls from 1940: the percent of jobs in the community that were in manufacturing in 1940, the number of children per capita in 1940, the share of the locality's population that was foreign born in 1940, and the share of the locality's population that was white in 1940 (Massachusetts Department of Employment and Training, 1940 and U.S. Census Bureau, 1940).[20] We use these 1940 controls because current variables like the industrial structure of the locality or the education level of its residents will be highly endogenous with respect to the amount of zoning. After all, one of the reasons why elite localities adopted restrictive zoning was to control the social character of the locality (Fogelson, 2005).[21] Table 5 shows this regression for our sample of localities from 1970 to 2000.

The first regression shows the impact of acre/lot on the logarithm of the quantity of housing in 1970. The coefficient estimate implies that as the number of acres per lot increases by one, the logarithm of the housing stock in a locality in 1970 decreases by .41 log points or approximately 40 percent. The coefficients on the other variables are generally sensible. The coefficient of .33 on locality area means that a one-percent increase in locality area is associated with a three-tenths of a percent increase in the

housing stock. The coefficient on distance to Boston implies that for each mile that the locality is further from Boston, density drops by about 1.5 percent. The coefficient on housing in 1940 means that as the housing stock in 1940 increases by 10 percent, the housing stock today increases by 6.03 percent.

Table 5. Effect of Minimum Lot Size on Housing Stock, 1970–2000

	(1)	(2)	(3)	(4)
	ln (hsg 1970)	**ln (hsg 1980)**	**ln (hsg 1990)**	**ln (hsg 2000)**
Acres per Lot	-0.411	-0.425	-0.363	-0.361
	(0.085)***	(0.088)***	(0.090)***	(0.090)***
ln (Town area)	0.328	0.425	0.433	0.463
	(0.045)***	(0.048)***	(0.043)***	(0.041)***
Distance to Boston	-0.015	-0.017	-0.015	-0.015
	(0.003)***	(0.003)***	(0.003)***	(0.003)***
ln (hsg 1940)	0.603	0.55	0.53	0.512
	(0.031)***	(0.031)***	(0.032)***	(0.031)***
Pct. Mfg. 1940	-0.204	-0.179	-0.097	-0.086
	(0.084)**	(0.083)**	(0.096)	(0.113)
Pct < 18 years old 1940	-0.002	0.001	0.005	0.011
	(0.010)	(0.009)	(0.009)	(0.008)
Pct. Foreign Born 1940	0.011	0.015	0.016	0.018
	(0.006)*	(0.006)**	(0.006)**	(0.006)***
Pct. White 1940	0.005	-0.012	-0.02	-0.016
	(0.008)	(0.008)	(0.009)**	(0.009)*
Constant	0.864	2.15	2.906	2.392
	(0.907)	(0.888)**	(1.013)***	(1.024)**
Observations	181	181	182	182
R-squared	0.93	0.92	0.91	0.91

Notes:
1. Standard errors clustered on town in parentheses
*2. * significant at 10%; ** significant at 5%; *** significant at 1%*

The other controls are generally less significant. More immigrants in 1940 are associated with more housing today and more manufacturing in 1940 is associated with less housing today (holding housing in 1940 constant), but both of these effects are, while statistically significant, rather small. Neither of the other variables is either statistically or economically significant. The overall R-squared of the equation is high. These variables can explain more than 90 percent of the variation in the housing stock today across cities and towns in eastern Massachusetts.

The coefficient on acre per lot is quite similar across the four decades. It declines slightly in absolute value from -.41 in 1970 to -.36 in 2000, but this decline is far from being statistically significant. The coefficients on locality area have increased over time and the coefficient on housing in 1940 has declined. These changes reflect the fact that housing in 2000 has become more evenly spread over the municipalities in our area, and is today less dependent on housing patterns.

Overall, these results suggest a strong connection between zoning and the housing stock. However, since many zoning requirements were put in place after 1940 and because zoning may also respond to housing density, these regressions may not accurately assess zoning's impact on the supply of housing. For that reason, we turn to the relationship between zoning and the number of single-family permits between 1980 and 2002. In this case, our regression is:

(4)

$$Log\ (Permits_{1980-2002}) = \alpha * \frac{Acre}{Lot} + \beta_1 Log\ (Area) + \beta_2 Log\ (Housing_{1940}) + Controls$$

The controls are the same as the last regression and we again use data from 1940. We also include a dummy variable that takes on a value of one if the city or town has a major college or university in it, defined as being among the top 50 universities or top 25 colleges on the *U.S. News and World Report's* most recent rankings.[22] Table 6 gives the results of the regression for 1980–2002, 1980–1989, and 1990–1999.[23]

Table 6. Effect of Minimum Lot Size on Total Single-Family Permits, 1980-2002

	(1)	(2)	(3)
	ln (total single family permits)		
	1980–2002	**1980–1989**	**1990–1999**
Acres per Lot	-0.497	-0.482	-0.644
	(0.143)***	(0.156)***	(0.180)***
ln (Town area)	1.075	0.993	1.289
	(0.086)***	(0.099)***	(0.100)***
Distance to Boston	0	-0.001	-0.002
	(0.004)	(0.004)	(0.005)
ln (hsg 1940)	0.082	0.127	-0.007
	(0.050)	(0.055)**	(0.061)
Major University	-0.278	-0.161	-0.715
	(0.159)*	(0.176)	(0.316)**
Pct. Mfg. 1940	0.306	0.315	0.15
	(0.233)	(0.220)	(0.275)
Pct < 18 years old 1940	0.021	0.028	0.012
	(0.013)	(0.014)**	(0.017)
Pct. Foreign Born 1940	0.008	0.018	-0.007
	(0.011)	(0.013)	(0.012)
Pct. White 1940	0.019	(0.002)	0.045
	(0.009)**	(0.009)	(0.015)***
Constant	-5.818	-4.317	-9.971
	(1.264)***	(1.297)***	(1.779)***
Observations	181	181	181
R-squared	0.65	0.6	0.62

Notes:
1. Standard errors clustered on town in parentheses
2. * significant at 10%; ** significant at 5%; *** significant at 1%

In the first regression, we estimate a coefficient of -.497 on acres per lot, which implies that one extra acre per lot is associated with a 49.7 percent decrease in permitting activity between 1980 and 2002. As before, this coefficient is quite significant both economically and statistically. Comparing across the three regressions, we find that the impact of minimum lot size appears to have been bigger in the 1990s than it was in the 1980s. Although the coefficient increases from -.48 to -.64, the difference is not statistically significant. Such an increase might suggest that permits are growing even more sensitive to increases in minimum lot size, but we cannot be statistically confident of this change.

The coefficient on locality area is much larger than in Table 5: a ten percent increase in land area is associated with a ten percent increase in total single-family permits. This coefficient also appears to be rising over time. While we have argued that lack of land is not driving the reduction in housing supply in eastern Massachusetts, there is no question that development has been concentrated in communities that are physically larger.

The coefficient on distance to Boston is small and statistically insignificant. The impact of housing stock in 1940 is, if anything positive, but it is only significant in the 1980s. Thus, if anything, there has been more construction in places with more initial stock holding land area constant, but this effect is weak. The coefficient on having a major college is negative overall and extremely negative in the 1990s. The other controls are almost all weak and insignificant with the exceptions that the share of the

population that is white in 1940 does appear to predict permitting in the 1990s and the share younger than 18 in 1940 predicts permitting in the 1980s.

To check the robustness of these results, Table 7 runs these regressions again controlling for the housing stock in 1980 and beginning-of-period controls (1980 for the first two regressions and 1990 for the third regression). Again, we control for the share of the population that is younger than 18 years old, the share of the population that is foreign born, the share of the population that is white, and the share of the population that has college degrees. These more recent controls are desirable because they ensure that acre per lot is not proxying for recent developments in the locality's social character. The more recent controls are problematic because they may themselves be the result of zoning activity.

Table 7. Effect of Minimum Lot Size on Total Single-Family Permits, 1980–2002

	(1)	(2)	(3)
	ln (total single family permits)		
	1980–2002	**1980–1989**	**1990–1999**
Acres per Lot	-0.384	-0.399	-0.341
	(0.145)***	(0.149)***	(0.193)*
ln (Town area)	0.839	0.789	0.92
	(0.102)***	(0.111)***	(0.129)***
Distance to Boston	0.006	0.005	0.005
	(0.005)	(0.005)	(0.006)
ln (Housing Stock)	0.325	0.365	0.386
	(0.085)***	(0.087)***	(0.113)***
Major University	0.055	0.091	-0.449
	(0.224)	(0.216)	(0.397)
Pct < 18 years old	0.048	0.042	0.057
	(0.012)***	(0.014)***	(0.017)***
Pct. Foreign Born	-0.009	-0.002	-0.012
	(0.017)	(0.019)	(0.024)
Pct. White	0.015	0.005	0.033
	(0.014)	(0.016)	(0.013)**
Pct. BA or Higher	-0.004	-0.003	0
	(0.003)	(0.003)	(0.004)
Constant	-6.141	-5.652	-10.112
	(1.565)***	(1.898)***	(1.618)***
Observations	185	185	185
R-squared	0.69	0.62	0.66

Notes:
1. Standard errors clustered on town in parentheses
*2. * significant at 10%; ** significant at 5%; *** significant at 1%*
3. Controls are from the initial year of the period examined. 1980 for (1) and (2) and 1990 for (3).

These concerns turn out to be relatively minor because the more recent controls have only a modest impact on the estimated coefficient. In the first regression, we find that a one-acre increase per lot is associated with a .38 log-point (or 38 percent) decrease in total single-family permits between 1980 and 2002. This coefficient falls slightly from .399 to .341 between 1980s and 1990s. Although the more recent controls do, as expected, reduce the coefficient estimate, the results are statistically robust and remain economically meaningful.

The other coefficients are generally similar. The logarithm of locality area remains the most important variable and the coefficient on this variable remains close to one. Measuring the quantity of housing stock in 1980 or 1990 rather than 1940 increases its coefficient significantly, that is, more housing in 1980 predicts more permits between 1980 and 2002. The endogeneity of this variable with respect to the pre-1980 zoning environment (which is similar to the post-1980 zoning environment) argues against

putting too much emphasis on this finding. The coefficient on the number of children is quite positive, but again endogeneity remains an issue (places that have built more housing have attracted more families with children). Other coefficients remain small and generally insignificant.

We now turn to multi-family lots. In this case, we again calculate

$$(2)$$

$$\frac{Acre}{Lot} = \frac{\sum_{Areas} Acreage}{\sum_{Areas} \dfrac{Acreage}{Minimum\ Lot\ Size}}$$

but in this case, the relevant minimum lot size is the minimum lot size for multi-family dwellings. We also consider only the areas of the locality that are zoned to allow multi-family lots and exclude the approximately 40 localities that have no areas that are zoned to allow by-right development of multi-family housing. We run our basic regression controlling for housing supply and the other factors as of 1940 as in Tables 5 and 6.

Table 8. Effect of Minimum Lot Size on Total Multi-Family Permits, 1980–2002

	(1)	(2)	(3)
	ln (total multi-family permits)		
	1980–2002	**1980–1989**	**1990–1999**
Acres per Lot	-0.097	-0.145	-0.059
	(0.035)***	(0.046)***	(0.063)
ln (Town area)	0.386	0.07	0.876
	(0.232)*	(0.259)	(0.301)***
Distance to Boston	-0.032	-0.021	-0.011
	(0.016)**	(0.019)	(0.024)
ln (hsg 1940)	0.729	0.848	0.521
	(0.129)***	(0.145)***	(0.176)***
Major University	-0.123	-0.555	0.391
	(0.315)	(0.572)	(1.121)
Pct. Mfg. 1940	0.847	1.39	0.551
	(1.054)	(1.149)	(1.647)
Pct < 18 years old 1940	-0.112	-0.068	-0.159
	(0.057)*	(0.059)	(0.060)***
Pct. Foreign Born 1940	0.035	0.066	-0.013
	(0.038)	(0.036)*	(0.040)
Pct. White 1940	0.079	-0.027	0.02
	(0.118)	(0.120)	(0.138)
Constant	-9.192	1.056	-7.584
	(12.367)	(12.835)	(14.444)
Observations	143	142	143
R-squared	0.42	0.45	0.18

Notes:
1. Standard errors clustered on town in parentheses
*2. * significant at 10%; ** significant at 5%; *** significant at 1%*

The coefficient on lot size reported in Table 8 is much smaller than in the previous regressions. A one-acre increase in minimum lot size is associated with a -.097 log point (or 9.7 percent) decrease in total permits between 1980 and 2002. Still the results are statistically significant. The impact of locality area on development is generally smaller than with single-family houses and the impact of the housing stock in the 1940 is much bigger. The other coefficients have generally modest effects.

Finally, in Table 9, we look at the impact of minimum lot size on total (single- and multi-family) permits. These regressions look extremely similar to those in Table 5.

Table 9. Effect of Minimum Lot Size on Total Permits, 1980–2002

	(1)	(2)	(3)
	ln (total permits)		
	1980–2002	1980–1989	1990–1999
Acres per Lot	-0.395	-0.428	-0.533
	(0.140)***	(0.164)***	(0.170)***
ln (Town area)	0.855	0.753	1.168
	(0.076)***	(0.083)***	(0.095)***
Distance to Boston	-0.007	-0.008	-0.004
	(0.004)*	(0.004)**	(0.005)
ln (hsg 1940)	0.245	0.309	0.097
	(0.049)***	(0.057)***	(0.055)*
Major University	-0.254	-0.398	-0.527
	(0.140)*	(0.207)*	(0.389)
Pct. Mfg. 1940	0.342	0.41	0.228
	(0.302)	(0.305)	(0.337)
Pct < 18 years old 1940	0.026	0.031	0.013
	(0.011)**	(0.012)***	(0.014)
Pct. Foreign Born 1940	0.023	0.034	0.005
	(0.009)**	(0.010)***	(0.012)
Pct. White 1940	0.007	-0.013	0.036
	(0.008)	(0.009)	(0.013)***
Constant	-3.749	-2.137	-8.773
	(1.140)***	(1.176)*	(1.598)***
Observations	181	181	181
R-squared	0.66	0.65	0.61

Notes:
1. Standard errors clustered on town in parentheses
2. * significant at 10%; ** significant at 5%; *** significant at 1%

The basic coefficient is -.4 (meaning an acre increase in minimum lot size is associated with an about 40 percent decline in permits) and it rises during the 1980s and 1990s. The coefficient on the logarithm of locality area is .85 (a one percent increase in locality area is associated with a .85 percent increase in permits), which lies between the estimates for single-family and multi-family units. The coefficient on housing in 1940 also lies between the estimates in the two previous tables. The number of youths in 1940 is also somewhat significant.

Overall, our results suggest a persistent story. Higher minimum lot sizes are strongly associated with lower levels of permitting and lower levels of total housing. Our estimates suggest that if the average acre per lot fell one-tenth of an acre, permitting would increase by four percent and the housing stock in the long run might rise by as much as five percent. Still, the endogenous nature of zoning means that these estimates cannot be interpreted as purely causal, but rather they should be interpreted as suggesting that zoning may significantly reduce the supply of new housing.

V. Beyond Lot Size: Wetlands, Septic Systems, and Subdivisions

In this section, we examine additional ways that cities and towns can block new construction. Our approach will again be to compare the level of construction across communities as a function of these regulations, and therefore we will not be evaluating non-regulatory methods for obstructing development, since litigation is possible everywhere. Nor will the limits of statistical inference allow us to examine every regulation, whether major or minor.

Therefore, we will focus on three of the most important forms of regulations: wetlands rules, septic rules, and subdivision rules. Because the regression framework with a limited number of localities cannot possibly discern the effects of fine gradations in these rules, we will only consider:

1. Whether the locality has a wetlands bylaw stricter than the state wetlands regulations;

2. Whether the locality has septic regulations that are more stringent than Title 5 (the section of the state environmental code that governs septic systems);

3. Whether the locality has subdivision rules; and

4. An index that is equal to the sum of the previous three regulations in each community in each year.

There are 131 cities and towns in our sample with a wetlands bylaw stricter than state standards, and 109 with septic regulations that go beyond Title 5. As previously noted, all but six communities in the database have subdivision rules. In most cases, we know when measures were adopted and, because most of the wetlands and septic regulations were adopted between 1980 and 2002, if the rule was adopted between 1980 and 2002 (the period for which we have permit data). Our preferred approach will be, then, to use panel data where an observation is a locality-year, and compare permit levels before and after the regulation was adopted.[24]

We run two types of regressions of the form:

$$(5)$$
$$Log\,(Permits_t) = \alpha_t + \beta_1 * Regulation_t + \; Controls \; or \; Town \; Fixed \; Effects$$

Table 10 gives the results of both types of regressions. In the first type, we include locality level controls as of 1970, but not locality fixed effects. The controls include the logarithm of locality area, the logarithm of housing in 1970, and our other basic controls—including our measure of average minimum lot size—and a dummy variable for each year. This method allows us to examine the variation that occurs across localities (comparing adopters with non-adopters). In the second type, we include locality fixed effects, which eliminate the need for locality level controls. This methodology allows us to eliminate all of the constant variation across localities and consider only the variation that occurs when a locality adopts a regulation.

Table 10. Effect of Zoning Policies on Annual Total Permits, 1980–2002

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	ln (total permits)		ln (total permits)		ln (total permits)		ln (total permits)		ln (total permits)	
Wetlands Bylaw	-0.055	-0.094					-0.036	-0.071		
	(0.057)	(0.068)					(0.071)	(0.084)		
Septic Rule			0.004	-0.038			0.009	-0.019		
			(0.068)	(0.073)			(0.094)	(0.103)		
Subdivision Rule					-0.072	-0.122	-0.116	-0.226		
					(0.083)	(0.098)	(0.090)	(0.097)**		
Regulation Index — Barrier									-0.057	-0.105
									(0.047)	(0.053)**
Town Controls	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Town FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	3928	3928	3910	3910	2941	2941	2507	2507	2507	2507
	0.49	0.65	0.47	0.62	0.49	0.64	0.49	0.63	0.49	0.63

1. * significant at 10%; ** significant at 5%; *** significant at 1%
2. Standard errors are clustered on town.
3. Dependant variable is ln(total permits) in each year for 1980-2002.
4. Town controls include minimum lot size, ln(townarea), ln(hsg 1970), major college dummy, pct kids 1970, pct white 1970, pct BA+ 1970
5. Towns who adopt regulations at unknown dates are excluded.

Regression (1) in Table 10 shows the estimated impact of wetlands bylaws in the specification with controls but not fixed effects. The basic coefficient is -.055, which implies that localities with wetlands bylaws allow on average 5.5 percent fewer permits than comparable localities without such a bylaw. Using clustered standard errors, this effect is not statistically significant; however, if we were to report traditional robust standard errors, this coefficient (and all others in this table except for the septic coefficients) would be quite significant. However, clustered standard errors, which better adjust for the fact that observations from different years in a different locality are not wholly independent observations, have become standard in recent years (Bertrand, Duflo, and Mullaination, 2004).

Because localities that adopt wetlands bylaws may be different from localities that do not adopt these bylaws in ways that are not captured by our controls, regression (2) reproduces regression (1) except that locality fixed effects replace the locality level controls. In this case, the coefficient should be interpreted as reflecting the extent to which introducing wetlands rules reduces new construction within a given locality. The basic coefficient estimate is -.094, which means that when localities introduce wetlands bylaws, their permits drop, on average, by about ten percent. Again, this coefficient is significant using robust standard errors, but not with clustered standard errors.

The correct interpretation of this finding is that the best estimate of stricter-than-state standards for wetlands is that they have a negative and moderately large impact on permitting. However, because of limitations on the data, it is difficult to be precise about the magnitude, and we cannot be certain that this coefficient is statistically different from zero or that it is double its estimated size.

In regression (3), we show the estimated impact of septic rules that go beyond Title 5. Without the locality fixed effect, the coefficient estimate is essentially zero. In regression (4), we examine septic rules with locality fixed effects. The coefficient estimate is -.038, but this coefficient is also quite insignificant.

Regressions (5) and (6) examine subdivision rules. The basic estimate with locality level controls but without locality fixed effects is -.072. With locality fixed effects, the coefficient rises to -.122. Both coefficients are statistically significant only when using robust standard errors. Again, although the effect is large in magnitude, the lack of precision leaves the actual size of the effect in question—it could be either much larger or much smaller than our estimated coefficient. It is also worth noting that most communities in our sample had already adopted subdivision regulations well before 1980.

As Table 10 shows, when we estimate the three types of regulations separately we get large effects for two of the three. Specifications (9) and (10) present results for a single variable that sums all three of the regulations (similar to Quigley and Raphael, 2004). This metric has the obviously desirable property of more precisely capturing the overall regulatory environment in each community, while avoiding the loss of statistical clarity associated with trying to look at the effects of all three regulations simultaneously.[25] Furthermore, Pollakowski and Wachter (1990) argue that "land-use constraints collectively have larger effects than individually." When we examine these three regulations together in the cross-town regression, we find an effect of -.057. In the locality fixed effect specification, we find a larger effect of -.105. This coefficient is significant with both clustered and robust standard errors, suggesting that, with a fairly high degree of certainty, an additional type of regulation reduces the amount of permitting in a locality by about 10 percent.

VI. Regulatory Relief: Cluster Zoning, Inclusionary Zoning, and Chapter 40B

In this section, we change directions and examine rules, such as cluster zoning and inclusionary zoning, that might make it easier for developers to build at higher densities. Cluster zoning generally allows developers to build at higher densities in exchange for setting some land aside as open space. As these provisions often vary significantly, we handle this variable by coding cities and towns as either having or not having provisions for cluster development. Of the 187 municipalities in our sample, 150 have passed some form of cluster zoning, almost half of them (70) after 1980.[26]

Table 11 shows the results when we estimate equation (5) with 1970 locality-level controls and then locality-specific fixed effects. Regression (1) shows that localities with cluster provisions have 18.4 percent more permits than communities without these provisions. This coefficient is quite statistically significant and remarkably large in terms of magnitude. In regression (2), we include locality fixed effects and the estimated coefficient is .13, which is statistically significant using both clustered and robust standard errors. Thus, cluster provisions appear to have a quite clear positive effect on permits.

Table 11. Effect of Cluster and Inclusionary Policies on Annual Total Permits, 1980–2002

	(1)	(2)	(3)	(4)	(5)	(6)
	ln (total permits)		ln (total permits)		ln (total permits)	
Cluster	0.184	0.13			0.144	0.111
	(0.075)**	(0.077)*			(0.074)**	(0.081)
Inclusionary			0.197	-0.03	0.18	-0.057
			(0.107)*	(0.102)	(0.118)	(0.117)
Town Controls	Yes	No	Yes	No	Yes	No
Town FE	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3290	3290	3681	3681	2949	2949
R-squared	0.47	0.63	0.5	0.65	0.49	0.64

1. * significant at 10%; ** significant at 5%; *** significant at 1%

2. Standard errors are clustered on town.

3. Dependant variable is ln(total permits) in each year for 1980-2002.

4. Town controls include minimum lot size, ln(townarea), ln(hsg 1970), major college dummy, pct kids 1970, pct white 1970, pct BA+ 1970

5. Towns who adopt regulations at unknown dates are excluded.

Inclusionary zoning rules either mandate some degree of affordable housing in a new development or give developers the option of including affordable housing in exchange for building at higher densities. Since mandated affordable housing is actually a hidden tax on new development, we will only examine the 77 communities with inclusionary zoning provisions that offer developers some regulatory relief in exchange for including affordable housing. (Another 22 communities require affordable units but do not offer regulatory relief).

Regression (3) in Table 11 reports an estimated coefficient of .197 log points on optional inclusionary rules (that is, inclusionary zoning is associated with a 20 percent increase in permits), controlling for locality-level controls. The coefficient is large but only weakly statistically significant. In regression (4), with locality fixed effects,

the coefficient flips signs and is statistically insignificant with either type of standard error estimation. The volatility of the coefficient, and the fact that the ordinary least squares and fixed effects estimates go in opposite directions, leave us no confidence in this estimate. It is possible that bonuses for affordable housing increase the housing supply, but our evidence certainly does not provide strong support for this view.

Chapter 40B offers developers another way to avoid local land-use regulations. Under this law, if ten percent of the housing units in a locality do not meet state standards for affordability, the state can override local land-use regulations for projects where 20–25 percent have long-term affordability restrictions.[27] While we are not able to accurately assess the total number of new projects that have used Chapter 40B to bypass local land-use regulations (or have used the threat of 40B to force localities to accept proposed new developments), it is clear that 40B has become increasingly attractive to developers. According to one study, for example, between 1970 and 2003, the law was used to build more than 30,000 units in almost 500 developments located in more than 200 communities across the state (Citizen's Housing and Planning Association, 2003). Use of the law seems to be increasing, moreover. Between 2002 and 2004, almost 9,000 units were produced in 151 cities and towns in eastern Massachusetts (Heudorfer and Bluestone, 2005).

Table 12. Combined Effect on Zoning Policies on Annual Housing Permits, 1980–2002

	(1)	(2)	(3)	(4)
	ln (total permits)		ln (total permits)	
Regulation Index	-0.12	-0.127		
	(0.055)**	(0.049)***		
Regulation Index— Barrier			-0.074	-0.116
			(0.055)	(0.062)*
Cluster			0.279	0.156
			(0.102)***	(0.098)
Town Controls	Yes	No	Yes	No
Town FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1981	1981	1981	1981
R-squared	0.48	0.63	0.48	0.63

1. * significant at 10%; ** significant at 5%; *** significant at 1%
2. Standard errors are clustered on town.
3. Dependant variable is ln(total permits) in each year for 1980-2002.
4. Town controls include minimum lot size, ln(townarea), ln(hsg 1970), major college dummy, pct kids 1970, pct white 1970, pct BA+ 1970
5. Towns who adopt regulations at unknown dates are excluded.
6. The regulation index is the sum of wetlands bylaw, septic rules, and subdivision rules minus cluster
7. Regulation Index -- Barrier is the sum of wetlands bylaw, septic rules, and subdivision rules

Finally, in Table 12, we combine all of the forms of regulation. The first set of specifications again presents results for a regulation index. This index is the same as was employed above except we now subtract one if the municipality has a cluster provision in place during that year.[28] Both specifications in this case produce nearly identical coefficient estimates, -.12 and -.127, and both estimates are highly significant using both forms of standard errors. The results are less precise when the regulation index and cluster provisions are examined independently. In the cross-locality specification (3), cluster provisions have a very large, statistically significant effect, while the regulation index is smaller and insignificant with clustered standard errors. The locality fixed-effects specification reverses this pattern. The regulation index is sizable and statistically significant, but the cluster estimates are smaller and insignificant.

In sum, while the precision of the estimates is somewhat suspect, the pattern of results seems quite clear. Additional regulations that increase the stringency of the

zoning environment reduce the levels of new construction in a community, while provisions, like cluster zoning, which reduce the stringency of zoning have a positive effect on the amount of new construction.

VII. The Impact of Land-Use Controls on Price

In the previous three sections, we have focused on the impact of zoning and other forms of regulation on the total supply of new housing. Now we turn to the impact of these regulations on price. In general, our price estimates will be far less precise than our permit results and for an obvious reason. The essence of our approach is to compare similar localities that zone differently. In the case of permitting, if two identical and adjacent localities zone differently, the locality with easy permitting will grow and the other will not. There is no sense in which one locality's refusal to permit will cause permitting in the other locality to drop. Any cross-locality effects, if they exist, will act to push up permitting in the more open locality and exacerbate differences.

The situation is different, however, in the case of price. While regulations clearly affect permitting in each community, their impact on price is more diffuse, because housing markets are regional, not just local. Stringent land-use restrictions in Wellesley, for example, would push up housing prices in Needham, even if Needham has less stringent land-use restrictions. Think of Needham and Wellesley as being two members of a cartel, like OPEC, that sells homes rather than oil. In OPEC, if Saudi Arabia restricts its crude production, this would raise the price of crude globally, but it would not raise the price of Saudi crude relative to Kuwaiti crude. In the same way, if Wellesley restricts production, it would not necessarily raise its prices relative to Needham (or at least not much), but it would likely push up prices in the entire region. Therefore, to the extent that greater Boston is a single housing market, each locality's restrictions affect everyone equally and it will be impossible to identify the impact of land-use regulation on prices by comparing across localities.

Through a rough, back-of-the-envelope calculation, we can provide a basic estimate of the effects of regulations on regional prices. Published estimates of housing demand elasticities range from -.5 to -.8 (Ermisch, Findlay, and Gibb 1996). While these housing demand estimates are crude and not specific to the Boston area, they suggest that, if instead of increasing by 9 percent since 1990, the housing stock had increased by 27 percent (as it did from 1960 to 1975), prices might be 23 to 36 percent lower than they are currently. That is, instead of a median price of $430,900, the price might be as low as $276,100). While this estimate is quite crude and rests on a number of assumptions (e.g. that demand is constant and that housing demand elasticities for Boston during this era fall within the range of published estimates), it does provide a basic vision of what prices might have been in a less regulated environment.

While using cross-locality price comparisons to look at the impact of supply restraints is inherently flawed when the localities are part of a similar housing market, we expect any effects to be modest and likely to underestimate the impact of land-use regulation on local housing prices. Some previous examinations of the effects of land-use regulations on prices confirm these expectations. Pollakowski and Wachter (1990), Wachter and Cho (1991), and Cho and Linneman (1993) all find spillover effects of local regulations on prices in neighboring communities.

Nonetheless, we present a basic discussion of the effect of minimum lot sizes on locality-specific prices. We begin by estimating the following regression using *Banker and Tradesman* sales data:

(6)

$$Log\,(Median\,Price_t) = \alpha * \frac{Acre}{Lot} + \beta_1 Log\,(Area) + \beta_2 Log\,(Housing_{1940}) + Controls$$

We are using again controls from 1940, since they are unlikely to themselves be the result of recent land-use regulations. Table 13 gives the price results of the regression for 1987, 1995, and 2001.

Table 13. Effect of MInimum Lot Size on Median Single-Family Sales Price, 1987, 1995, and 2001

	(1)	(2)	(3)
	In (median sales price, $2004)		
	1987	**1995**	**2001**
Acres per Lot	0.158	0.113	0.192
	(0.063)**	(0.079)	(0.076)**
In (Town area)	0.021	0.097	0.038
	(0.033)	(0.046)**	-0.04
Distance to Boston	-0.016	-0.02	-0.022
	(0.002)***	(0.003)***	(0.002)***
In (hsg 1940)	-0.071	-0.134	-0.101
	(0.021)***	(0.029)***	(0.027)***
Major University	0.32	0.519	0.519
	(0.111)***	(0.165)***	(0.155)***
Pct. Mfg. 1940	-0.067	-0.103	-0.1
	(0.067)	(0.087)	(0.070)
Pct < 18 years old 1940	-0.026	-0.03	-0.031
	(0.006)***	(0.007)***	(0.007)***
Pct. Foreign Born 1940	-0.005	-0.009	-0.005
	(0.005)	(0.006)	(0.005)
Pct. White 1940	0.02	0.028	0.023
	(0.005)***	(0.006)***	(0.007)***
Constant	11.805	10.721	11.887
	(0.629)***	(0.764)***	(0.758)***
Observations	182	182	182
R-squared	0.42	0.43	0.48

Notes:
1. Standard errors clustered on town in parentheses
2. * significant at 10%; ** significant at 5%; *** significant at 1%

Regression (1) for 1987 shows that an increase in minimum lot size is associated with a .158 log point (or 15.8 percent) increase in the cost of housing. The other important controls are proximity to Boston, the presence of a leading college or university, and the share of young people and whites in 1940. The housing stock in 1940 is also quite significant. Indeed, one of the biggest problems in estimating regressions of this form is the high correlation between the housing stock and minimum lot size, and it is often extremely difficult to separately identify these effects.

The second regression shows that the effect of minimum lot size drops between 1987 and 1995 from .158 to .113. This difference is not statistically significant, but the coefficient on acre per lot is not statistically significant in 1995 either. In the third regression, the coefficient shoots up to .192, which means that an extra acre per lot causes prices to rise by about 19 percent. The time pattern suggests that the impact of land-use regulations on price was higher during boom periods (1987 and 2001) than during the trough of the real estate cycle (1995).

These findings have focused on median sales price, but we have not controlled for housing characteristics or lot size. While we believe that we have shown that more stringent land-use regulation is associated with higher median sales prices, we have not shown whether there are higher sales prices even controlling for housing characteristics.[29]

We again run our basic regressions using *Banker and Tradesman* data:

$$(7)$$

$$Log\,(Sales\,Price) = \alpha * \frac{Acre}{Lot} + \beta_1 Log\,(Rooms) + \beta_2 Log\,(Acreage) +$$

$$\beta_3 Log\,(Home\,Size) + \beta_4\,Year\,Built + Town\,Controls$$

Thus our regressions control for the number of rooms, the age of the home, the total acreage of the lot, the internal square footage, and the age of the home. The regression is meant to answer, then, whether an increase in minimum lot size raises prices holding home characteristics constant.[30]

Table 14. Effect of MInimum Lot Size on Sales Prices with House Controls, 2000–2005

	(1)	(2)	(3)
	ln (sales price, $2005)		
Acres per Lot	0.115	0.138	-0.09
	(0.062)*	(0.059)**	(0.081)
Year Built	0.001	0.001	0.001
	(0.000)***	(0.000)***	(0.000)***
ln (total number of rooms)	0.252	0.245	0.233
	(0.038)***	(0.035)***	(0.034)***
ln (interior sq. ft.)	0.587	0.574	0.585
	(0.032)***	(0.032)***	(0.031)***
ln (lot size)	0.095	0.099	0.07
	(0.014)***	(0.014)***	(0.010)***
ln (town area)	-0.066	-0.062	0.009
	(0.050)	(0.051)	(0.049)
Distance to Boston	-0.014	-0.016	-0.019
	(0.005)***	(0.004)***	(0.004)***
Major University	0.403	0.405	0.434
	(0.104)***	(0.096)***	(0.094)***
Pct <18 years old 1940		-0.016	-0.024
		(0.008)**	(0.008)***
Pct. White 1940		-0.002	0.002
		(0.015)	(0.015)
Pct. Mfg. 1940		-0.098	-0.102
		(0.119)	(0.106)
ln (hsg 1940)			-0.101
			(0.028)***
Constant	5.589	6.01	6.403
	(0.445)***	(0.719)***	(0.679)***
Year FE	Yes	Yes	Yes
Observations	54950	54759	54759
R-squared	0.46	0.46	0.47

Notes:
1. Standard errors clustered by town.
2. * significant at 10%; ** significant at 5%; *** significant at 1%
3. Excludes towns >30 miles from Boston.

These results are presented in Table 14. In the first regression, we control only for distance to Boston, the logarithm of the locality area, and whether the locality has a major college or university. In this case, the coefficient is .115, which means that in localities with one greater acre per lot, prices rise by about eleven percent. This number is smaller than that in the basic pricing regression. The second regression includes controls for the share of the population that is younger than 18, the share of the locality that is non-Hispanic white, and the share of jobs in the community in manufacturing in 1940. In this case, the coefficient rises to .138 (an additional acre is associated with a 13.8 percent price increase) and becomes more statistically

significant. Finally, the third regression includes a control for the housing stock in 1940. In this case, the coefficient flips its sign and becomes statistically insignificant.

Overall, there do seem to be correlations between land-use regulation and higher prices. Median sales price is certainly higher in communities with large minimum lot sizes, even controlling for density in 1970. Also, there are price effects even controlling for house and historical community characteristics and these effects are significant economically and statistically. However, these results are not robust to including controls for historical density levels.

Although this exercise focuses on median price, much of the concern about land-use regulation is that it may reduce the amount of affordable housing in the greater Boston area. To look at this issue, we take the *Banker and Tradesman* data and classify a home sale as affordable if the sales price times the average prime rate in the year of the sale is less than 30 percent of the median income in the Boston metropolitan area as a whole in the year 2000. For each locality, we then calculate the share of sales that were affordable and we divide by the total number of sales for that locality in the *Banker and Tradesman* data. This captures the total number of sales in a locality between 2000 and 2005 in which the interest payment on the home would have been less than 30 percent of the median income in the area.

We then regress this quantity across localities on the acre per lot measure and other controls. It will turn out that our results are quite sensitive to controlling for the density of housing. This is not surprising because the primary way that land-use regulation should reduce the amount of affordable housing is by reducing the size of the housing stock. Regression (1) in Table 15 controls only for the logarithm of locality area and distance to Boston. In this regression, a one-acre increase in acre per lot decreases the share of the homes that are affordable by 20 percent. This is the raw correlation between zoning and affordability and it is obviously immense. Regression (2) then includes controls for characteristics of the locality in 1970, including whether it has a leading college or university, the share of the population younger than 18, the share of the population that is white and most importantly the share of the population with a college degree. This education variable is particularly powerful and it strongly

Table 15: Effect of Minimum Lot Size on Share of Affordable Housing Sales, 2000–2005

	(1)	(2)	(3)
	Pct Sales Affordable		
Acres per Lot	-20.043	-8.438	2.813
	(3.580)***	(2.669)***	(3.207)
ln(Townarea)	-0.164	0.339	-5.003
	(3.180)	(1.620)	(2.061)**
Distance to Boston	1.384	0.567	0.828
	(0.171)***	(0.129)***	(0.141)***
ln(hsg 1970)			7.701
			(1.839)***
Major University		-5.902	-7.482
		(4.562)	(5.079)
Pct <18 years old 1970		0.309	0.673
		(0.223)	(0.271)**
Pct. White 1970		-1.189	-1.106
		(0.622)*	(0.569)*
Pct. BA or Higher 1970		-1.865	-1.833
		(0.098)***	(0.095)***
Constant	37.528	177.825	126.501
	(27.366)	(63.958)***	(59.849)**
Observations	186	186	186
R-squared	0.28	0.77	0.8

1. Standard errors clustered on town in parentheses
*2. * significant at 10%; ** significant at 5%; *** significant at 1%*
*3. Dependant variable in first section is equal to the fraction of sales in Banker and Tradesman 2000–2005 sample such that Prime Rate*Sales Price <.3*Median Family Income in Boston*

predicts both high prices and a lack of affordability. In this extended regression, the effect of acre per lot drops but remains both economically and statistically significant. A one-acre increase in the acre per lot is associated with an eight percent reduction in the share of home that are affordable. Regression (3) includes a control for the housing stock in the locality in 1970, which is highly correlated with the size of the housing stock today. This variable eliminates the effect of minimum lot size.

VII. Toward a Policy Solution

In this penultimate section, we discuss potential policy responses to the problems created by the current maze of land-use regulation in greater Boston's cities and towns. We begin by noting that while land-use regulation appears to reduce new construction and raise prices, these regulations do sometimes serve legitimate goals. Abutters and neighborhoods may indeed suffer from new construction. Cities and towns may lose fiscally from new construction, especially if the property taxes raised from new homes are insufficient to compensate for the cost of providing services, particularly schools (see Carman, Bluestone, and White, 2005). The challenge of any regulatory system is to address these legitimate concerns in ways that allow needed new construction to move forward.

The preceding analyses indicate that the greater Boston's currently regulatory system does not meet this test. The analyses also suggest that the current system has four structural features that must be addressed if proposals for change are likely to be effective. In the rest of this section, we describe those four features and then suggest four types of policies that could address the problems that these features create.

Feature #1: Cities and towns face strong incentives to excessively restrict new development

Both theory and evidence suggests that communities will not regulate new construction in a way that is optimal for residents of the state. While we have not conducted a cost-benefit analysis of land-use regulations in Massachusetts, in other settings (Glaeser, Gyourko, and Saks, 2006b, forthcoming, in a study of New York City) building restrictions have been found to excessively restrict new construction. The basic theoretical point is that localities are politically entities designed primarily to serve the interests of their current residents. If enough of those residents are homeowners, a major goal of local governments will (and probably should) be to protect property values (Fischel, 2002).

The attention to local property values often has laudable consequences. Property values are based, in part, on expectations about the community's long-term health, and this leads politicians and activists to think about investments that will matter beyond the next election cycle (Glaeser, 1996). Most notably, since housing prices are so intimately related to school quality, the focus on property values helps encourage residents without school-age children to support investments in local education (Mayer and Sinai, 2003).

For the same reason, the focus on property values also encourages other laudable policy initiatives that increase community desirability such as reducing crime or improving public services.

There is at least one reason why maximizing local property values, however, does not improve social welfare: community residents have a certain amount of monopoly power, through land-use regulation, over local community attributes. By keeping a commodity scarce, the price is kept high. Current owners have every incentive to

impede new construction that increases supply and reduces the value of their homes. Indeed, this study's key finding—land-use regulations in greater Boston restrict supply, which increases the cost of housing—makes it obvious why land-use regulation will be popular. It is economically rational for homeowners to want high housing costs, and it would be political suicide for a politician in a small community to inform his (or her) homeowner voters that his (or her) main objective is to increase housing supply so that their housing values will fall.

However, what is best for a set of homeowners is not what is best for the state of Massachusetts: homeowners gain at the expense of those who do not already homes in that town. Land-use regulation is like rent control in that it favors current residents but hurts outsiders and those who would like to move into the community. Business owners are particularly harmed by housing-supply restrictions because they either have to pay high wages as the price of being in Massachusetts or move out of state to a place with lower housing costs and wages. Indeed, in the past few years, business leaders have pointed to high housing costs as a significant problem involved in doing business in Massachusetts and, in efforts such as the Commonwealth Housing Task Force, they have actively worked to find solutions. As the task force concluded, the only solution to this problem, and to the rising cost of living within Massachusetts, is serious state intervention. Only statewide action can internalize the cross-jurisdiction externalities created by the current regulatory system (see Carman, Bluestone, and White, 2003).

Feature #2: Localities have the ability and incentives to subvert many state-level policies

Our work on local land-use restrictions shows that communities act in incredibly creative ways to restrict the construction of new housing. In the last 30 years, an increasingly complex system of regulations has sprung up, at least in part, to restrict new development. Strong local regulations on wetlands and septic system or stringent local rules on plot contours, for example, can make the developers' job much harder. Such regulations work together as a system, which means that attempts to standardize regulation along any one dimension will not have significant impacts on total permitting. The state, for example, could establish wetlands regulations that limit the abilities of localities to impose controls beyond statewide norms. However, recent history shows that communities that want to restrict new construction will cleverly find other ways of making it hard to build. As long, then, as responsibility for implementing the rules remains in local hands, any attempt to standardize rules will fail. Therefore, the state must either alter local incentives or usurp some of the power of the cities and towns.

Feature #3: The current system has too much uncertainty

Section III described a dizzying array of regulations, made even dizzier by the ambiguity and inconsistency in many of those regulations. The uncertainty created by this system appears to have led to more lawsuits, some brought by developers challenging ambiguous regulations, others brought by local residents challenging permits issued by local boards. Such long and costly challenges create two important barriers to new development. First, risk is expensive: developers have a harder time raising money for projects that can get tied up for years in court. As a result, many potentially beneficial projects are never proposed and developers must recoup their legal costs from those that are built. This erects a barrier against smaller developers who are not wealthy and legally savvy enough to withstand lengthy legal challenges. Second, the lack of clear property rights makes it difficult to work out agreements

that compensate abutters and host communities for the costs and impacts created by new development. Moreover, even if one set of residents are satisfied by such agreements, there is nothing to stop other residents from deciding that they too deserve some form of compensation and beginning a new set of legal proceedings against a new project. Because ill-defined property rights do not benefit developers, homeowners, or local governments, they should all, theoretically, welcome a well-designed policy that reduces uncertainty.

Feature #4: Property rights are diffuse and ill defined.

The current system has only limited procedures that allow developers to compensate current residents and communities for a new development's negative impacts. In general, under the current system land-use decisions hinge on whether the project is net plus for the community and residents. However, this is not the economically relevant question. Instead, the process should be designed to allow projects in which developer profits are large enough to share with the affected community in ways that benefit everyone.

Consider a simple case where a new project yields $10 million dollars to a developer and costs the current residents of the community $1 million. In this case, economic rationality suggests that the developer might pay the community $2 million for permission to go ahead with the project. Both parties would be better off. Without a system of side payments, the community has good reasons to fight the project. This issue becomes particularly stark when considering the fiscal effects of new development. If the property taxes on new homes do not cover the costs of educating the children who will live in those homes or the infrastructure costs necessary to take care of the new residents, communities will oppose the new development on fiscal grounds. Standard economic reasoning suggests a better outcome will occur if the developer pays for the fiscal shortfall and goes ahead with the new units. If the developer's profits can cover the shortfall, then the development should proceed; if they do not, then the development should be left to flounder.

Adding impact fees to existing regulation would only further inhibit new construction. However, replacing the rule with fees would enable developers to bypass the uncertainty and legal costs of the current system. A system of fees that takes into account the externalities associated with development would be far superior to the social waste involved in delay and litigation.

Potential Solutions

We will now highlight four possible avenues for state intervention: (1) carrots and sticks, (2) overriding local regulation, (3) legal reform, and (4) a more robust system of impact fees. The first two approaches recognize that localities have strong incentives to restrict new housing production and, therefore, they propose state-level measures to either change those incentives or overrule those communities. The third set of ideas focuses on reducing uncertainty in the court system.

Approach #1: Change Incentives with Large Carrots and Sticks

In the previous section, we argued that localities have strong incentives to restrict new production and that they will subvert most mild attempts to reform land-use controls. This does not mean that measures such as state model zoning codes are useless, but rather that such measures are unlikely to yield large impacts. Instead, if we are trying to change the behavior of localities, the most natural approach surely is to create incentives—carrots and sticks—that will make it in the communities' interests to allow

more construction. As such, one intervention is to tie state aid much more closely to increases in new construction. Such an intervention could make anti-growth polices costly and induce communities that are currently indifferent about growth to move towards pro-growth policies.

This type of intervention is not new. The Office of Commonwealth Development's Commonwealth Capital program distributes discretionary state funds in ways that reward localities for pursuing several goals, including the construction of more housing. The amount of money in this program is relatively small and there is little evidence from Massachusetts or elsewhere suggesting that it will have a significant impact on housing production. Similarly, the recently passed 40S law, which grew out of the work of the Commonwealth Housing Task Force, is supposed to ensure that when communities allow certain types of new housing they do not incur education costs in excess of the property taxes generated by that housing (see Carman, Bluestone, and White, 2003).

As laudable as these current measures may be, they are probably too small to change local behavior in significant ways. However, the state contributes about a third of the budget of its localities, which, used wisely and amply, gives it enormous clout in local housing policy. The state could, locality by locality, assess demand by examining current housing prices, and supply by examining the density of current housing, and derive from their relation a target number of annual permits for each city or town. The state would penalize communities that fall short of their targets, and transfer their lost aid to communities that meet or exceed their targets. Given the limits associated some forms of state aid, particularly education, it may be that some state aid would not be subject to this policy. For these effects to occur however, the policy would have to apply to a significant share of all local aid. Moreover, this policy would be much better if it was continuous, so that communities did not just get an incentive to get over some threshold, but instead faced strong incentives to keep on building. Such a system might also have the effect of transferring resources from wealthier suburbs to poorer areas.

Approach #2: Override Local Control

A second, more intrusive, intervention would be to give state or regional entities the power to overrule local land-use decisions. Overriding local control is a draconian measure that is sure to be wildly unpopular, but it is also the only sure way of allowing new housing. The model for state overrides of local land use controls is Chapter 40B, which can be used by developers when 20 to 25 percent of the units in the proposed developments have long-term restrictions on rents or sales prices (a requirement that likely has led to limited use of 40B by developers.)

A natural extension of Chapter 40B would be to draft a statewide code that would replace local regulations when a locality was underperforming in terms of permits, prices, and density.[31] In other words, towns with very low density levels that had high prices and low numbers of permits might become non-conforming and developers would have recourse to bypass local control and apply instead to the statewide land use control. Following feature # 4 above, such a state-wide land use program would also be that developers would have to pay significant impact fees in exchange for eliminating the rules and uncertainty of local control.

Approach #3: Reform the Legal Environment

A third statewide policy would be to impose modest costs on local lawsuits against new development. As we have discussed previously, these lawsuits have proved to

be an effective way to raise the cost of, and discourage, new construction. Of course, these lawsuits are not always frivolous—they can protect neighborhoods against harmful developments or environmentally sensitive areas from destruction. Thus, the point of such a policy would be to increase the costs of lawsuits enough to discourage frivolous suits, not ban them altogether.

One way of imposing such costs would be to require plaintiffs litigating against new developments to pay a modest fee, perhaps equal to one percent of the expected value of the project. If the plaintiffs are unwilling to pay this fee then it seems unlikely that their lawsuit will bring them benefits proportionate to the social costs of stopping the new development. In one version of this scheme, the fee would be due to the state treasury when the lawsuit was filed. In another version, the fee would fall due only if the plaintiff lost the case. Another variant would require that plaintiffs who lost a case against a new development paid the developers' legal fees.

Approach #4: Replace Some Controls with Fees

As noted above, a well-designed impact-fee system could lead to more development in ways that reduces uncertainty and enhances the welfare of developers, abutters, and communities. We want to emphasize, however, that impact fees could only increase new construction and housing affordability if they replace existing barriers to new construction. Even a reform that was neutral towards development overall but allowed developers to exchange a fee for a pass on some segments of the regulatory process or for the exclusion of litigation would be make life easier for developers and residents. But adding impact fees on top of the existing system would only further deter construction.

As with our other suggestions, this is not a new idea. Like localities throughout the country, many Massachusetts localities already charge impact fees on new development (see Altshuler and Gómez-Ibáñez, 1993). As previously noted, such fees are usually in imposed in consort with existing regulations. Moreover, the state's courts have set stringent limits on the use and extent of such fees. In contrast, courts in other states, such as California, have given localities more leeway on the use and extent of such fees (Barron and Frug, forthcoming). A system that gives localities more leeway if they forego regulatory restrictions and uncertainty has great potential.[32]

IX. Conclusion

Over the past 25 years, the greater Boston area has experienced a surge in housing prices. Some of the surge is the price of the last two decades of economic success. However, economic vitality does have to lead to rising housing prices. In other parts of the country, economic booms have had a much more muted impact on prices because the supply of housing has kept pace with increasing demand. In Massachusetts, the supply of new housing has been modest since the 1980s, and this can be seen (along with rising demand) as the cause of higher housing prices in the greater Boston area.

There is more than one cause for lagging new construction in the greater Boston area, but land-use regulation is one of the most important. After all, many of Boston's suburbs are not particularly dense, and even dense places can readily add housing stock (by building up) in a favorable regulatory environment. The greater Boston area's housing shortage is not the result of a shortage of land, but rather of restrictions on the existing land that make denser development difficult to impossible. While low densities have their virtues, they also ensure that housing will stay expensive and retard economic growth.

In this paper, we presented a new data set detailing the wide range of regulations that affect land use in the greater Boston area. Two facts emerge from the data set. First, there is an enormous number of ways in which localities regulate new construction. Second, there is enormous heterogeneity across the greater Boston area in the extent and nature of these regulations. While there are many ways in which home rule is quite limited (Barron and Frug, 2002), when it comes to controls over the use of land, localities have been aggressively creating a web of restrictions tailored to their own interests.

We then examined the extent to which these regulations affected the amount of new construction and the cost of housing. We found significant evidence for the view that land-use controls impede new construction. On average, as the average minimum lot size increased by a quarter-acre, the number of new permits fell by ten percent. These results were much stronger among localities with other significant restrictions on new development than in localities with less restrictive regulations. These results were also generally robust to a wide number of controls and different regression specifications.

The relation between land-use regulation and housing prices was also striking. Regionally, housing prices might have been 23 to 36 percent lower if regulation had not greatly slowed new permitting since 1990. Moreover, increasing average minimum lot sizes increases median prices and individual sales prices within a community by over 10 percent. These estimates are more sensitive than the results on new permits, but they also appear to be robust to a number of different functional forms and to including a number of different controls. Finally, a one-acre increase in acre per lot decreases the share of the homes that are affordable to the region's residents by between 8 and 20 percent.

Minimum lot size is not the only factor affecting new housing starts. First, there are measures that mitigate minimum lot size requirements, such as Chapter 40B and cluster zoning. Chapter 40B allows developers to bypass local land-use controls; cluster zoning sometimes allows development of more units than conventional by-right zoning in exchange for setting aside some open space. Since Chapter 40B affects virtually every locality in our sample, it is impossible to accurately assess its impact on new construction (especially since much of its impact may derive from a locality's allowing projects under the threat of a Chapter 40B development), but the available evidence suggests that it is responsible for a significant amount of new construction. Cluster zoning also appears to be effective, particularly for the construction of multi-family units.

Second, there are regulations that augment the effect of minimum lot size, making new construction even more difficult: wetlands regulation, septic system require-ments, and subdivision regulations. We also found evidence that minimum lot size has become less important over time, as construction has declined even in communities with small minimum lot sizes, which suggests that these secondary sorts of regula-tions have taken on a larger role in stifling new construction over time.

While it is clear that local land use regulations restrict supply and push up prices, the public policy implications of these facts are less clear. There are externalities from new construction and this study was not a cost-benefit analysis of new construction. Nonetheless, there are reasons to think that local control over construction may well lead to over-regulation, especially when property rights are ill-defined. In the final section of this paper, we suggested a number of different avenues for state action on this issue. We believe that all of these are worth considering, even if we are unsure whether any of them are worth adopting.

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Endnotes

[1] This figure and figures for housing prices in other regions can be found at http://www.realtor.org/Research.nsf/files/REL05Q3T.pdf/$FILE/REL05Q3T.pdf

[2] This information is from the HUD State of the Cities Database: http://socds.huduser.org/

[3] This paper uses the terms regulation, bylaw, ordinance, and rules interchangeably. Legislative bodies in cities adopt ordinances, while in towns the legislative bodies adopt bylaws. Regulations and rules are promulgated after public hearings by the municipality's executive branch (boards, commissions, and departments). Illustratively, zoning comes in the form of bylaws and ordinances while planning boards promulgate subdivision regulations and boards of health promulgate septic regulations. To exceed state standards for wetlands protection, municipalities must adopt a bylaw or ordinance. In many localities, the conservation commission then promulgates regulations implementing those bylaws and ordinances. In addition to these formally adopted requirements, many municipal boards and commissions also have written and unwritten policies in these areas. The dataset, however, focuses only on measures officially adopted as bylaws, ordinances, regulations, and rules.

[4] We employ two types of *Banker and Tradesman* data. One dataset includes the median sales prices for all sales in each town from 1987–2004. The other dataset is a one in three random sample of all sales transactions in the 187 municipalities from January 2000 through September 2005. There are over 130,000 observations in the full dataset, and over 80,000 single-family homes. This dataset includes details on the sales price, house location, and other house characteristics (e.g., age and size).

[5] Throughout, we include the major college or university control in order to capture the large change in local amenities and housing markets that are associated with major colleges and universities.

[6] While the economic renaissance was a major factor, other factors that are likely to have contributed to the increase in demand include changing demographics and the easing of credit constraints through falling interest rates and the increasing use of alternative mortgages.

[7] We exclude the portion of the Boston MSA that is in Hew Hampshire from this analysis.

[8] The area reaches from the coast beyond Worcester, north to the New Hampshire border, and south to Plymouth. The coverage does not correspond to OMB definitions of the metropolitan statistical area, or other regional definitions; rather, it extends beyond the Boston MSA into communities that only recently have begun facing development pressures. The 187 municipalities comprise over half of Massachusetts's 351 municipalities. The City of Boston is not included in this group because it is not subject to the state zoning enabling legislation.

[9] These 22 communities are Berlin, Bolton, Boylston, Cohasset, Dover, Dunstable, Essex, Groveland, Hamilton, Harvard, Lancaster, Manchester, Millville, Paxton, Plympton, Princeton, Sherborn, Topsfield, Wenham, West Boylston, West Bridgewater, and West Newbury.

[10] The coefficient on land area reflects the effect on an additional square foot of lot on the sales price. To get the price of an acre, we multiply the coefficient by 43,560: .382 X 43,560= $16,600.

[11] The full database, including a more detailed description on how it was collected and text from the regulations, is online at www.pioneerinstitute.org/municipalregs/.

[12] Interestingly, inclusionary zoning rules have been more common in localities with higher levels of education and housing values. The average share of the adult population with college degrees in those communities that have adopted inclusionary zoning is 44 percent. The average share of the adult population with college degrees in those communities that have not adopted these provisions is 33 percent

[13] We have not been able to ascertain in the other 35 localities that have passed inclusionary zoning provisions whether they had been used.

[14] We were unable to ascertain the date of adoption for seven localities.

[15] The only variable that seems to be different between communities with and without wetlands regulations is that 40.7 percent of the adults in communities with wetlands regulations have college degrees as opposed to 34.7 percent of the adults in communities without wetlands regulations. This may reflect greater environmentalism among the more educated or just the tendency of the more educated to adopt new regulations more quickly.

[16] Of the 187 communities in the dataset, 53 rely entirely on septic systems, 26 rely entirely on sewers; and 108 rely on sewers for some homes and on septic systems for the rest. About two-thirds of the cities and towns that are not entirely served by sewer systems have adopted septic regulations that exceed Title 5.

[17] Somerville technically has "subdivision regulations," but since they do not address the variables tracked in this study and do not resemble the other local regulations, they are not included in our sample.

[18] Examining MassGIS data on acres zoned in broad predominant use categories (e.g., low-density residential or industrial) in 1971, 1985, and 1999, we get a rough sense of changes in zoning from 1971 to the present. If there were massive changes in the relative portion of high-density residential areas to medium- or low-density areas within communities, then we might be concerned that our average minimum lot size measure was very inaccurate for many of the years in our sample. However, this does not appear to be the case. The fraction of residential land zoned with large minimum lot sizes (low-density residential) has, on average, increased by only 4 percent for the communities in our sample. Thus, while there is certainly some measurement error in our estimates, it does not appear to be substantial. Still, one might be concerned that changes in minimum lot size respond to changes in demand for housing (e.g., communities try and slow growth by increasing minimum lot size) which would bias the results. The data do not allow for a precise exploration of this concern, but there is no systematic relationship between permit growth in 1980-1985 and growth in low-density area between 1985 and 1999 (and there is only a very weak relationship with permit growth in 1980-1999).

[19] If we accept the acre/lot measure as causal, then this can be seen as the total effect of zoning on the housing stock. We are, however, concerned that zoning reflects omitted characteristics, and, as such, we believe that these regressions (like all of our regressions) should be interpreted warily.

[20] For this regression and all others in this section, we have checked the robustness of our results to the inclusion of additional controls.

Specifically, our results are essentially unchanged by including controls for if the community is on the coast, if the community contains a superfund site, the total acreage of forest in 1907, the total acres of water in 1971, acres for recreational use in 1971, total acres of undeveloped land in 1971, and percent of the community with greater than a BA in 1970.

[21] We also control for the logarithm of locality area. This implies that we are essentially measuring the density of the locality, and this regression is equivalent to one in which the logarithm of housing per acre is the dependent variable. The only difference between this regression and a regression where the logarithm of housing per acre is the dependent variable is that the coefficient on the logarithm of land area would equal the estimated value of β_1 from regression (2) minus one. The other coefficient estimates, especially the estimate of α would remain unchanged. Alternatively, since we are controlling for the logarithm of the housing stock in 1940, the regression can be interpreted as the impact of minimum lot size on the growth of the logarithm of the housing stock between 1940 and time t. Again, in this alternative specification, the estimate of α would remain the same.

[22] In our sample, only Cambridge, Medford, Newton, Waltham, and Wellesley meet this criteria.

[23] The functional form of our estimation means that the coefficient on acre per lot can be interpreted as the impact of minimum lot size on the logarithm of total permits, or the logarithm of permit per locality area or the logarithm of permits relative to the housing stock in 1940. As described above, alternative specifications that change the dependent variables by deflating for either the early housing stock or land area would have the effect of changing the estimated coefficients on the log of land area or the log of housing (i.e., by subtracting one from our estimated coefficients), but they would not change the estimated coefficient on acre per lot. As we are unsure if the most relevant specification is total permits, permits per acre or permits relative to the existing stock, this specification is quite appealing.

[24] These analyses exclude localities where we unable to establish the date that a rule was adopted.

[25] This is seen in specifications (7) and (8).

[26] These analyses exclude localities where we were unable to establish the date that a rule was adopted.

[27] According to the website for the Citizen's Housing and Planning Association, 33 of the 351 communities in the state have achieved the ten percent goal. In communities that do not meet the ten percent threshold, developers can seek "Comprehensive Permits" from the local Zoning Board of Appeals (ZBA) for developments with at least 20–25 percent of the units under long-term affordability restrictions. At least 25 percent of the units must be affordable to lower income households who earn no more than 80 percent of the area median income or 20 percent of the units to households below 50 percent of median income. In reviewing applications for Comprehensive Permits, the ZBA does not enforce local zoning, wetlands, septic, or other requirements (although all state regulations remain in force) and must have a compelling basis to reject the application. The methods used to calculate whether communities have met the ten percent threshold, it bears mention, are complex and controversial (see Euchner, 2003).

[28] Given the highly volatile estimates of the inclusionary provisions, we do not include them in the index.

[29] There is also still the conceptual question about whether supply controls in a given area will increase prices holding a full set of characteristics constant.

[30] We also excluded from these regressions cities and towns more than 30 miles from Boston, though it is worth noting that none of the previous results would have been much different had we excluded this outer ring of municipalities there too. We are still left with 54,950 observations in this regression.

[31] Indeed, somewhat paradoxically, long-term housing affordability might be best facilitated if the affordable housing requirements in these laws were dropped and developers were allowed to bypass local land-use regulations whenever a locality failed to meet a set of targets based on price, density, or new permits. This might spark a surge in supply that, in time, would push down prices.

[32] Such an approach would have to be carefully designed because federal and state courts view zoning and other forms of land-use regulation as an exercise of state police powers, which implies that it cannot and should not be sold (see Fischel, 1999).

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