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**Land Use Regulation and the Rental Housing Market:
A Case Study of Massachusetts Communities**

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Abstract

The effect of local land use regulations on housing markets has been the subject of extensive research and discussion among both urban economists and policymakers. However, very few studies distinguish between the effects on owner-occupied and rental housing. Since most low- and moderate-income families are renters, the effects of regulation on the rental market will have important implications for what is traditionally regarded as “affordable” market-rate housing. In this paper, I use a uniquely detailed dataset on local zoning in eastern and central Massachusetts to examine the extent, origins, and effects of regulations on the rental housing market. Results suggest that communities with less restrictive zoning issue significantly more building permits for both multifamily and single-family units and have lower prices of owner-occupied housing, but do not have significantly lower rents. However, the effect of regulations on rents may be confounded by the development of subsidized rental housing under the state’s affordable housing law.

Section 1: Introduction

The role of local land use regulations in rising housing prices has been the subject of extensive theoretical and empirical research by urban economists, as well as a topic of concern to policymakers and affordable housing advocates. However, very few studies distinguish between the effects on owner-occupied and rental housing. Although the majority of American households own their homes, most low- and moderate income households are renters, so the effects of regulation on the rental market have important implications for what is traditionally referred to as “affordable” unsubsidized housing. In this paper, I examine the extent, origins and effects of local land use regulations on the rental housing market in Massachusetts.

Massachusetts offers an interesting setting to test for regulatory impacts on rental housing. Rents in Massachusetts are quite high relative to other parts of the country; the median monthly contract rent in the Boston metropolitan area was \$727, well above the national average of \$519, and third highest among the ten largest PMSAs (after San Francisco and Washington, DC), according to the 2000 census. Yet new construction of rental housing is fairly scarce; as shown in Figure 1, 79 of the cities and towns the Boston metropolitan area issued no permits for new multifamily construction between 2000 and 2005, while another 57 issued permits for fewer than 50 units during the six-year period. The state’s legal environment and history are conducive to strict land use regulations, combining a strong tradition of home rule by local governments, aesthetic and cultural preferences for low-density housing consistent with the character of New England towns, and highly fragmented political authority across a large number of small cities and towns, each of which contains only a small fraction of the metropolitan area’s labor force and housing stock.

To analyze the effects of local land use regulations on Massachusetts’ rental housing market, I use a uniquely detailed dataset on local zoning in 187 cities and towns in eastern and central Massachusetts to construct multidimensional measures of regulatory stringency. I then estimate cross-sectional reduced-form regressions of the number of new housing permits, rents and prices on the regulatory measures, controlling for standard demand- and supply-side variables. Results suggest that communities with less restrictive zoning issue significantly more building permits for both multifamily and single family housing and have lower prices for owner-occupied housing but do not have significantly lower rents. However, the effect of zoning

on rents may be confounded by the development of subsidized rental housing under the state's affordable housing law.

In Section 2 of the paper, I briefly review the existing literature on the effects of land use regulations, with particular emphasis on studies that address the rental market. Section 3 describes the types of regulatory tools specific to rental housing and the determinants of the regulations; Section 4 outlines the empirical strategy and data; Section 5 presents regression results and Section 6 concludes.

Section 2: Existing literature

There is an extensive theoretical and empirical literature on the effects of zoning and land use regulation on land values, housing prices and housing supply. I provide a brief review of the most relevant general literature and a more detailed discussion of the relatively few papers that address the effects of regulations on rental housing specifically.

2.1 General Literature on Regulations

The theoretical basis for the effects of regulation on land values has been explored in a number of papers that modify the standard monocentric city model of land rents (see, for example, Capozza and Helsley 1989; Fujita 1982 and Wheaton 1982). Growth controls – such as greenbelts or urban growth boundaries – will drive up the value of developed land and existing housing prices by constraining the supply of land. Brueckner (1990) argues that the effect on the value of undeveloped land is ambiguous, although growth controls may delay the receipt of rents or reduce the allowable density, by reducing negative population externalities mild growth controls may raise total rents. More traditional types of zoning, such as minimum lot sizes, may reduce land values by lowering allowable density below the profit-maximizing point, but are likely to raise the price of finished housing by requiring high per-unit land consumption (Fischel 1985). Moreover, since such zoning encourages and strengthens Tiebout sorting, it is likely to lead to enclaves of high-income households with similar demand for high-quality public services; the quality of the services will be capitalized into higher land and house values (Gyourko and Voith 1997, Oates 1969, Stull 1974). In most of these studies, the mechanism by which regulations affect prices is by changing the underlying value of land. Since house prices are simply the capitalized stream of house rents, the models implicitly assume that

the effects of regulations on prices of owner-occupied and rental housing will be the same (barring any interactions between regulations and user cost of capital).

A considerable number of empirical studies have tested the effects of regulations on prices; although the magnitudes of the effects differ across studies, the majority of papers finds evidence that regulation increases prices and reduces the amount of new construction. Fischel (1990) provides a thorough review of the early empirical evidence. More recent papers have found increased prices both across submarkets within a single housing market (for example, Green 1999, Pollakowski and Wachter 1990) and across metropolitan areas (Malpezzi 1996, Glaeser and Gyourko 2001, 2002). A few studies have specifically tried to estimate the effects of regulations on supply elasticity and have concluded that, as expected, heavily regulated areas have lower levels of new construction and lower supply elasticities than less regulated metropolitan areas (Mayer and Somerville 2000, Green, Malpezzi and Mayo 1999).

2.2 Regulations and Rental Housing

A number of the empirical papers examining the effects of regulations on rents (and indeed, the literature on regulations in general) use California as an example; this likely reflects both the fact that California was one of the earliest states to see widespread adoption of local growth controls and the availability of relatively good data on such controls. In 1988, the League of California Cities surveyed cities and counties about their use of growth controls, and a follow-up survey was conducted in 1992. Using the 1988 data, Levine and Glickfeld (1992) find a positive correlation between the number of multifamily units permitted and the number of growth control measures adopted by a locality; since both variables are observed simultaneously; however, it is unclear which direction the causal arrow should go. In addition, cities and counties with more growth control measures are also more likely to have adopted some inclusionary housing provisions, but actually produced fewer affordable housing units. In a later analysis using both the 1988 and 1992 surveys, Levine (1999) finds that growth controls reduce the number of rental units and increase median rent, although he finds no statistically significant effect on quantity or prices of owner-occupied housing. It should be noted that the methodology used is fairly simple and suffers from endogeneity problems. More recently, Quigley and Raphael (2005) use the same survey data in a more sophisticated analysis, using predicted changes in local employment as an instrument for housing demand shocks to identify the effects

of growth controls on housing prices, rents and elasticity of supply. They find that the number of regulations is strongly positively correlated with rents, and that price elasticity of rental housing in regulated cities is much lower than in unregulated cities.

Besides the studies on California, several papers comparing rental housing markets across metropolitan areas also find effects of regulation. Green and Malpezzi (1996) conduct an exploratory analysis using several regulatory measures (primarily the Wharton data on state and MSA-level regulations and the share of land unavailable for development) and conclude that restrictive regulations drive up both rents and housing prices. They point out that restrictions on any type of new construction – not just low-cost housing – will reduce the supply and increase the price of low-quality, low-cost housing. An explanation of the mechanism by which restrictions on new construction reduce the affordable housing stock is offered by Somerville and Mayer (2002), who seek to identify how regulations (impact fees, growth controls and rent control) change the probability that individual rental units filter into or out of the affordable housing stock. They find that the likelihood of an affordable unit “filtering up” and becoming unaffordable increases with the presence of growth controls and impact fees, as well as a low overall elasticity of housing stock. The findings on rent control are more surprising; affordable uncontrolled units in neighborhoods with a high proportion of rent controlled stock are less likely to filter upwards, although this may reflect selection bias from poor quality housing or negative externalities from the presence of poorly maintained rent-controlled properties. In any case, given the relative scarcity of rent control compared to other forms of regulation, these findings are less relevant for the larger debate. In one final paper of note, Quigley and Raphael (2004) examine the role of regulations as one of several possible hypotheses for changes in rent burdens and the share of affordable rental stock over the past 40 years. They conclude that much of the change in the number of affordable units is due to changes in housing quality, some of which is likely driven by demand (such as the addition of plumbing and kitchen facilities), but that more recent improvements probably reflect minimum quality (or quantity) standards set by government regulations. Moreover, they point out that the prices and rents of constant quality housing have been rising, consistent with the theory that regulations constrain new supply.

2.3 Questions for Future Research

Overall, the literature on land use regulations and rental housing suggests that regulations contribute to lower levels of construction, higher rents, and a decrease in the supply of low-cost, low-quality rental housing that constitutes the unsubsidized portion of the affordable housing stock. However, several important areas of research on the relationship between regulations and rental housing have not yet been addressed. First, most of the formal theoretical literature does not attempt to distinguish between rental and owner-occupied markets, and most treat “regulation” as a monolithic object, rather than the highly varied set of tools that actually comprise current zoning. Theoretical papers that identify potential differences in the effects of regulations on rental and for-sale housing – particularly while considering the various forms of regulation, such as spatial growth controls and conventional zoning – would be a valuable addition. Second, very little attention has been paid to the difference between formal “on-the-books” regulations and informal policies or implementation (one exception is Landis 1992, who suggests that implementation matters but does not empirically test for it, see also Sims and Schuetz 2006 for a discussion of wetlands regulations). Many of the growth controls surveyed in the studies of California, or the general zoning requirements included in the Wharton regulatory data, could apply to either rental or owner-occupied housing. But given some of planning literature on opposition to low-income housing, it is reasonable to ask whether local governments choose to apply or enforce regulations differentially by the tenure of proposed developments. Similarly, it would be interesting to know to what extent regulations are applied differently to luxury rental housing versus more standard projects. If we accept the premise that reducing barriers to new construction of any type increases the likelihood that older existing housing will filter down into the affordable stock, this suggests that encouraging the development of luxury rental housing, which may be politically more feasible, can have substantial positive results for the supply of affordable rental housing as well.

Section 3: Extent and Determinants of Rental Housing Regulation in MA

Cities and towns in Massachusetts have a wide variety of tools available to regulate rental housing, and the type and stringency of regulations they choose reflects historical characteristics and interests. Data on regulations are taken from the *Local Housing Regulation Database*, which contains detailed information on local zoning bylaws/ordinances and other forms of local land

use regulation used by 187 cities and towns in eastern and central Massachusetts as of 2004. The database covers cities and towns within a 50 mile radius of Boston but excludes Boston itself; the area corresponds roughly, but not exactly, to the Boston-Worcester-Lawrence CMSA.¹

Zoning bylaws (and other forms of local land-use regulation) rarely distinguish between owner-occupied and rental housing – traditionally zoning regulates uses by structure type rather than tenure. Thus as a proxy for regulation of rental housing, in the remainder of this paper I focus on zoning specific to multifamily structures. Rental housing is most likely to be in multifamily buildings; as of 2000, approximately 64% of the rental units in the metropolitan area were in multifamily structures, as shown in Table 1. Most new construction intended for rental housing is multifamily; over 70 percent of the rental units added between 1990 and 2000 were in multifamily buildings. Although two-family structures make up about one-fifth of the current rental stock, only about half of two-family structures are rented, while nearly 80 percent of multifamily units are rented. In a few communities, single-family detached units make up a significant fraction of the rental stock, as shown in Figure 2; most of these are communities with a small absolute number of rental units.

3.1 How Do Cities and Towns Regulate Rental Housing?

The ways in which rental housing is allowed, regulated and restricted are as numerous as the jurisdictions themselves. The most commonly used tools in Massachusetts are restrictions on the amount of land zoned for multifamily; procedural barriers to development; dimensional requirements; and resident age restrictions. In addition, the state’s affordable housing law, which enables developers to override local zoning, is frequently used to develop rental/multifamily housing.

At the most basic level, zoning bylaws divide municipalities into “districts” and enumerate the uses that are allowed in each district. Cities and towns can most directly constrain rental housing by restricting the amount of land on which rental-appropriate structures can be built. In most communities, relatively little land is zoned to allow multifamily housing, townhouses or accessory apartments compared to the amount of land available for single-family houses which are typically owner-occupied. As shown in Figure 3, 70 percent of cities and

¹ More information about the methodology used to develop the database can be found at www.pioneerinstitute.org/municipalregs/.

towns allow single-family housing on at least 80 percent of their land, while over 60 percent of communities allow multifamily on less than 20 percent of their land area.

The second way in which municipalities restrict rental housing is to create procedural barriers to development, most commonly by requiring special permits. Whereas development of single-family structures in conventional subdivisions – by far the most typical form of owner-occupied housing – is generally allowed “as of right”, most multifamily development in Massachusetts is allowed only by special permit. The specific requirements for obtaining a special permit – and thus the difficulty of obtaining the permit – vary considerably across communities, but in general the process gives local government agencies and town residents a great deal of discretion to allow projects on a case-by-case basis. In some communities, the special permit granting process is relatively straightforward and predictable (at least to developers who have existing relationships with the Zoning Board of Appeals or other Special Permit Granting Authority), in other communities the special permit process essentially sets up a negotiation under which the developer can offer infrastructure upgrades or design concessions in exchange for obtaining the permit, and in other cases the process appears to be so difficult or uncertain that it may discourage developers even from applying for permits. Unfortunately there are no readily available data on approval rates of permit applications or length of time from application to permit that would enable researchers to quantify the difficulty of the process. Requiring special permits for multifamily development is relatively recent in Massachusetts zoning history; the process emerged in the 1970s after a revision of the state’s zoning enabling law, Chapter 40A (Schuetz 2006). As Figure 4 shows, just under one-third of communities still allow some multifamily to be developed as of right while approximately half allow multifamily only by special permit.²

Zoning regulations also establish dimensional requirements for multifamily housing, as for other types of land uses. The most common requirement for residential uses, the minimum lot size, often restricts multifamily housing to low densities more comparable to single-family developments. As shown in Figure 5, although communities are more likely to allow multifamily than single family on moderately-sized lots (under 30,000 square feet), they are also more likely to require very large lots (over 75,000 square feet) for multifamily than single family

² These calculations include communities that allow multifamily only as part of cluster or planned unit development, both of which require special permits for the entire project.

housing. Beyond minimum lot sizes, towns may have other dimensional or physical requirements that make multifamily development quite onerous, such as building height caps, FAR restrictions or a high number of parking spaces per unit. If multifamily is allowed under cluster zoning provisions, the minimum lot size is generally relaxed but the regulations impose requirements for minimum parcel size and the percent of total parcel preserved as open space.

A more subtle form of regulation that can apply to both rental and owner-occupied housing and is intended to reduce the fiscal burden from new development is the use of resident age restrictions. A trend which emerged in the late 1990s and has become especially popular in the past five years, such provisions allow development of multifamily housing only if occupants meet a minimum age requirement (usually 55). Often such housing is intended as part of a larger planned retirement community, including age-restricted single family housing, assisted living and community facilities.³ Approximately one-third of the communities surveyed have some provision for age-restricted multifamily and eight municipalities allow multifamily only if it is age-restricted. Although no data are available on tenure rates within age-restricted multifamily, anecdotally it appears that these units are more likely to be condominiums than non-elderly new multifamily developments. For this reason, the analysis in Section 5 will exclude districts that allow only age-restricted multifamily housing.⁴

Given the layers of complex regulations required to develop multifamily housing under conventional zoning, many developers in Massachusetts choose to bypass local zoning and develop rental housing using the state's Low- and Moderate-Income Housing law. Adopted in 1970, the "Anti-Snob Zoning Act" or Chapter 40B allows developers to apply under an expedited process for a permit to build housing that does not conform to local zoning, if a minimum percentage of the housing units are affordable to low- and moderate-income households. If the developer's application is denied by the local Zoning Board of Appeals, the state Housing Appeals Committee can override the Board's decision and order the issuance of the permit (Massachusetts Department of Housing and Community Development 2004). Chapter 40B is sometimes used by not-for-profit organizations to develop projects that are entirely affordable (usually including state or federal subsidies), but it is also frequently used by for-

³ The more recent type of age-restricted multifamily is almost exclusively market-rate, compared to earlier provisions for elderly-only low-income housing, such as HUD's Section 202 subsidy program.

⁴ Excluding districts with only age-restricted multifamily makes very little difference to the measures of regulation described in Section 3.2 below, and so is unlikely to alter the regression analysis by much. Future versions of this paper will include robustness checks using both measures.

profit developers who wish to build at higher densities than would be allowed under conventional zoning. In such cases, the developers use internal cross-subsidies from the market-rate units to offset the losses from the affordable units; the state law essentially serves as the lever to develop higher density market-rate rental housing. Unfortunately, there is no complete and accurate inventory of the housing that has been built under Chapter 40B, so it is difficult to assess either the effectiveness of the state law or the true effects of conventional zoning.⁵ I will discuss some of the potential problems caused by this for my analysis in Sections 5 and 6.

3.2 Measuring the Stringency of Regulation

As indicated by the previous description of zoning tools, local regulation of rental housing in Massachusetts is both varied and complex. The complexity creates a challenge for quantitative research: how can regulation be measured consistently and objectively across jurisdictions to allow systematic analysis of its effects? Although it is impossible to create measures that capture every nuance and layer of zoning bylaws, I have developed measures which reflect the three dominant tools affecting rental housing: the amount of land zoned to allow multifamily housing, the procedural requirement of special permits, and the minimum lot size (Schuetz 2006). For purposes of this paper, I define multifamily as new construction of a residential structure with three or more dwelling units.⁶ For each of the 186 cities and towns⁷, I calculate the maximum number of multifamily lots that could potentially be developed under current zoning by dividing the land area of each zoning district allowing multifamily by the minimum lot size in that district, then aggregating across all districts, as shown in the equation below:

$$NumberLots = \sum \frac{Area_i}{LotSize_i}$$

⁵ The state Department of Housing and Community Development maintains the Subsidized Housing Inventory dataset, a list of completed 40B projects that are self-reported by towns, and a dataset on planned projects that have entered the development pipeline since roughly 2000. However, both datasets are incomplete and the information contained in them is inconsistent at best.

⁶ I chose three-unit structures as the cutoff rather than five units because of the frequency of “triple-deckers”, structures with three apartments each occupying a floor. Multifamily housing allowed by conversion of existing structures (either subdivision of single-family houses or conversion of non-residential structures) is excluded because such units are not counted in the Census Bureau’s data on new construction residential permits.

⁷ The city of Lowell is excluded from the analysis because the land area of its zoning districts was not available.

I calculate the measure for multifamily lots allowed by right, by special permit, and by any process. As shown in Figure 6, even communities that allow some multifamily by right have very few potential lots zoned; only 16 percent of communities allow more than 500 potential lots by right. By contrast, about half of the cities and towns have zoned more than 500 potential lots by special permit, and 11 percent allow more than 10,000 potential lots by special permit.

3.3 What Determines Stringency of Rental Housing Regulation?

Since zoning regulations are adopted through the local political process, the stringency of zoning surely reflects the characteristics and motivations of local residents. Most of the theoretical literature assumes that zoning is driven by “exclusionary” motives of affluent suburban jurisdictions, but few studies attempt to test empirically for the role of such motives. In this section I discuss and present empirical results for several hypotheses on the local interests and characteristics that affect stringency of zoning, particularly the influence of exclusionary motives, the type of municipal government, historical composition of the housing stock and incentives under the state’s affordable housing law.⁸

The most commonly mentioned hypothesis behind restrictive zoning is that residents prefer to live with neighbors of the same social class or race, so that affluent or largely white suburbs will seek to exclude lower-income households and people of color through restrictive zoning. A related version is that current residents are concerned that multifamily housing will increase demand for schools and other public services without generating sufficient property tax revenue to offset the cost of these services. If so, communities with little commercial development that are more dependent on residential property taxes may be more concerned about the fiscal impact of multifamily dwellings. I test whether the restrictiveness of multifamily zoning is related to a community’s wealth (indicated by median rent or the share of population with college/graduate degrees), demographics (share of native-born population), fiscal composition (ratio of jobs to population) and proximity to urban centers.

The second hypothesis I test is whether the type of municipal government affects the degree to which pro-growth and anti-growth interests can influence regulations. The town meeting form of government may be more influenced by homeowners who are often hostile to

⁸ This section is adapted from an earlier paper, “Guarding the Town Walls: Mechanisms and motives for restricting multifamily housing in Massachusetts.” The full paper can be found online at http://www.jchs.harvard.edu/publications/governmentprograms/w06-3_schuetz.pdf.

multifamily development, while city councils may be more influenced by businesses and other interests favorable to development. Therefore I examine whether communities governed by city councils are less restrictive than those governed by town meetings.

Third, zoning for multifamily dwellings may be influenced by the historical composition of the housing stock, prior to the adoption of the first zoning bylaw. If so, multifamily structures are more likely to be allowed in communities that had already developed some multifamily prior to zoning. Using the density of existing housing in 1940, I test for correlations between zoning stringency and pre-zoning composition of the housing stock.

The final hypothesis to be tested is whether the state's adoption of Chapter 40B in 1970 encouraged municipalities to relax their zoning to accommodate a limited amount of affordable housing. Developers can only invoke the state law to override local zoning if less than 10 percent of the existing stock meets affordability criteria. If Chapter 40B changed local incentives, we would expect to see communities with little land zoned for multifamily as of the law's adoption in 1970 (that is, little land zoned for multifamily by right) allowing more multifamily by special permit thereafter.

To test these hypotheses, I regress two measures of multifamily housing regulation described above – the potential number of multifamily lots allowed, by right and by special permit – on historical municipal characteristics. Because zoning bylaws adopted in the 1940s and 1950s allowed multifamily by right, the number of by right lots are regressed on characteristics as of 1940, while the number of special permit lots are regressed on 1970 characteristics. The general form of the regressions is shown below.

- (1) *Number of by right lots₂₀₀₄ = f (Rent₁₉₄₀, Job-to-pop₁₉₄₀, Percent native-born₁₉₄₀, Distance to satellite city, Housing density₁₉₄₀, City council)*
- (2) *Number of special permit lots₂₀₀₄ = f (Percent BA₁₉₇₀, Job-to-pop₁₉₇₀, Percent native-born₁₉₇₀, Distance to satellite city, Predicted share by-right land₁₉₇₀, City council)*

Results suggest that regulation of multifamily housing in Massachusetts occurred in two distinct waves, each of which used a different mechanism and was shaped by different determinants, as shown in Table 2. Under regulations adopted in the 1940s and 1950s,

multifamily housing was either allowed by right or prohibited altogether. Early zoning bylaws seemed to be driven by historical precedent and market forces rather than the desire to exclude lower-income households. Communities with a highly dense housing stock prior to the adoption of zoning, higher rents and a city council form of government tended to be less restrictive.⁹ Towns with low-density housing in 1940 were generally agricultural communities with below average rents rather than wealthy suburbs, so wealth does not appear to have constrained density prior to the adoption of zoning. The second wave of regulations in the 1970s led to expanded use of special permits to allow multifamily housing. In this wave, exclusionary motives were more important; smaller, more affluent communities were more restrictive of multifamily housing. The results also indicate the influence of Chapter 40B, since communities with little land zoned for multifamily prior to 1970 generally allow more multifamily by special permit. The hypothesis that predominantly white communities would be more restrictive of multifamily development could not be tested because there was relatively little variation in the racial composition of the communities.

Section 4: Empirical Strategy and Data Description

To identify the effects of local zoning on rental housing markets in Massachusetts, I develop a cross-sectional reduced form model of housing outcomes, controlling for standard demand and supply determinants. The general form of the model is described below:

$$Rents_{i2000}/Permits_{i2000-05} = \beta_0 + \beta_1 R_{i2004} + \beta_2 D_{i2000} + \beta_3 S_{i2000} + \epsilon_i$$

where R_i is a measure of regulatory stringency, D_i is a vector of housing demand variables, and S_i is a vector of housing supply determinants, and ϵ is a municipality-specific error term. Table 3 gives data sources and brief descriptions of each variable.

The primary dependent variables are median contract rents in 2000 and the total number of multifamily housing permits issued from 2000 to 2005. I also include the median value of owner-occupied housing in 2000, total single-family permits from 2000 to 2005, and the ratio of total multifamily permits (2000-05) to housing units in 2000. Using median contract rents, as reported in the 2000 Census, is a slightly problematic measure of true rents

⁹ Although the coefficient on rent is not significant on the number of potential lots, shown in Column 2, higher rents are associated with significantly smaller minimum lot sizes, an intermediate component of the potential lots measure.

since it does not account for differences across towns in rental housing quality. Several recent papers (Malpezzi, Chun and Green 1998, Quigley and Raphael 2004) have constructed hedonic price indices using household-level data from the Public Use Microdata Samples (PUMS), which have the advantage of allowing researchers to compare the rents and prices of constant-quality units across geographic areas. This methodology assigns housing units in each Public Use Microdata Area (PUMA) to each political jurisdiction within the PUMA and adjusts the housing weights by the proportion of housing in the PUMA contained in that jurisdiction. The hedonic regressions thus calculate a unique set of coefficients, and a unique predicted rent for a constant-quality unit, for each PUMA. Unfortunately, the limitations of the geographic identifiers prevent me from using this methodology to construct hedonic indices for cities and towns in my sample, essentially within one CMSA.¹⁰ For the 187 regulating jurisdictions in my dataset, there are only 38 PUMAs, producing only 38 uniquely predicted rents for the same quality housing unit; this leaves too little variation in the dependent variable to identify the effects of regulations. Implications of using non-quality adjusted rent measures will be discussed further in the conclusions.

As indicators of regulatory stringency, I use predicted values of the three measures described in Section 3.2: the number of potential multifamily lots that could be developed in a city or town, by right, by special permit or by any process. Although it appears naïve to look for effects of regulations in place as of 2004 on housing market outcomes from concurrent or earlier dates, the timing of the regulations is not as problematic as it first seems. Municipalities can and do amend their zoning bylaws frequently but most revisions are fairly minor (adding or changing a definition, procedural requirements, etc.). The fundamentals of zoning bylaws – such as the establishment of zoning districts or the uses allowed in those districts – are altered very rarely, perhaps once every 20 to 30 years, since major revisions (particularly those that necessitate the zoning map to be redrawn) require a significant investment of time and resources from local government officials. Since my measures of regulation rely on district areas and established uses, it is reasonable to assume that measures have been quite stable for at least the past five years. The component of my regulation measures that is most likely to have changed is the allowable minimum lot size; anecdotally we know that towns have been downzoning (increasing

¹⁰ Since the cities and towns in the regulation database were chosen on proximity to Boston rather than demographic or economic variables, the sample does not exactly correspond to the Boston-Worcester-Lawrence CMSA, but it is quite close.

lot sizes) for single-family homes during past 10 to 15 years, but it is unclear whether similar trends apply to multifamily lot sizes. As discussed in Section 3.3, much of the zoning related to multifamily housing dates from either the 1940s or the 1970s, and since much of the land zoned for multifamily has already been developed, it seems probable that multifamily zoning has been revised less recently than single-family uses.

Moreover, since I have identified several of the key determinants of regulations, I can predict current (2004) regulations as a function of historical municipal characteristics, conceptually similar to an instrumental variables estimation, thereby alleviating concern over endogeneity due to timing. Using specifications shown in Columns 2 and 4 of Table 2, I predict the number of potential multifamily lots allowed by right and by special permit, and sum them to calculate the total potential lots. A second methodological concern that is resolved by using predicted rather than observed values of regulations is truncation of values at zero. As shown in Figure 6, a large number of communities are clustered at zero on the measures of regulation; they cannot zone a negative number of lots, although their true underlying preferences may be less than zero. Using left-censored data on the regulations is likely to bias the coefficient estimates towards zero. A comparison of results using observed and predicted values is shown in Appendix A. One of the dependent variables – the number of multifamily permits – is also left-censored at zero; I correct for this by using tobit models and show a comparison of the results in Appendix A as well.

In addition to measures of regulation, my models control for standard demand- and supply-side housing determinants. The vector of demand-side variables includes the distance to Boston, the share of the population with a BA degree or higher (a measure of permanent income), and demographic characteristics, including age distribution, the share of foreign-born and the share of non-Hispanic whites in the population. I am unable to control for another typical indicator of housing demand, the quality of local public schools (measured here by scores on Massachusetts Comprehensive Assessment System tests), because it is almost perfectly correlated with the measure of permanent income. Controls for housing supply include three measures of land availability: a dummy variable indicating that less than 20 percent of the land area is undeveloped,¹¹ the total land area, and the population density. The other two inputs into housing supply – labor and materials – are not relevant, since all the cities and towns in my

¹¹ Undeveloped land is defined here as land in cropland, pasture, woody perennial, open land and forest.

sample are within essentially the same metropolitan area, so the costs are unlikely to vary much across jurisdictions. As an indicator of existing housing capacity, I include the share of existing stock in multifamily buildings in the regressions on new multifamily construction. To account for differences in the quality of the rental stock, in the rent regressions I include two somewhat crude measures of housing quality, the share of rental housing built before 1950 and the median number of rooms in rental units. Finally, I include a dummy variable for the city of Worcester, which is an extreme outlier on the regulation measures. Worcester is by far the largest city in the sample, with a population approximately four times larger than the next largest community, and allows roughly six times as many potential multifamily lots as the number allowed by the next in line. A comparison of the results with and without the dummy variable is shown in Appendix A.

One methodological problem that I cannot correct at the moment is the confounding influence of development under the state's affordable housing law, Chapter 40B. From interviews with developers and town officials, it is apparent that a substantial fraction of the rental housing built in Massachusetts (especially in affluent suburban communities) is developed under the 40B process and would not be permitted under conventional zoning. This causes problems for my analysis on both permits and rents. First, some communities that technically do not allow multifamily housing have issued permits for multifamily units, almost certainly under 40B. Second, if a significant portion of the rental stock in restrictive communities is affordable housing built under 40B, the rents in those highly restrictive places will be artificially low, reflecting the subsidies attached to the units. Both circumstances will tend to bias the estimated effects of the regulations on permits and rents towards zero. Unfortunately, given the available data, I cannot separate out development under conventional zoning from projects built by overriding zoning, or even identify with certainty which communities have had 40B projects.

Section 5: Effects of Regulations on New Housing Construction and Rents

5.1 Regulations and New Construction

Table 4 presents the results of regression analysis of the relationship between regulations and new construction. In brief, the number of new multifamily housing permits increases with the number of potential lots that could be developed under existing zoning, controlling for standard determinants of housing demand and supply. The results are significant for lots allowed

by special permit, but not for lots allowed by right. Cities and towns with less restrictive zoning allow not only a larger absolute amount of new construction, but more new development relative to their existing housing stock. Communities that are less restrictive of multifamily housing also issue more single-family permits, suggesting that regulation of rental housing may be indicative of the overall regulatory environment.

Column 1 presents results for a basic model of new multifamily construction as a function of standard demand and supply influences, excluding any measure of regulation. As would be expected, the number of multifamily permits decreases with distance to Boston, since land values should decrease as we move farther from the central business district. More affluent communities (indicated by the share of the population with a college or graduate degree) issue fewer permits for multifamily, although the coefficient is only significant at the 10 percent level and becomes insignificant when the measures for total potential lots and potential lots by special permit are added to the regression (shown in Columns 3, 5, 6 and 7); not surprisingly, wealth and zoning restrictiveness are positively correlated. As expected, the number of permits increases with land area, since more land is available for new construction. Communities with little undeveloped land also permit more multifamily housing, perhaps to make better use of scarce land. And the number of multifamily permits increases with the share of existing housing stock in multifamily, suggesting persistence in the composition of new construction over time. None of the coefficient estimates on demographic controls – percent children, foreign-born, or non-Hispanic white population share – are statistically significant. Since the jurisdictions in the sample are mostly suburban communities, they tend to be demographically quite homogenous.

The models in the remainder of Table 4 test the relationship between the amount of new multifamily construction and zoning restrictiveness. As shown in Column 2, communities that have less restrictive regulations do permit more new construction of multifamily housing; an increase of 1000 potential multifamily lots is associated with an 18.4 percent increase in multifamily units permitted, based on a simple bivariate regression. Adding demand and supply controls reduces the significance level to ten percent but does not change the magnitude of the effect by much, shown in Column 3; 1000 additional lots are associated with a 19.5 percent increase in permits, controlling for housing demand and supply determinants.

Models 4 and 5 test the measures of regulation that incorporate procedural requirements. As shown in Column 4, the relationship between by-right lots allowed and new multifamily

permits is not statistically different from zero. Although it might seem that towns are more likely to grant building permits if they allow multifamily by right, anecdotally it appears that most of the land zoned for by right development has already been built out. At a minimum, it would require costly redevelopment, and in many cases the land has already been fully built to capacity so that even redevelopment would not yield additional units. The coefficient on the number of potential lots allowed by special permit, shown in Column 5, suggests that an increase of 1000 lots is associated with a 26.5% increase in multifamily permits issued. The mean number of permits issued over the 5 year period is about 74, so a 27 percent increase would be about 20 more permits over 5 years, not an enormous number in absolute terms. Not only do less restrictive communities allow a larger absolute amount of new multifamily construction, they allow more construction as a share of existing housing stock. As shown in Column 6, an increase of 1000 multifamily lots allowed by special permit is associated with 0.026 permits per existing housing unit in 2000.

The final column in Table 4 tests whether the amount of single-family new construction varies by multifamily regulations. Interestingly, the relationship between potential multifamily lots allowed by special permit and number of single-family permits is also positive and statistically significant, although the magnitude is much smaller than that on multifamily permits. Each additional 1000 potential multifamily lots allowed by special permit is associated with a 9.2 percent increase in single-family permits, holding other factors constant. Since regulation of multifamily housing should have no direct influence on single-family construction, this suggests that the measure of multifamily zoning may be indicative of the overall regulatory stringency in the community. Some towns also define “multifamily housing” in their zoning to include townhouses, which the census bureau’s construction statistics define as single family. Nonetheless, it seems reasonable that some communities may be generally less restrictive in their zoning of both rental and owner-occupied housing.

5.2 Regulations and the Cost of Housing

Table 5 shows the results of regression analysis on the relationship between rents and regulations. The results on rents are more ambiguous than those on permits; although some specifications indicate that rents decrease with less restrictive regulations, most

coefficient estimates are not significantly different than zero and do not align closely with the results on new construction.

The first column of Table 5 shows results of the basic model, without measures of regulation. Rents decrease with the distance to Boston, consistent with the monocentric city model. Rents are increasing with education or affluence of residents; this could indicate higher willingness to pay, a social premium to living in wealthy community, or higher quality public services (the share of population with college and graduate degrees is almost perfectly correlated with measures of MCAS scores). Rents are also increasing in the share of the population that is white, non-Hispanic. The positive and significant coefficient on the share of foreign-born may indicate that presence of immigrants increases demand for rental housing (compared with the negative sign on price of owner-occupied housing, although that is not significant). Communities in which less than 20 percent of the land is undeveloped have higher rents, although the coefficient is only weakly significant. Rents also rise with improved housing quality; relatively new rental stocks and larger units are associated with higher rents.

The results indicating the effects of regulations on rents are somewhat ambiguous. A simple bivariate regression of rents on multifamily lots allowed (Column 2) does suggest that stringency of regulation matters; an increase of 1000 potential multifamily lots is associated with a 0.4% decrease in rents, statistically significant at the five percent level. However, when demand and supply controls are added, the coefficient becomes positive and statistically insignificant, shown in Column 3. As with the results on new construction, testing the effects of lots allowed by right and by special permit yields different results, although in the opposite direction of the results on permits. As shown in Column 4, allowing 1000 more potential multifamily lots by right is associated with a one percent decrease in rents, although the coefficient is not statistically significant. However, the coefficient on potential lots allowed by special permit is positive, although very small in magnitude and not statistically distinguishable from zero, shown in Column 5. These results are somewhat puzzling when compared with the results on permits; if allowing more multifamily by special permit leads to increased multifamily construction, why would there be no discernible difference in rents?

Two characteristics of the rental market in Massachusetts could be confounding the effect of the regulations. First, the geographic sample being examined includes a number of towns that have virtually no rental housing stock, in both absolute and relative terms, so that median rents

for those communities may reflect idiosyncratic characteristics of individual developments. The thinness of the rental market in these towns is particularly problematic in light of the state's affordable housing law, Chapter 40B; if communities with highly restrictive zoning have a small number of rental units, all of which were developed with subsidies under Chapter 40B then rents will be artificially low in these towns. Since I do not have reliable data on development under 40B, I cannot directly test for the relationship between subsidized housing and overall rents.¹²

The models shown in the final two columns of Table 5 examine the relationship between the multifamily regulation measures and prices of owner-occupied housing. The coefficient estimates on potential lots allowed by special permit appear to coincide with the results on single-family permits in Table 4. Communities that allow more multifamily by special permit have lower single-family housing prices, as might be expected of places that issue more single-family permits. It could be that communities that allow more multifamily are expanding their housing stock sufficiently to take pressure off single-family prices, or it may be that zoning restrictiveness of multifamily housing is indicative of general zoning stringency, along dimensions that affect owner-occupied housing more directly. The coefficient estimate on number of potential by-right multifamily lots is negative as well, although not statistically significant.

Section 6: Conclusions

Overall, the analysis of the relationship between multifamily housing regulation and rental market outcomes is suggestive that regulations are constraining the development of new rental housing, but some puzzles remain unanswered. The results on permits provide reasonable evidence that communities that allow more potential multifamily lots by special permit develop more new multifamily housing, both in absolute numbers of permits and as a share of the existing housing stock. Allowing more potential multifamily by right does not seem to affect new construction, probably reflecting the fact that most land zoned for by-right multifamily has long since been built out to capacity. The results also indicate that communities that are less restrictive of multifamily housing issue more single-family permits, suggesting that stringency of regulation across housing types may be correlated.

¹² In robustness checks, I included the state's estimated count of 40B units in regression models; none of the coefficient estimates were close to significant, but it is impossible to know whether this reflects the true relationship or the poor quality of the data.

A puzzle emerges from the results on rents, however: less restrictive communities do not appear to have significantly lower rents. If the results on permits are correct, why is increased construction not reflected in lower rents? I offer several possible explanations for these results, three of which are essentially technical problems with the analysis, while the fourth reflects a more fundamental operation of housing markets.

One possible explanation is the weakness of measuring rents using median contract rents for the community. Rents reflect not only town-level characteristics that I have controlled for in the regression analysis (proximity to employment centers, demographics, local public services and land availability), but unit-specific characteristics, such as size and construction quality. However, unit-level data on rents and characteristics are not available at the city/town level, and the probabilistic matching process from AHS or PUMS data used to construct hedonic rent indices across MSAs is not effective within a single MSA. I include somewhat crude controls for housing quality, the share of rental housing built before 1950 and the median number of rooms per rental unit, but it is possible that underlying differences in quality across towns could still be driving rent differentials.

A second potential problem with the analysis, which unfortunately cannot be corrected at this time either, is the influence of Massachusetts' Chapter 40B law. Ideally, I would be able to net out units developed under Chapter 40B (or other subsidized housing programs) from the analysis, to examine the effect of zoning only on housing units constructed in accordance with conventional zoning. The lack of a complete, accurate inventory of projects and units developed under Chapter 40B is a serious problem for housing researchers in Massachusetts; at least one effort is currently underway to survey communities in the Boston metropolitan area about their experiences under Chapter 40B that may enable better analysis in the future. It should also be possible to include measures of other forms of subsidized housing, such as low-income housing tax credit developments, in future versions of the analysis.

Third, the measures of regulation that I use – although considerably more comprehensive and nuanced than measures used in many of the empirical studies to date – may not fully capture cross-sectional differences in regulation. In particular, I cannot determine the true difficulty of the procedural barriers required to obtain a special permit. Since we know anecdotally that the likelihood of securing a special permit varies widely across communities, my measures may have a high ratio of noise to signal on the true strength of regulations. If

that is true, however, it is surprising that the estimates on building permits reflect a fairly strong relationship to the regulatory measures.

The final possible explanation addresses a more substantive question on the operation of the rental market. While the data on permits can pick up highly localized effects of regulations, it is possible that the effects of regulations on rents are more diffuse, as suggested in Glaeser, Schuetz and Ward (2006). That is, constraining multifamily development in one community should reduce the permits issued in that town, but a reduction in overall supply may increase rents not only in the highly restrictive town, but in its less restrictive neighbors as well. Alternatively, the lack of rent differentials may reflect relatively elastic demand for rental housing. Renters face lower transactions costs from moving across communities within a single housing market than homeowners and may be less willing to pay for some of the location-specific benefits that are capitalized into house prices (for instance, renters are less likely to have children and thus may care less about school quality), making it difficult for landlords to extract higher rents in restrictive communities. These general equilibrium effects could explain why my results do not show significant rent effects across communities within a single metropolitan area, which have previously been found in many of the empirical studies across multiple distinct housing markets (or of single-family prices within a single market). My analysis cannot rule out the possibility that zoning bylaws that constrain the development of rental housing in specific towns have contributed to higher rent levels in Greater Boston and Massachusetts more generally.

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Figure 1: Little New Multifamily Housing Construction in Massachusetts, 2000-05

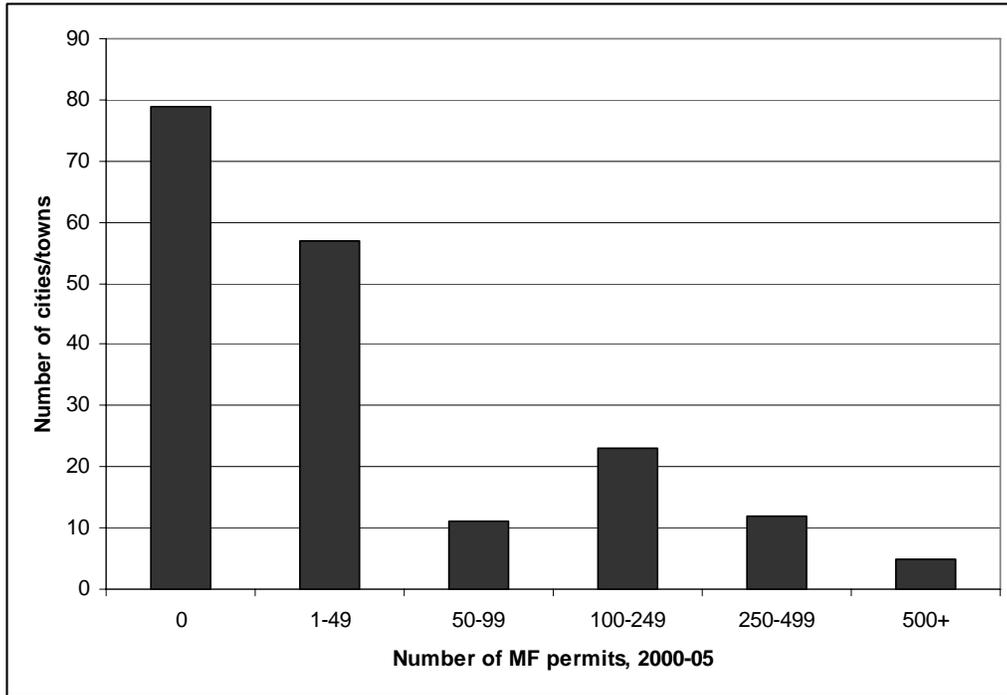


Figure 2: Non-multifamily Share of Rental Housing Stock, 2000

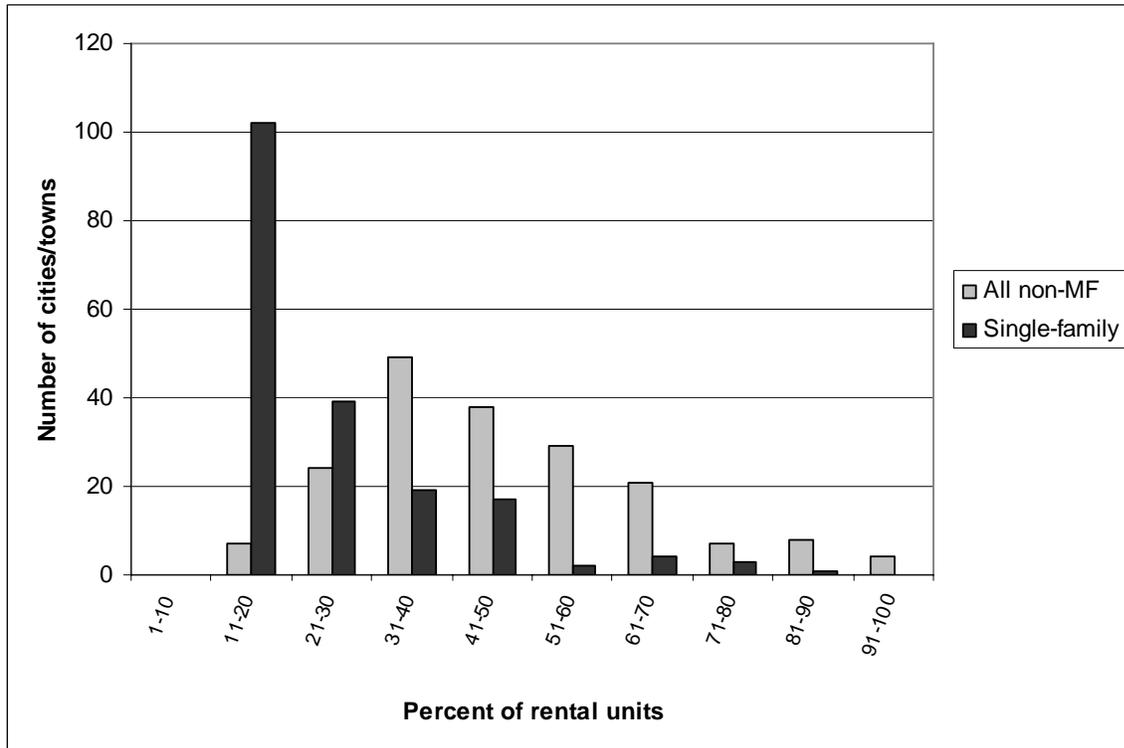


Figure 3: Land Zoned For Single-Family and Multifamily Housing (2004)

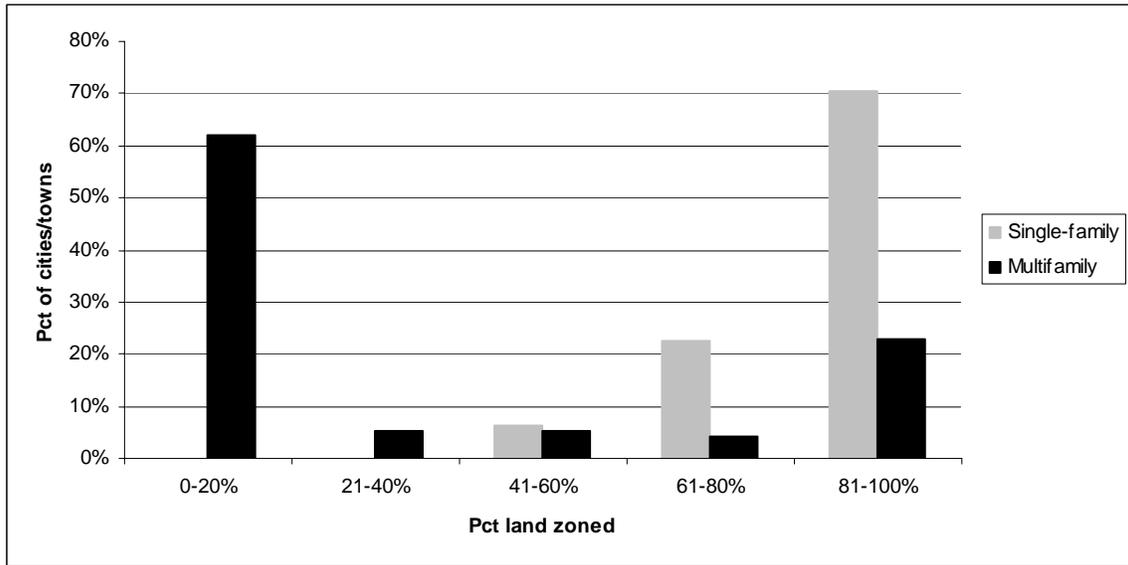


Figure 4: Procedural Requirements for Developing Multifamily Housing (2004)

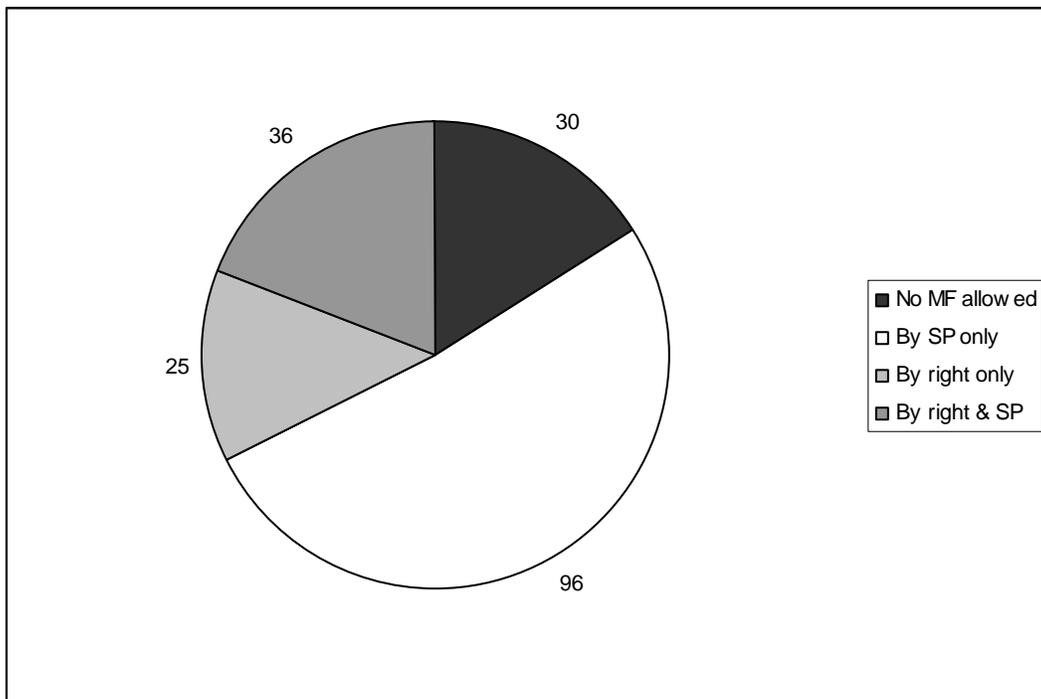


Figure 5: Minimum Lot Size Requirements for Single- and Multifamily (2004)

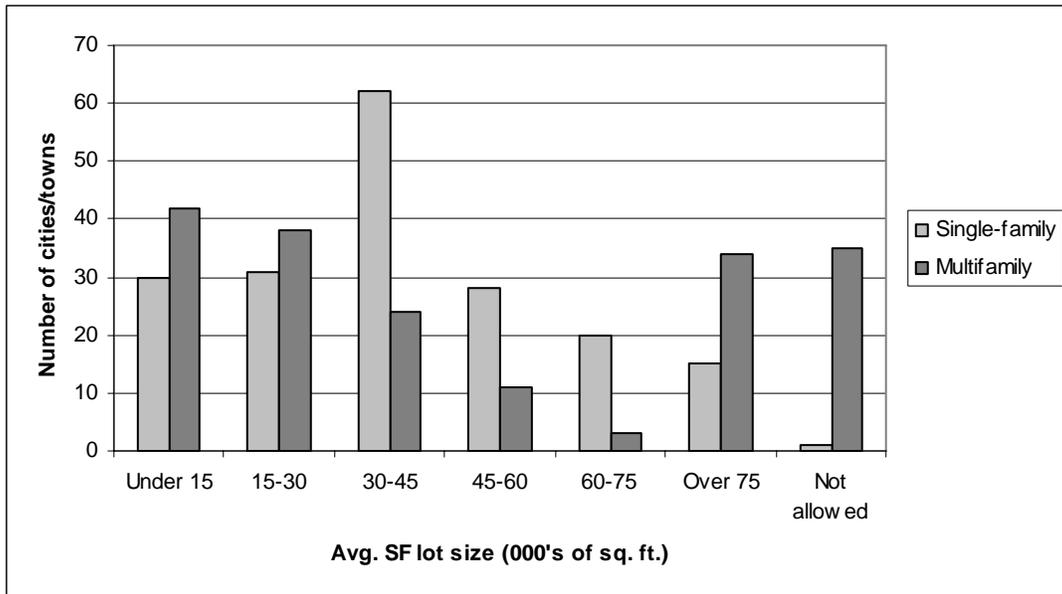


Figure 6: Comparison of Potential Multifamily Lots Measures

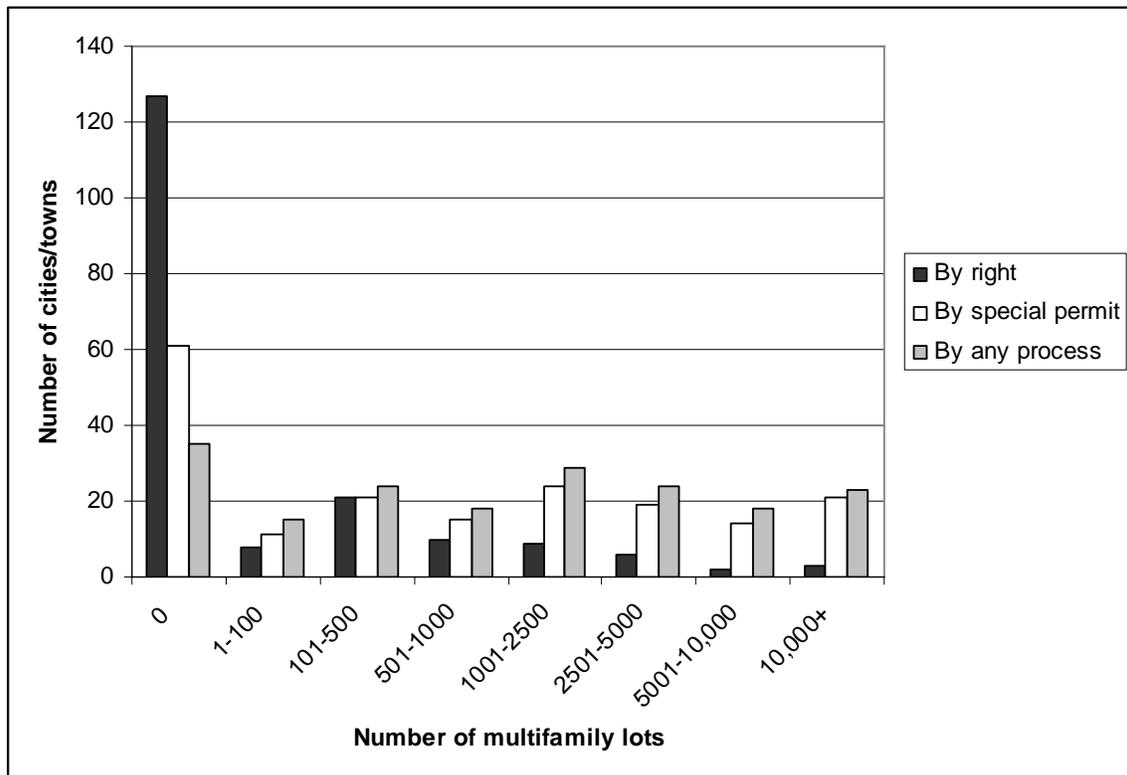


Table 1: Composition of Rental Stock in 2000, By Decade Built and Structure Type

Decade	Multifamily	2-family	Single-family			Total
			detached	Townhouse	Other	
Pre-1940	22.6	12.2	4.1	1.0	0.0	39.9
1940-49	5.5	2.6	1.3	0.3	0.0	9.7
1950-59	6.3	2.4	2.4	0.4	0.0	11.5
1970-79	9.2	1.6	1.5	0.4	0.1	12.9
1980-89	16.5	1.5	1.3	0.6	0.2	20.2
1990-2000	4.2	0.6	0.6	0.4	0.1	5.8
Total	64.1	20.9	11.2	3.2	0.5	100.0

Source: Author calculations using PUMS 2000. "Other" includes mobile homes, boats and recreational vehicles.

Table 2: Determinants of Multifamily Zoning

Dependent variable: (Estimator)	Number of by-right lots (Tobit)		Number of special permit lots (Tobit)	
	(1)	(2)	(3)	(4)
Variable:				
Rent, 1940	4.36 (3.86)	0.48 (1.24)		
Pct native-born, 1940		-20.59 (52.21)		
Job-to-pop ratio, 1940		1,081 (955)		
Distance, satellite city		41.84 (29.51)		-39.51 (87.53)
Housing density, 1940		748*** (229)		
City council		1,497** (717)		2,974 (2,392)
Log(population), 1940		214 (275)		
Percent BA plus, 1970			-203.1*** (72.9)	-214*** (74)
Percent native-born, 1970				-480 (294)
Job-to-pop ratio, 1970				-4,553 (5,401)
Percent by-right land, predicted				-557*** (193)
Log(pop), 1970				1,235 (973)
Observations	186	183	186	184
Pseudo R-squared	0.001	0.049	0.003	0.009

Standard errors in parentheses

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

Columns 1 and 2 are tobit models on the number of multifamily lots allowed by right; Columns 3 and 4 are tobit models of the number of multifamily lots allowed by special permit. Tobit models are used to adjust for the large number of communities that allow no multifamily by each process (i.e. left-censored data). Coefficients are directly interpretable as marginal effects.

Table 3: Variable Definitions and Data Sources

Variable	Description (Year)	Data source
<i>Dependent variables</i>		
Log(rent)	Log of median contract rent (2000)	Census
Log(price)	Log of median owner-occupied housing value (2000)	Census
Log(MF permits)	Log of total multifamily units permitted (2000-05)	Census, New Residential Construction series
Log(SF permits)	Log of total single-family permits (2000-05)	Census, New Residential Construction series
MF permits/ hsg stock	Log of multifamily permits (2000-05)/housing units (2000)	Census of population and New Residential Construction series
<i>Measures of regulation</i>		
MF lots, 000s	Potential non-age restricted multifamily lots allowed (2004)	Local Housing Regulation Database
MF lots by right, 000s	Potential non-age restricted multifamily lots allowed by right (2004)	Local Housing Regulation Database
MF lots by SP, 000s	Potential non-age restricted multifamily lots allowed by special permit (2004)	Local Housing Regulation Database
<i>Control variables</i>		
Distance to Boston	Distance in miles to Boston (constant over time)	Census
Pct BA, post-grad	% of population with BA, graduate or professional degree (2000)	Census
Pct < 18 yrs	% of population under 18 years (2000)	Census
Pct foreign born	% of population born outside U.S. (2000)	Census
Pct non-Hisp white	% of population white, non-Hispanic (2000)	Census
Less than 20% undev land	Dummy = 1 if less than 20% land area undeveloped (1999)	Mass GIS
Log(area)	Log of total area in acres (1999)	Mass GIS
MF share, existing stock	% of housing units in MF buildings (2000)	Census
1000 pop/sq mile	Population (000s)/ square mile (2000)	Census
Rental hsg stock, pre-1950	% of rental units in 2000 that were built before 1950	Census
Median rooms, rental hsg	Median number of rooms in rental housing units (2000)	Census
Worcester Any 40B?	Dummy = 1 for Worcester Dummy = 1 if any 40B developments (2004)	MA Department of Housing & Community Development

Table 4: Effects of Regulations on New Housing Construction, 2000-2005

Dependent variable: Variable	Log(MF permits)					MF permits/ hsg stock	Log (SF permits)
	(1)	(2)	(3)	(4)	(5)		
MF lots, 000s		0.184*** (0.042)	0.195* (0.115)				
MF lots by right, 000s				-0.149 (0.253)			
MF lots by SP, 000s					0.265** (0.124)	0.026* (0.014)	0.092*** (0.024)
Distance to Boston, miles	-0.138*** (0.036)		-0.126*** (0.037)	-0.147*** (0.038)	-0.131*** (0.036)	-0.014*** (0.004)	-0.007 (0.006)
Pct BA, post- grad	-0.034* (0.019)		-0.011 (0.024)	-0.038* (0.020)	-0.009 (0.023)	-0.001 (0.003)	-0.001 (0.005)
Pct < 18 yrs	0.045 (0.090)		0.085 (0.093)	0.047 (0.091)	0.097 (0.093)	0.012 (0.011)	0.020 (0.016)
Pct foreign born	-0.030 (0.110)		-0.051 (0.111)	-0.012 (0.112)	-0.046 (0.110)	-0.006 (0.013)	-0.027 (0.021)
Pct non-Hisp white	0.070 (0.063)		0.065 (0.064)	0.075 (0.064)	0.058 (0.064)	0.007 (0.007)	0.003 (0.011)
Log(area)	1.997*** (0.539)		1.659*** (0.565)	2.003*** (0.550)	1.626*** (0.555)	0.160** (0.063)	0.927*** (0.104)
Less than 20% undev land	2.046* (1.097)		1.728 (1.129)	2.282* (1.225)	2.116* (1.114)	0.219* (0.128)	0.174 (0.241)
MF share, existing stock Worcester	0.129*** (0.032)		0.103*** (0.035)	0.134*** (0.035)	0.109*** (0.033)	0.012*** (0.004)	0.010* (0.006)
			-9.838 (7.684)	8.308 (11.294)	-2.717 (3.900)	-0.335 (0.447)	-0.397 (0.408)
Observations	187	186	186	186	186	186	186
R-squared							0.60

Standard errors in parentheses

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

Notes: Columns 1-5 are tobit models on the log of multifamily permits issued between 2000-05. Column 6 is an OLS model on the log of single-family permits, 2000-05. Column 7 is a tobit model on the ratio of the log of multifamily permits (2000-05) to the initial stock of housing (2000). The variables MF lots, MF lots by SP and MF lots by right are predicted values of the number of multifamily lots allowed, in total, by special permit and by right. Predicted values are obtained from the regression specifications shown in Table 2, columns 2 and 4.

Table 5: Effects of Regulations on Median Rents and Prices, 2000

Depend. Var.:	Log(rent)					Log(price)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
MF lots, 000s		-0.004** (0.002)	0.005 (0.004)				
MF lots by right, 000s				-0.010 (0.015)		-0.009 (0.013)	
MF lots by SP, 000s					0.007 (0.005)		-0.017*** (0.005)
Distance to Boston, miles	- 0.008*** (0.001)		-0.008*** (0.002)	-0.008*** (0.002)	-0.008*** (0.001)	-0.009*** (0.002)	-0.010*** (0.002)
Pct BA, post-grad	0.004*** (0.001)		0.005*** (0.001)	0.004*** (0.001)	0.005*** (0.001)	0.017*** (0.001)	0.015*** (0.001)
Pct < 18 yrs	-0.006* (0.003)		-0.005 (0.004)	-0.006* (0.003)	-0.004 (0.004)	0.002 (0.003)	-0.002 (0.003)
Pct foreign born	0.011** (0.004)		0.009** (0.004)	0.010** (0.004)	0.009* (0.004)	-0.005 (0.004)	-0.001 (0.004)
Pct non-Hisp white	0.005** (0.002)		0.004* (0.002)	0.004* (0.002)	0.004* (0.002)	0.002 (0.002)	0.002 (0.002)
Less than 20% undev land	0.060* (0.035)		0.063* (0.037)	0.058 (0.038)	0.059 (0.037)	0.008 (0.045)	0.020 (0.044)
Log(area)	0.025 (0.019)		0.019 (0.019)	0.033 (0.022)	0.020 (0.019)	0.001 (0.022)	0.012 (0.019)
1000 pop/sq mile	-0.006 (0.006)		-0.007 (0.006)	0.000 (0.010)	-0.003 (0.007)	0.007 (0.011)	-0.005 (0.007)
Rental hsg stock, pre-1950	-0.002** (0.001)		-0.002*** (0.001)	-0.002** (0.001)	-0.002*** (0.001)	0.000 (0.001)	0.001 (0.001)
Median rooms, rental hsg Worcester	0.171*** (0.025)		0.174*** (0.026)	0.169*** (0.025)	0.175*** (0.026)	0.020 (0.022)	0.012 (0.022)
			-0.375 (0.280)	0.355 (0.657)	-0.216** (0.105)	0.192 (0.547)	0.147 (0.100)
Observations	187	186	186	186	186	186	186
R-squared	0.64	0.02	0.64	0.64	0.64	0.88	0.89

Robust standard errors in parentheses

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

Notes: Columns 1-6 are OLS models on the log of median contract rent in 2000. Columns 7 and 8 are OLS models on the log of median owner-occupied housing value in 2000. The variables MF lots, MF lots by SP and MF lots by right are predicted values of the number of multifamily lots allowed, in total, by special permit and by right. Predicted values are obtained from the regression specifications shown in Table 2, columns 2 and 4.

Appendix A: Some Robustness Checks

Dependent variable:	Log(MF permits)			
Variable:	(1)	(2)	(3)	(4)
MF lots by SP, 000s	0.450*** (0.115)	0.279*** (0.071)	0.331*** (0.092)	
Distance to Boston, miles	-0.085** (0.034)	-0.058*** (0.020)	-0.097*** (0.033)	-0.105*** (0.035)
Pct BA, post-grad	0.007 (0.022)	0.005 (0.014)	-0.009 (0.021)	-0.044** (0.019)
Pct < 18 yrs	0.009 (0.087)	-0.004 (0.048)	-0.012 (0.087)	-0.122 (0.084)
Pct foreign born	-0.038 (0.106)	0.002 (0.070)	0.002 (0.104)	0.047 (0.108)
Pct non-Hisp white	0.010 (0.058)	0.014 (0.033)	0.027 (0.058)	0.017 (0.060)
Less than 20% undev land	0.184 (1.187)	-0.147 (0.762)	0.340 (1.192)	0.631 (1.203)
Log(area)	1.477*** (0.511)	0.947*** (0.278)	1.508*** (0.515)	1.887*** (0.531)
1000 pop/sq mile	0.457** (0.189)	0.293** (0.124)	0.387** (0.186)	0.278 (0.192)
Worcester	-6.359* (3.671)	-3.353** (1.484)		2.296 (3.094)
Observed SP lots, 000s				-0.000 (0.037)
Observations	186	186	186	187
R-squared		0.34		

Standard errors in parentheses

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

Column 1 is a tobit model. Column 2 is an OLS model using the same variables. Column 3 is a tobit model, excluding the Worcester dummy from Model 1. Column 4 is a tobit model, using actual (observed) values of potential lots by special permit rather than predicted values, used in the other models.