Silver Bullet or Trojan Horse?
The Effects of Inclusionary Zoning on Local Housing Markets

Jenny Schuetz
School of Policy, Planning and Development
University of Southern California
jschuetz@sppd.usc.edu

Rachel Meltzer
Milano The New School for Management and Urban Policy
New School University
meltzerr@newschool.edu

Vicki Been
Furman Center for Real Estate and Urban Policy
New York University
beenv@exchange.law.nyu.edu

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Abstract

Many local governments are adopting inclusionary zoning (IZ) as a means of producing affordable housing without direct public subsidies. In this paper, we use panel data on IZ in the San Francisco metropolitan area and Suburban Boston to analyze how much affordable housing the programs produce and how IZ affects the prices and production of market-rate housing. The amount of affordable housing produced under IZ has been modest and depends primarily on how long IZ has been in place. Results from Suburban Boston suggest that IZ has contributed to increased housing prices and lower rates of production during periods of regional house price appreciation. In the San Francisco area, IZ also appears to increase housing prices in times of regional price appreciation but to decrease prices during cooler regional markets. There is no evidence of a statistically significant effect of IZ on new housing development in the Bay Area.

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Section 1: Introduction

Rising housing prices and rents in many metropolitan areas over the past decade have drawn the attention of policymakers, housing advocates, and academics. Although the causes of price inflation may differ by location, there is considerable evidence that in some parts of the country, restrictive land use regulations have contributed to higher housing prices (see, for example, Fischel 1990; Glaeser, Gyourko and Saks 2005; Malpezzi and Green 1996; Malpezzi 1996; Pollakowski and Wachter 1990; Quigley and Rafael 2004). Faced with rapidly rising prices of market-rate housing, stagnant real incomes for many households, and limited availability of federal or state subsidies, local governments are actively seeking new policy tools to help low- and moderate-income households afford housing. One increasingly popular policy is local inclusionary zoning (sometimes called inclusionary housing or incentive zoning). Inclusionary zoning (IZ) programs either require developers to make a certain percentage of the units within their market-rate residential developments available at prices or rents that are affordable to specified income groups, or offer incentives that encourage them to do so. Despite the growing popularity of IZ among policymakers, there has been almost no empirical research on the effects of these programs, either about how much affordable housing they actually produce, or about their broader impacts on the price and quantity of market-rate housing. This study seeks to fill this gap in the literature by examining IZ programs in two regions in which IZ is relatively widespread and of long duration: the San Francisco metropolitan area and the Boston-area suburbs.

IZ has become a controversial topic, with avid supporters and critics. Many economists and developers believe that IZ imposes additional costs on new residential development, and as such predict that it will constrain the supply and increase the price of housing in jurisdictions that adopt it. Affordable housing advocates counter that IZ can be an effective means of producing

below-market rate units that would not otherwise be produced and that, unlike traditional affordable housing programs, it does not require direct public subsidies and produces affordable units in a geographically dispersed pattern.

In this study, we present empirical evidence of the effects of IZ on local housing markets. We have assembled panel data sets for the San Francisco metropolitan area and Suburban Boston, including characteristics of IZ programs, housing prices, new residential construction permits and standard determinants of housing market supply and demand (such as demographics and existing housing stock). For each region, we conduct regression analysis to determine what IZ program characteristics and housing market conditions affect the production of affordable housing and how IZ programs have affected the price and production of market rate single-family housing. In brief, our empirical analysis suggests that the ideological debate over IZ has greatly exaggerated both the benefits and the dangers of IZ: any negative effects on housing prices and production have been relatively slight, but only modest amounts of affordable housing have been produced through IZ programs. We also find that IZ has different impacts on local housing markets, depending on the condition of regional housing prices.

The remainder of this study is organized as follows. Section 2 summarizes previous empirical research; Section 3 lays out theoretical predictions about the impacts IZ will have on housing production and prices; Section 4 provides background and descriptive statistics on IZ programs in each region; Section 5 discusses our empirical strategy and describes our data; Section 6 presents findings of regression analysis; and Section 7 concludes.

Section 2: Previous empirical research

Although there is a fairly extensive literature on the economic and legal theory of inclusionary zoning, to date there has been very little quantitative empirical analysis of the effects of IZ on housing supply. Below we review the only other large-scale statistical analysis of IZ, several descriptive studies, including some on IZ outside the U.S., and research on impact fees, a closely related form of land use regulation.

Knaap, Bento and Lowe (2008) examine the impact of IZ programs on the production and prices of housing in Northern California. Controlling for year and city-specific fixed effects, they find that IZ has no significant effect on the number of permits for either single- or multifamily housing units. However, they find that single-family permits as a share of total permits are lower in jurisdictions with IZ, particularly where IZ programs have lower project size thresholds and require higher shares of affordable units. To estimate the effect of IZ on housing prices and size, Knaap et al. estimate property-level hedonic regressions that control for property characteristics, the year and quarter of the sale, and the local school district and neighborhood. They find that in jurisdictions with IZ, housing prices increase, on average, by 2.2 percent. This effect, however, differs for high- and low-priced houses: IZ programs actually lower the price by about 0.8 percent for houses below median price and raise prices by about 5 percent for above-median priced houses. Their results also suggest IZ programs decrease the mean single-family housing size by approximately 48 square feet, particularly for houses below the median price.

Powell and Stringham (2004a and 2004b) use a more descriptive methodology in a pair of widely cited studies of California cities and counties, . They define the "cost" of each affordable unit as the difference between the average market price in the jurisdiction and the maximum affordable price allowed under IZ; by their calculations, the median cost of each affordable unit across all cities was $346,212. Powell and Stringham also assess the impact of IZ

on production levels by comparing the average number of housing permits issued in cities with IZ over several time intervals before and after the adoption of the ordinance; on average, permits declined by 31 percent in the seven years after IZ was adopted. However, as critics have pointed out (Basolo and Calavita 2004), Powell and Stringham's work relies on several questionable assumptions. For instance, the cost differential assumes that in the absence of IZ policies, the same total number of units would have been constructed and all units would have sold for the average market price. Moreover, the study provides no evidence on changes in housing prices and new permits in California jurisdictions without inclusionary zoning over the same time period, so it is unclear whether the decline in permitting is due to IZ or to exogenous contemporary changes that affect all jurisdictions. In short, the results of the two studies should be interpreted only as descriptive, not as proof of a causal relationship between IZ and housing market outcomes.

Although local IZ programs are most prevalent in the U.S., several other countries have adopted similar policies that mandate or encourage affordable housing through land use planning or zoning. Examples include Section 106 of the 1990 Town and Country Planning Act in the U.K., Part V of Ireland's Planning and Development Act of 2000, as well as local IZ programs in Vancouver, Montreal, Rome, Florence, and the Basque Region of Spain (see Calavita 2006 for more detail on international IZ programs). Research on the effectiveness of these programs at producing affordable housing suggests that production has lagged behind initial goals but has increased over time, with some potential to crowd out other affordable housing programs (Crook et al 2002, Monk et al 2005, Whitehead 2007, Norris and Shiels 2007).

The paucity of rigorous empirical research on the effects of IZ is due in large part to the difficulty of obtaining accurate data on the presence and characteristics of inclusionary zoning programs across jurisdictions and over time, as well as units produced under such programs. To predict how inclusionary zoning might affect the supply and price of housing, however, we can draw upon empirical studies of similar forms of land use regulation, although with some caveats about the comparability of the programs. Below we review empirical research on the effects of related land use regulations, specifically impact fees and statewide "fair share" housing requirements.

Empirical studies of impact fees find somewhat varied effects, although most recent studies conclude that housing prices rise with the imposition of impact fees. Delaney and Smith (1989a, 1989b) were the first to empirically measure the effect of impact fees on the prices of existing and new housing. They look specifically at housing prices in Dunedin, FL, over a period of 12 years and find significantly higher prices relative to two of three non-fee control communities. These differences, however, disappear after about seven years into the study period. A series of studies followed, many of which do find empirically sound evidence of price increases (see, for instance, Baden and Coursey 1999; Mathur, Waddell and Blanco 2004 and reviews of other studies summarized by Been 2005 and Evans-Cowley and Lawhon 2003). However, it is unclear what drives housing prices to increase: the added value from infrastructure/public services made possible by the fees, or a possible supply constraint due to the tax. How land prices are affected is less definitive in the literature (Nelson and Lillydahl 1992; Skaburskis and Qadeer 1992); however a more recent study by Ihlanfeldt and Shaugnessy (2004) improves upon many of the limitations of previous investigations and finds significant reductions in land prices. The empirical results on housing production are also mixed. Skidmore

and Peddle (1998) found a significant negative correlation between impact fees and the number of new homes built. On the other hand, Burge and Ihlanfeldt (2006) find no discernable effect of impact fees on number of single-family home completions. The theoretical prediction about how impact fees would affect completions is ambiguous: impact fees increase developer costs, but may also increase rates of project approval by local governments (see also Mayer and Somerville 2000). Given the theoretical differences between impact fees and IZ – impact fees (in theory) are used to pay for services enjoyed by new homeowners who pay the fees, while most new residents in jurisdictions with IZ do not live in the affordable units – and the jurisdiction-specific evidence, it is unclear how much can be extrapolated from these findings.

Another conceptually similar set of policies, albeit on the state level, are regional "fair share" arrangements, under which each locality is required to provide some predetermined proportion of the region's low-income housing. The state with the oldest and best known such policy is New Jersey (developed in response to the series of Mount Laurel court decisions). In New Jersey, communities must develop a state-certified plan to reach their fair share obligation through one or more of the following tools: building or rehabilitating low-income housing directly, paying other communities within the region to provide up to 50 percent of their housing obligation, or allowing developers to build at higher densities in exchange for developing affordable units. A study conducted approximately 5 years after the state law went into effect showed that over half of the 59 municipalities with certified housing plans had some density bonus provision, and nearly 60 percent of the units built were through a density bonus (Rubin et al. 1990). Assuming that municipalities adopt plans that minimize the cost of meeting their obligations, this can be viewed as indirect evidence that voluntary density bonuses are more efficient means of producing affordable units than the other two tools. However there are

significant differences in choice of tools across municipalities, reflecting variation in resident preferences and/or development costs; places that had higher initial housing densities were less likely to adopt density bonuses, and more affluent communities were more likely to pay other jurisdictions to provide their allotment. Thus the presence and structure of inclusionary zoning ordinances is clearly endogenous and must be treated accordingly in empirical analysis.

Section 3: What are the predicted impacts of IZ on housing supply?

Mandatory IZ programs are essentially a tax on new residential development (Been 1991, Clapp 1981, Ellickson 1981), and as such, we would expect them to raise the prices and reduce the quantity of housing. The size and incidence of the impacts will depend on a variety of factors, including the stringency and structure of the IZ program, the stringency of other types of land use regulations, and the relative elasticities of housing supply and demand. In this section, we discuss some predicted effects of IZ on housing supply, based on standard models of urban economics and public finance.

Under traditional IZ programs, a proposal for new residential development triggers a requirement to produce a specified share of units that will be sold or rented at a set price/rent that is below the market price/rent for that unit.[1] Because developers will receive lower revenues on the affordable units, they are likely to earn lower total profits than in the absence of IZ. In response, developers may choose not to build in jurisdictions with IZ, unless they are able either to raise prices on market-rate units or pay lower prices for land. The extent to which a developer can raise prices on market-rate units will depend on a number of factors, including the relative elasticities of supply and demand (discussed in more detail below) and whether alternative land uses (other types of residential or non-residential development) face similar taxes. Because

[1] We begin by discussing mandatory IZ programs and later discuss different implications for voluntary IZ programs.

fewer households are willing to pay for higher priced units, this implies that lower numbers of units will be produced, both by an individual developer and in the aggregate. Assuming that both developers and households are mobile, some of the IZ tax will likely be capitalized into decreased values of residential land. At lower prices, fewer landowners will be willing to sell, so lower land prices also imply lower levels of housing production. By acting as a constraint on new supply, this type of IZ policy is likely to increase the prices of existing housing in the jurisdiction as well the price of newly built units.

The size of the effective tax imposed by IZ, and thus the size of the impacts on housing and land prices and housing production, will depend on the stringency and characteristics of the IZ program. IZ ordinances can be structured in an almost infinite number of ways, with various implications for stringency. Below we consider how, in theory, several key characteristics are likely to affect the size of impacts on the price and production of market rate housing; in Section 4, we describe the actual characteristics of IZ programs in our two study areas.

One of the essential characteristics of IZ programs is whether they are mandatory, requiring developers to set aside below-market rate units, or voluntary, offering incentives for developers to participate. All else equal, mandatory programs will clearly be more restrictive and are likely to have larger impacts on housing supply than voluntary programs. A second key characteristic is the breadth of applicability. Some IZ programs are written to apply broadly to most residential developments, while other programs grant exemptions for certain types of development, based on project size, tenure or structure type. The greater the number of exemptions, the less stringent the IZ program will be, and the smaller the size of the effective tax, compared to a program with no exemptions. Exemptions may also encourage gaming by developers, such as proposing developments just under the size threshold that triggers IZ. Third,

many IZ programs offer some type of cost offset to the developer, such as density bonuses or fast-track permitting. With a density bonus, developers are allowed to build a larger number of units on a given parcel than would be allowed under conventional zoning. The larger the number of additional units allowed under the density bonus, the greater the offsetting profit for the developer and the smaller the effective tax imposed by IZ. A fourth characteristic of IZ programs is the availability of buyout options, that is, alternatives to building below-market rate units on site. The most commonly granted alternatives are permission to produce the required affordable units at a different location within the jurisdiction, allowing developers to pay cash in lieu of development, or allowing developers to donate land intended for future affordable housing. If the buyout options are set at lower costs than on-site development (for instance, the amount of cash per unit is less than the unit cost of development), then granting buyout options can lower the size of the effective tax imposed by IZ. IZ programs also vary in the share of total units that must meet affordability restrictions; the larger the required share, the higher the effective size of the tax and the larger the impacts on housing prices and production. Most programs specify the income of the target population, for instance, low income versus moderate income households. Setting a lower income target implies greater reductions in developer profits and a larger effective tax. Finally, IZ programs may specify that the affordability restrictions be in place for different lengths of time. The length of affordability restrictions may have somewhat different impacts depending on whether the program primarily affects rental or owner-occupied units, but in general, we assume that longer periods of cost restrictions are more stringent.

Because IZ ties affordable housing production to production of market-rate housing, the number of affordable units that will be produced under IZ also depends on the size of the tax. In particular, if highly stringent IZ programs greatly reduce the amount of new market-rate housing

developed, then they may produce relatively few affordable units. All of the characteristics that affect the stringency of IZ programs thus have implications for the programs' success at producing affordable units. In theory, voluntary IZ programs that offer very attractive cost offsets to developers to participate could result in greater numbers of affordable units than a highly stringent mandatory program, while also avoiding the negative impacts on price and production of market-rate housing. Many IZ advocates claim that voluntary programs are seldom used and produce few affordable units, although this is not consistent with our data.[2]

In addition to the structure and characteristics of the IZ program, the anticipated effects on housing and land prices and the quantity of new housing produced also depend on the elasticities of housing supply and demand. The relative elasticities also will determine the incidence of any effects. The elasticity of supply depends on standard supply-side variables, such as physical or regulatory constraints on developable land, the relative cost of non-residential development, including land costs, zoning, and the appropriateness of location (Clapp 1981, Katz & Rosen 1987). Any factors that reduce the relative cost of non-residential development will increase the likelihood that an IZ program will cause landowners and developers to shift away from residential uses, so that the burden of IZ will fall more on homebuyers or renters. The elasticity of demand will depend on income and preferences of new households, particularly their willingness to pay to live in a particular jurisdiction (Dietderich 1997). Location-specific amenities or institutions may increase willingness to pay the higher taxes imposed by IZ (Ellickson 1981). For instance, two of the jurisdictions in our sample with mandatory IZ

[2] In Massachusetts, among the 26 jurisdictions that have had IZ programs in place for at least two years and that reported whether IZ had produced any affordable units, half of the purely optional programs had produced some affordable housing, as had half the purely mandatory programs. Three of the four California jurisdictions with voluntary IZ reported having produced at least 200 units of affordable housing each (compared to a median of 78 units for mandatory programs), while the fourth voluntary program has been in place only since 2001 and did not report how many units have been built.

programs are Palo Alto and Cambridge; the presence of relatively immobile academic institutions whose students and faculty may place a premium on proximity to the university, along with closely related private-sector firms, may result in relatively inelastic demand for those jurisdictions, allowing developers to pass along cost increases to consumers and decrease production by relatively little. It is unclear how many jurisdictions, beyond the examples given, have such inelastic demand that they can absorb IZ with little decrease in production. In general, anything that decreases the relative price or increases the relative attractiveness of nearby jurisdictions will decrease households' willingness to bear taxes and shift the burden towards landowners and developers. In addition, if supply is relatively inelastic (for instance, developers would face high barriers to transferring business to other locations), then more of the costs of IZ will be borne by developers than consumers. Moreover, there are likely to be spillover effects from surrounding jurisdictions; the prevalence of IZ, other affordable housing production programs and other land use regulations in neighboring jurisdictions will affect the ability of both developers and households to substitute away from jurisdictions with IZ.

IZ was originally conceived as a tool to allow local governments to harness increased land values in times of strong housing demand to finance affordable housing development; by its nature, the effectiveness of IZ to produce affordable housing depends on surrounding housing market conditions. Thus it follows logically that the effects of IZ on production and prices of market-rate housing will also vary by the strength of the underlying housing market. For instance, in particularly hot housing markets, developers may be more able to pass along increased prices to consumers without reducing the amount of new development, while in cooler markets the effects may primarily show up in reduced construction. Since many IZ programs are written in such a way to grant local governments considerable discretion over their

implementation, it is also possible governments will choose to enforce the affordable housing requirements more strictly in hot housing markets, when developers enjoy robust profits, while in cooler markets developers may more credibly threaten to reduce development of market-rate units if the local government insists on extracting affordable units.

Section 4: Characteristics of IZ in San Francisco and Suburban Boston Areas

The structure and details of IZ programs vary widely across jurisdictions, reflecting local differences in policy goals, housing market conditions and political circumstances. The ways in which IZ programs are structured and implemented also are likely to vary systematically across states, in response to the amount and type of authority over land use policy granted to local governments by the states, as well as differences in the states' land use programs and initiatives to produce affordable housing. In the previous section, we discussed how several of the key characteristics of IZ programs, including mandatory status, exemptions and cost offsets, can affect the stringency of the program and thus the size of the impacts on housing prices and production levels. In this section we briefly describe the characteristics of IZ programs adopted by jurisdictions in the San Francisco metropolitan area and the Boston-area suburbs.[3] In addition, we summarize several state-specific laws and policies that could affect incentives and the ability of local governments to adopt and enforce IZ programs. Variation in such laws across states makes it difficult to compare the outcomes of IZ across our two regions.

State regulatory environments and related policies

Both California and Massachusetts have very high housing costs and highly stringent land use regulations, compared to other parts of the U.S. (Glaeser, Schuetz and Ward 2006; Gyourko, Saiz and Summers 2006). Perhaps because of the high level of housing costs, both

[3] For a more detailed description of IZ policies in the two regions, see Schuetz, Meltzer and Been (2009).

states also have a number of statewide policies and programs to encourage the development of below-market rate housing, described in more detail below.

Since 1979, California state law has required that each city or county provide density bonuses and incentives to developers seeking to build affordable or age-restricted housing.[4] The state mandate essentially creates a voluntary IZ program in jurisdictions that have not adopted a local IZ ordinance. Interviews with local officials suggest that the state law is not widely understood and is infrequently invoked by developers (Furman Center 2007). A second related policy is the state's mandate that counties and cities submit a general plan containing a housing elementthat outlines a plan to provide "decent" housing for "people of all economic means".[5] A third mechanism for providing affordable housing under the state's legal framework is the designation of Redevelopment Agencies to oversee construction in blighted areas.[6] These agencies receive a portion of the incremental taxes from newly redeveloped areas that can be used to subsidize affordable housing. There is no systematic data on the production of affordable units under any of the three state programs; however staff in several jurisdictions mentioned having negotiated the inclusion of affordable units on a case by case basis prior to having adopted IZ. In some cases, such as Contra Costa County, these alternative mechanisms may have resulted in development of a significant number of units (Furman Center 2007).

Similarly, Massachusetts has several state laws that could supplement or replace IZ programs adopted by cities or towns.[7] The oldest of these, Chapter 40B, allows developers to apply under an expedited process for a permit to build housing that does not conform to local

[4] To qualify as affordable, a proposed development must include at least 10% low income housing, 5% very low income housing, with affordability restrictions for at least 30 years Cal. Gov. Code §65915 (2007) (this statute is part of the chapter entitled "Density Bonuses and Other Incentives")
[5] Cal Gov. Code at §65580, *See also* 66 Cal. Jur. 3d §33
[6] Several of the interviewees in the Furman Center's survey mentioned this as a method by which the state encourages the production of affordable housing.
[7] Because all land in Massachusetts is incorporated within cities and towns, counties have no role in land use regulation.

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-profit developers who wish to build at higher densities than would be allowed under conventional zoning, similar to voluntary IZ programs. Communities are only subject to Chapter 40B if less than 10% of their existing stock meets state affordability criteria. A review of selected recent master plans suggests that many communities adopt IZ in order to increase production of affordable housing, up to their 10% quota, in a manner perceived as giving more local control than 40B developments. However, for communities that have learned to manage the 40B process to their liking (i.e. have good relationships with selected affordable housing developers), the state law may reduce the incentive to adopt some form of IZ.[8] Unfortunately, there is no reliable 40B data available to test the relationship between IZ and 40B production.

Data sources

Data on the presence and characteristics of IZ in the Bay Area were assembled from a variety of different sources. The primary source is a survey conducted in 2002 by the California Coalition for Rural Housing (CCRH) and Nonprofit Housing Association of California (NPH). Because that survey did not obtain complete data on several key variables, including the date of IZ adoption, mandatory status and the presence of density bonuses, the Furman Center conducted a supplementary telephone survey in June 2007 with municipal officials in approximately 35

[8] For more discussion and analysis of Anti-Snob laws in Massachussetts, Rhode Island and Connecticut, see S. Cowan, 2006, "Anti-Snob Land Use Laws, Suburban Exclusion, and Housing Opportunity," *Journal of Urban Affairs*, 28 (3): 295-313.

jurisdictions.[9] We then compared our dataset against several additional sources: a 1994 survey conducted by Calavita and Grimes; a list of IZ programs reported by Vandell (2003), originally compiled by Rusk (2003); a new Inclusionary Housing Policy database released in the summer of 2007 by CCRH; and a 2007 report by NPH, CCRH and several other organizations.[10] The various sources contain a number of discrepancies even on basic facts such as the year IZ was adopted. It is unclear whether such discrepancies result from changes in program characteristics over time (for instance, changing from an informal to an official IZ policy, or a major revision in the law), differences in the surveys and respondents or simply reporting errors. We have attempted to reconcile the discrepancies for the year of IZ adoption by choosing the earliest date corroborated by at least two of the sources referenced above.

All data on inclusionary zoning in Massachusetts are taken from the Local Housing Regulation Database, compiled in 2004 by the Pioneer Institute for Public Policy and the Rappaport Institute for Greater Boston.[11] Most variables were coded directly from bylaws or ordinances; information on production of affordable units under IZ was obtained from telephone and email communication with municipal staff and cannot be independently verified.

Characteristics of IZ programs in both regions

The structure and characteristics of IZ programs across the two regions have both similarities and differences, as shown in Table 1. IZ has been widely adopted by local governments in both regions. As of 2006, forty-eight percent of jurisdictions in Bay Area had adopted IZ, representing 51% of population and 50% of land area. In Suburban Boston, 53% of

[9] More information about the survey, including the survey instrument and list of officials interviewed, can be found at www.furmancenter.nyu.edu/publications/documents/IZDraftfinal.pdf

[10] According to the most recent survey, 77 jurisdictions in the Bay Area had adopted IZ as of 2006. We use the 55 jurisdictions identified in the earlier survey for our analysis, since the most recent programs are too new to have produced measurable effects.

[11] More information on the development of the database, and downloadable data, can be found at www.pioneerinstitute.org/municipalregs/.

cities and towns, comprising 58% of population and 55% of land area, were covered by IZ as of 2005. In general, IZ programs took hold earlier in the Bay Area: half the IZ programs in the San Francisco MSA were adopted before 1992, while half of the Boston-area programs have been adopted since 2001.

Along several of the dimensions measured, IZ programs in the Bay Area appear to be more stringent than those in Suburban Boston. Over 90% of Bay Area IZ programs are mandatory, compared to 58% of programs in Suburban Boston. Perhaps the most striking difference is the breadth of applicability: in the Bay Area, most IZ programs apply broadly to all residential development, with only a few exemptions for very small projects (fewer than 5 units). By contrast, a large majority of IZ programs in Suburban Boston apply only under a fairly narrow set of circumstances, for instance, to developments in specific zoning districts or certain structure types (generally multifamily). Although it is difficult to determine what share of proposed developments would actually trigger the IZ requirements in any jurisdiction, at least in theory, the more narrowly written programs in Suburban Boston are likely to affect fewer developments. Perhaps offsetting the difference in breadth of applicability, however, 86% of IZ programs in the Bay Area include a variety of buyout options for developers, most commonly in-lieu fees or off-site construction. Only 38% of the IZ programs in Suburban Boston (but more than half the mandatory programs) offer buyout options.

IZ programs across the two regions differ less on several other characteristics. The median share of units required to be set at below-market rents/prices in both regions is 15%; most Bay Area jurisdictions require either 10% or 15%, while Boston-area IZ programs have much higher variance on this dimension, with some programs requiring that up to one-half of units meet income targets. Bay Area programs are more likely to require that some units meet

affordability targets for very low income households, although in both regions some mixture of low- and moderate-income households is the norm. Roughly similar shares of programs across the regions offer density bonuses. Affordability restrictions are generally shorter in the Bay Area, with a median of 45 years. One-third of programs in Suburban Boston require permanent or very long-term restrictions (80 or more years), although half the programs either do not specify a set term or use ambiguous language ("as long as allowable under state law").

Production of affordable housing under IZ varies both within and across regions. Nearly all jurisdictions in the Bay Area reported that at least some affordable units have been developed as a result of the IZ program. Summing across all jurisdictions and all years, IZ has yielded an estimated 9154 units in the Bay Area through 2003, with median annual production of 15 units per year for counties, and 6 units per year for cities. Given the relatively short period of time many IZ programs in Suburban Boston have been in effect, it is difficult to draw conclusions about the prospects for affordable housing production in the region. According to reports by municipal staff, only 22% of communities with IZ programs reported having produced at least some affordable units had been produced as of December 2004. Over one-third of communities were unable to state whether any affordable units had been built. The lack of production may reflect the very recent dates of adoption in many communities, however.

Section 5: Empirical strategy and data description

Using data on IZ in the San Francisco metropolitan area and Suburban Boston, we examine what affects the amount of affordable housing produced under IZ, and how IZ has affected the price and production of market-rate housing. In this section, we describe in greater detail the empirical strategy and data used to analyze each of these questions.

5.1 What affects the quantity of affordable housing produced under an IZ program?

The potential costs of IZ are the predicted negative impacts on housing markets (increased prices or decreased production), while production of affordable units is the primary potential benefit. We would expect various structural components of IZ (such as whether it offers density bonuses) and the length of time IZ has been in place to affect the amount of affordable housing produced under the program. Economic determinants of housing supply and demand that affect production of market-rate housing should also affect production of affordable units. Some political and institutional variables, such as the type of jurisdiction, the prevalence of IZ in nearby communities and the partisan leanings of the community, may also affect production. We use regression analysis to test these hypotheses for IZ programs in the San Francisco area. However, in the Boston suburbs, many of the programs were too new to have produced affordable units by the time of the survey, and many of the older programs did not report whether they had produced any affordable housing.[12] Therefore for the Boston area we cannot conduct statistical analysis on the factors that affect production, and simply tabulate the number of programs that have produced any affordable units and present the counts separately by program age. Equation 1 shows the general specification to be estimated for San Francisco.

$$(1) \qquad IZ\_units_{it} = f(Log(IZ\_years_{it}), IZ\_structure_{it}, X_{it-1})$$

where IZ_units_{it} is the number of affordable units built under IZ in jurisdiction i by time t,[13] $Log(IZ\_years_{it})$ is the natural logarithm of the number of years since IZ was adopted,

[12] Results of t-tests on mean differences in a number of characteristics (shown in Appendix A) show few systematic differences between jurisdictions that report the year IZ was adopted and those that do not (those missing year of adoption are less highly educated and more likely to target very low income households). Jurisdictions that do not report whether IZ has ever been applied tend to have larger, older populations, higher housing density, less restrictive zoning and older IZ programs.

[13] Time t is the year in which the survey of IZ programs was conducted.

$IZ\_structure_{it}$ is a vector of variables describing the characteristics of the IZ program, and X_{it-1} is a vector of housing supply and demand determinants in jurisdiction i at time t-1. Structural characteristics of the IZ program are observed in 2006, concurrent with production levels, and for the analysis are assumed to have remained constant since the date of adoption. However, we know anecdotally that at least some places have substantially amended their IZ programs since original adoption; changes in the stringency of IZ components since adoption will introduce noise into the estimated coefficients on the structural characteristics.[14] Further descriptions of the variables are shown in Table 2.

For the San Francisco region, IZ programs have on average been in place for a longer time than those in Boston, and we have better data on affordable housing production. However, there are still a few limitations that constrain the analysis of the effect of structural and market dynamics on the number of affordable housing units produced.[15] Most of the IZ programs in the Bay Area have existed for at least a decade, but only 55 jurisdictions had IZ as of 2006, yielding quite a small sample for statistical analysis. Of those 55 IZ programs, only four are optional, so it is not possible to test for statistically significant differences between mandatory and optional programs. Data are missing on the required length of affordability for roughly one-fifth of the programs (12/55), making it difficult to identify the effect of that characteristic.

5.2 How have IZ programs affected housing prices and production?

To the extent that IZ imposes additional costs on new development, we would expect it to reduce production of new housing and increase prices of both new and existing houses, holding

[14] There is no evidence of any systematic pattern: some places have increased stringency over time while others have relaxed it.

[15] Nine jurisdictions did not report the number of units produced and must be excluded from this analysis. The numbers of units were self-reported by municipal staff and have not been independently verified. In many cases it is unclear whether staff reported the number of affordable units currently in existence or the number of units ever created (which could include units with expired affordability). Since the accuracy of the exact unit counts is questionable, we ran the specifications both on the number of units as a continuous variable and as an ordered categorical variable; results are essentially the same, so we report only the estimates on the continuous measure.

other factors constant. To test these hypotheses, we use panel data to estimate reduced-form models of housing prices and permits, including measures for the presence of IZ, as shown in Equation 2 below.

$$(2)\ Permits_{it} = f(IZ\_years_{it}, IZ\_years_{it} * Rising\_mkt_t, Rising\_mkt_t, X_{it}, Other\_regs_{it}, LIHTC_{it}, City_i, Year_t)$$

where $Permits_{it}$ is a measure of housing permits (or prices) in jurisdiction i at time t, IZ_years_{it} is the natural logarithm of the years since IZ was adopted, $Rising\_mkt_t$ is a dummy variable indicating that housing prices in the region were increasing during that time period, $IZ\_years_{it}*Rising\_mkt_t$ is an interaction between the log of years since IZ adopted and the dummy for appreciating regional housing prices; X_{it} is a vector of housing supply and demand determinants in jurisdiction i at time t, $Other\_regs_{it}$ is a vector of variables measuring other types of land use regulations in jurisdiction i in time t and $LIHTC_{it}$ is the number of LIHTC units built in jurisdiction *i* as of time *t*. $City_i$ is a vector of jurisdiction fixed-effects and $Year_t$ is a vector of time trend variables, selected for each dependent variable based on the shape of the underlying data (for permits in both regions this includes 4th order polynomials, for prices in Suburban Boston the time trend is a cubic form, and for prices in San Francisco the time trend includes a squared term). We chose to use continuous variables for the time trends rather than individual year fixed effects to allow for a more flexible time trend and to avoid mechanical correlations with the binary variable, *Rising_mkt*.

One of the main challenges to identifying the effects of IZ (and other land use regulations) on housing prices and production is the possible confounding effects of omitted (and sometimes unobservable) variables. In particular, if jurisdictions that adopt IZ differ systematically from those that do not – for instance, by adopting other land use regulations or policies that constrain development, or if their residents are more likely to use the political

process to block development – we run the risk of attributing the effects of those other policies and practices to IZ. We include fixed effects for each jurisdiction to help control for any characteristics of jurisdictions that do not change over time (perhaps including resident preferences over development). But if adoption of IZ is concurrent with other changes that affect housing market outcomes, such as revisions to the baseline zoning, then our estimated coefficient on the IZ variables may still be biased.

Ideally, we would also control for annual changes within jurisdictions in housing supply and demand determinants, including other land use regulations, which could impact housing prices and production. Because most of our control variables are drawn from the decennial census, we can only interpolate values for the intervening years and extrapolate for years after 2000. This method should give reasonable approximations of annual values for variables that change slowly over long periods of time, such as demographic trends, but are less reliable for variables that experience large changes over this period or have high annual variance.

We use annual permits for single-family houses as a measure of housing production in both metropolitan areas. We chose to use single family permits because they make up the overwhelming majority of all housing permits issued in both areas during the period from 1980 to 2005. In any given year, single-family permits average over 90 percent of total permits, and between 50 and 90 percent of jurisdictions in our sample issue no permits for multifamily housing. Using a measure of combined single-family and multifamily permits is not feasible, because the two markets display very different patterns over time and with respect to basic market determinants (for instance, multifamily permits rise in the mid-1980s before dropping off sharply after 1986, likely in response to changes in federal tax policy under the Tax Reform Act of 1986, while single family permits continue to rise until the early 1990s). Moreover, in the

Suburban Boston area, a large share of multifamily housing in recent years has been developed under Chapter 40B, which changes the economics of development. Because annual permits are highly variable (for instance, a large subdivision may be permitted in a single year but built over several years, in which very few new permits are issued), we construct three-year rolling averages of permits as the dependent variable.[16]

Similarly, we use data on the sales prices of single family homes as the most relevant measure of housing costs. Most jurisdictions in our sample have very few sales of other property types for which sales data are available.[17] Table 2 provides more detailed descriptions and sources of the housing sales data for each area. Our analysis focuses on price effects in the owner-occupied market rather than the rental market for two reasons. First, the rental market in most jurisdictions in the sample is quite small (median owner-occupancy rate is approximately 75-80 percent, and many jurisdictions have a small absolute number of rental housing units), so that median rents may reflect idiosyncratic characteristics of a few large properties. Second, the only source of data on rents is the decennial census, so effects of IZ on rents could only be seen on a small number of widely spaced observations.

To indicate the presence of IZ in a given jurisdiction and year, we use the natural logarithm of the years since IZ was adopted. Because developments that are approved prior to the adoption of IZ usually will be grandfathered in, we would expect some lag time before IZ

[16] The universe of permit-issuing jurisdictions changes over time as the census adds and removes places. Thirteen places in our sample of CA jurisdictions are missing permit data for at least some years, including four places with IZ. However, all but one adopted IZ well after permit data became available, so this should not affect the results.

[17] We repeat the specifications for Suburban Boston, shown in Table 5, using median price for all property sales as well. Besides single-family, two- and three-family and condos, "all properties" includes larger multifamily, commercial buildings, and vacant land sales. Several of the smaller towns have small numbers of single-family sales but substantial numbers of total sales – given the locations and characteristics of these towns, it seems likely that total sales include a number of vacant land parcels intended for residential subdivisions, a property type that should reflect price effects of IZ. Regression results using total sales prices are substantively the same as results of single-family prices, but more strongly significant. However, given the uncertainty about the composition of sales, we do not show these results here.

produces any effects on housing prices or permits. Conversations with developers and local officials in several Boston area jurisdictions suggest that it takes about 2-3 years for residential projects to be completed. The effects of IZ may also change over time, as developers and officials become more adept at implementing the program. In both regions, the distribution of the number of years IZ programs have been in place is highly skewed (a small number of programs have been in effect for long periods of time), and the natural logarithm transformation produces a more approximately normal distribution. The results are robust to several other functional form specifications, including a simple dummy variable for the presence of IZ (lagged by 2 years), a linear indicator of time since adoption and a set of dummies for time in place.[18] All specifications exclude jurisdictions that do not report the year IZ was adopted. Ideally we would also like to include measures of the structural components of IZ described in Section 2 (mandatory status, density bonus, etc.). However, the sample size and limited variation across these components within each metropolitan area in our sample hinder our ability to do this.

The binary variable $Rising\_mkt_t$ and the interaction term, *IZ_years*Rising_mkt*, allow us to test whether the impacts of IZ on housing prices and permits vary depending on regional housing market conditions. As discussed in Section 3, there are a number of reasons why the policy might produce different effects when regional markets are strong, including the ability of developers to pass along increased costs to consumers and variation in implementation. As shown in Figure 1, real housing prices in the Boston area declined from 1987 to 1994, rose from 1995 to 2005, then declined again from 2006 to 2008.[19] We also identify the period from 1981-1987 as a "rising" market based on large annual increases in housing permits during this time;

[18] Results from these specifications are available upon request from the authors.
[19] All prices are adjusted to constant 2000 dollars using the regional urban consumers' price index series from the Bureau of Labor Statistics. In general annual housing permit data is much noisier than annual price data, so we use price data to define general trends where possible.

we do not have annual price data prior to 1987. Using housing price and permits data for the San Francisco area, we define "rising" markets from 1982 to 1988 and from 1995 to 2006. When the interaction term is included in the regression, the coefficient on *IZ_years* will be interpreted as the estimated effect of IZ in cooler housing markets, while the coefficient on the interaction term should be interpreted as the difference between the effect of IZ in times of rising regional housing prices and that in cooler markets.

In addition to including the interpolated controls for market determinants of housing supply and demand, in the Suburban Boston specifications we also control for adoption of several other types of land use regulations, namely cluster zoning, growth management, wetlands bylaws and septic rules. The effects of these regulations are likely to vary with the length of time they have been in place, so we control for the log of years since each regulation was adopted.[20]

The final control variable used in the regressions is a measure of the number of units built under the Low Income Housing Tax Credit (LIHTC) program in each year. IZ is only one of several policy tools for producing affordable housing; if the amount of affordable housing developed under other policies is correlated with the likelihood of adopting IZ and with housing market outcomes, omitting this variable may bias our estimates. Unfortunately we have no data on other local housing policies, but since LIHTC is by far the largest program for producing below-market rate housing at the national level, this should be a good proxy for the level of participation in non-IZ affordable housing production.

[20] We are missing data on the year of adoption for a number of each of these regulations as well, so those jurisdictions with missing data are excluded from the regression. Unfortunately, dropping these observations excludes one third (33) of the sample jurisdictions with IZ, raising concerns about the possibility of selection bias among the remaining observations. In Appendix A, we present several robustness checks on the functional form of other land use regulations; using lagged dummies rather than log of years gives similar results.

Section 6: Regression results

6.1 Affordable housing produced under IZ

The strongest predictor of the amount of affordable housing produced under IZ in the San Francisco area is the age of the program, although some other program characteristics appear to influence production(Column 1 of Table 4). A one percent increase in the time since IZ was adopted is associated with nearly a one percent increase in affordable units developed. In addition, the number of units built increases as the minimum project size that triggers IZ increases. The number of units built also increases if the program provides a density bonus, although the coefficient is only significant at the 10% level. These results suggest that less stringent programs might actually produce more affordable units, a plausible result if developers avoid jurisdictions with highly stringent programs.

Market conditions and institutional factors are also correlated with the number of affordable units produced (Column 2). The number of units increases with the size of the black population but decreases with the size of the Hispanic population. Somewhat counter-intuitively, jurisdictions with more growth management practices produced more affordable units. The number of affordable units produced under IZ decreases as the number of LIHTC units increases, suggesting these two mechanisms may be used as substitutes. Jurisdictions with a higher share of neighboring jurisdictions in the county that also have IZ programs also produced more affordable housing under IZ.

Column 3 adds controls for market forces and institutional factors to IZ program characteristics. The coefficient on the log of years since IZ was adopted is of similar magnitude to the estimate in the simpler model (Column 1), although now only significant at the 10% level. Most other coefficient estimates and significance levels are fairly robust, and the explanatory

power of the model increases considerably. The small sample size raises two possible concerns with the results, however; standard errors increase in small samples, decreasing the probability of observing statistically significant estimates, while some of the significant results could reflect spurious or idiosyncratic correlations of these particular jurisdictions that are not observed in the larger population. Thus these results should be interpreted with caution.

The model shown in Column 4 excludes counties, to determine whether production patterns differ between cities and counties; the most notable change is that there is no longer a statistically significant relationship between the age of the IZ program and affordable housing production. Among the four counties that report affordable units produced, there is nearly perfect correlation (0.97) between years of IZ and units produced, while the correlation between these two variables among cities and towns is relatively weak (0.21). Moreover, counties have produced on average more than three times as many affordable units over the lifetime of IZ as cities and towns, although the years of IZ adoption are roughly similar across jurisdiction types.

The recent date of adoption for many IZ programs in Suburban Boston, and the lack of reported production data from older programs, prevents us from conducting a similar analysis of affordable housing production in that region. As Table 5 shows, of the 99 IZ programs adopted by 2004, only 22% reported producing any affordable units, 43% reported no units developed and approximately one third were unable or unwilling to report production numbers. Among IZ programs adopted before 2000, and thus with sufficient time to have successfully produced results, a larger share (30%) had built some affordable units, but the non-response rate was also higher (45%). Not surprisingly, a majority of the IZ programs adopted in 2001 or later had not built any affordable units, but it is encouraging that the non-response rate for this group is less than half that of the older programs (21% compared to 45%). If jurisdictions wish to evaluate

whether their IZ programs are successful, monitoring the output of the programs is an essential first step.

6.2 Effects of IZ on single-family permits and prices in Boston-area suburbs

The estimated effects of IZ on single-family permits in Suburban Boston, shown in Columns 1-4 of Table 6, provide some evidence that IZ constrains new development, particularly during periods of regional housing price appreciation. The simplest model, which includes the log of years since IZ was adopted as well as jurisdiction fixed effects and a polynomial time trend, suggests that a 1% increase in the time since IZ was adopted is associated with a 0.06% decrease in annual single-family permits, significant at the five percent level (Column 1). The estimated magnitude is quite small, although since the median age of IZ programs is about 5 years, a 1% increase in age corresponds to less than one month. Evaluated at the median number of permits (35 per year), the coefficients imply that a 6-month increase in IZ program age is associated with a decrease of about 2 permits per year. Parsing the effects of IZ by regional housing market condition (Column 2) is weakly suggestive that IZ constrains housing production during periods of rising housing prices but shows no impact of IZ in flat or declining housing markets. The coefficient on the interaction term is negative, marginally statistically significant (at the 10% level), while the coefficient on Log(years IZ) alone is no longer significant. Adding controls for market forces and LIHTC units (Column 3) yields largely similar results. Only one of the coefficients on the control variables, Pct BA+, is statistically significant. As discussed in Section 5, however, most of the controls are linearly interpolated or extrapolated and thus are imperfect measures for variables that experience large variations in annual changes over the decade.

Adding controls for several other types of land use regulations (Column 4) does not change the magnitude of the coefficient on the interaction term but does increase the standard errors, so the estimate is no longer statistically significant. But this specification raises the concern of selection bias, because it excludes all the jurisdictions for which we do not have data on the year that the other regulations in the regression were adopted. The overall sample size and the number of jurisdictions with IZ programs drops by one-third from Model 3 to Model 4; robustness checks shown in Appendix Table B.1 suggest that the estimated coefficients are quite sensitive to the exclusion of these observations in other specifications as well.

The results in Columns 5-8 of Table 6 show stronger evidence that IZ has put upward pressure on single-family home prices in Boston-area suburbs between 1987 and 2008, particularly during hot housing markets. The estimated coefficient on log of years of IZ (Column 5) suggests that a 1% increase in age of IZ is associated with a 0.014 percent increase in prices, controlling for jurisdiction fixed effects and a cubic time trend, although weakly statistically significant. Once again adding the interaction with regional housing markets indicates that IZ has more effect in hot housing markets; the coefficient on the interaction term is double the estimate in Column 6 and now significant at the 1% level, while the coefficient on the non-interacted term, representing the effect in cooler markets, is not statistically significant. This is consistent with the theoretical models discussed in Section 3, that developers are more able to pass along price increases when housing demand is strong, or that governments enforce the policy more rigorously when developers' profits are higher. The coefficient on the interaction term is largely robust to adding controls for population size and interpolated changes in other local demographics (Column 7), as well the addition of controls for other types of regulations (Column 8).

6.3 Effects of IZ on single-family permits and prices in San Francisco area

The analysis shows no evidence of a statistically significant effect of IZ on single-family permits in the San Francisco area, but consistent with the Boston results, suggests that IZ impacts housing prices differently when regional housing markets are appreciating. Columns 1-3 of Table 7 show regression results of the effect of IZ on permits, using the log of years since IZ was adopted, then adding the interaction between age of IZ and regional housing prices, as well as jurisdiction fixed effects, polynomial time trends and, in Column 3, controls for various housing market determinants. In none of the regression are any of the coefficients on IZ (alone or interacted) statistically different from zero, suggesting that IZ has not constrained single-family housing production in the region

The results on prices tell a more nuanced story, one that is more consistent with the Boston results. In the simplest model of IZ on housing prices (Column 5), the estimated coefficient on log of years since IZ adopted is close to zero and not statistically significant, controlling for jurisdiction fixed effects and a squared time trend. Once the results are estimated separately for appreciating and declining regional housing prices, however, the coefficients on both the simple and interacted terms are strongly statistically significant and with opposite signs. Older IZ programs are associated with a decrease in local housing prices when regional housing prices are declining, but an increase in local housing prices in periods of regional appreciation. The magnitude on the interaction term is larger than on the log of IZ years, implying a net positive effect (0.013 percent) of older IZ programs in "rising" housing markets. While the positive impact in rising markets is consistent with theoretical predictions, the negative coefficient on IZ in declining markets is less intuitive. One possible explanation is that places with older, more restrictive IZ programs are somehow less desirable, and when regional housing

prices decline households are more likely to avoid those jurisdictions. Alternatively, it may also be true that jurisdictions with older IZ programs attract more mobile residents, perhaps due to the types of jobs available. In "down" markets, these types of residents may be more likely to move out of the region in search of other job opportunities. These coefficient estimates are quite robust to adding controls for local housing supply and demand determinants (Column 6).

Several problems with the data suggest that the results should be interpreted cautiously. One concern with the San Francisco data is that the identification strategy relies on the year IZ was adopted; as described in Section 4, the various surveys of IZ do not always agree on the year of adoption. If some of the dates used in the regressions are just random errors, or mistakenly report the dates that the jurisdictions adopted informal or less stringent precursors to the programs currently in place, this variable will be an imperfect measure and will be less likely to yield significant results. For both regions, the regressions provide estimates of the average effect of IZ across all jurisdictions; if the effects of IZ vary among jurisdictions, either because of differences in how IZ programs are structured, how they are implemented, or interactions with different economic or political conditions in the particular location, then the average may obscure the effects of some types of IZ. For instance, as mentioned in Section 5, some jurisdictions may adopt IZ in order to fulfill state regulatory requirements, but may have little interest in enforcing the policies once they are on the books. Those jurisdictions will see little effect from IZ (and bring down the average effect for the entire data set), not because IZ has no effect on the supply or price of housing, but because the IZ is not enforced.

Section 7: Conclusions and future research

In this study, we examine the experience of local IZ programs in the San Francisco metropolitan area and Suburban Boston, and analyze two important questions: what market conditions and characteristics of IZ programs affect the production of affordable housing units under IZ; and how has IZ impacted overall housing prices and production. Below we briefly summarize the results of our research and outline some areas for future research.

The descriptive statistics reveal considerable diversity in the structure and characteristics of IZ programs, both within and across the two regions examined. Nearly half the jurisdictions in the San Francisco area have IZ and the median program has been in place for 15 years. In California, most IZ ordinances are mandatory and apply broadly to all residential development, with only a few exemptions. However, alternatives to on-site construction, such as fees or land in-lieu, are widely offered, as are density bonuses or other cost offsets. IZ is equally widespread in Suburban Boston but many programs have only come into effect in the past five years. IZ programs in the Boston area are more narrowly written than in California; rather than applying to most residential construction, IZ is often triggered by development proposals in certain locations, structure types or in combination with cluster zoning.

There also is considerable variation across the two regions in affordable housing production under IZ. Nearly all jurisdictions with IZ in the Bay Area have produced some affordable housing under the program; the median jurisdiction has built 85 units over the program's existence, or roughly seven units per year. Across all jurisdictions in the area, 9,154 affordable units had been built as of 2003 through IZ. To put this in the context of other affordable housing production programs, 29,636 affordable units have been built in the Bay Area under the Low Income Housing Tax Credit (LIHTC) program between its inception in 1987 and

2003, implying annual production rates for LIHTC of about 1800 units.[21] In San Francisco, production of IZ units amounts to roughly 2-3 percent of total housing production over the past 25 years. The San Francisco results suggest that more flexible programs may produce more affordable units. Because many IZ programs in Suburban Boston were adopted shortly before the 2004 survey and because a large share of older IZ programs do not report whether affordable housing has been produced, we are unable to determine the effectiveness of those programs at producing affordable units, but efforts should be made to collect better data on production in the region for future analysis.

Our analysis of how IZ has impacted housing prices and permits offers a certain amount of evidence that IZ has constrained housing supply and increased prices. Results of regression analyses for the Boston-area suburbs suggest that IZ has increased prices and lowered production during periods of regional housing price appreciation, although the estimated effect is relatively small. IZ does not appear to have an effect on Suburban Boston housing markets when the regional housing market is soft. The analysis of IZ in the Bay Area shows no evidence of statistically significant effects of IZ on production levels. However regressions suggest that IZ does contribute to increased sales prices of existing single-family homes during rising regional markets, and may depress local housing prices when regional prices decline. The interaction between IZ and regional market conditions is consistent with theoretical predictions and may indicate variable enforcement of the policy by local governments.

One concern that arises in identifying the effects of IZ in both regions is the difficulty of defining clear treatment and control groups. Both California and Massachusetts have statewide laws that may encourage more jurisdictions to adopt IZ than would do so in the absence of the

[21] Data on production of LIHTC units is available online at http://www.huduser.org/datasets/lihtc.html#data. Some units built under IZ may receive subsidies through LIHTC.

laws, while at the same time establishing mechanisms for jurisdictions without local IZ programs to develop affordable housing. This suggests that some of the control jurisdictions may operate as though they have informal IZ programs, with similar effects on housing supply, while some of the treatment jurisdictions may have IZ programs on the books that are seldom used or not rigorously enforced. If this is the case, then the relevant question may not be whether having an IZ policy on the books raises prices and constrains supply, but whether the jurisdiction actively requires (or offers incentives for) affordable housing through any mechanism.

Because of the difficulty in collecting systematic data on enforcement of IZ or alternative affordable housing mechanisms, it may be more feasible to develop a better understanding of the various motives that prompt jurisdictions to adopt IZ (or comparable informal policies). Our models implicitly assume that IZ is a response to market conditions, such as past or anticipated increases in housing prices. However, the demand by local residents for land use regulation also may reflect more complex political, social or institutional factors, such as the desire for economically or ethnically homogenous neighbors, and aesthetic or environmental preferences over the timing, location and type of development. Some of these factors are likely to be captured by our control variables (for instance, the racial and ethnic heterogeneity of the current population is likely to be a reasonable predictor of racial exclusive preferences). And many of the institutional or political factors are likely to remain fairly constant over time, so will be absorbed by the jurisdiction fixed effects in the models on housing permits and prices. Nonetheless, we recognize that our models may be omitting important political or social preferences that affect both the likelihood of adopting IZ and how effective IZ is at producing affordable housing. Developing a better understanding of the political economy of IZ is thus an important area for future research.

Finally, there are two particular characteristics of our study areas that may explain the relatively small effects of IZ on housing markets. First, both the Bay Area and Suburban Boston are widely acknowledged to have highly restrictive regulatory environments for housing development. IZ is only one of many policies (and a fairly recent one) that is likely to affect housing production and prices. Thus the marginal effect of IZ is unlikely to be very large, compared to the cumulative effect of all regulations. Second, the effects of IZ and other types of regulations may be fairly small compared to the market determinants of supply and demand, such as changes in population size, income, or costs of labor and building materials. IZ programs were most widely adopted in the Bay Area jurisdictions during the 1990s and in Suburban Boston after 2000, both of which represented periods of extremely strong housing demand in the respective regions. As our results suggest, changes in the strength of the regional housing market alter the impact of IZ on local housing markets. It will be important to monitor how effective IZ is at producing affordable housing in weaker housing markets, when developers are less able to pass along the costs of those units to consumers.

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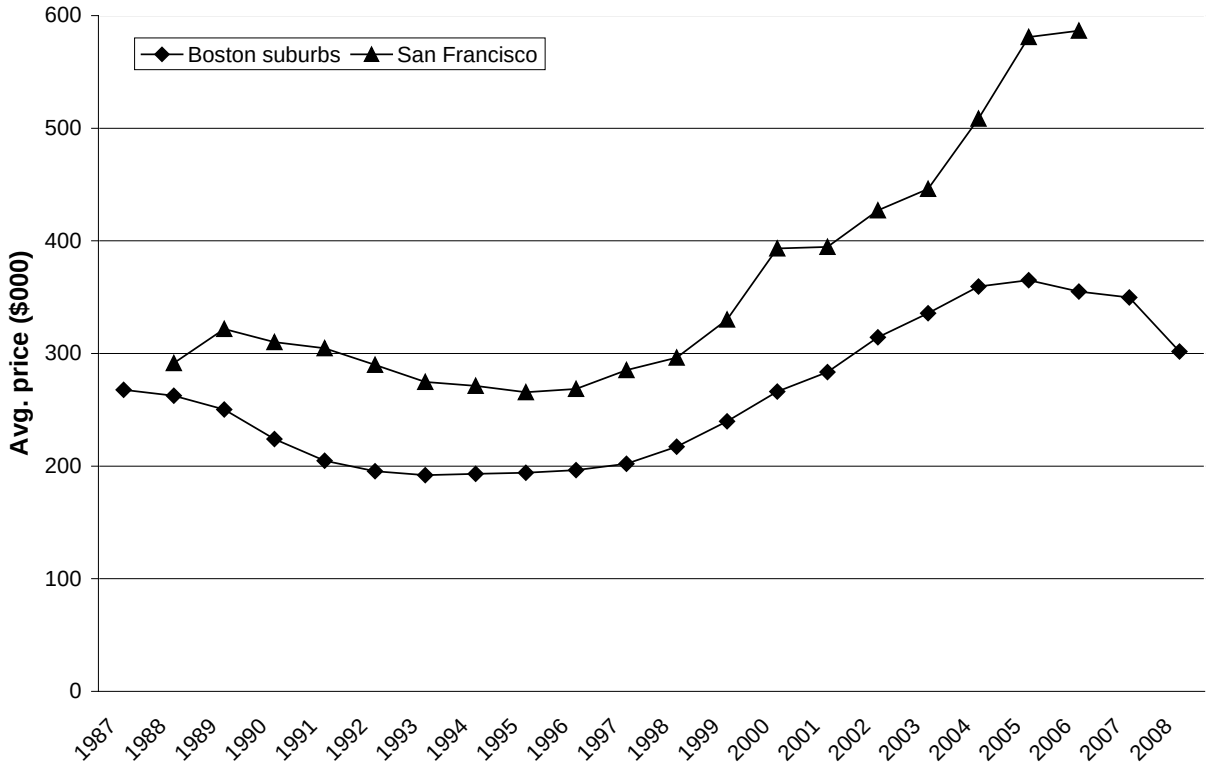
Figure 1: Single-family price trends, Boston suburb and San Francisco



Sources: DataQuick and The Warren Group

Table 1: Characteristics of IZ programs in Bay Area and Suburban Boston

		San Francisco MSA	Suburban Boston
Prevalence of IZ		6/9 counties 49/105 cities/towns	99/187 cities/towns
Year adopted	Median Range	1992 1973-2006	2001 1972-2004
Mandatory		93%	58%
Exemptions		Broadly applicable	Limited eligibility Broad exemptions
Buyouts		86%	38%
% affordable required (median)		15%	15%
Density bonus		67%	71%
Income targets		Very low, low & mod Low & mod	Low Low & mod
Affordability		Median 45 yrs	1/3 require permanent Half don't specify
Median annual production		Counties: 15 units Cities/towns: 6 units	22% produced some units; 34% did not report

Table 2: Variable definitions and sources

Variable	Definition/source
IZ variables – Boston-area suburbs	**Source: LHR database**
IZ	= 1 if jurisdiction has adopted IZ by 2004. Also included as dummy variable for IZ lagged by two years.
Log(years IZ)	Log(Number of years since IZ adopted)
Mandatory	= 1 if IZ program is mandatory, 0 if optional
Density bonus	= 1 if IZ offers density bonus, 0 otherwise
Buyout options	= 1 if IZ includes options besides on-site construction, 0 otherwise
Minimum size trigger	= 1 if IZ triggered by minimum project size, 0 otherwise
Cluster trigger	= 1 if IZ triggered by cluster zoning, 0 otherwise
IZ year adopt missing	= 1 if data missing on year IZ adopted
IZ ever applied	= 1 if IZ program applied by 2004, 0 otherwise
IZ variables – San Francisco	**Source: CA Coalition/NHC of CA, Furman Center survey**
IZ	= 1 if jurisdiction has adopted IZ by 2006.
Mandatory	= 1 if IZ is mandatory
Density bonus	= 1 if IZ offers density bonus
Number of buyout options	Number of buyout options (4 maximum)
Min project units	Minimum project size needed to trigger IZ
Min % affordable	Pct affordable units required
Some units target VLI	= 1 if some units targeted at very low income households
Years affordable	Required number of years affordable
Years IZ in place	Years since IZ adopted
Affordable units	Number of units produced 1 = < 20 units; 2 = 21-100; 3 = 101-250; 4 = 251+
Pct in county w/ IZ	% of jurisdictions in county with IZ
Avg year IZ adopted, county	Average year IZ adopted within county
Housing market outcomes – all areas	
SF permits	Annual single-family units permitted (1980-2006 San Francisco, 1980-2008 Boston) Source: Census New Residential Construction series
Prices – Boston-area suburbs	Median sales price, single-family homes in constant 2000$ (annual, 1987-2008) Source: Banker and Tradesman TownStats
Prices – San Francisco	Median sales price, existing single-family homes in constant 2000$ (annual, 1988-2006). Data on 8 pairs of cities are reported jointly. Source: Data Quick
Demographic and other control variables – all areas	
Log(pop)	Log of population (1970, 1980-2006). Intermediate and subsequent years linearly interpolated/extrapolated. Source: All demographic variables taken from decennial census.

% change pop	Percent change population, 1970-1980
% change price	Percent change in housing prices, 1970-1980
Pct BA, post-grad	% of population with college, graduate degrees. Linearly interpolated/extrapolated between census years.
Pct non-Hisp white	% of population, white non-Hispanic.
Pct non-Hisp black	% population black, non-Hispanic
Pct non-Hisp Asian	% population Asian, non-Hispanic
Pct Hispanic	% population Hispanic
Pct < 18 yrs	% of population < 18 years.
Housing density	Housing units/land area.
Log(area)	Log of land area.
Distance to Boston, Distance to Boston^2	Distance to Boston (miles), distance squared. Calculated using lat-long coordinates from centroid of each jurisdiction.
Distance to San Francisco	Distance (miles) to San Francisco
Distance to San Jose	Distance (miles) to San Jose
County	= 1 if jurisdiction is a county; city or town is omitted category
Pct Democratic vote 1992	% of votes cast for Democratic U.S. Senate candidate in 1992 (Source: Statewide Database at University of California-Berkeley)
Other land use regulations – Boston-area suburbs	
Pct in county w/ IZ	% of jurisdictions in county with IZ. Source: All data on Boston regulations from LHR.
Log(SF lot size)	Log of average single-family minimum lot size (2004).
Log(MF lots)	Log of potential MF lots allowed under zoning (2004).
Cluster	= 1 if cluster zoning allowed, 0 otherwise
Growth	= 1 if annual cap on permits or subdivision phasing.
Wetlands bylaw	= 1 if jurisdiction has adopted local wetlands bylaw.
Septic rules	= 1 if jurisdiction has adopted septic regulations.

Table 3: Variable summary statistics

Area	Variable	Mean	Std. Dev.	N
Boston-area suburbs				
	IZ	0.529	0.500	187
	Years IZ	6.061	7.792	99
	Mandatory	0.576	0.497	99
	Density bonus	0.707	0.457	99
	Buyout options	0.384	0.489	99
	Minimum size trigger	0.150	0.358	99
	Cluster trigger	0.176	0.382	99
	IZ year adopt missing	0.091	0.288	99
	IZ ever used	0.338	0.477	65
	SF permits	51.57	56.92	187/yr
	SF price	248,456	112,390	187/yr
	Pop	21,575	22,158	187/yr
	% change pop	0.109	0.228	187/yr
	% change price	0.219	0.126	187/yr
	Pct BA, post-grad	27.17	16.23	187/yr
	Pct non-Hisp white	95.60	6.54	187/yr
	Pct < 18 yrs	28.80	6.43	187/yr
	Hsg density	1.07	1.72	187/yr
	Area	11,309	7180	187
	Distance to Boston	22.54	9.94	187
	Pct in county w/ IZ	52.94	16.74	187
	SF lot size	40,031	21,887	187
	MF lots	4172	8168	187
	Cluster	0.802	0.399	187
	Growth	0.289	0.454	187
	Wetlands bylaw	0.701	0.459	187
	Septic rules	0.583	0.494	187
San Francisco CMSA				
	IZ	.48	.502	113
	Mandatory	.927	.269	52
	Density bonus	.70	.454	50
	Number of buyout options	2.0	1.31	56
	Min project units	5.33	5.57	54
	Min % affordable	13.56	4.39	54
	Some units target VLI	.554	.502	56
	Yrs affordable	55.36	27.15	42
	Years IZ in place	12.87	7.85	55
	Affordable units	199	289	46
	Pct in county w/ IZ	49.56	19.55	113
	Avg year IZ adopted, county	1993	4.9	113
	Population	82,208	195,683	113
	County government	.080	.272	113
	Pct BA, post-grad	27.6	15.1	113
	Pct non-Hispanic black	4.87	9.43	113

Pct non-Hispanic Asian	5.75	5.41	113
Pct Hispanic	10.11	8.69	113
Housing density	.0005	.0004	113
Land area	2.00e+08	6.25e+08	113
Distance to San Francisco	29.3	16.6	113
Distance to San Jose	43.1	24.4	113
Price, single-family existing	439,692	283,628	2146
Single-family permits	152	282	2870

Table 4: Determinants of affordable housing production under IZ, San Francisco

Dependent variable:	Log(affordable units)			
Variable:	(1)	(2)	(3)	(4)
Log(years IZ in place)	0.993***		0.902*	0.507
	(0.201)		(0.411)	(0.613)
Density bonus?	0.861*		0.749**	0.650
	(0.387)		(0.280)	(0.368)
Number of buyout options	0.352		0.392*	0.352**
	(0.245)		(0.196)	(0.146)
Min project units	0.126***		0.115***	0.120***
	(0.032)		(0.022)	(0.021)
Min % affordable	-0.046		0.071	0.046
	(0.036)		(0.040)	(0.057)
Some units target VLI	-0.216		-0.672**	-0.756***
	(0.400)		(0.235)	(0.199)
Log(pop)		-0.739	0.455	0.634
		(1.300)	(0.814)	(0.689)
Pct BA +		-0.020	0.004	0.005
		(0.015)	(0.014)	(0.017)
Pct black		0.064**	0.081***	0.079***
		(0.020)	(0.010)	(0.014)
Pct Asian		-0.029	0.006	0.010
		(0.038)	(0.016)	(0.017)
Pct Hispanic		-0.053**	-0.040	-0.050*
		(0.023)	(0.023)	(0.023)
Pct < 18 yrs		0.047	0.044	0.040
		(0.047)	(0.032)	(0.035)
Hsg units/acre		1846	1095	767
		(1724)	(1125)	(907)
Growth mgt index		0.312***	0.182**	0.175**
		(0.082)	(0.068)	(0.070)
LIHTC units, 1990		-0.227**	-0.282***	-0.196*
		(0.092)	(0.068)	(0.095)
Log(area)		1.207	0.351	0.062
		(1.134)	(0.899)	(0.749)
Distance to San Fran		0.023	0.033**	0.039**
		(0.017)	(0.011)	(0.014)
Distance to San Jose		-0.024	0.005	0.001
		(0.013)	(0.009)	(0.010)
Pct in county w/ IZ		0.049**	0.017	0.017*
		(0.020)	(0.009)	(0.009)
County govt		-2.420	-1.210	
		(2.790)	(2.679)	
Pct Democratic vote 1992		-0.034	-0.088**	-0.088**

		(0.046)	(0.029)	(0.027)
Observations	45	46	45	42
R-squared	0.41	0.554	0.821	0.794

Robust standard errors clustered by county in parentheses. Column 4 excludes counties.
*significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Affordable housing production under IZ by program age, Boston-area suburbs

	Affordable units built No. of programs (%)	**None built** No. of programs (%)	**Production unknown** No. of programs (%)	**Total**
IZ adopted 1974-2000	12 30%	10 25%	18 45%	40
IZ adopted 2001-2004	8 19%	25 60%	9 21%	42
Year adopted unknown	2 12%	8 47%	7 41%	17
All IZ programs	**22** **22.2%**	**43** **43.4%**	**34** **34.3%**	**99**

Table 6: Effects of IZ on housing permits and prices, Boston-area suburbs

Dependent variable:	Log(SF permits, 1980-2008)				Log(SF median price, 1988-2008)			
	(1)	(2)	(4)	(5)	(6)	(7)	(9)	(10)
Log(years IZ in place)	-0.059**	-0.034	0.024	0.054	0.014*	-0.005	-0.019	-0.013
	(0.019)	(0.023)	(0.024)	(0.068)	(0.007)	(0.009)	(0.010)	(0.013)
Log(Yrs IZ)*Rising mkt		-0.040*	-0.040*	-0.040		0.028***	0.024**	0.021***
		(0.019)	(0.019)	(0.024)		(0.006)	(0.006)	(0.005)
Rising hsg mkt		0.188***	0.172***	0.175***		-0.135***	-0.120***	-0.117***
		(0.027)	(0.029)	(0.027)		(0.007)	(0.010)	(0.009)
Log(pop)			0.311	0.570***			0.173	0.146
			(0.167)	(0.095)			(0.105)	(0.088)
Pct BA +			-0.018**	-0.016*			0.006**	0.006**
			(0.005)	(0.008)			(0.002)	(0.002)
Pct white			-0.004	0.002			0.001	0.002*
			(0.008)	(0.013)			(0.001)	(0.001)
Pct < 18			0.0003	0.004			-0.010	-0.005
			(0.021)	(0.029)			(0.007)	(0.006)
Hsg units/acre			-0.422	-0.422**			0.134*	0.157*
			(0.307)	(0.148)			(0.056)	(0.066)
Any LIHTC units			-0.171	-0.101			0.007	0.025
			(0.101)	(0.141)			(0.013)	(0.023)
Pct towns in county w/ IZ			-0.002	-0.004			0.003***	0.003***
			(0.002)	(0.003)			(0.000)	(0.000)
Log(yrs cluster zoning)				0.095*				0.010
				(0.041)				(0.019)
Log(yrs growth controls)				0.026				-0.012
				(0.083)				(0.014)
Log(yrs wetlands bylaw)				-0.106***				-0.011
				(0.025)				(0.007)
Log(yrs septic regs)				-0.097**				-0.009**
				(0.029)				(0.004)
Time trend	4^{th} power	4^{th} power	4^{th} power	4^{th} power	Cubic	Cubic	Cubic	Cubic
City/town fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	4930	4930	4930	3277	3308	3308	3308	2185
R-squared	0.733	0.737	0.744	0.738	0.945	0.953	0.957	0.963

Robust standard errors clustered by county in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

The decreased sample size in models (4) and (8) are caused by missing data on the year of adoption for cluster zoning, growth controls, wetlands bylaws and septic regulations. Model 4 reflects data on 113 jurisdictions, model 8 includes 110 jurisdictions; the other models reflect data for 166 jurisdictions (observations missing data on the year IZ was adopted are excluded from all models). Regressions on prices exclude all observations with fewer than 50 sales in a given year.

Table 7: Effects of IZ on housing permits and prices, San Francisco

Dependent variable:	Log(SF permits, 1980-2006)			Log(SF median price, 1988-2006)		
	(1)	(2)	(4)	(5)	(6)	(8)
Log(years IZ in place)	0.061	0.074	0.118	0.005	-0.035***	-0.038***
	(0.045)	(0.043)	(0.072)	(0.007)	(0.010)	(0.009)
Log(Yrs IZ)*Rising mkt		-0.017	-0.017		0.048***	0.049***
		(0.021)	(0.023)		(0.009)	(0.010)
Rising hsg mkt		0.137**	0.137*		-0.066***	-0.065**
		(0.057)	(0.066)		(0.020)	(0.022)
Log(pop)			0.241			0.028
			(0.181)			(0.016)
Pct BA +			-0.008			-0.002
			(0.015)			(0.002)
Pct black			-0.003			0.000
			(0.012)			(0.003)
Pct Asian			-0.008			0.001
			(0.005)			(0.002)
Pct Hispanic			0.024			0.002
			(0.016)			(0.002)
Pct < 18 yrs			0.017			-0.002
			(0.021)			(0.003)
Hsg units/acre			-2066*			367**
			(953)			(147)
Pct towns in county w/ IZ			-0.006			0.000
			(0.006)			(0.001)
Log(LIHTC units)			-0.028			0.003
			(0.031)			(0.004)
Time trend	4th power	4th power	4th power	Squared	Squared	Squared
Jurisdiction fixed effects	Y	Y	Y	Y	Y	Y
Observations	2870	2870	2870	2072	2072	2072
R-squared	0.792	0.792	0.803	0.959	0.961	0.962

Robust standard errors clustered by county in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix A: Robustness checks on missing data, Boston

Table A.1 Differences between reporting and non-reporting jurisdictions, Boston

	Year IZ adopted			IZ ever used			
Variable	**Missing**	**Not missing**	**Difference**	**Missing**	**Not missing**	**Difference**	**n**
IZ program characteristics							
Mandatory	0.50	0.59	-0.09	0.60	0.56	0.04	99
Density bonus	0.67	0.72	-0.05	0.71	0.70	0.01	99
Buyout options	0.22	0.42	-0.20	0.49	0.33	0.16	99
Number IZ triggers	1.06	1.27	-0.21	1.29	1.20	0.08	99
Min project size	0.17	0.31	-0.14	0.37	0.23	0.14	99
Cluster trigger	0.33	0.33	0.00	0.34	0.33	0.02	99
District trigger	0.11	0.12	-0.01	0.11	0.13	-0.01	99
Structure trigger	0.28	0.16	0.12	0.14	0.20	-0.06	99
Yrs affordable	78.6	74.9	3.6	63.1	81.1	-18.0*	51
Income target	20.4	14.2	6.2**	15.2	15.3	-0.1	72
IZ ever used	0.20	0.35	-0.15				
Ever used missing	0.44	0.33	0.11				
Year IZ adopted				1993	1998	-4.8**	81
Year missing				0.23	0.16	0.07	99
Demographics/location							
Population	13,924	23,524	-9,600	31,227	16,762	14,465***	99
Pct BA plus	20.1	27.8	-7.7**	25.7	26.9	-1.3	99
Pct white	95.9	97.0	-1.1	96.2	19.2	77.0	99
Pct < 18	29.7	28.5	1.2	26.7	29.8	-3.1***	99
Housing density	0.8	1.1	-0.3	1.9	0.6	1.2***	99
Distance Boston	25.8	21.7	4.1	20.8	23.2	-2.4	99
Other regulations							
Pct in county with IZ	53.0	59.3	-6.3	60.4	57.0	3.4	99
SF min lot size	45,664	39,828	5,836	34,346	44,377	-10,031**	99
# MF lots	2,700	5,819	-3,119	8,147	3,717	4,430**	99
Cluster zoning	0.88	0.96	-0.08	0.94	0.95	-0.01	99
Growth caps	0.41	0.30	0.11	0.34	0.31	0.03	99
Wetlands bylaw	0.76	0.78	-0.02	0.66	0.84	-0.18**	99
Septic rules	0.71	0.61	0.10	0.51	0.69	-0.18*	99

*, ** and *** denote statistical significance of two-tailed t-tests at 10%, 5% and 1% levels, respectively

Appendix B: Robustness tests on functional form of other regulations, Boston

Table B.1 Robustness checks on single-family permits

Dependent variable:	Log(SF permits, 1980-2008)			
Variables:	(1)	(2)	(3)	(4)
Log(years IZ in place)	-0.025	0.032	0.030	0.030
	-0.046	-0.046	-0.052	-0.063
Log(pop)		0.438**	0.469***	0.548***
		-0.129	-0.111	-0.086
Pct BA +		-0.0179*	-0.0172*	-0.015
		-0.008	-0.008	-0.008
Pct white		0.003	0.004	0.005
		-0.009	-0.009	-0.011
Pct < 18		0.006	0.008	0.011
		-0.028	-0.029	-0.028
Hsg units/acre		-0.381	-0.405**	-0.447**
		-0.221	-0.153	-0.143
Pct towns in county w/ IZ		-0.00632*	-0.00627*	-0.00664*
		-0.003	-0.003	-0.003
Cluster zoning (2-yr lag)			0.162***	
			-0.035	
Growth controls (2-yr lag)			-0.022	
			-0.132	
Wetlands bylaw (2-yr lag)			-0.160***	
			-0.029	
Septic rules (2-yr lag)			-0.0933**	
			-0.036	
Log(yrs cluster zoning)				0.0932**
				-0.038
Log(yrs growth controls)				0.025
				-0.082
Log(yrs wetlands bylaw)				-0.113***
				-0.025
Log(yrs septic regs)				-0.0962**
				-0.028
City/town FEs	Y	Y	Y	Y
Time trend	4th power	4th power	4th power	4th power
Observations	3277	3277	3274	3277
R-squared	0.719	0.728	0.735	0.734

Robust standard errors clustered by county in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table B2: Robustness tests on single-family housing prices

Dependent variable:	Log(SF prices, 1987-2008)			
Variables:	(1)	(2)	(3)	(4)
Log(years IZ in place)	0.0181*	-0.001	-0.002	-0.001
	(0.007)	(0.010)	(0.010)	(0.012)
Log(pop)		0.134	0.134	0.165*
		(0.086)	(0.093)	(0.084)
Pct BA +		0.007**	0.007**	0.007**
		(0.002)	(0.002)	(0.002)
Pct white		0.001	0.001	0.001
		(0.001)	(0.001)	(0.001)
Pct < 18		-0.007	-0.007	-0.007
		(0.006)	(0.006)	(0.006)
Hsg units/acre		0.168**	0.173**	0.153**
		(0.060)	(0.066)	(0.062)
Pct towns in county w/ IZ		0.004***	0.004***	0.004***
		(0.001)	(0.001)	(0.001)
lagclust			0.017	
			(0.036)	
laggrow			-0.009	
			(0.030)	
lagwet			-0.001	
			(0.016)	
lagsept			0.000	
			(0.010)	
Log(yrs cluster zoning)				0.012
				(0.022)
Log(yrs growth controls)				-0.011
				(0.014)
Log(yrs wetlands bylaw)				-0.010
				(0.008)
Log(yrs septic regs)				-0.010***
				(0.002)
City/town FEs	Y	Y	Y	Y
Time trend	4th power	4th power	4th power	4th power
Observations	2185	2185	2185	2185
R-squared	0.953	0.957	0.958	0.958

Robust standard errors clustered by county in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%