# Inclusionary Zoning and Housing Market Outcomes

Emily Hamilton

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*Emily Hamilton. "Inclusionary Zoning and Housing Market Outcomes." Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, September 2019.*

**Abstract**

As regions across the United States are experiencing high and rising house prices, inclusionary zoning is increasing in popularity as a tool to increase the availability of affordable housing for households making less than their region's median income. However, when inclusionary zoning requires private developers to subsidize below-market-rate units, it may act as a tax on housing, leading to reduced supply and higher prices than cities would experience without the policy. Few empirical studies have attempted to measure how inclusionary zoning affects housing supply and prices. In this paper, I use a new dataset on inclusionary zoning in the Baltimore-Washington region to estimate its effects on market-rate house prices and building permits in a difference-in-difference study. I find some evidence that inclusionary zoning increases market-rate house prices, but none that it reduces new housing supply. Additionally, I find that most optional programs that offer developers increased development rights if they choose to provide below-market-rate housing units have been unsuccessful in producing affordable units. Alexandria, Virginia, and Falls Church, Virginia, are exceptions, where density bonuses are very valuable owing to traditional zoning's restrictions on new housing construction.

*JEL* codes: R52, R58, R31, R32

Keywords: inclusionary zoning, affordable housing, housing prices, housing supply, regional housing market, residential real estate, land development, land use, land use regulation, zoning

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**Author's Note**

I thank Alice Calder, Mackenzie Dickhudt, Olivia Gonzalez, and Alec Staap for their help gathering data on inclusionary zoning programs. Additionally, I thank Alex Tabarrok, Tyler Cowen, Richard Wagner, Tracy Miller, Salim Furth, Bob Hazel, and three anonymous reviewers for their suggestions that improved this paper. Thanks to Nolan Gray for creating a map of inclusionary zoning in the Baltimore-Washington region. All remaining errors are my own.



This paper can be accessed at https://www.mercatus.org/publications/urban-economics/inclusionary-zoning-and-housing-market-outcomes

# Inclusionary Zoning and Housing Market Outcomes

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## I. Introduction

Inclusionary zoning (IZ) is a policy under which local governments require or incentivize real estate developers to provide some below-market-rate housing units in new housing developments. IZ proponents promote it as a tool to address the important public policy concern of access to affordable housing for households of diverse income levels. Its name indicates that its creators view IZ as an antidote to exclusionary zoning policies. Exclusionary zoning rules include minimum-lot-size requirements, multifamily housing bans, and other rules that limit the housing supply in a jurisdiction, thereby driving up housing prices.[1]

While IZ may be intended to address the serious consequences of other land use regulations that limit housing supply and drive up prices, economic theory predicts that IZ could actually exacerbate regulatory constraints on housing supply. As legal scholar Robert Ellickson explains, IZ is a tax on the construction of new housing units and a price ceiling on the units that must be set aside at below-market rates.[2] Both of these factors can be expected to reduce the quantity of housing supplied, resulting in higher prices for units that are available at market rates.

IZ programs vary widely in design. Many jurisdictions offer developers density bonuses in exchange for providing set-aside units. This practice allows more market-rate units to be built than would otherwise be permitted, offsetting some or all of the cost of providing below-market-

[1] Sanford Ikeda and Emily Washington (now Hamilton), "How Land-Use Regulation Undermines Affordable Housing" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington VA, November 2015).
[2] Robert Ellickson, "The Irony of Inclusionary Zoning" (Faculty Scholarship Series No. 468, Yale Law School, New Haven, CT, January 1981).

rate units. These density bonuses will be more valuable where market-rate prices are higher and where other land use regulations are more binding. If the value of these density bonuses outweighs the cost of providing below-market-rate units, the real-world effects of IZ could be the opposite of Ellickson's predictions.

As a further complication, in some cases, IZ units are required to serve households making up to 120 percent of their region or locality's median income, and little rent reduction may be required relative to market rents. In these cases, IZ may have little effect on development outcomes. In other cases when IZ units are required to serve very-low-income households, IZ programs may be a large tax on development.

While Ellickson describes mandatory IZ programs that require developers to set aside affordable units as a condition of building new housing, some jurisdictions have optional IZ programs under which developers may provide affordable units in exchange for a density bonus. Some past empirical work on the effect of IZ on housing markets has not distinguished between the effects of mandatory and optional IZ programs, but theory says they should have different effects. Mandatory IZ may be a tax on new housing if the cost of providing below-market-rate units exceeds the benefit of density bonuses or other offsets to developers. Optional IZ, however, allows developers to participate in the program if the value of the density bonuses exceeds the cost of providing subsidized units. The introduction of optional IZ should either lead to increased housing supply and lower prices relative to a jurisdiction's status quo or have no effect if developers elect not to participate in the program.

In this paper, I review the empirical and theoretical evidence of the effects of IZ on housing market outcomes and contribute a new analysis of the effects of IZ on house prices and new housing supply in the Baltimore-Washington region. The following section will review the

literature on the effects that IZ has on house prices and new housing supply. Section 3 describes the history and growth of IZ in the Baltimore-Washington region. Section 4 explores how economic theory predicts IZ programs of various designs can be expected to affect house prices and new housing supply. Section 5 explains my dataset and data-gathering process. In section 6, I explain the results of my empirical model, in which I use a difference-in-difference study design to estimate the effects of IZ in the Baltimore-Washington region on house prices and new housing supply. Building on past empirical work on IZ, I distinguish between mandatory and optional programs, which have different expected effects on market outcomes, and I use a spatial model to account for IZ's potential cross-border effects. I find some evidence that IZ raises prices, but none that it decreases housing supply. The final section concludes.

## II. Literature Review

While IZ programs continue to proliferate,[3] their effect on housing market outcomes remains in debate. IZ advocates often promote two key goals for these programs: (1) promoting mixed-income housing development as a tool to reduce socioeconomic segregation, and (2) serving a population that may struggle to afford market-rate rents in their neighborhood or jurisdiction of choice (particularly new-construction housing), but who are not recipients of other public assistance for housing that is typically targeted toward a lower-income population. In her testimony on New York City's IZ program, legal scholar and Commissioner of the Department of Housing Preservation and Development City Planning Commission Vicki Been explains the program will "stretch our public dollars so that we can devote more public funds to the most

[3] One study identifies 507 programs in the United States, most of which were adopted in the first decade of the 21st century. See Brian Stromberg and Lisa Sturtevant, "What Makes Inclusionary Zoning Happen?," National Housing Conference, May 2016, http://media.wix.com/ugd/19cfbe_2b02286eba264acd872fd2edb3d0cb8f.pdf.

critical needs, will enhance neighborhood economic diversity, and [will] allow mobility among our neighborhoods, thereby reducing inequality."[4]

On the other hand, critics of IZ suggest that Ellickson's analysis of its effects on the housing market are correct; IZ comes with the cost of taxing new development, reducing supply, and increasing market-rate house prices. IZ undoubtedly benefits the households that receive below-market-rate units, but if these benefits to a small percentage of generally middle-income households come at the cost of increased housing scarcity and higher prices for everyone not receiving IZ units, the programs likely exacerbate the problems they are trying to help.

Only four studies have used causal inference methods to measure the effect of IZ on broader housing market outcomes. This literature is likely small because of the difficulty of gathering data on IZ policy across permitting jurisdictions. Three of the four studies examine the effects of IZ across California localities, and one uses data from the Bay Area and the Boston region.

Antonio Bento and his coauthors use a two-way fixed effects model to measure the effects of IZ on housing starts, the percentage of housing starts that are single family versus multifamily, the prices of new homes, and the size of new homes.[5] They find that IZ caused prices to increase 2 to 3 percent faster relative to jurisdictions without the policy, but that IZ did not decrease housing starts. They also find that IZ reduced the size of new single-family homes and led to a larger portion of new construction being multifamily rather than single family. The

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[4] Vicki Been, "Testimony of Vicki Been, Commissioner of the Department of Housing Preservation and Development City Planning Commission," December 16, 2015, https://www1.nyc.gov/assets/hpd/downloads/pdf/community/vicki-been-testimony-cpc.pdf.

[5] Antonio Bento, Scott Lowe, Gerrit-Jan Knaap, and Arnab Chakraborty, "Housing Market Effects of Inclusionary Zoning," *Cityscape* 11, no. 2 (2009): 7.

authors characterize their findings: "The results are fully consistent with economic theory and demonstrate that inclusionary zoning policies do not come without costs."[6]

Ann Hollingshead also studies IZ in California, looking at the effect of a state court ruling that IZ programs without density bonuses or other offsets violated a state prohibition on local rent control. This ruling reduced the tax effect of IZ by leading some jurisdictions to increase their density bonuses and to transition from mandatory to optional programs.[7] Hollingshead does not find that reducing the burden of IZ programs led to a reduction in house prices.

Jenny Schuetz, Rachel Meltzer, and Vicki Been study the effects of IZ in the Boston area and the Bay Area on the single-family home market.[8] They use a model with jurisdiction fixed effects, time trends, and a control for whether house prices were appreciating during a given year. In the Boston area, they find that the implementation of IZ rules has corresponded with higher housing prices and reduced construction rates during times of regional house-price appreciation, but not during soft markets. In the Bay Area, Schuetz, Meltzer, and Been find that, as in Boston, IZ corresponds with more rapidly rising house prices during periods of market appreciation but that it decreases prices during soft markets.[9] They find no evidence of a relationship between IZ and housing supply in the Bay Area.[10]

Tom Means and Edward Stringham use a first difference model to estimate the effect of IZ on California housing markets, controlling for the number of years that each jurisdiction has

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[6] Bento et al., "Housing Market Effects of Inclusionary Zoning," 7.
[7] Ann Hollingshead, *When and How Should Cities Implement Inclusionary Housing Policies?* (Berkeley, CA: Cornerstone Partnership, 2015), http://www.monroecountyem.com/DocumentCenter/View/9447/Implement-Inclusionary-2015-APA2?bidId=.
[8] Jenny Schuetz, Rachel Meltzer, and Vicki Been, "Silver Bullet or Trojan Horse? The Effects of Inclusionary Zoning on Local Housing Markets in the United States," *Urban Studies* 48, no. 2 (2011): 297.
[9] Schuetz, Meltzer, and Been, "Silver Bullet or Trojan Horse?," 297.
[10] Schuetz, Meltzer, and Been, "Silver Bullet or Trojan Horse?," 297.

had an IZ program in place.[11] They find significant and large effects of IZ increasing house prices and reducing new housing supply, and they find that IZ's effect on house prices has increased over time. Their work builds on Benjamin Powell and Stringham's case study work on IZ in California.[12]

## III. History of Inclusionary Zoning in the Baltimore-Washington Region

In 1971, Fairfax County, Virginia, adopted the country's first ordinance that required developers to build below-market-rate housing as a condition of building market-rate housing. The program did not offer a density bonus or other regulatory reduction to offset the cost of providing subsidized units.[13] Following the rule's implementation, the development company DeGroff Enterprises, Inc. sued the county for takings without just compensation. Their case reached the Virginia Supreme Court in 1973. The court overturned the county's IZ ordinance, finding that IZ was not a power granted to local governments under the state's zoning enabling act and that the requirement was a regulatory taking without compensation.[14]

Following this decision, the Virginia General Assembly passed two new sections to the Code of Virginia that enabled localities to implement IZ programs. The first, Va. Code Ann. § 15.2-2304, applies specifically to Albermarle, Arlington, Fairfax, and Loudoun counties, and Alexandria and Fairfax cities.[15] These jurisdictions are permitted to implement IZ programs that include density bonuses in exchange for below-market-rate units or other incentives to

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[11] Tom Means and Edward P. Stringham, "Unintended or Intended Consequences? The Effect of Below-Market Housing Mandates on Housing Markets in California," *Journal of Public Finance and Public Choice* 30, nos. 1–3 (2012): 39–64.
[12] Benjamin Powell and Edward Stringham, "Housing Supply and Affordability: Do Affordable Housing Mandates Work?" (Reason Policy Study No. 318, Reason Public Policy Institute, Los Angeles, April 2004).
[13] Housing Virginia, "Welcome to the Neighborhood: A Practitioner's Guide to Inclusionary Housing," September 2017, http://www.housingvirginia.org/wp-content/uploads/2018/07/HV_Inclusionary_Guidebook.pdf.
[14] Housing Virginia, "Welcome to the Neighborhood."
[15] Va. Code Ann. § 15.2-2304, https://law.lis.virginia.gov/vacode/title15.2/chapter22/section15.2-2304/.

compensate developers for at least some of the cost of the affordable units.[16] The second, Va. Code Ann. § 15.2-2305, enables all the state's municipalities to implement IZ programs for projects that receive a rezoning or otherwise do not comply with their jurisdiction's by-right development.[17] Programs allowed by § 15.2-2305 must have affordability set-asides that are not more than 57 percent of the density bonus they offer (in other words, if a project requires 57 income-restricted units, the density bonus would have to allow the developer to build at least 100 more units than they would be allowed under the baseline zoning). Additionally, the number of IZ units required may not exceed 17 percent of the total units in a new development.

In addition to the IZ programs specifically enabled by Va. Code Ann. § 15.2-2304 and § 15.2-2305, any Virginia municipality may enact optional IZ programs. Under these programs, developers are not required to build below-market-rate housing as a condition of building market-rate housing even under a rezoning; however, jurisdictions may offer incentives such as density bonuses to developers that choose to provide below-market-rate housing.

Shortly after Fairfax County's original IZ program was found to violate the Virginia constitution, Montgomery County, Maryland, implemented its Moderately Priced Dwelling Unit (MPDU) program in 1974.[18] It is now the longest-running IZ program in the region and the country. Montgomery County's program has been held up frequently as an example of successful IZ.[19]

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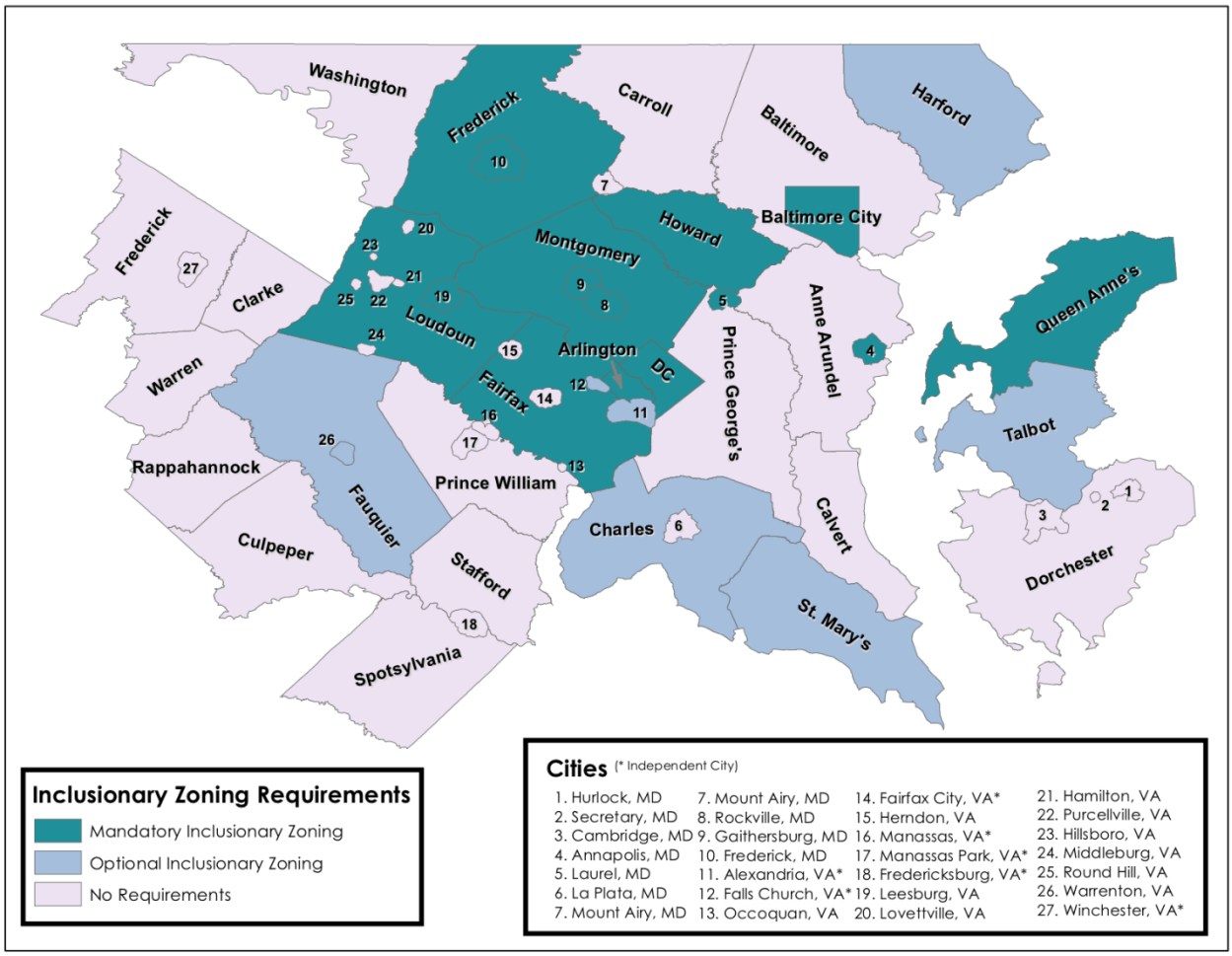
[16] Housing Virginia, "Welcome to the Neighborhood."
[17] Va. Code Ann. § 15.2-2305, https://law.lis.virginia.gov/vacode/title15.2/chapter22/section15.2-2305/.
[18] Jurisdictions use various terms to refer to requirements or incentives for developers to provide below-market-rate housing. Aside from MPDU programs, other terms include bonuses for Affordable Dwelling Units or Workforce Dwelling Units. I refer to all of these programs as IZ throughout.
[19] Diane K. Levy et. al, *Expanding Housing Opportunities through Inclusionary Zoning: Lessons From Two Counties* (Washington, DC: Department of Housing and Urban Development, Office of Policy Development and Research, December 2012).

In 2004 Montgomery County policymakers made a few changes to the MPDU program.[20] They increased the affordability period for IZ units from 20 to 99 years for rental units and from 10 to 30 years for owner-occupied units. At the same time, the county reduced the project size that triggers MPDU requirements from 35 to 20 units and adopted a 20 percent density bonus for projects that include MPDUs. The reform also began allowing the affordable units to be provided off-site in some cases.

Most of the permitting in the Baltimore-Washington region is done at the county level, but some cities and towns are also permitting jurisdictions. Today, among the 26 permitting jurisdictions in Maryland within the Baltimore-Washington region, 14 have IZ programs, 5 of which are optional programs. Of the 28 Virginia permitting jurisdictions that are part of the Baltimore-Washington region, 8 have adopted IZ programs, 4 of which are optional. The District of Columbia adopted a mandatory IZ policy in 2009. The map in figure 1 shows mandatory and optional IZ programs across the region as of 2017.

[20] Montgomery County Code Chapter 25A, "Housing, Moderately Priced," http://library.amlegal.com/nxt /gateway.dll/Maryland/montgom/partiilocallawsordinancesresolutionsetc/chapter25ahousingmoderatelypricednote ?f=templates$fn=default.htm$3.0$vid=amlegal:montgomeryco_md_mc$anc=JD_Chapter25A.

**Figure 1. Jurisdictions with Mandatory and Optional Inclusionary Zoning Programs, 2017**

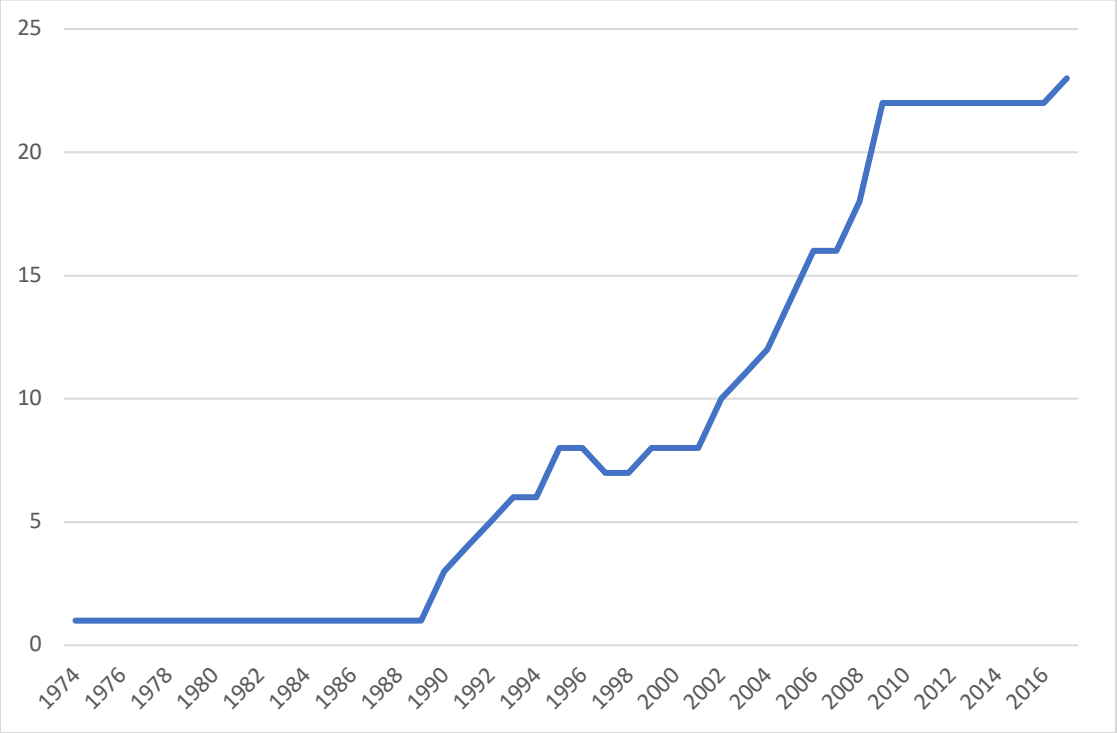



Source: Illustration by Nolan Gray.

Aside from Fairfax County, whose first IZ program ended because of the Virginia Supreme Court ruling, Prince George's County, Maryland, is the only locality in the region that implemented and then abolished an IZ program. In 1991, the county adopted an IZ program that applied to portions of the jurisdiction. County policymakers repealed the program in 1996 because, as a Brookings Institution report describes, county officials "believed that Prince

George's County had more than its fair share of the region's affordable housing."[21] With this exception, the prevalence of regional IZ programs has increased steadily over time. Figure 2 shows the number of IZ policies in the region over time.

**Figure 2. Number of Jurisdictions with Inclusionary Zoning in the Baltimore-Washington Region, 1974–2017**




Source: Data are gathered from the zoning ordinances of the permitting jurisdictions in the Baltimore-Washington region.

Policymakers in the region have indicated awareness and concern about how their IZ programs affect market outcomes. In 2015, five years after Washington, DC, adopted a mandatory IZ program, two local organizations, the Coalition for Smarter Growth and the DC

[21] Karen Destorel Brown, *Expanding Affordable Housing through Inclusionary Zoning: Lessons from the Washington Metropolitan Area* (Washington, DC: Brookings Institution Center on Urban and Metropolitan Policy, October 2001).

Fiscal Policy Institute, proposed amendments to the program that would require a larger percentage of IZ units and would target rental IZ units to households earning 60 percent of area median income (AMI) rather than 80 percent.[22] They pointed out that housing affordable to residents earning 80 percent of AMI is available on the private market, whereas households earning 60 percent of AMI may struggle to find housing they can afford. These organizations also demonstrated that following the adoption of IZ in DC, new housing supply continued its recovery following the 2008 financial crisis, providing evidence that the original program was not a tax on development, or at least not such a tax that it choked off new construction drastically. In response to their proposal, the Office of Planning revised its IZ program to require rental IZ units to be affordable to households earning 60 percent of AMI but kept the number of units required at 8 to 10 percent of new units in projects covered by IZ requirements.

The recommendation to reduce the income limits for IZ units in DC was based on a model showing that the expected value of bonus density more than offset the cost of providing set-aside units under the original IZ program.[23] In adopting changes to increase the cost of subsidized units relative to bonus density, DC policymakers seemed to be seeking an IZ policy that produced as much income-restricted housing as possible while maintaining roughly the same amount of total new development permitted under its zoning regime before the adoption of IZ.

Aside from the distinction between mandatory and optional IZ programs, IZ policy varies widely across regional jurisdictions. Most of the regional jurisdictions with IZ programs offer density bonuses for affordable units, with the exceptions of Howard County, Maryland, and Gaithersburg, Maryland. The density bonuses that developers receive as a condition of providing

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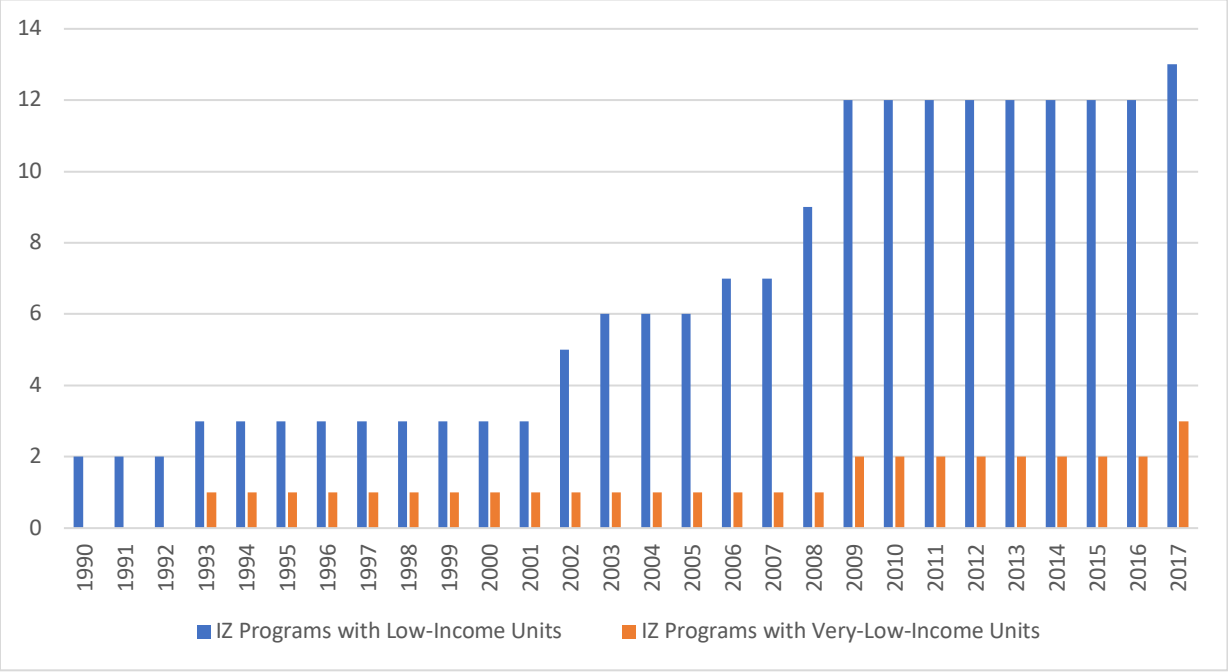
[22] Claire Zippel and Cheryl Cort, "Petitioner Statement in Support for Zoning Case No. 04-33G" (Testimony before the District of Columbia Zoning Commission, March 3, 2016), https://www.smartergrowth.net/wp-content/uploads/2016/03/2016.3.3-Petitioner-statement-for-ZC-No-04-33G-IZ.pdf.

[23] Zippel and Cort, "Petitioner Statement in Support for Zoning Case No. 04-33G."

affordable housing range from 10 to 100 percent of density that would be permitted without IZ. In some suburban jurisdictions, these density bonuses generally mean a reduction in minimum-lot-size rules.

Following others in the IZ literature, I define IZ units that must be affordable to households making 50 percent or less of the AMI as applying to "low-income households" and those that must be affordable to households making less than 30 percent of the AMI as applying to "very-low-income households." Until 1990, no IZ programs in the region included requirements to serve low- or very-low-income households, but the number of IZ programs requiring set-asides for lower-income households has increased steadily since then. Figure 3 shows this trend over time.

**Figure 3. Number of Inclusionary Zoning Programs that Require Units Affordable to Low- and Very-Low-Income Households, 1990–2017**




Source: Data are gathered from the zoning ordinances of the permitting jurisdictions in the Baltimore-Washington region.

Table 1 provides additional information on some of the key details of the IZ programs in place in the region as of 2017. I gathered all the data on IZ mandates and the details of programs from local land use ordinances and special reports on IZ. In some cases where these sources were ambiguous or incomplete, I contacted planning offices for clarification via phone or email.

IZ programs in the region have varied widely in the number of income-restricted units they have produced. Among the jurisdictions with optional IZ programs, only Alexandria, Virginia, and Falls Church, Virginia, have produced any units. In addition to offering density bonuses in exchange for subsidized units, the Alexandria rule gives planners discretion to reduce parking requirements.[24] In jurisdictions where land is expensive, complying with parking requirements presents a large cost to developers, so this may be a particularly valuable offset.[25] Falls Church offers reduction development fees in addition to density bonuses in exchange for affordable units.

Relative to other jurisdictions with optional IZ programs, Alexandria and Falls Church have high house prices. Among my full sample, the median per-square-foot house price in 2017 is $206. Among those with IZ, it is $239. Among the jurisdictions with mandatory versus optional programs, the medians are $247 and $210, respectively. The median price in Alexandria is $361 per square foot and in Falls Church it is $417, both well above the typical jurisdiction with an optional IZ program. These high prices are owing in large part to the jurisdictions' otherwise exclusionary zoning. Large parts of both municipalities permit only single-family, detached development.

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[24] City of Alexandria, VA, Municipal Code, Article VII: Supplemental Zone Regulations, Sec. 7-700 (1995), https://library.municode.com/va/alexandria/codes/zoning?nodeId=ARTVIISUZORE_S7-700ALINFLARRADEHEREREOREPAINPRLODCOHO.

[25] Donald C. Shoup, "The High Cost of Free Parking," *Journal of Planning Education and Research* 17 (1997): 3–20.

**Table 1. Inclusionary Zoning Policies in the Baltimore-Washington Region in 2017**

| Jurisdiction | Years IZ in place as of 2017 | Mandatory IZ | Number of units that triggers IZ program | IZ units required | Applies to households earning 50% or less of AMI | Applies to households earning 30% or less of AMI | Payment to jurisdiction allowed in lieu of IZ units | IZ units may be provided off-site | Maximum density bonus |
|---|---|---|---|---|---|---|---|---|---|
| Alexandria County, VA | 23 | No | 5 | 9.0% | No | No | Yes | Yes | 30% |
| Annapolis, MD | 14 | Yes | 10 | 6.0% | No | No | Yes | No | 15% |
| Arlington County, VA | 13 | Yes | 50 | 5.0% | No | No | Yes | Yes | 25% |
| Baltimore, MD | 9 | Yes | 30 | 10.0% | Yes | Yes | Yes | Yes | 20% |
| Charles County, MD | 26 | No | 50 | 12.0% | No | No | No | No | 100% |
| Fairfax County, VA | 28 | Yes | 50 | 12.0% | Yes | No | Yes | Yes | 20% |
| Falls Church, VA | 16 | No | 0 | 6.0% | Yes | No | Yes | No | 20% |
| Fauquier County, VA | 23 | No | 2 | 20.0% | No | No | No | No | 100% |
| Frederick County, MD | 15 | Yes | 25 | 12.0% | Yes | No | Yes | Yes | 22% |
| Frederick, MD | 9 | Yes | 25 | 12.5% | No | No | No | No | 22% |
| Gaithersburg, MD | 12 | Yes | 20 | 15.0% | Yes | No | Yes | No | 0% |
| Harford County, MD | 9 | No | 0 | 10.0% | Yes | No | No | No | 20% |
| Howard County, MD | 19 | Yes | 0 | 10.0% | No | No | Yes | Yes | 0% |
| Laurel, MD | 10 | Yes | 50 | 6.0% | Yes | No | No | No | 6% |

*(continued on next page)*

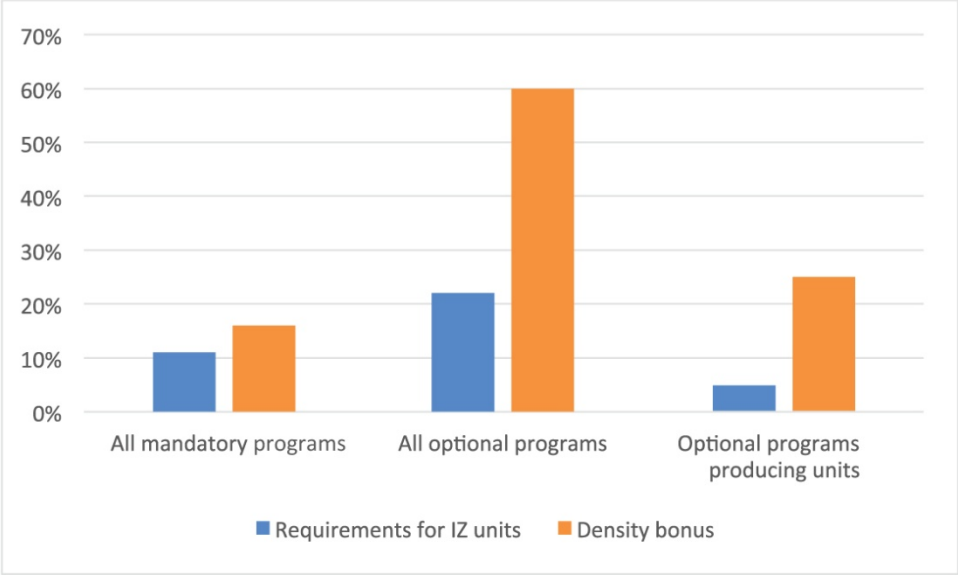
| Jurisdiction | Years IZ in place as of 2017 | Mandatory IZ | Number of units that triggers IZ program | IZ units required | Applies to households earning 50% or less of AMI | Applies to households earning 30% or less of AMI | Payment to jurisdiction allowed in lieu of IZ units | IZ units may be provided offsite | Maximum density bonus |
|---|---|---|---|---|---|---|---|---|---|
| Leesburg, VA | 10 | Yes | 24 | 6.3% | Yes | No | Yes | No | 20% |
| Loudoun County, VA | 25 | Yes | 50 | 6.3% | Yes | Yes | Yes | No | 20% |
| Montgomery County, MD | 44 | Yes | 20 | 12.5% | No | No | Yes | Yes | 20% |
| Queen Anne's County, MD | 13 | Yes | 20 | 10.0% | No | No | Yes | Yes | 10% |
| Rockville, MD | 29 | Yes | 50 | 12.5% | Yes | No | No | Yes | 22% |
| St. Mary's County, MD | 16 | No | 0 | 12.0% | Yes | No | No | No | 10% |
| Talbot County, MD | 12 | No | 0 | 50.0% | No | No | No | No | 100% |
| Warrenton, VA | 1 | No | 2 | 0.0% | Yes | Yes | No | No | 100% |
| Washington, DC | 9 | Yes | 10 | 8.0% | Yes | No | No | No | 20% |

Source: Data are gathered from the zoning ordinances of the permitting jurisdictions in the Baltimore-Washington region.

Alexandria's and Falls Church's limitations on the rights to build housing give their density bonuses value. Because they permit much less housing than what developers would provide absent land use regulations, developers are willing to provide affordable housing in exchange for the right to build very valuable market-rate housing. In other jurisdictions with optional programs, typical land use regulations are likely less binding, so density bonuses are less of an incentive for providing subsidized units. In these jurisdictions the value of the density bonuses may not outweigh the cost of providing below-market-rate units.

On the whole, the ratio of density bonuses relative to below-market-rate units that optional IZ programs would require is much larger than under mandatory programs. Alexandria and Falls Church have larger density bonuses and require fewer IZ units than the typical mandatory IZ program. This provides some evidence that density bonuses under the region's mandatory programs are not large enough to offset the cost of providing IZ units, particularly considering that Alexandria's program, with high density bonuses relative to the typical mandatory program, has delivered only 17 IZ units per year on average, and Falls Church has delivered fewer than 5 units per year on average. However, this evidence is also consistent with density bonuses in the jurisdictions with optional programs offering little value because their existing zoning does not constrain housing supply significantly. Figure 4 shows average IZ unit requirements and density bonuses for all optional programs, mandatory programs, and optional programs that have produced IZ units.

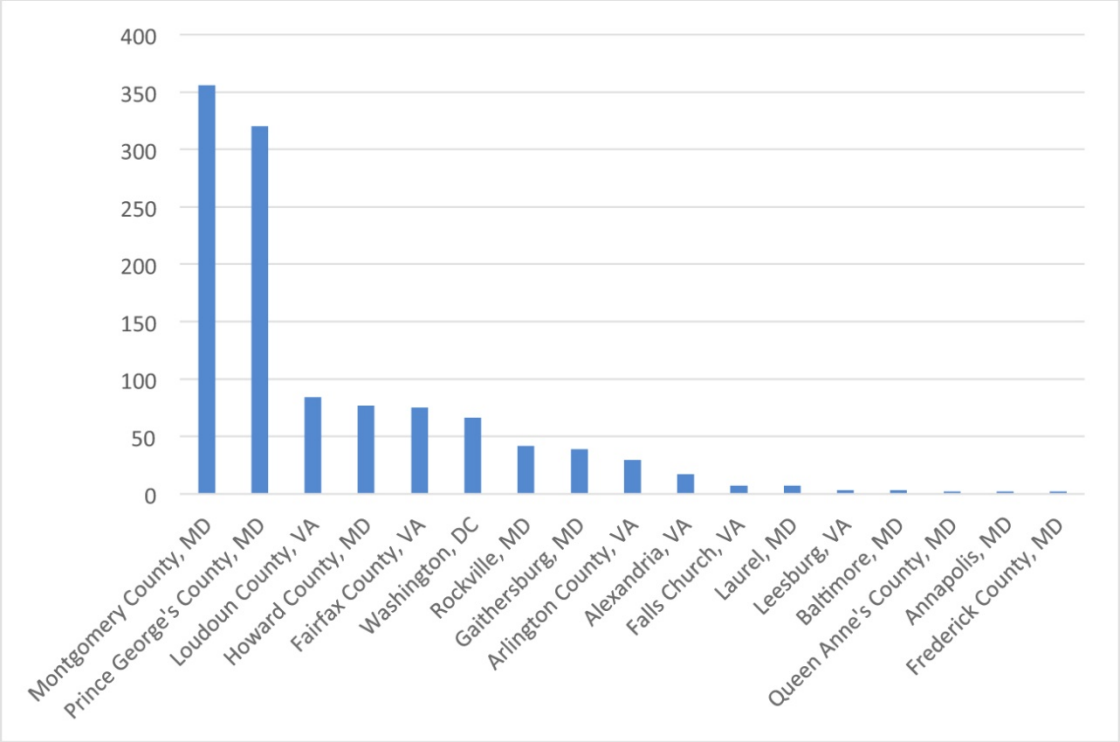
**Figure 4. Mean Inclusionary Zoning Requirements and Density Bonuses across Program Types**




Source: Author's calculations, based on data gathered from the zoning ordinances of the permitting jurisdictions in the Baltimore-Washington region.

Over half of the IZ units in the entire region have been built in Montgomery County (15,660 of 26,733 units). This is partly a result of the program's long history, but Montgomery County's program is also the most productive on an annual basis. Figure 5 shows the production of IZ units by jurisdiction, per year the IZ program has been in place.

**Figure 5. Inclusionary Zoning Units Produced under the Baltimore-Washington Region's IZ Programs per Year of Program, 1974–2017**




Source: Data are gathered from permitting jurisdictions' reports on their IZ programs, supplemented with conversations with planning staff where necessary.

One complicating factor in studying the effect of IZ on overall housing supply and prices is that many jurisdictions' IZ programs give city planners wide discretion to determine requirements on a site-by-site basis. For example, many of the large multifamily buildings permitted since Washington, DC, adopted IZ have received approval through the city's Planned Unit Development (PUD) process that allows projects to be built that deviate from the city's by-right zoning. When developers receive approvals through the PUD process, they are required to provide a benefits and amenities package to the project's neighborhood. Often these packages include more affordable housing units, and units that are affordable to lower-income households, than would otherwise be required under the city's IZ ordinance. The requirement to provide

additional affordable units as a result of negotiations between the developer, the city's Zoning Board of Adjustments, and other vested interests is not reflected in the de jure ordinances.

Additionally, local policymakers have often granted themselves discretion to waive IZ requirements on a project-by-project basis. Baltimore city's IZ program has produced only 27 units since it went into effect in 2009. The city's IZ ordinance provides for a 20 percent density bonus, but if developers are able to show that this bonus does not compensate them for the cost of providing the IZ units, they can receive waivers from complying with the requirement.[26] As a result of these waivers, the IZ units produced have fallen far short of what the ordinance would seem to require, and the program is having less of an effect on the city's housing market as a whole.[27]

Thirteen jurisdictions allow developers to pay fees rather than providing affordable units in a mixed-income building. In some cases, the revenue raised by these programs has become unmoored from the narrow goals that are typically associated with IZ. Arlington County, Virginia, has collected more fees in lieu of IZ units than any other jurisdiction in the region. The fees collected from developers go into the county's Affordable Housing Trust Fund. These funds are used to build homeless shelters and projects that consist of entirely subsidized housing. In these cases, fees collected do not meet typical IZ objectives of supporting mixed-income housing, but they are in line with the county's stated goal of directing subsidies for its least-well-off individuals.[28]

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[26] Baltimore City Department of Legislative Reference, Art. 13, "Housing and Urban Renewal (As Last Amended by Ord. 16-503)" (2016), http://legislativereference.baltimorecity.gov/sites/default/files/Art%2013%20-%20Housing.pdf.
[27] Natalie Sherman, "Despite Rule, Few Affordable Units Created in New Developments," *Baltimore Sun*, December 27, 2014.
[28] Arlington County Department of Community Planning, Housing, and Development, *Annual Affordable Housing Targets Report for 2015*, February 2016.

Finally, in some cases, the complex array of an IZ program's taxes and subsidies has little effect on ultimate rent prices for IZ units relative to market-rate units. For example, one Washington, DC, project built in 2016 includes units affordable to households earning 30 percent, 60 percent, 100 percent, and 120 percent of AMI. In many cases, the units affordable to households earning 100 percent to 120 percent of AMI receive only a slight subsidy of less than $100 per month relative to market rents.[29] The discrepancy between real-world IZ implementation and stated policies presents a challenge to measuring their effects empirically.

## IV. Thc Economic Theory of Inclusionary Zoning

Given that IZ programs vary widely in their implementation, economic reasoning will predict different effects on housing market outcomes from different specific programs. Table 2 describes how common aspects of IZ programs can be expected to affect new housing supply and in turn prices, all else equal. An explanation of how each aspect of IZ programs can be expected to affect housing markets follows.

Components of typical IZ programs contribute to the "IZ tax," while others are an "IZ subsidy." The primary IZ subsidy to development is the density bonus that developers usually receive when they are required to provide IZ units under mandatory IZ programs or incentivized to provide them under optional programs. Allowing for more potential units under current zoning is the key way IZ programs may increase new housing supply and, in turn, potentially lower market-rate prices in addition to producing new subsidized units.

[29] Gordon Chaffin, "The Wharf Development Raises the Question: How Affordable Is Affordable?," *Greater Greater Washington*, January 12, 2018.

**Table 2. Inclusionary Zoning Components' Expected Effects on New Housing Supply and Prices**

| Policy | Expected effect on new building permits | Expected effect on market rate house prices |
|---|---|---|
| Density bonus | ↑ | ↓ |
| Percent of new units required to be income restricted | ↓ | ↑ |
| Income-restricted units for lower-income residents | ↓ | ↑ |
| Years IZ units are income restricted | ↓ | ↑ |
| Developer allowed to make a payment to the jurisdiction in lieu of building IZ units | ↑ | ↓ |
| IZ units allowed to be built off-site | ↑ | ↓ |
| Applies to both multifamily and single family development | ↓ | ↑ |
| IZ program applies to entire jurisdiction | ↓ | ↑ |
| Minimum project size IZ program applies to | ↓ | ↑ |
| Participation in IZ program is optional | ↑ or no effect | ↓ or no effect |
| Participation in IZ program is mandatory | ↑, ↓, or no effect | ↑, ↓, or no effect |

The IZ tax consists of the cost of providing IZ units, which includes several components. The percentage of total new units required to be subsidized, the requirement of IZ units to be affordable to lower-income residents, and the length of time that the IZ units must remain subsidized all contribute to the cost of complying with the program.

Finally, some programs include flexibility for developers to comply in ways that reduce their cost. In the case of mandatory IZ programs that as a whole tax new housing construction, introducing flexibility will reduce the IZ tax, holding other aspects of the program constant. In some jurisdictions, developers are permitted to contribute to an affordable housing fund in lieu of providing units. If the required contribution is less than the cost of providing subsidized units over the required affordability period, this option will reduce the program's tax. Similarly, some programs allow developers to provide affordable units at a site other than where the new market-rate units are built. This may reduce the cost of the IZ units if, for example, they are built in a

mid-rise building with lower per-unit construction costs than new market-rate units in a high-rise building. In some cases, IZ programs apply to only multifamily development or only single-family development. If the IZ program as a whole is a tax on development, but it only applies to new multifamily construction, new supply can move to single family rather than multifamily, causing a smaller decline in new construction and a smaller increase in market-rate prices than the program would have caused otherwise. Similarly, when IZ requirements apply to only a portion of the jurisdiction, developers may move construction to the exempted portions rather than reducing it overall. IZ programs vary in the size of new development that they apply to. Projects that only apply to large new developments may allow new construction to continue apace if developers are able to avoid the IZ tax by building more, smaller new housing projects.

Ideally, studies of IZ would take into account the nuances of each IZ program to determine the effects of each program aspect on housing market outcomes. Bento and his coauthors come closest by controlling for IZ programs that apply to projects with 10 or fewer housing units and programs that apply to low-income households.[30] In my study, the sample size is unfortunately too small to include IZ program characteristics beyond distinguishing between optional and mandatory programs.

In addition to the disparate effects from each aspect of an IZ program, the programs will have different effects over time. On the supply side, IZ programs that are a tax on development can be expected to reduce new housing supply as soon as the program goes into effect. They may lead to a spike in permits before their implementation if developers know that an IZ tax will affect development in the future and advanced notice of the coming IZ requirement gives them an opportunity to secure building permits before the program takes effect. On the price side, the

[30] Bento et al., "Housing Market Effects of Inclusionary Zoning."

effects of IZ can be expected to increase the longer the program is in place. Whether an IZ program as a whole is a tax or a subsidy, its effects on price will increase the longer the program affects a city's new housing supply and, in turn, its total housing stock.

Because housing in one jurisdiction is a substitute for housing in nearby jurisdictions, IZ programs may affect market outcomes not only in the jurisdiction that implements them but in their neighboring jurisdictions as well. If an IZ program is a tax on development, it can be expected to reduce new housing supply in the jurisdiction that implements it while increasing supply in nearby localities where development can be expected to become relatively more profitable. On the price side, an IZ program that taxes development can be expected to raise prices in the jurisdiction that implements the program and also to cause a smaller price increase in nearby jurisdictions.

De jure and de facto IZ programs often differ significantly, creating challenges for estimating the effects of an IZ program on market outcomes. In many jurisdictions, the permitting process for each major project is a negotiation between a developer and city officials. This process may result in actual IZ requirements being greater or less than the policy would seem to require. In my empirical work, I use the number of IZ units produced relative to a jurisdiction's population as a proxy for the program's expected effect on house prices and new housing supply. The following section explains the data on IZ in the Baltimore-Washington region that I use to test the effects of IZ on house prices and new building permits.

## V. Data

The sample I use in my analysis includes the 56 permitting jurisdictions in the Baltimore-Washington Combined Statistical Region that are in Maryland, Virginia, and the District of

Columbia. These are 28 counties, 5 independent cities, 22 cities and towns that are within counties, and the District of Columbia. I exclude the region's jurisdictions in West Virginia, Pennsylvania, and Delaware. None of these jurisdictions have IZ programs. Twenty-four jurisdictions in my sample have or once had IZ programs, 16 mandatory and 8 optional. Within the time period for which I have data on new housing supply, 20 jurisdictions adopted IZ, and Prince George's County repealed it. Within the time period for which I have data on house prices, 16 jurisdictions adopted IZ.

In coding each jurisdiction's IZ ordinance, I use some discretion in determining how to categorize specific features of each program. The program in Arlington County, Virginia, is ambiguous in whether it is mandatory or optional. The county does not require developers to provide affordable units in any projects that are permitted by right. However, the county does require IZ units for any projects that require a site plan review. The median project size that triggers IZ requirements in the region is 20 units. Any project of 20 units or more in Arlington will very likely go through the site plan review process, so I classify this program as mandatory.

The most difficult data to gather, and potentially the least accurate data in my dataset, are the number of units that have been built in each jurisdiction and the fees they have collected in lieu of affordable units. These data are in dispersed places if jurisdictions report it at all. Montgomery County, Maryland, Washington, DC, Arlington, Virginia, and Alexandria, Virginia, provide excellent reports on their IZ programs, including detailed information on the number of units produced and fees collected, where applicable. For other jurisdictions, I pieced together information from their websites, conversations with planning staff, news reports, and reports from other researchers to develop the most accurate dataset possible. In some cases, I obtained data on the total number of IZ units produced, but not the year in which each unit was delivered.

In these cases, I reported the average number of units produced for each year of the program's existence. If my data on the number of units produced and fees collected are not accurate, they are likely biased toward 0 because planning staff in jurisdictions with IZ programs that produce few units may not know about a small number of units produced in the past. My data reflect the total number of IZ units produced under each program, to the best of my knowledge, but not all of these units are still income restricted.

In order to isolate the effect of IZ on housing supply and house prices, ideally a model would control for the effect of a jurisdiction's other land use regulations on these outcome variables. However, simply controlling for the existing land use regulations across jurisdictions will not be an effective control because the effect of the same regulations on house prices and new housing supply will vary across jurisdictions. The effect of, say, a minimum-lot-size regulation on housing supply and prices will be heterogeneous across jurisdictions. For example, a 10,000-square-foot minimum-lot-size requirement in a jurisdiction where the market would otherwise provide multifamily housing will have a much larger effect on housing supply and prices than the same regulation would have in a jurisdiction where the market would provide single family homes on 5,000-square-foot lots.

Rather than attempt to control for the effects of land use regulations on my dependent variables of interest, I restrict my analysis to those jurisdictions where IZ was introduced at a distinct time from other land use regulations. The majority of the jurisdictions in my sample introduced IZ with a stand-alone IZ ordinance rather than including IZ as a component of a larger zoning rewrite. The exceptions are Loudoun County, Virginia, which adopted IZ and a new zoning ordinance in 1993; Annapolis, Maryland, in 2004; and Harford County, Maryland, in 2008. I exclude these three jurisdictions from my regressions since I am unable to isolate the

effect of IZ relative to other land use policies introduced at the same time. After this I am left with a sample of 56 jurisdictions, 7 with optional IZ programs and 13 with mandatory IZ programs.

To measure the effect of IZ on house prices, I use Zillow data on median per-square-foot house prices.[31] Zillow researchers provide an index that mimics the price of a constant set of homes in each jurisdiction over time, using both actual sale data and data on the hedonic factors that affect house value, even among houses that are not sold during the period. Zillow uses its Zestimate value for each home in a jurisdiction to identify an estimate of the median home in that jurisdiction.[32] Zillow has found its Zestimates to be unbiased.[33] Relative to repeat sales indices, Zillow's methodology better reflects the effect of new-construction homes on median prices as well as any type of housing that is relatively unlikely to be sold during the period of interest.

Permitting jurisdictions in the Baltimore-Washington region include counties, independent cities, and incorporated cities and towns that do their own permitting. Zillow provides price data at the county level, which include any towns and cities within those counties, and at the city level. Counties with incorporated towns or cities that issue building permits require an adjustment to isolate the prices for homes in the county outside of other permitting jurisdictions. I use the number of households in each jurisdiction from Decennial Censuses and the American Community Survey (ACS) to take a weighted average of the prices of incorporated jurisdictions relative to county prices to isolate the median price at the county level.

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[31] Since Zillow has made its estimates available, economists have been using them in real estate research. See, for example, Laurie S. Goodman and Christopher Mayer, "Homeownership and the American Dream," *Journal of Economic Perspectives* 32, no. 1 (2018): 31–58.
[32] Zillow Research, "Zillow Home Value Index: Methodology," Zillow.com, January 3, 2014, https://www.zillow.com/research/zhvi-methodology-6032/.
[33] Zillow Research, "Zillow Home Value Index: Methodology."

For measuring the effect of IZ on new housing supply, I use jurisdictions' total permitted housing units from the Census and the Department of Housing and Urban Development's Building Permit Survey (BPS). This is not a perfect data source for new housing supply because it reflects gross new housing permits rather than permits net of demolitions. Additionally, not all permitted housing ends up being built, and the rate of building to permits may vary across jurisdictions. In spite of these problems, the BPS is used widely as a supply variable in the housing literature, including in some work on the effects of IZ on housing supply.[34]

I use demographic control variables from the ACS and from the Decennial Census at the county level and place level in the years in which they are available. I use linear interpolation to fill in these control variables in the years in which they are not available. These years include non-Census years prior to the start of the ACS in 2005 and the years in which not all demographic controls are available for places in the ACS. Margaret M. Weden and her coauthors provide support for using linear interpolation for Census demographic controls in longitudinal studies at the county level.[35] Table 3 provides summary statistics for my data on house prices, housing permits, demographic data, and mandatory and optional IZ.

The observations I am able to use in my regression analysis range from 561 to 1,054, depending on the specification. My spatial regressions require strongly balanced panels, causing them to have fewer observations than the standard cross-sectional regressions.

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[34] For example, Schuetz, Meltzer, and Been use it in their research on the effects of IZ on housing supply.
[35] Margaret M. Weden et al., "Evaluating Linearly Interpolated Intercensal Estimates of Demographic and Socioeconomic Characteristics of U.S. Counties and Census Tracts 2001–2009," *Population Research and Policy Review* 34, no. 4 (August 2015): 541–59.

**Table 3. Summary Statistics for Data Included in Regressions**

| Variable | Observations | Mean | Std. dev. | Min. | Max. |
|---|---|---|---|---|---|
| Price per square foot | 864 | 163.70 | 75.46 | 43 | 495 |
| Residential unit building permits | 1,320 | 756.40 | 1,172.21 | 0 | 7898 |
| Inclusionary zoning | 2,645 | 0.12 | 0.33 | 0 | 1 |
| Mandatory IZ | 2,645 | 0.09 | 0.28 | 0 | 1 |
| Optional IZ | 2,645 | 0.04 | 0.19 | 0 | 1 |
| Inclusionary units built | 2,645 | 9.16 | 60.43 | 0 | 1,224 |
| Population | 1,483 | 148,397 | 252,472 | 54 | 1,142,234 |
| Population density | 1,445 | 1,909.71 | 2,142.59 | 24.8 | 10,154.7 |
| Median household income | 1,367 | 63,632.28 | 21,767.46 | 20,185 | 148,750 |
| Mean commute time | 1,378 | 31.49 | 5.62 | 16.6 | 63 |
| Percentage over age 25 with bachelor's degree or higher | 1,371 | 28.48 | 14.93 | 2.5 | 80.9 |
| Percentage of white non-Hispanic householders | 1,366 | 75.14 | 16.79 | 16.1 | 100 |

## VI. Model

I use a difference-in-difference study design and a two-way fixed effects model to estimate the effect of IZ on new housing supply and prices by comparing the change in these outcome variables after jurisdictions adopt IZ to outcomes in jurisdictions that have not adopted it.

Endogeneity is a potential identification problem in this research—if IZ corresponds with higher market-rate housing prices, this could either be because of an IZ tax that reduces new housing supply and drives up house prices or because localities adopt IZ programs in response to high and rising prices. To test for this endogeneity, I use a two-way fixed effects model to estimate whether the years before a jurisdiction adopts an IZ program correspond with price increases. Equation 1 shows this model:

$$P_{jt} = \beta_1 I_{jt-1} + \beta_2 I_{jt-2} + \beta_3 I_{jt-3} + u_j + v_t + \varepsilon_{jt} \quad (1)$$

Here, $P_{jt}$ is the log of median per-square-foot house price at the level of permitting jurisdiction $j$ at time $t$. $I_{jt\text{-}1}$ is a dummy variable indicating whether a permitting jurisdiction adopted a mandatory or optional IZ program in the following year, $I_{jt\text{-}2}$ indicates whether the jurisdiction adopted IZ two years later, and $I_{jt\text{-}3}$ indicates adoption three years later. Table 4 shows the result of this basic model in column 1. In column 2 I add demographic controls.

**Table 4. House Prices in the Years Preceeding Inclusionary Zoning Implementation**

| | 1 | 2 |
|---|---|---|
| **Variables** | **ln(price per sq. ft.)** | **ln(price per sq. ft.)** |
| One year before IZ | –0.013 | –0.0072 |
| | (0.018) | (0.017) |
| Two years before IZ | –0.016 | –0.0056 |
| | (0.016) | (0.015) |
| Three years before IZ | –0.021 | –0.0086 |
| | (0.020) | (0.019) |
| ln(median household income) | | 0.090 |
| | | (0.14) |
| Population density | | 0.00015*** |
| | | (0.000029) |
| Mean commute time | | -0.0066 |
| | | (0.0041) |
| Percentage over age 25 with bachelor's degree or higher | | –0.0023** |
| | | (0.00090) |
| Percentage of white non-Hispanic householders | | 0.0055** |
| | | (0.0021) |
| Constant | 4.442*** | 3.041* |
| | (0.018) | (1.54) |
| Jurisdiction fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |
| Observations | 864 | 818 |
| $R^2$ | 0.940 | (0.952) |
| Number of Jurisdictions | 41 | 41 |

Notes: Robust standard errors clustered by jurisdiction in parentheses. *** represents $p < 0.01$, ** represents $p < 0.05$, * represents $p < 0.1$.

In both models, the coefficients on the IZ leads are small, negative, and insignificant, providing evidence that IZ is not adopted in response to a price spike. Among the demographic controls, population density and the percentage of householders who are white alone have small, positive coefficients, and the percentage of residents over age 25 with a bachelor's degree or higher has a surprising small, negative coefficient.

Next, I test the effect of IZ programs on median per-square-foot prices at the permitting jurisdiction level. I take advantage of the difference between mandatory and optional programs in my sample to distinguish between programs that are likely to have an effect on housing markets versus those that are not. Because jurisdictions with optional programs have adopted these affordability policies, we know they share some characteristics with the jurisdictions that have mandatory programs, including policymakers who express concern for affordability and a willingness to provide density bonuses in exchange for below-market-rate units. However, because the optional programs, with the exception of those in Alexandria and Falls Church, have not produced IZ units, the adoption of these programs should not have an effect on house prices and housing supply within the jurisdiction. To use a randomized control trial analogy, it is as if the jurisdictions with optional IZ programs that are not producing units are receiving a placebo rather than the treatment.

I first test the effect of mandatory IZ programs on house prices and supply, using jurisdictions with no IZ program as the control group. Then I separately test the effect of optional IZ programs, dropping Alexandria and Falls Church, with jurisdictions with no IZ program as the control group. My dependent variable is $P_{jt}$, again the log of median per-square-foot house prices in jurisdiction *j* at time *t*, as shown in equation 2:

$$P_{jt} = \beta_0 + \beta_1 Y_{jt} + u_j + v_t + \varepsilon_{jt} \quad (2)$$

## Table 5. Effect of Length of Mandatory Inclusionary Zoning Programs on House Prices

| | 1 | 2 | 3 |
|---|---|---|---|
| **Variables** | **ln(price per sq. ft.)** | **ln(price per sq. ft.)** | **ln(price per sq. ft.)** |
| Number of years of mandatory IZ | 0.011*** | 0.0081*** | 0.011* |
| | (0.0026) | (0.0018) | (0.0061) |
| ln(median household income) | | 0.0026 | 1.6*** |
| | | (0.13) | (0.087) |
| Population density | | 0.00012 | 0.000031 |
| | | (0.000029) | (0.000039) |
| Mean commute time | | –0.0057044 | –0.0019 |
| | | (0.0038) | (0.0053) |
| Percentage over age 25 with bachelor's degree or higher | | –0.0019 | –0.0026 |
| | | (0.00081) | (0.0016) |
| Percentage of white non-Hispanic householders | | 0.0074 | –0.0031 |
| | | (0.0028) | (0.0028) |
| Constant | 4.420*** | 3.830*** | |
| | (0.020) | (1.332) | |
| Jurisdiction fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | |
| Spatial autoregression | | | Yes |
| Number of years of mandatory IZ × year | | | Yes |
| Spatial autocorrelation $\lambda$ | | | 3.50 |
| | | | (2.21) |
| Observations | 734 | 690 | 561 |
| $R^2$ | 0.947 | 0.955 | |
| Pseudo $R^2$ | | | 0.113 |
| Number of jurisdictions | 35 | 35 | 33 |

Notes: Robust standard errors clustered by jurisdiction in parentheses. *** represents $p < 0.01$, ** represents $p < 0.05$, * represents $p < 0.1$. In the maximum likelihood estimation, the pseudo $R^2$ is $\{corr(y \, . \, \hat{y})\}^2$.

Because IZ can be expected to affect prices over time, with little or no effect on prices before its effect on new housing supply has had cumulative effects on the jurisdiction's total housing stock, my variable of interest is $Y_{jt}$, the number of years a mandatory IZ program has been in effect. Table 5 shows the results of this model.

Column 1 shows the results of this basic specification. I find that each year of a mandatory IZ program can be expected to increase per-square-foot house prices by 1.1 percent, significant at the 1 percent level. In column 2, I add demographic controls, which reduces the coefficient of interest to 0.81 percent. The demographic controls are all small and insignificant.

In column 3, I move to a spatial model. The "IZ tax" that increases prices in the jurisdiction that adopts it can also be expected to increase prices in nearby jurisdictions, since real estate markets are competitive across borders. To account for this, I use a model with spatial lags. I create a weighting matrix, $W$, of the inverse distance between the centroid of each jurisdiction relative to the other jurisdictions in the region, weighted by the jurisdiction's share of the region's total population. I use the maximum likelihood estimation method Lung-fei Lee and Jihai Yu developed to estimate the effect of $Y_{jt}$ on $P_{jt}$ with a spatial lag on price.[36] Because this model does not allow for year fixed effects with my sample size, I instead use an interaction term of year and the number of years the jurisdiction's IZ program has been in place, as shown in equation 3:

$$\begin{aligned} P_{jt} = \ & \lambda W_j P_{jt} + \beta_0 Y_{jt} + \beta_1 \left( Y_{jt} \times T_j \right) + u_j + \ \varepsilon_{jt} \\ & \varepsilon_{jt} = \rho W \varepsilon_{jt} + v_{jt}, \end{aligned} \tag{3}$$

[36] Lung-fei Lee and Jihai Yu, "Estimation of Spatial Autoregressive Panel Data Models with Fixed Effects," *Journal of Econometrics* 154, no. 2 (February 2010): 165–85.

where $\varepsilon_{jt}$ is a spatially autoregressive error term. In this specification, I find that one additional year of a mandatory IZ program can be expected to increase per-square-foot home prices by 1.1 percent, indicating that model 2 may understate the effect of mandatory IZ on price. The spatial autocorrelation coefficient $\lambda$ is not quite significant at the 10 percent level. In this specification, all of the demographic controls are small and insignificant, except for the natural log of median income, which is large, positive, and significant at the 5 percent level.

**Table 6. Effect of Length of Optional Inclusionary Zoning Programs on House Prices**

| | 1 | 2 |
|---|---|---|
| **Variables** | **ln(price per sq. ft.)** | **ln(price per sq. ft.)** |
| Number of years of optional IZ | 0.00086 | 0.0018 |
| | (0.0022) | (0.0016) |
| ln(median household income) | | –0.028 |
| | | (0.11) |
| Population density | | 0.000073*** |
| | | (0.000023) |
| Mean commute time | | –0.0026 |
| | | (0.0030) |
| Percentage over age 25 with bachelor's degree or higher | | –0.0017 |
| | | (0.0012) |
| Percentage of white non-Hispanic householders | | 0.0019 |
| | | (0.0014) |
| Constant | 4.37*** | 4.57*** |
| | (0.0234) | (1.21) |
| Jurisdiction fixed effects | Yes | Yes |
| Time fixed effects | Yes | Yes |
| Observations | 560 | 5243 |
| $R^2$ | 0.957 | 0.955 |
| Number of jurisdictions | 27 | 27 |

Notes: Robust standard errors clustered by jurisdiction in parentheses. *** represents $p < 0.01$, ** represents $p < 0.05$, * represents $p < 0.1$.

I turn next to testing the effects of optional IZ requirements on price after dropping Alexandria and Falls Church. Because these programs have not produced IZ units, I expect them to have no effect on price. The results from these models are reported in table 6.

As expected, the coefficient on the number of years an optional program has been in place is small and insignificant in column 1. After including the demographic controls in column 2, the coefficient of interest remains insignificant. Population density is the only significant demographic control, and it is positive and small.

Turning now to the effects of IZ on new housing supply, I use the same two-way fixed effects approach to estimate the effect of mandatory IZ programs on total new residential units permitted, as shown in equation 4:

$$T_{jt} = \beta_0 + \beta_1 U_{jt} + u_j + v_t + \varepsilon_{jt} \quad (4)$$

On the supply side, my dependent variable is total residential units permitted, $T_{jt}$. My independent variable of interest, $U_{jt}$, is the number of IZ units delivered under a mandatory IZ program in jurisdiction $j$ in year $t$ per 10,000 residents. I use this variable as a proxy for the size of the IZ program's effect on its jurisdiction's housing market. Mandatory IZ requirements that are commonly waived, such as in Baltimore, will produce few units and in turn will have little effect on housing market outcomes. Similarly, IZ programs that are enforced will have little effect on the jurisdiction's housing market if they apply only to large projects and if developers can avoid them if they are a tax on development. The results from this regression model are reported in table 7.

**Table 7. Effect of Inclusionary Zoning Unit Production under Mandatory Programs on New Building Permits**

| Variables | 1<br>log(total permits) | 2<br>log(total permits) | 3<br>log(total permits) |
|---|---|---|---|
| IZ units per 10,000 people | 0.021 | 0.036 | –0.19 |
| | (0.022) | (0.027) | (78) |
| ln(median household income) | | 0.45 | –1.03*** |
| | | (1.2) | (0.36) |
| Population density | | –7.2 | –0.00017 |
| | | (0.00040) | (0.00012) |
| Mean commute time | | –0.010 | 0.0025 |
| | | (0.045) | (0.027) |
| Percentage over age 25 with bachelor's degree or higher | | –0.0095 | –0.0025 |
| | | (0.012) | (0.0083) |
| Percentage of white non-Hispanic householders | | 0.029 | 0.082*** |
| | | (0.037) | (0.011) |
| Jurisdiction fixed effects | Yes | Yes | Yes |
| Time fixed effects | Yes | Yes | |
| Spatial autoregression | | | Yes |
| IZ units per 10,000 people × year | | | Yes |
| Constant | 5.47*** | –1.02 | |
| | (0.14) | (12.65) | |
| Spatial autocorrelation λ | | | –2.31 |
| | | | (4.08) |
| Observations | 1054 | 1005 | 900 |
| $R^2$ | 0.82 | 0.81 | |
| Pseudo $R^2$ | | | 0.0010 |
| Number of jurisdictions | 46 | 45 | 36 |

Notes: Robust standard errors clustered by jurisdiction in parentheses. *** represents $p < 0.01$, ** represents $p < 0.05$, * represents $p < 0.1$. In the maximum likelihood estimation, the pseudo $R^2$ is $\{corr(y \, . \, \hat{y})\}^2$.

Here, I find no evidence of mandatory IZ programs having an effect on new housing supply in the results of the cross-sectional models reported in columns 1 and 2. Column 3 uses the same spatial autoregression approach described in equation 3 above for new housing supply rather than price. As in the cross-sectional models, I find no evidence that mandatory IZ reduces

new building permits. Finally, I test the effect of IZ units delivered per 10,000 residents in jurisdiction *j* in year *t* on house price. The results are reported in table 8.

**Table 8. Effect of Inclusionary Zoning Unit Production under Mandatory Programs on House Prices**

| Variables | 1<br>ln(price per sq. ft.) | 2<br>ln(price per sq. ft.) | 3<br>ln(price per sq. ft.) |
|---|---|---|---|
| IZ units per 10,000 people | 0.0040 | 0.00074 | -0.00036 |
| | (0.0030) | (0.0018) | (0.012) |
| ln(median income) | | 0.0068 | 1.7*** |
| | | (0.15) | 0.087 |
| Population density | | 0.00015 | 0.000052 |
| | | (0.000031) | (0.000037) |
| Mean commute time | | –0.0059 | –0.0014 |
| | | (0.0043) | (0.0053) |
| Percentage over age 25 with bachelor's degree or higher | | –0.0027 | –0.0029 |
| | | (0.00093) | (0.0016) |
| Percentage of white non-Hispanic householders | | 0.0067 | -0.0029 |
| | | (0.0027) | (0.0029) |
| Jurisdiction fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | |
| Spatial autoregression | | | Yes |
| IZ units per 10,000 people × year | | | Yes |
| Constant | 4.43*** | 3.82** | |
| | (0.02) | (1.54) | |
| Spatial autocorrelation $\lambda$ | | | 1.17 |
| | | | (1.92) |
| Observations | 732 | 690 | 561 |
| $R^2$ | 0.941 | 0.957 | |
| Pseudo $R^2$ | | | 0.275 |
| Number of jurisdictions | 35 | 35 | 33 |

Notes: Robust standard errors clustered by jurisdiction in parentheses. *** represents $p < 0.01$, ** represents $p < 0.05$, * represents $p < 0.1$. In the maximum likelihood estimation, the pseudo $R^2$ is $\{corr(y \, . \, \hat{y})\}^2$.

The results of the cross-sectional models in columns 1 and 2 and the spatial model in column 3 indicate that, using this dependent variable as a proxy for a mandatory IZ program's effect on market-rate prices, mandatory IZ does not have an effect on price.

The specification in equation 2, with the number of years a mandatory IZ program has been in place as the dependent variable of interest (results in table 5), provides some support for Ellickson's description of mandatory IZ as a tax on development. If mandatory IZ programs tax construction and result in reduced new housing construction, their effect will increase over time as reduced housing construction year after year reduces a jurisdiction's total housing supply relative to what it would have had without the IZ program. The results in table 4 provide evidence that IZ is not adopted in response to rising prices, indicating that its effect on price is exogenous. Further, optional IZ programs (results in table 6) that do not produce units have no effect on prices, indicating that these jurisdictions do not experience the same price increase as jurisdictions where IZ may tax new construction. My empirical finding that, on average, mandatory IZ programs in the Baltimore-Washington region tax market-rate housing is supported by the lack of uptake of optional IZ programs with higher density bonuses than those offered under the region's mandatory programs.

However, the supply model in table 7 provides evidence that IZ programs, proxied by the number of units they produce relative to their jurisdiction's size, have no effect on new housing permits. A potential explanation for mandatory IZ increasing price while not decreasing supply is that IZ increases the cost of building new housing without reducing the quantity of construction. For example, IZ may lead developers to pursue more, smaller projects.[37] Smaller projects may

[37] Since Portland, Oregon, has adopted an IZ program that applies to new housing developments with 20 or more units, it has seen an uptick in permits for projects between 12 and 19 units. See Noel Johnson and Mike Kingsella, "The Cautionary Tale of Portland's Inclusionary Housing Policy," *Up for Growth*, April 25, 2019.

allow them to avoid IZ requirements by staying below a unit threshold for each project. It may be less efficient to build smaller numbers of units in each project, resulting in higher prices without a reduction in total new supply. Alternatively, IZ may lead developers to shift to higher-end housing that has the profit margins to cross-subsidize IZ units where lower-end new construction may be infeasible under IZ requirements.[38]

As reported in table 8, I find that using a jurisdiction's number of IZ units produced relative to its population as the independent variable of interest indicates that IZ programs do not affect market prices. While I think that the number of years an IZ program has been in place is the more theoretically sound model for how IZ programs can be expected to affect prices, this finding shows that the results reported in table 5 are sensitive to specification.

## VII. Conclusion

IZ's prevalence is rapidly increasing, but relatively little work has been done to study its effects on housing markets. My results contribute to the small literature on this question and provide new data on the characteristics of IZ programs in the Baltimore-Washington region.

Measuring the effects of IZ on housing market outcomes is difficult because each program is unique, and the sample size of jurisdictions in a housing market is relatively small. Actual requirements for income-subsidized units may deviate from a locality's stated policy, so data on IZ policies are noisy.

These measurement challenges provide reasons to be cautious about making strong claims about IZ's effect on housing markets based on empirical studies, but the body of research

[38] Emily Hamilton and Stephen Smith, "The Renewed Debate on Inclusionary Zoning," *Market Urbanism*, October 10, 2012.

attempting to measure the causal effect of IZ on house prices and new housing construction provides some evidence that IZ increases house prices and reduces housing supply.

In my analysis of IZ's effects in the Baltimore-Washington region, I find evidence that mandatory IZ programs increase house prices but not that they reduce new housing construction. Measuring the effect of optional programs separately from that of mandatory programs allows me to distinguish between programs that Ellickson's theory would predict act as a tax on development versus those that it would not. As expected, I find that optional programs that are not producing IZ units are not associated with higher house prices.

As IZ continues to gain prevalence as a tool for attempting to increase access to affordable housing, more empirical work on its effects on housing markets is needed to evaluate whether it is possible for IZ to achieve affordable housing goals without exacerbating affordability problems for those who do not receive IZ units. Additionally, case study work on specific IZ programs can provide important insights. For example, the general lack of IZ production under optional programs indicates that even large density bonuses may not offset the cost of providing below-market-rate units.

Optional IZ programs with density bonuses large enough to result in production present a way for policymakers to incentivize affordable housing construction without the risk of introducing a new tax on market-rate development. However, optional programs rely on exclusionary zoning to work, as the cases of Alexandria and Falls Church show. They do not solve an underlying problem of exclusionary zoning.