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The Price of Inclusion:

Evidence from Housing Developer Behavior

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Abstract

In many cities, incentives and regulations lead developers to integrate low-income housing into market-rate buildings. How cost-effective are these policies? I study take-up of a tax incentive in New York City using a model in which developers trade off between tax savings and pre-tax income. Estimating the model using policy variation and microdata on development from 2003 to 2015, I find a citywide marginal fiscal cost of $1.6 million per low-income unit. Differences in neighborhoods, not developer incidence, explain the cost premium over other housing programs. Weighing costs against estimates of neighborhood effects, I conclude middle-class neighborhoods offer "opportunity bargains."

JEL Codes: H21, H22, H32, H71, R28, R31, R38

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1 Introduction

Inclusionary housing programs, which encourage or require developers to include low-income units in new market-rate multifamily housing construction, are an increasingly common type of urban policy in the United States. Of the top 100 U.S. cities by population, 33 had an inclusionary housing program as of 2020, 18 of which did not in 2010. A key motive for these policies is social integration: Recipient households usually live in buildings with higher-income tenants and in higher-income neighborhoods than recipients of other forms of housing assistance. Yet the benefits of such policies come at a price. When mandatory, inclusionary housing is an implicit tax on market-rate housing; when voluntary, it requires subsidies or valuable exceptions to zoning regulations to generate participation. How costly is it to induce developers to provide inclusionary housing? What explains cost differences between it and other housing programs? And are the better neighborhoods it obtains for recipients worth their costs?

I build and estimate a model of housing developer behavior to answer these questions. In my model, developers choose whether to enter a new building into a voluntary inclusionary housing program, in which they receive tax benefits for reserving a fraction of units in the building for low-income tenants who pay regulated rents. Developers compare their potential tax savings and forgone rental income, participating if the former exceeds the latter in present value. To estimate the model, I use several sources of policy variation that cause developers of similar buildings to be offered tax benefits of greatly different value. As the tax benefit a developer receives is a function of potentially endogenous building characteristics, such as its number of units, I apply a simulated-instruments approach, as in Currie and Gruber (1996). This approach exploits both policy variation in the tax-benefit formula as well as a subset of lot characteristics, such as lot area and zoning, that are plausibly exogenous to tax policy but that greatly affect building choices. From my estimates, I obtain the distribution of developers' breakeven thresholds, the supply of inclusionary units, and the average marginal fiscal cost per unit.

In my empirical analysis, I evaluate New York City's 421-a property tax exemption for inclusionary housing. With an annual fiscal cost of $1.6 billion as of 2020, 421-a is New York City's

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largest residential property tax expenditure and the largest inclusionary housing program of any U.S. city. From 2003 to 2015, the period I study, about 12,000 onsite inclusionary units were built under 421-a, or 4.7 percent of all exemption-eligible new residential units. Developers of eligible buildings face the same choice as in my model: They may accept the exemption in compensation for setting aside one in five units for low-income tenants, or they may decline the exemption and charge market rents on all units. I estimate the model using the participation decisions of all eligible developments and data on their lot and block characteristics. I use my estimates to characterize developer behavior in the face of 421-a, both on citywide average and for 179 neighborhoods. I also evaluate the cost-effectiveness of 421-a relative to Section 8 vouchers and the Low-Income Housing Tax Credit (LIHTC), analyzing in particular the roles of neighborhood differences and incidence on developers in determining program cost differences. Finally, I use external estimates of neighborhood effects to weigh the fiscal costs of 421-a against the long-run benefits of moving households to higher-opportunity neighborhoods.

There are five main conclusions of my empirical analysis. First, developers respond to incentives. I estimate that increasing the 421-a incentive by one percentage point of building value would increase the take-up rate by 0.59 percentage points. Second, 421-a is costly by comparison to other forms of housing assistance in New York City. On citywide average, I estimate that the fiscal cost of the marginal inclusionary unit is about $1.6 million, which is about six times the citywide per-unit cost of Section 8 vouchers or the LIHTC. Third, there is immense variation across neighborhoods in developers' breakevens, supply responses, and average marginal fiscal costs per inclusionary unit. For instance, in some Manhattan neighborhoods, the average marginal fiscal cost of an inclusionary unit is as high as $2 million. By contrast, in many neighborhoods in the Bronx, Queens, and Staten Island, the average marginal fiscal cost is less than $150,000.

These disparities across neighborhoods also suggest that cost differences between 421-a and other housing assistance programs may simply reflect differences in the geographic distributions of their units. Whereas Section 8 voucher and LIHTC units are concentrated in low-income neighborhoods, inclusionary units are concentrated in higher-income ones. In my fourth empirical contribu-

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tion, I adjust for neighborhood differences to conduct a closer comparison of programs. Applying the reweighting method of DiNardo et al. (1996), I estimate how much the average inclusionary unit would cost New York City if, instead, such units had the same geographic distribution as Section 8 and LIHTC units. By this counterfactual, I find that the average cost difference between 421-a and these programs entirely reflects differences in neighborhoods. I also rule out the possibility that differential incidence on developers explains an economically significant share of the 421-a cost premium. Between-program cost differences thus primarily reflect the fundamental trade-off in housing policy between quality and cost per unit.

Should New York City's government be willing to pay such a premium for inclusionary units in higher-rent neighborhoods? In my fifth and final contribution, I estimate the marginal value of public funds (MVPF) of using 421-a to add inclusionary units in each neighborhood. To do so, I combine my neighborhood-specific estimates of the marginal fiscal cost of inclusionary units with estimates of the long-run effects of neighborhoods on children's adult incomes from Opportunity Insights (Chetty et al., 2018). As in Hendren and Sprung-Keyser (2020), the MVPF of 421-a weighs its present-value fiscal cost, net of fiscal externalities, against households' willingness to pay for inclusionary units and the long-run neighborhood effects on their children's after-tax incomes. I detect "opportunity bargains" in many middle-class neighborhoods. Other neighborhoods have low MVPFs, due to high fiscal costs in the highest-income neighborhoods and negligible benefits in the lowest-income neighborhoods. An across-the-board increase in the 421-a incentive would be poorly targeted, producing more inclusionary housing in low-MVPF neighborhoods than in high-MVPF ones. Overall, 421-a appears a mistargeted, but not inefficient, policy to encourage mixed-income housing development.

My results inform debates over inclusionary housing policies in New York City and other cities. 421-a's future is now in question amid legislative gridlock over state property-tax reform, and much controversy surrounds a Mandatory Inclusionary Housing (MIH) policy in select neighborhoods. Proposals for inclusionary housing policies are also under consideration in several mid-size U.S. cities. Meanwhile, several U.S. states have preemption laws that forbid their cities from estab-

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lishing inclusionary housing programs. Such policy activity belies the near-total lack of evidence on the impacts of inclusionary housing. Interestingly, the key questions in these debates relate to housing supply under inclusionary policies. For example, the Association for Neighborhood and Housing Development, an advocacy group for housing nonprofit organizations, writes that 421-a "forfeits billions of dollars in public money for minimal public benefit in return," describing it as "a windfall for real estate developers, with little return for communities." On the other hand, a former senior official of the Department of City Planning criticizes New York City's MIH program for undercompensating developers: "MIH reflects a fundamental failure to recognize that inclusionary zoning is always voluntary. No development occurs without the expectation of a threshold rate of return on investment."[1] My results also inform debates over MIH policies and, in particular, suggest that MIH's implicit surtax is large relative to typical property tax rates.

This paper contributes to several literatures in public finance and urban economics. It is one of the first to conduct a microeconometric evaluation of developer participation in any type of housing program. DiPasquale (1999) argues that "our understanding of the micro foundations of housing supply" would be best advanced by "bringing new data to bear on the decision-making processes" of developers. Credible evidence on cost-effectiveness is particularly scarce in housing policy: Olsen and Zabel (2015) argue that such analyses should be "the highest priority for housing policy research." Scholars have previously studied market-level equilibrium impacts of Section 8, the LIHTC, and other housing subsidies (Susin, 2002; Sinai and Waldfogel, 2005; Gibbons and Manning, 2006; Baum-Snow and Marion, 2009; Eriksen and Rosenthal, 2010; Diamond and McQuade, 2019). This paper is also related to research evaluating the impacts of housing policies, especially ones aimed at inclusion and desegregation (Wong, 2013; Chetty et al., 2016; Chyn, 2018; Collinson and Ganong, 2018; Diamond et al., 2019; Favilukis et al., 2019; Van Dijk, 2019; Bergman et al., 2020; Davis et al., 2020). The central role of developer and landlord participation

[1] Association for Neighborhood and Housing Development, "421A Developer's Tax Break," 2 January 2014. Eric Kober, "De Blasio's Mandatory Inclusionary Housing Program: What Is Wrong, and How it Can Be Made Right," Manhattan Institute, January 2020.

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in U.S. housing policy since the 1970s suggests many applications of my approach beyond inclusionary housing. Previous research on inclusionary housing is limited to city-level case studies (e.g., Schuetz et al., 2011). A recent paper, Singh (2020), uses reforms to 421-a as a source of variation to study the impact of new housing development on gentrification. Methodologically, my work takes a revealed-preference approach to study selection into voluntary regulation, similar to Anderson and Sallee (2011) on fuel-economy standards, Benzarti (2020) on tax itemization, Kisin and Manela (2016) on bank capital requirements, and Einav et al. (2020) on provider choice of payment systems in public health insurance.

This paper proceeds as follows. Section 2 explains New York City's 421-a exemption and the broader context. Section 3 explains how I measure the 421-a tax incentive. Section 4 presents a model of developer behavior under voluntary inclusionary housing. Section 5 introduces the data. Section 6 presents simple graphical evidence for developer responses to 421-a. Section 7 shows how I estimate my model of developer behavior, and Section 8 reviews the estimation results. Section 9 evaluates the cost-effectiveness of 421-a. Section 10 concludes.

2 Inclusionary Housing in New York City and the U.S.

In this section, I first provide an overview of inclusionary housing in the context of U.S. housing policy. I then explain relevant details about the housing market in New York City. Finally, I introduce the key features of New York City's 421-a exemption.

2.1 Inclusionary Housing and U.S. Housing Policy

One third of the 100 most populous U.S. cities had inclusionary housing policies in 2020, as shown in Appendix Figure A1. There is, however, much variation in form across cities. First, inclusionary housing policies may be mandatory or voluntary. Of these 100 cities, 24 have mandatory programs, and 12 have voluntary programs. Second, among voluntary policies, cities differ in the type of incentives used to attract developer participation. Most commonly, cities grant "density bonuses," which are development rights to exceed allowable floor area on a given lot under zoning regulations, or expedite the permitting process. Third, policies vary in the covered share of new buildings

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and in the set-aside share of units inside covered buildings.[2] The long history of New York City's 421-a program, its considerable scale, and the explicit cash value of the incentive make it a natural starting point for economic research on inclusionary housing.

There are major differences between inclusionary housing and the two main forms of low-income housing policy in the U.S. (Collinson et al., 2015), Section 8 vouchers and the LIHTC. These differences lie the nature of the buildings and the neighborhoods in which recipient households live. Table 1 shows these differences in New York City by combining several sources of microdata from the U.S. Department of Housing and Urban Development (HUD, see Appendix C). In LIHTC buildings in New York City, nine in ten units are for low-income tenants. By comparison, one in five units are for low-income tenants in 421-a buildings. The surrounding neighborhoods also differ. The median household in an inclusionary unit lives in a Census block group with a median annual income around $100,000, more than twice that of Section 8 voucher or LIHTC households. The educational and demographic composition of neighborhoods with 421-a, Section 8, and LIHTC units also differs markedly. At both building and neighborhood levels, inclusionary housing is unusual among U.S. housing policies in deconcentrating poverty.

2.2 The Housing Market in New York City

New York City's housing market is atypical among U.S. cities in several respects that are relevant to my analysis. First, in the extent of government intervention: Of rental units, about 14 percent are social housing (i.e., public or subsidized), and about half are rent-regulated, both much more than in other U.S. cities (Metcalf, 2018). It is thus possible to conduct sensible comparisons within New York City between housing programs. Second, zoning and other land-use regulations are set such that, at the lot level, they are usually a binding constraint on housing supply (Glaeser et al., 2005). As development is almost predetermined, there is little space for responses to tax incentives along margins such as the number of units or type of land use.

[2] Other margins of variation include the existence of options to build inclusionary units offsite or to pay "in-lieu fees" to be discharged of obligations, the comparability of market-rate and inclusionary units, allowable rents on inclusionary units, and the income range of inclusionary tenants.

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Third, New York City's property tax code exhibits very high statutory tax rates (above 10 percent, see Appendix Figure A4) but on assessed values that are usually small fractions of properties' market values. On average, effective property tax rates in New York City (expressed as a share of market value) are below rates in most U.S. cities for owner-occupied housing but are near the U.S. average for rental housing (Lincoln Institute of Land Policy and Minnesota Center for Fiscal Excellence, 2019). The existence of high statutory rates and often-arbitrary assessment practices, however, generates variation between buildings in effective tax rates and sustains demand from developers for tax relief. In particular, 421-a is one of several tax incentives for property investment in New York City. An implication of these alternatives is that the budgetary cost of 421-a overstates the additional revenue New York City would raise if 421-a were abolished, as some developers who take up 421-a would take up other exemptions in its absence. The existence of alternative tax incentives also creates challenges for my analysis that I discuss in Sections 3 and 8.

2.3 The 421-a Exemption

Section 421-a of the New York State Real Property Tax Law codifies an "exemption of new multiple dwellings from local taxation." Here I discuss its key features and history from its introduction in 1971, through the period I study (2003–2015, coinciding approximately with Michael Bloomberg's three terms as mayor), up to its latest iteration following a reform in 2015. In Section 3, I describe in detail the sources of policy variation I use in estimation. In both sections, I draw primarily on the text of the statute as well as on administrative rules.

421-a is a multi-year partial exemption from property taxation that is primarily for multifamily residential developments with "inclusionary" units—that is, units for low-income tenants who pay regulated below-market rents. The exemption applies only to the building (i.e., non-land) component of property value, thereby transforming the property tax into a de-facto land value tax. It may last between 10 and 25 years after construction. In some neighborhoods, residential buildings are eligible for a shorter "as-of-right" exemption even if they do not provide any inclusionary housing. In 1985, New York City introduced its requirement that 421-a buildings include low-income units, a stipulation at first applying only to midtown Manhattan.

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The 421-a exemption is the largest residential property tax expenditure in New York City. Since the 1980s, about one in three new units received a 421-a exemption, as shown in Appendix Figure A2. The fiscal cost of 421-a is substantial: In total, 421-a exempts from taxation about 15 percent of the assessed value of all multifamily residential property in New York City. With the continued rise of property values in New York City over time, the tax expenditure on 421-a has grown about twenty-fold in inflation-adjusted terms since 1999. Appendix Figure A17 shows that 421-a's cost greatly exceeds that of other tax expenditures on residential property in New York City.

To receive the most generous exemption, a developer must reserve one in five units for inclusionary tenants. This fraction is fixed; developers cannot reserve more or fewer units than one in five to adjust the value of the exemption. In each year, the maximum rent on inclusionary units is fixed citywide relative to the Area Median Income (AMI) for New York City, as determined by HUD. Inclusionary unit rents must be less than 30 percent of income to households making 60 percent of the New York City AMI. In 2019, the AMI for a family of three was $96,100, and so their maximum monthly rent was $1,442. Whereas these rent caps apply uniformly across New York City, market rents vary markedly, creating variation in the "replacement rate" of the regulated rent for the market rent. Inclusionary tenants are selected through a non-market allocation process jointly run by the city government and the property manager.

A new multifamily dwelling is eligible for 421-a if it has a sufficient number of units and is built on an eligible lot. Before December 2007, the minimum number of units was three, after which the minimum rose to four units. A lot is eligible if it was vacant or deemed "underutilized" for three years before construction. Residential buildings are eligible whether their market-rate units are rentals or owner-occupied as a cooperative or condominium.

Until December 2007, developers could choose whether to build inclusionary units onsite or offsite. If offsite, they received a shorter tax exemption. From 2008 onward, the offsite option was abolished. The focus of this paper is onsite inclusionary housing, but I analyze the offsite option in Appendix D. Developers have an obvious incentive to minimize the value of onsite units they set aside for low-income tenants. The comparability of onsite inclusionary units to market-rate units

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in the same building is, accordingly, a focus of regulation and enforcement.[3]

In January 2016, beyond my data, the 421-a program temporarily closed to new development. It returned in April 2017 as the Affordable New York Housing Program with several notable reforms that applied retroactively to developments that filed an initial permit after December 2015.[4] Under the new policy, developers may select among various combinations of a set-aside share and tenant income bands for inclusionary units.

3 Measuring the 421-a Incentive at the Building Level

This section sets out my definition of the value of tax savings from 421-a. It then discusses the key sources of policy variation in developers' incentives to participate in 421-a, as determined by a microsimulation model of New York City's property tax code (see Appendix C).

3.1 Definition of Tax Savings

The ideal economic measure of a developer's incentive to provide onsite inclusionary housing under 421-a is the difference in the present values of its expected after-tax profits between accepting 421-a and its next-best alternative option. There are two conceptual challenges in implementing this measure in the data. First, I do not know the developer's forecast for their building's market value over time, which determines assessed values and thereby tax payments. Second, I do not know the developer's entire choice set, including all combinations of tax exemptions and buildings that could have been built on their lot, from which it finds its next-best alternative. To make

[3]Since July 2008, developers are required to have a "proportional" mix of inclusionary and market-rate units with respect to the number of bedrooms, spread across floors, with equal access to building amenities. Many unit characteristics, from views to appliances, are also regulated. Developers have nevertheless tried to game these rules, infamously in the 2014 "poor door" scandal.

[4]The reform also allowed buildings where construction began before December 2015, but which had not yet received any 421-a benefit, to opt into a more generous exemption. The developers who accepted this option appear to have already decided to accept 421-a in its prior form. I treat the 16 affected buildings as accepting 25-year exemptions.

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progress, I specify developers' expectations and choice sets.

For each building i, I define the 421-a tax savings as the difference in its present values of tax liabilities between providing and not providing onsite inclusionary housing, expressed as a share of i's total market value and holding fixed all other building characteristics. Let $\tau_{i,s}^1$ and $\tau_{i,s}^0$ be i's potential tax rates in year s, respectively conditional upon participating and not participating. The difference in present values is approximately

$$\Delta\text{PDV}_{i,0} \approx \text{E}_0 \left[\sum_{s=0}^{\infty} \beta^s \left(\tau_{i,s}^0 - \tau_{i,s}^1 \right) V_{i,s} \right],$$

where $\text{E}_s[\cdot]$ is expectation in year s and $V_{i,s}$ is i's market value in s.[5] To simplify this expression, I make three further assumptions. First, market values reflect expected paths of future rents: $V_{i,t} = \text{E}_t \left[\sum_{s=t}^{\infty} \beta^s (1-\tau_s) R_{i,s} \right]$. Second, the expected path of future rents is $\text{E}_t[R_{i,s}] = R_{i,t}(1+r)^{s-t}$. Dividing $\Delta\text{PDV}_{i,0}$ by $V_{i,0}$, substituting for $V_{i,s}$, and letting $\rho = [\beta(1+r)]^{-1} - 1$ be the capitalization rate, I obtain my measure of tax savings:

$$\Delta\tau_i = \frac{\Delta\text{PDV}_{i,0}}{V_{i,0}} = \text{E}_0 \left[\sum_{s=0}^{\infty} \frac{\tau_{i,s}^0 - \tau_{i,s}^1}{(1+\rho)^s} \right],$$

which is the sum over time of differences in property tax rates between participating and not participating in 421-a, discounting by the capitalization rate. I set $\rho = 0.05$, consistent with industry surveys (e.g., by the CBRE Group) of multifamily housing developers in New York City.

3.2 Sources of Variation in the 421-a Exemption

In Appendix C, I explain how New York City determines property tax bills, and I replicate their calculations in a microsimulation model of the property tax code. Here I review the policy variation in 421-a, as embedded in my microsimulation model, that occurs due to features of 421-a itself and indirectly due to interactions of 421-a with the rest of the property tax code.

The duration in years of the 421-a exemption depends upon whether the development provides inclusionary housing, whether the inclusionary housing is onsite or offsite, the year of filing the

[5] This approximation ignores that a lower tax rate may raise the building's market value, indirectly raising tax payments.

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initial construction permit, and the region of New York City in which the development is located (see Appendix Table A2). In summary, developments receive longer exemptions when they provide onsite inclusionary housing, and the incentive to provide inclusionary housing is considerably stronger in some neighborhoods of New York than in others.

Several sources of geographic variation exist in the incentive for inclusionary units. First, there is the "Geographic Exclusion Area" (GEA), which initially covered midtown Manhattan. Development in the GEA faces a larger incentive for inclusionary units than development outside the GEA. The GEA has also changed its boundary over time. In May 2005, some of the Greenpoint–Williamsburg neighborhood of Brooklyn was added to the GEA as part of a rezoning. In July 2008, reforms to 421-a expanded the GEA region to cover all Manhattan as well as several other neighborhoods, primarily parts of Brooklyn. Appendix Figure A5 maps the GEA over time.

Second, as part of the Neighborhood Preservation Program (NPP)—a now-obscure policy established in 1973 to prevent urban decay—buildings in areas of Brooklyn, the Bronx, and Queens were eligible until 2008 for the longest-duration 421-a exemption "as of right," meaning they faced no tax incentive to provide inclusionary housing. Appendix Figure A6 maps the NPP areas.

The same 2008 law also limited as-of-right 421-a exemptions citywide in buildings with more than four units to the first $65,000 of assessed value per unit, a reform known as the "AV cap." The introduction of the AV cap therefore strengthened incentives to provide inclusionary housing for more-expensive buildings relative to less-expensive buildings.

Policy variation in 421-a also emerges indirectly through assessment practices. Exemptions are less valuable to developers who anticipate the assessed value of their building will be lower relative to the building's true market value. In particular, a bias in the valuation of condominiums and limits on the growth of assessed values, discussed in Appendix C, mean that 421-a predictably reduces some buildings' effective tax rates, defined with respect to market value, more than those of other buildings. Furthermore, the AV cap is less likely to bind for underassessed buildings, further reducing their 421-a incentive.

To rule out the possibility my results are driven by other policies in New York City, not 421-a,

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my analysis also controls for several smaller-scale housing policies of which I am aware and that plausibly interact with 421-a. I discuss these in Appendix C.

4 Tax Incentives and Housing Developer Behavior

This section develops a model of a profit-maximizing developer who chooses whether to participate in a voluntary inclusionary housing program. In particular, I show their participation choice is governed by a trade-off between the present values of tax savings and pre-tax rental income.

In return for setting aside a share λ of units for low-income tenants who pay below-market rents, participating developers pay a reduced property tax rate. I let $\Delta\tau_i \geq 0$ denote the present value of tax savings, expressed as a share of building i's value. I take the building as fixed and assume away any intensive margin response in housing supply, motivated by the stringency of zoning regulations in much of New York City. I also treat the housing market as perfectly competitive, so that conditional on the set-aside share λ, developers take rents as given. Appendix B presents a model that relaxes both assumptions. Taxes are levied in proportion to rental income.

Inclusionary tenants pay rents to the developer that are fixed at r_t citywide in year t. In market-rate units, the rent $m_{i,t}(\lambda)$ is a function of building characteristics and the set-aside share. If $\partial m_{i,t}(\lambda)/\partial\lambda < 0$, then setting aside units for inclusionary tenants reduces the willingness to pay of market-rate tenants. Putting these together, the building average rent in year t is:

$$p_{i,t}(\lambda) = \lambda r_t + (1-\lambda)m_{i,t}(\lambda).$$

Letting building i's pre-tax rental income in year t be $R_{i,t}(\lambda) = N_i p_{i,t}(\lambda)$, where N_i is its number of residential units, the present value of expected after-tax rental income is

$$\pi_i(\lambda) = \mathrm{E}_0\left[\sum_{s=0}^{\infty}\beta^s(1-\tau_s(\lambda))R_{i,s}(\lambda)\right].$$

To analyze the impact of the inclusionary units, it will be convenient to define the log-difference in the present-value average rent between the participation and nonparticipation options:

$$\Delta\log p_i(\lambda) \approx \sum_{s=0}^{S}\frac{p_{i,s}(\lambda)-p_{i,s}(0)}{(1+\rho)^s p_{i,s}(0)} = -[\lambda\mu_i + (1-\lambda)\delta_i(\lambda)], \tag{1}$$

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where I further define

$$\mu_i = \sum_{s=0}^{\infty} \frac{m_{i,s}(0) - r_s}{(1+\rho)^s m_{i,s}(0)} \quad \text{and} \quad \delta_i(\lambda) = \sum_{s=0}^{\infty} \frac{m_{i,s}(0) - m_{i,s}(\lambda)}{(1+\rho)^s m_{i,s}(0)}.$$

The term μ_i reflects the inclusionary discount: It is the difference in rent between an inclusionary unit and a market-rate unit in the nonparticipation counterfactual. The term $\delta_i(\lambda)$ reflects the disamenity: It is the discount on rent that the developer offers on market-rate units to compensate for the presence of inclusionary units. Weighted by the set-aside share, these terms yield the forgone rental income, expressed as a share of potential rental income.

The developer participates in the inclusionary housing program if its potential after-tax rental income under participation exceeds its potential after-tax rental income under nonparticipation:

$$D_i = 1[\Delta\pi_i(\lambda) \geq 0],$$

where $\Delta\pi_i(\lambda) = \pi_i(\lambda) - \pi_i(0)$ denotes the difference in after-tax rental income for i. As market rents are fixed conditional on λ and the developer has no intensive supply margin, the log-difference in after-tax rental income is

$$\Delta \log \pi_i(\lambda) = \Delta\tau_i + \Delta \log p_i(\lambda), \tag{2}$$

reflecting the offsetting forces of a lower property tax liability and a lower pre-tax rental income. As $\Delta\pi_i(\lambda) \geq 0$ if and only if $\Delta \log \pi_i(\lambda) \geq 0$, I obtain the program participation condition:

$$\Delta\tau_i \geq \lambda\mu_i + (1-\lambda)\delta_i(\lambda), \tag{3}$$

using the expression for $\Delta \log p_i(\lambda)$ in Equation 13. In deciding whether to participate in an inclusionary housing program, a developer compares the tax savings (the left-hand side of Equation 3) and the impact of the lower average rent on its pre-tax rental income (the right-hand side of Equation 3). Forgone rental income is greater when the set-aside share λ, the inclusionary discount μ_i, or the disamenity $\delta_i(\lambda)$ is larger.

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5 Data

I use several public data sources on property taxation and land use in New York City. Together, my data cover the universe of new development that was eligible for 421-a and allow me to calculate, for each such development, the potential property tax savings under 421-a from building onsite inclusionary units, whether or not the developer in fact chose to participate. Observing both the potential tax savings at the individual building level and developers' actual decisions allows me to estimate the supply of inclusionary units. For technical details about the data, see Appendix C.

5.1 Sources

Building Permits. I identify lots with new development from 2003 to 2015 using the Department of Buildings permit database, in which each construction project is assigned a Building Identification Number (BIN). To define the sample period, I use the issuance date of the initial permit for a new building at each BIN, which is also the date at which 421-a eligibility is determined.

Lot and Building Characteristics. I use the Department of City Planning's Primary Land Use Tax Lot Output (PLUTO) database, which contains detailed information on lot and building characteristics. All rental buildings, as well as all individual owner-occupied units, are uniquely identified in New York City records by a Borough–Block–Lot (BBL) code. Since developers decide whether to take 421-a in common across units in a building, not independently by unit, I collapse owner-occupied unit data up to the building level.

Property Tax Assessments. I use two datasets on assessments. First, I scraped assessment documents, in PDFs formatted exactly as sent to taxpayers, from the Department of Finance website. I parsed these assessment PDFs to obtain administrative codes which identify the type of any 421-a tax exemptions. This information allows me to determine whether the developer built inclusionary housing offsite, onsite, or not at all. See Appendix Figure A7 for an example. Second, I use the 2010–2019 Real Property Assessment Databases of the Department of Finance, which contain the universe of assessed values, to forecast the dynamic impacts of assessment growth caps.

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Block Characteristics. From public-use tabulations of 2010 U.S. Census and the 2013–2017 American Community Survey (ACS), I collect characteristics of the immediate area surrounding the development at the block or block-group level. From the Census at the block level, these are the median age of the resident population, shares of the resident population by race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, Asian), the share of households that rent rather than own their homes, and the share of housing units that are vacant. From the ACS at the block-group level, I observe median household income, the poverty rate, educational attainment shares (less than high school, high school graduate, some college, four-year college graduate, more than four years of college), and commuting mode shares (car, bus, subway, walk, other). For blocks with missing data, I impute values from either the block-group or tract level.

Throughout this paper, I use a statistical definition of neighborhoods from the Department of City Planning: the Neighborhood Tabulation Area (NTA), which aggregates Census tracts to 195 distinct areas, 179 of which contain development in my sample. These NTAs are intended to reflect coherent neighborhoods. For example, separate NTAs exist for the East Village, the Lower East Side, and Chinatown. The NTA is always the level at which I cluster standard errors.

5.2 Summary Statistics

Table 2 reports that, from 2003 to 2015, New York City added 261,572 housing units in 12,146 421-a eligible new buildings. In 2019, the total market value of these buildings, as estimated by the Department of Finance, amounted to $210 billion. Of these, 581 buildings, representing 4.7 percent of buildings and 22.7 percent of residential units, chose to provide onsite inclusionary housing. These figures imply that around 11,878 onsite inclusionary units were developed under 421-a, at an annualized loss of tax revenue of $439 million, or $36,920 per unit per year.

Developers who faced stronger tax incentives to provide onsite inclusionary housing were more likely to provide it. On average, developers who chose to provide onsite inclusionary housing received a tax exemption worth 33 percent of building value for doing so, as compared to an exemption worth 5 percent of building value that developers who declined to provide such housing would have received. On a per-inclusionary-unit basis, developers who did not provide onsite inclusion-

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ary housing forewent an average tax savings of $126,610, whereas developers who provided such housing saved $443,782 on average. In present value, 421-a buildings pay an average tax rate about 0.16 percentage points below that of buildings who decline 421-a. The buildings where onsite inclusionary housing was provided differ in their observable characteristics from eligible buildings where developers chose not to provide onsite inclusionary housing.

6 Simple Evidence of Developer Responses to 421-a

This section presents graphical evidence that developers are more likely to build onsite inclusionary units if offered more valuable tax exemptions for doing so. I focus on two reforms to 421-a that I describe in Section 3: the GEA expansion and the end of as-of-right 421-a in NPP areas. In later sections, I use my measure of the 421-a incentive, $\Delta\tau_i$, to estimate a model of developer behavior.

In Figure 1, I show how these reforms changed 421-a incentives in different regions of New York City and, side-by-side, the attendant changes in participation rates over time in each region. The panels in the first row focus on the GEA expansion. The left panel shows that, among developments in the year they were issued their initial permit, the average 421-a incentive offered in the GEA expansion region increases sharply in 2008, when this reform occurs. By contrast, increases in the incentive in 2008 are smaller for two comparison regions: lots always and never in the GEA. The right panel shows that, in the GEA expansion region, the 421-a participation rate rises relative to both comparison regions after 2008.

In the second row, I offer the same presentation for the NPP reform. I compare lots in NPP areas to lots that are not themselves in an NPP area but are in Census tracts that partially overlap with an NPP area. The left panel shows that, before 2008, developers in NPP areas have no incentive to provide onsite inclusionary units, whereas developers just outside of an NPP area do have incentives before 2008. After 2008, developers in NPP areas face similar incentives to those just outside of an NPP area. Upon the reform, the 421-a participation rate in NPP areas rises from zero to about 15 percent, the participation rate on lots just outside of an NPP area.

The figure can be used to estimate the developer supply response to 421-a by taking the ratio of a participation-rate change and an incentive change. Relative to the never-GEA region, the

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average 421-a incentive and developer participation rate respectively increase by about 50 percent of building value and 30 p.p. in the GEA expansion region. This would imply a local supply response of about 0.6 (= 0.3/0.5). Similarly, relative to non-NPP areas in the same Census tract, the average incentive and participation rate in NPP areas rise by about 10 percent of building value and 5 p.p. respectively, also implying a local supply response of about 0.5. Reassuringly, both numbers are close to my estimate of the developer supply response in Section 8. In Appendix D, I redo these analyses as event-study regressions and find similar results.

7 Estimating a Model of 421-a Participation Choice

This section introduces my approach to estimating the model of 421-a participation. First, I present a baseline that takes building, lot, and neighborhood characteristics as exogenous to the participation decision. Second, given the potential endogeneity of building characteristics to the value of 421-a, I also present a simulated-instruments approach that requires that some subset of lot and block characteristics are exogenous to tax policy but determine the building characteristics that determine the value of 421-a. Third, I report estimates under both approaches.

7.1 Exogenous Building Characteristics

Following Equation 3, I assume that a building i's share of rent that it would forego if it provides onsite inclusionary units is well approximated by observable characteristics x_i of the lot and block. I also allow for unexplained cost components $e_{i,1}$ and $e_{i,0}$ of providing and not providing inclusionary units, which I assume are both distributed i.i.d. Type I extreme value with dispersion parameter σ. Writing the difference of these components as $\Delta e_i = e_{i,1} - e_{i,0}$, the log-difference in developer i's after-tax rental income $\Delta \log \pi_i$ between providing onsite inclusionary housing under 421-a and not participating in 421-a is

$$\Delta \log \pi_i = \Delta \tau_i + x_i \beta + \Delta e_i. \quad (4)$$

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Under the distributional assumption on the error terms, the probability that building i participates in 421-a, conditional on its characteristics x_i, is a logit:

$$\Pr(D_i = 1 \,|\, x_i) = \frac{\exp[(\Delta\tau_i + x_i\beta)/\sigma]}{1+\exp[(\Delta\tau_i + x_i\beta)/\sigma]}, \tag{5}$$

suppressing the conditioning on the tax incentive $\Delta\tau_i$. I estimate the logit parameters (σ, β) by maximum likelihood, clustering standard errors by Neighborhood Tabulation Area.

7.2 Endogenous Building Characteristics

Developers may choose what type of building to build with the possibility of receiving the 421-a exemption in mind. Such simultaneity is likely to bias upward my estimates of the responsiveness of participation to the incentive. For example, consider a lot which is relatively overassessed, making 421-a relatively more attractive. All else equal, a developer should be relatively more likely to build a large rental-unit building on such a lot. This is because such buildings typically face higher tax rates than smaller rental buildings or condominiums, and so the high value of 421-a on this lot gives such a building a comparative advantage relative to other possible buildings on this lot or similar buildings on other lots. The value of 421-a will thus be larger precisely because the developer already intended to take 421-a when designing the building.

I address this endogeneity problem using an extension of the simulated-instruments approach of Currie and Gruber (1996). In my application, I simulate potential buildings on each lot by sampling from the empirical distribution of buildings on other lots, calculating the value of 421-a in each simulation, and instrumenting for the actual value of 421-a using the mean simulated value of 421-a. To increase statistical power, I restrict the set of simulated potential buildings on a given lot to those in the same borough and which would be "feasible" on that lot. Here as in its original application, the simulated-instruments approach can be viewed as a way of parametrizing exogenous policy variation while purging endogenous characteristics.

Formally, I estimate the logit specification in Equation 5 by generalized method of moments.

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My moment conditions take the form:

$$\mathrm{E}\left[\left\{D_i - \Lambda\left(\frac{\Delta\tau_i + x_i\beta}{\sigma}\right)\right\} z_i\right] = 0, \tag{6}$$

where $\Lambda(\cdot) = \exp(\cdot)/[1+\exp(\cdot)]$ and the instrument vector is $z_i = \left(\widetilde{\Delta\tau_i}, x_i\right)$. The simulated instrument $\widetilde{\Delta\tau_i}$ is defined as the unweighted mean of the value of 421-a for lot i over all simulated buildings j in $\mathscr{F}_i$, the set of all other buildings that would have been feasible on i's lot:

$$\widetilde{\Delta\tau_i} = \frac{1}{|\mathscr{F}_i|} \sum_{j \in \mathscr{F}_i} \Delta\tau(b_j, x_i),$$

where $|\mathscr{F}_i|$ is the cardinality of i's feasible set, b_j is j's vector of endogenous building characteristics, and $\Delta\tau(b_j, x_i)$ is obtained using my tax microsimulation model from Section 3. As above, I cluster standard errors by Neighborhood Tabulation Area.

I say a building j is "feasible" on a lot i, as denoted by $j \in \mathscr{F}_i$, if the pair (i, j) passes two tests. First, j's lot area must be within 20 percent of i's lot area.[6] Second, I restrict to lots in the same zoning class as i. In New York City, zoning classes are primarily defined with respect to the maximum allowable floor area ratio—that is, floor area divided by lot area—and range from areas that only allow detached single-family residences to areas that allow skyscrapers. For a typical lot, these restrictions eliminate about 80 percent of all other lots in the same borough. For further detail on the simulated instrument, including a case study showing how it purges endogenous variation in building choice, see Appendix C.

Is the simulated instrument $\widetilde{\Delta\tau_i}$ plausibly valid and informative for $\Delta\tau_i$? Its validity rests on two assumptions: Neither the 421-a exemption formula itself, nor the subset of lot and block characteristics used to predict building characteristics, is endogenous to the participation decision. I argue that both assumptions are reasonable. As I document in Sections 2 and 3, the evolution of 421-a, along with that of the broader property tax code, reflects citywide political and fiscal considerations, not efforts to rig the formula to benefit specific developments. Furthermore, the dimensions and zoning of the lot are essentially predetermined at the time of construction.[7] In Section 8, I

[6] Appendix Table A13 shows that my results are robust to changing this 20-percent threshold.

[7] No change in zoning occurred between 2002 and 2019 for 59 percent of lots in the data.

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show that $\widetilde{\Delta\tau_i}$ is highly informative for $\Delta\tau_i$. This should be unsurprising. First, there is substantial variation in the tax-rate formula over time and geography. Second, the physical dimensions of a lot, along with zoning regulations, constrain the feasible set of buildings. These constraints typically bind. Insofar as the 421-a exemption formula varies with building characteristics that are likely constrained by lot size and zoning—such as the number of units—such restrictions make the $\Delta\tau_i$ of buildings on similar lots a highly relevant predictor of a building's own $\Delta\tau_i$.

7.3 Do Developers Respond to 421-a?

Table 3 presents estimates of Equation 5 with various sets of controls, as well as with fixed effects for boroughs or neighborhoods. The fixed effects and controls help to isolate policy variation by removing static differences among locations that may otherwise be a source of confounding relationships. As Section 6 documents in two examples, there is considerable policy variation in 421-a tax incentives across locations over time. The controls are introduced in Section 5. I report the estimated fixed effects and control-variable coefficients in Appendix Tables A7 and A8.

The results suggest that, holding lot and block characteristics fixed, developers are more likely to participate in 421-a when offered more in tax savings. In particular, an increase in the 421-a tax savings of one percent of building value would increase a building's participation probability by 0.18 to 0.26 percentage points. For comparison, I also report linear probability model estimates in Appendix Table A4. In the rest of the paper, I take the specification in Column 4 of Table 3, with fixed effects for borough and year as well as lot and block controls, as the baseline specification.

These reduced-form estimates also have a structural interpretation. The coefficient in Table 3 is not only a behavioral semi-elasticity but also $1/\sigma$, a measure of the dispersion of unobservable profit shocks Δe_i in my model.[8] My results imply that the standard deviation of unobservable profit shocks Δe_i is on the order of 30 percent of market value. Furthermore, the estimated coefficients

Almost all changes in zoning are part of neighborhood-wide rezonings. Individual-lot rezonings are rare due to New York City's laborious review process for any change in zoning.

[8]The parameter σ determines the shape of the Type I extreme value distribution for e_i. Using distributional properties, the standard deviation of Δe_i is $\sigma\pi/\sqrt{3}$.

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$\widehat{\beta}$ in Appendix Tables A7 and A8 can be interpreted as descriptively characterizing variation in forgone rental income. I also check the goodness-of-fit of my model using the two policy reforms examined in Section 6. In particular, Appendix Figure A8 confirms that the predicted probabilities of 421-a participation evolve similarly to the actual probabilities around these reforms. The reforms occur in the sample but do not constitute all of the variation in the incentive $\Delta\tau_i$.

7.4 Allowing for Endogenous Building Characteristics

In Figure 2, I present binned scatterplots for the "zeroth" and first stages of the simulated instruments GMM approach I develop in Section 7.2. In the zeroth stage, I confirm that buildings resemble, on endogenous building characteristics, the buildings to which they are matched using the subset of lot characteristics. In particular, the matching approach finds comparison lots whose buildings have quite similar numbers of residential units, floor area, floor area ratios, condominium shares of residential units, and total assessed values. Developers appear to have relatively little scope to respond to 421-a on these margins of building characteristics.

The rightmost lower panel of Figure 2 is a binned scatterplot of the first stage. The 421-a tax savings from the matched buildings is lower than the savings from the actual building, especially at the high end of tax savings. What explains this discrepancy? Tax exemptions are substitutes. If a developer does not accept 421-a, it has a financial incentive to take up another exemption. This will reduce both its tax liability and its potential savings if it also were to pursue 421-a. For instance, a developer could instead use the building for university faculty housing, which is also tax-exempt, leaving no further savings from providing onsite inclusionary housing. Tax planning, rather than construction, seems to be the primary margin of adjustment to 421-a.

In my simulated-instrument GMM approach, I treat other exemptions as endogenous building attributes. Appendix Table A10 repeats the format of Table 3, but using simulated-instrument GMM, and finds similar coefficient estimates. However, this approach does not address mismeasurement of the value of the tax incentive among participants due to alternative tax exemptions. To evaluate the likely direction of bias, I incrementally scale down the value of the 421-a incentive among participants as a way to approximate substitution to these alternatives. These results sug-

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gest that this bias causes me to overstate developer responsiveness to 421-a. By implication, the measurement bias is toward understating, rather than overstating, 421-a's fiscal cost per unit.

8 The Supply and Fiscal Cost of Inclusionary Housing

In this section, I define and estimate the key economic objects of interest. These are the distribution of developer breakevens, supply responses to changes in the 421-a incentive, and fiscal costs per inclusionary unit, on the margin and on average.[9]

8.1 Definitions

Breakevens. A developer's breakeven $\Delta\tau_i^*$ is the amount of tax savings per inclusionary unit that would make it indifferent in expectation between having building i participate versus not participate in 421-a. From Equation 4, this breakeven occurs at

$$E[\Delta\pi_i|x_i] = \Delta\tau_i + x_i\widehat{\beta} = 0 \implies \Delta\tau_i^*(x_i) = -x_i\widehat{\beta}.$$

To obtain breakevens in dollar terms, I multiply by the market value per inclusionary unit:

$$\text{Breakeven}_i = -(v_i/\lambda)\cdot x_i\widehat{\beta}, \tag{7}$$

where λ is the set-aside share and v_i is the average market value per unit in building i.

Supply Response. From the logit functional form, I obtain an expression for the supply response of inclusionary units in a neighborhood n to a change in the tax incentive $\Delta\tau_i$. This expression is

$$\eta_n = \int \frac{\partial \Pr(D_i = 1|x_i)}{\partial(\Delta\tau_i)}\, dF_n(x_i) = \frac{1}{\sigma}\int \Pr(D_i = 1|x_i)\,[1 - \Pr(D_i = 1|x_i)]\, dF_n(x_i), \tag{8}$$

where $F_n(x_i)$ is the distribution of buildings with characteristics x_i in n. Neighborhood-level supply responses crucially reflect both dispersion σ in building-level unobservables as well as observable

[9] Appendix D includes supplementary empirical analyses: (1) I estimate the entire supply curve for inclusionary housing; (2) I estimate the effects of changing the set-aside share on the total production of inclusionary housing; (3) I investigate developer heterogeneity and sorting; and (4) I estimate a model with developer choice between no, offsite, and onsite inclusionary housing.

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heterogeneity among buildings, as implied by variation in $\Pr(D_i = 1|x_i)$. In implementation, I weight by the number of residential units in each building.

Marginal and Average Fiscal Costs. For a neighborhood n, I measure the average marginal fiscal cost of inclusionary units, given a small change in the 421-a incentive $\Delta\tau_i$, as the ratio of the resulting total change in the 421-a tax expenditure in n to the resulting total change in the number of inclusionary units in n:

$$\begin{aligned} \text{MFC}_n &= \frac{1}{\lambda} \int \frac{\partial [v_i \Delta\tau_i \Pr(D_i = 1|x_i)]}{\partial(\Delta\tau_i)} \, dF_n(x_i) \Big/ \int \frac{\partial \Pr(D_i = 1|x_i)}{\partial(\Delta\tau_i)} \, dF_n(x_i) \\ &= \frac{1}{\lambda} \int \left[\frac{v_i \Pr(D_i = 1|x_i)}{\eta_n} + \omega_i v_i \Delta\tau_i \right] dF_n(x_i) \end{aligned} \tag{9}$$

The second line of Equation 9 shows that the average marginal fiscal cost MFC_n is the sum of two terms, which respectively reflect the contributions of inframarginal and marginal units. First, the contribution of inframarginal units to cost depends inversely upon the supply response, η_n. As η_n increases, $\Delta\tau_i$ must increase less to obtain one additional inclusionary unit, and so less tax revenue is lost to inframarginal units. Second, the contribution of marginal units to cost is a weighted average of the 421-a tax savings of all buildings in neighborhood n, with weights ω_i proportional to building-level supply responses.[10] Intuitively, the average marginal fiscal cost up-weights buildings on the margin of 421-a participation.

The average fiscal cost per inclusionary unit in neighborhood n is, quite similarly,

$$\text{AFC}_n = \frac{1}{\lambda} \int v_i \Delta\tau_i \Pr(D_i = 1|x_i) \, dF_n(x_i) \Big/ \int \Pr(D_i = 1|x_i) \, dF_n(x_i). \tag{10}$$

To compute supply responses as well as marginal and average fiscal costs, I increment all tax differentials $\Delta\tau_i$ in neighborhood n by a small $\varepsilon > 0$. I then simulate the predicted probability of 421-a participation for each building i in neighborhood n under the new and old $\{\Delta\tau_i\}$. The average difference in these probabilities, weighting by the number of residential units and dividing by ε, yields the estimated supply response. With the set-aside share and the actual assessed value of each building i, I also use the predicted probabilities to simulate both the total change in tax

[10] $\omega_i = \Pr(D_i = 1|x_i)\,[1 - \Pr(D_i = 1|x_i)] \,/\, \int \Pr(D_i = 1|x_i)\,[1 - \Pr(D_i = 1|x_i)] \, dF_n(x_i)$.

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revenue from increased 421-a participation and the total change in the number of inclusionary units. Dividing the former by the latter yields the marginal fiscal cost. I compute standard errors for both supply responses and marginal fiscal costs by the cluster bootstrap.

8.2 Distribution of Developer Breakevens

Figure 3 plots a histogram of developer breakevens, expressed in dollars per inclusionary unit, split by 421-a status. Citywide, the median building's breakeven is about $810,000. There is much variation in breakevens: The 25th and 75th percentiles are respectively around $500,000 and $1,600,000. Participating buildings are visibly selected towards lower breakevens, both in dollar terms and, as I show in Appendix Figure A13, in terms of shares of building value.

At most levels of breakeven cost, there are both buildings that accept and reject 421-a. This is for two reasons. First, both the 421-a benefit and its opportunity cost are larger in dollar terms when buildings are more expensive. This explains why a $100,000-per-unit benefit could be accepted by a low-rent building, but a $500,000-per-unit benefit could be rejected by a high-rent building. Second, I cannot perfectly explain the participation decision with observables. Estimated breakevens thus will not perfectly divide buildings into those which accept and those which reject.

What descriptively explains this variation in breakevens? In Appendix Figure A10, I present a binned scatterplot of buildings' breakevens versus the average capitalized rent of units in the same block group as the building. There is a robust positive relationship between breakevens and block-group rents. However, breakevens are higher than typical capitalized rents in the same block.

8.3 Citywide Supply Response and Marginal Fiscal Cost

Table 4 reports my estimates of the citywide supply response, marginal fiscal cost, and average fiscal cost of inclusionary units, as derived respectively in Equations 8, 9, and 10. Column 1 contains the baseline estimates that treat building characteristics as exogenous, while Column 2 presents the simulated-instrument GMM results.

I find a citywide 421-a supply response η of 0.59. This estimate implies that an increase in the 421-a tax savings of one percentage point of building value would increase the number of

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inclusionary units by 0.59 percent. I also find a citywide marginal fiscal cost of about $1.6 million per unit. The average fiscal cost is lower at about $640,000 per unit. Accounting for endogenous building characteristics leads to a slightly larger supply elasticity and a slightly lower cost per inclusionary unit. For the rest of this paper, all results take building characteristics as exogenous.

In Appendix Table A11, I estimate the supply response and marginal fiscal cost under alternative parametric specifications: a logit model with neighborhood random effects, a probit model, and a linear probability model. These specifications reassuringly suggest my estimates are not highly sensitive to functional form. In Appendix Figure A25, I show how the supply response and average marginal fiscal cost would change under alternative capitalization rate assumptions. Supply responses are increasing, and marginal fiscal costs are decreasing, in the capitalization rate. These shifts occur because the present value of the 421-a incentive decreases in the capitalization rate. If, for instance, the capitalization rate were instead 2.5 percent rather than 5 percent, I would obtain a marginal fiscal cost around $1.8 million and a supply response of about 0.5.

8.4 Estimates by Neighborhood

How do the supply responses and average marginal fiscal costs of inclusionary units vary among neighborhoods? In this subsection, I compute these objects by Equations 8 and 9 for each of the 179 Neighborhood Tabulation Areas with eligible development from 2003 to 2015. In all specifications, I include lot- and block-level controls as well as borough fixed effects.[11]

Panel A of Figure 4 maps estimated supply responses η_n for each neighborhood. They vary dramatically: The minimum is less than 0.01 and the maximum is 1.22. Supply responses are highest in Manhattan and the Bronx and are lowest in Queens and Staten Island. Variation in supply responses between neighborhoods primarily reflects variation in take-up rates rather than between-neighborhood variation in the extent of within-neighborhood building heterogeneity.

[11]To estimate the logit with NTA fixed effects, I must drop NTAs in which all buildings either uniformly accept or reject 421-a. Such NTA fixed effects are otherwise perfect predictors of 421-a participation. For results with NTA fixed effects, see Appendix Figure A15. In all my results, I cannot estimate quantities of interest in neighborhoods without eligible new development.

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Panel B of Figure 4 maps neighborhood average marginal fiscal costs per inclusionary unit. The citywide average masks substantial variation by neighborhood. In high-rent Manhattan neighborhoods such as the West Village and the Upper East Side, the fiscal cost of the marginal inclusionary unit is around $2 million. Such high estimates are sensible for these neighborhoods, where two-bedroom condominiums regularly traded at prices above $1 million during my period. By contrast, in typical neighborhoods in the Bronx, Queens, and Staten Island, the fiscal cost of the marginal inclusionary unit is less than $150,000. Such low fiscal costs are consistent with market rents close to the regulated maximum rent on inclusionary units.

9 The Cost-Effectiveness of Inclusionary Housing

In this section, I evaluate the cost-effectiveness of 421-a in three parts. First, I benchmark 421-a's fiscal cost per unit against Section 8 vouchers and the LIHTC. I focus here on average, rather than marginal, fiscal costs due to a lack of marginal-cost estimates for Section 8 and the LIHTC. Second, I explain these cost differences, focusing on the roles of neighborhoods and incidence on developer profits. Third, I calculate the marginal value of public funds spent on 421-a in each neighborhood, combining my cost estimates with external estimates of the long-run benefits of moving households to higher-opportunity neighborhoods.

9.1 Cost Differences Between Programs

I construct estimates of the average fiscal cost of Section 8 voucher and LIHTC units in New York City for comparison to my estimates for 421-a inclusionary units. For Section 8 vouchers, I consult the HUD Picture of Subsidized Households database (see Appendix C), which aggregates household-level administrative data from local housing authorities. On average in 2015, the fiscal cost per Section 8 voucher unit in New York City was $245,800. For the LIHTC, I consult four external sources of estimates, as reviewed in Appendix C. These estimates range from $197,400 to $234,580, suggesting there is relatively little uncertainty about the per-unit cost of the LIHTC. I take $220,000 as a reasonable midpoint estimate. In New York City, Section 8 voucher and LIHTC units therefore have similar average fiscal costs. Figure A19 shows, however, that average costs for

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421-a units are much costlier than either program. In particular, my estimate of the average fiscal cost per inclusionary unit is about three times higher than that of Section 8 or the LIHTC.

There are several potential explanations for the higher average cost of 421-a inclusionary units. These explanations can be divided into between- and within-neighborhood factors. The obvious between-neighborhood explanation is that 421-a units are in costlier neighborhoods, consistent with Table 2, implying higher breakevens. However, it is also possible that 421-a inclusionary units are costlier than Section 8 or LIHTC units within the same neighborhood. Potential explanations of such within-neighborhood differences include differences between programs in administrative costs, building amenities, and incidence on developer profits.

Here I examine the extent to which between-neighborhood differences can explain the 421-a cost premium and the empirical importance of one salient within-neighborhood explanation: developer incidence. One virtue of such a decomposition is that, insofar as governments have some willingness to pay to move households to "better" neighborhoods, it has welfare implications. That is, the 421-a cost premium may be justified as the price of better neighborhoods, whereas within-neighborhood factors (especially incidence) seem less conducive to such justifications.

Neighborhoods. To assess the role of differences in neighborhoods to cost differences, I attempt to make the neighborhoods of 421-a units comparable to those of Section 8 voucher and LIHTC units. I do so following DiNardo et al. (1996), which reweights a sample so that its distribution over a set of variables resembles the distribution of a target sample on those variables.

For a Census block b, let $N_{1,b}$ be the number of 421-a units, and let $N_{0,b}$ be the number of pooled Section 8 and LIHTC units. I then construct a block's 421-a share of units $s_{1,b} = N_{1,b}/(N_{0,b}+N_{1,b})$ and estimate the fractional logistic regression $s_{1,b} = \exp(z_b\gamma)/[1+\exp(z_b\gamma)]$, which describes the 421-a share of units as a function of block characteristics z_b. Applying Bayes' rule, DiNardo et al. (1996) obtain the reweighting factor

$$\psi(z_b) = \frac{dF(z_b\,|\,\text{Unit in Section 8 or LIHTC})}{dF(z_b\,|\,\text{Unit in 421-a})} \propto 1 - 1/\widehat{s_{1,b}},$$

where $dF(z_b\,|\cdot)$ is a joint density function over block characteristics, conditional on units being in

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either 421-a or pooled Section 8 and LIHTC, and $\widehat{s_{1,b}}$ is the fitted 421-a share from the fractional logistic regression. The reweighting factor $\psi(z_b)$ thus makes the 421-a units resemble the Section 8 and LIHTC units on block characteristics. In particular, $\psi(z_b)$ tends to up-weight 421-a buildings in low-cost neighborhoods, given that Section 8 and LIHTC units are concentrated in low-cost neighborhoods relative to 421-a units, as shown in Appendix Figure A12.

Introducing these weights into Equation 10, I obtain the reweighted citywide average fiscal cost under the counterfactual in which 421-a units are geographically distributed as if they are Section 8 and LIHTC units:

$$\widetilde{\text{AFC}} = \frac{1}{\lambda}\int \psi(z_i) v_i \Delta\tau_i \Pr(D_i = 1|x_i)\, dF(x_i) \Big/ \int \psi(z_i) \Pr(D_i = 1|x_i)\, dF(x_i).$$

Estimation of reweighted average cost follows the same procedures in Section 7 for actual marginal and average cost. Appendix Figure A19 displays the results of this reweighting. While there are large unadjusted cost differences between 421-a and Section 8 or between 421-a and the LIHTC, these cost differences are entirely eliminated once the 421-a units are reweighted. The large differences in neighborhood characteristics between 421-a and other housing programs, as documented in Table 1, are therefore key to the cost premium of 421-a.

Developer Incidence. How much of every dollar spent on 421-a do developers capture? I define the incidence of 421-a as the share of the fiscal cost that accrues to developer profits. By the distributional assumption on Δe_i in Section 7, developer incidence has a convenient expression: a log-sum of exponentials, akin to the measure of consumer surplus in Small and Rosen (1981):

$$\frac{E[\Delta \log \pi_i \,|\, D_i = 1]}{E[\Delta\tau_i \,|\, D_i = 1]} = \frac{\sigma \log \int \left[1 + \exp\left(\frac{\Delta\tau_i + x_i\beta}{\sigma}\right)\right] dF_n(x_i \,|\, D_i = 1)}{\int \Delta\tau_i \, dF_n(x_i \,|\, D_i = 1)}, \tag{11}$$

where $F_n(x_i \,|\, D_i = 1)$ is the distribution of characteristics among 421-a participants in a neighborhood n. To measure incidence with respect to the average dollar spent on 421-a, I weight by market value. I report estimates and cluster-bootstrap standard errors in Appendix Table A9.

I estimate that, citywide, developers capture in additional profits about \$0.46 of every \$1 spent

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on 421-a.[12] This degree of developer incidence appears similar to that of Section 8 and the LIHTC: Collinson and Ganong (2018), for example, find developers also capture \$0.46 cents of every \$1 in increased Section 8 voucher generosity. Consequently, higher developer incidence of 421-a versus other housing programs is unlikely to be an important source of the 421-a cost premium. This conclusion contradicts critics of inclusionary housing programs quoted in Section 1.

Is there "excess" developer incidence of 421-a? That is, could a tax reform designed to "squeeze" developers meaningfully reduce the 421-a tax expenditure without reducing take-up? I argue that the answer is likely not, and that potential savings are considerably less than the estimated developer incidence of 46 percent. As developer breakevens are private information, any tax incentive that achieves positive take-up must pay an information rent and therefore cannot achieve zero developer incidence.[13] It can be shown that the incidence-minimizing feasible policy that attains a developer participation rate of p is

$$\Delta\tau^*(x_i, p) = \log\left(\frac{p}{1-p}\right) - x_i\beta.$$

Intuitively, these tax incentives minimize developer incidence because the incidence share in Equation 11 is convex in $\Delta\tau_i$, which implies a necessary condition for incidence minimization is equalization of take-up probabilities. This $\Delta\tau^*(x_i, p)$ uniquely equalizes them at p.

I then simulate incidence under this counterfactual policy. To do so, I set p to the true take-up probability and use my estimates $\hat{\beta}$. I find that, under this incidence-minimizing counterfactual, developers capture about 36 percent of the total fiscal cost of 421-a, 10 percentage points less than actual incidence. Excess developer incidence appears to represent a small share of the total fiscal cost of 421-a and is unimportant to explaining cost differences between housing programs.[14]

[12]For incidence by Neighborhood Tabulation Area, see Appendix Figure A18.

[13]Developers only accept if $\Delta\pi_i \geq 0$. Idiosyncratic costs Δe_i are unobservable, uncorrelated with x_i, and have positive variance. Thus, it is infeasible to offer a set of incentives $\{\Delta\tau_i\}$ that achieves $\Delta\pi_i = 0$ for all i. A positive mass of developers must therefore be offered $\Delta\pi_i > 0$ if the participation rate is positive. This implies developer incidence.

[14]If developers earn profits under nonparticipation, then breakevens include a profit component.

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9.2 Valuing the Benefits of Inclusionary Housing

Should governments be willing to pay the 421-a cost premium to move households into such neighborhoods—and, if so, which neighborhoods are best? Should governments move a few households to the highest-income and highest-cost neighborhoods, or should they move more households to middle-income neighborhoods that are less costly? Here I compare the neighborhood-level benefits and costs of 421-a. Such an exercise entails substantial further assumptions, as I explain below, relative to my analysis thus far. The intent of this section is therefore to illustrate how my cost estimates could be combined with estimates of benefits to conduct a cost-benefit analysis.

To value the benefits of 421-a, I focus on the long-run effects of such neighborhoods on children's future income and tax payments as adults.[15] In particular, I follow Bergman et al. (2020) in using external estimates of neighborhood effects from the Opportunity Atlas (Chetty et al., 2018). In combination with my cost estimates, I use these estimated benefits to conduct an analysis of the marginal value of public funds (MVPF) of 421-a by neighborhood. Defined in Hendren and Sprung-Keyser (2020) as the ratio of households' WTP for a policy and its cost to the government net of fiscal externalities, a policy's MVPF measures the shadow price to the government of raising a household's utility via the policy. While a direct non-distortionary transfer has an MVPF of one—a household values $1 at exactly the $1 it costs the government—policies may have MVPFs above or below one depending on willingness to pay and fiscal externalities per dollar of program cost. The MVPF is therefore a useful summary measure of cost-effectiveness that enables comparisons, both between policies and places.

My calculation of MVPFs requires four present discounted values for each neighborhood: the

Then incidence is the incremental profit developers earn above their profit under nonparticipation.

[15]This definition of benefits omits several considerations. First, policy interventions to reduce segregation may have an efficiency motive due to non-fiscal externalities, e.g. via human capital spillovers (Bénabou, 1993). Second, I do not account for any impacts on WTP or fiscal externalities via crime or other channels beyond the tax-and-transfer system. Third, I ignore non-individualistic motives for inclusion. Fourth, I ignore all impacts on incumbent residents of neighborhoods.

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WTP for housing, the marginal fiscal cost, the neighborhood effect on children's after-tax incomes as adults, and the long-run fiscal externality on children—that is, the increase in their tax payments as adults. In particular, the MVPF of 421-a in neighborhood n is defined as

$$\text{MVPF}_n = \frac{\text{PDV}(\text{WTP for Housing}_n) + \text{PDV}(\text{Future After-Tax Income}_n)}{\text{PDV}(\text{Marginal Fiscal Cost}_n) - \text{PDV}(\text{Long-Run Fiscal Externality}_n)}. \quad (12)$$

If the impact of inclusionary housing on earnings and thus the long-run fiscal externality is zero, then the MVPF of 421-a in a neighborhood follows from developer incidence. To the extent that its intergenerational impacts are economically large, however, the MVPF will diverge from incidence.

I use my estimates to compute the PDVs of the WTP for housing and the marginal fiscal cost. For the first item, I compute "high-WTP" and "low-WTP" scenarios. In the high-WTP scenario, I assume that households value inclusionary units at exactly their breakeven cost. This represents an upper bound if households can rent units on the private market at their breakevens. In the low-WTP scenario, I assume that households value each \$1 of breakeven at \$1 to the extent it is less than their counterfactual housing expenditure and at zero for every \$1 above this counterfactual. This is a lower bound insofar as the marginal utility of housing consumption is weakly positive. Second, I use directly my estimates for neighborhood-specific costs.

To obtain the fiscal externality and the impact on after-tax income, I closely follow the procedure in Bergman et al. (2020) to predict the upward mobility impacts of moving households to specific neighborhoods. This procedure converts the Opportunity Atlas estimates of intergenerational income mobility by neighborhood into percentage changes in income using the citywide income distribution and an assumption that 62 percent of the variation in upward mobility across neighborhoods reflects their causal effects on adult income rank. The main departure from the Bergman et al. (2020) procedure is that, as I do not observe a household's counterfactual neighborhood had the inclusionary unit not existed, I use a calibrated model of neighborhood choice to predict these counterfactual neighborhoods. Building upon the publicly-released code base of Hendren and Sprung-Keyser (2020), I compute the implications of 421-a for children's lifetime after-tax income and fiscal externalities. This calculation also requires information on New York

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City's labor income tax schedule, age–earnings profile, and intergenerational rank–rank mobility function as well as several statistics on 421-a beneficiary households that I assemble from several sources of available data. As observed in Hendren and Sprung-Keyser (2020), the calculation of MVPFs involves numerous "judgment calls," which I document in further detail in Appendix C.[16] Appendix D contains several extensions and robustness checks of the MVPF analysis.

Figure 5 maps the MVPF of 421-a by Neighborhood Tabulation Area in the low-WTP scenario. MVPFs vary immensely between neighborhoods: Whereas 421-a produces near-zero benefit per dollar of net fiscal cost in some neighborhoods (MVPF ≈ 0), the benefits of a better neighborhood come very cheaply in others (MVPF > 5). Neighborhoods broadly divide into three groups with respect to their MVPFs. First, some have low fiscal costs but such poor outcomes for children that their MVPFs are near zero. Most strikingly, this condition characterizes the South Bronx. Second, some neighborhoods have good outcomes for children but are quite costly, as in Manhattan, generating MVPFs below one in the low-WTP scenario. Third, some neighborhoods are "opportunity bargains." These neighborhoods have low fiscal costs and yet children raised there achieve outcomes no worse than do children raised in high-cost areas. These high-MVPF neighborhoods are largely middle-class communities in Queens, Staten Island, and outlying areas of Brooklyn.

10 Conclusion

Residential segregation by household income is a fact of urban life, one that harms children who grow up in neighborhoods that offer little hope of upward mobility. Local governments have introduced housing policies that seek to alleviate segregation and expand economic opportunity via mandates and incentives for mixed-income housing development. How costly are these programs? How do their costs compare to housing programs that leave unaddressed the socioeconomic divisions between neighborhoods? Is paying more today for inclusionary housing a cost-effective way to improve the long-run outcomes of children born into low-income households?

In this paper, I introduce a microeconometric approach to evaluating a voluntary inclusionary

[16] One key assumption is that the average 421-a household has 1.44 children, which I calibrate using data on all housing-subsidy recipient households in New York City from 2003 to 2015.

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housing program, and I apply it to the paradigmatic example of such policies, New York City's 421-a tax incentive for mixed-income development. My approach begins from the observation that these programs face a participation constraint: Developers participate only if it is profitable for them. From the distribution of these constraints emerges the supply of inclusionary units. Using developer revealed preference and variation in potential tax savings under 421-a, I estimate the marginal fiscal cost of inclusionary units, both citywide and neighborhood-by-neighborhood.

I find that, on citywide average, it would cost New York City $1.6 million to add another inclusionary unit under 421-a, which greatly exceeds the per-unit costs of Section 8 vouchers and the LIHTC. However, I also find that the 421-a cost premium primarily reflects differences in the distribution of units across neighborhoods, rather than within-neighborhood cost differences. There is no evidence of differentially higher incidence of 421-a on developers. Whether 421-a is cost-effective thus boils down to whether governments should pay higher rents to move families on housing assistance into better neighborhoods. Weighing 421-a's costs against its potential long-run benefits, I find that some—but not all—neighborhoods are "opportunity bargains."

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Table 1: How Do 421-a Onsite Inclusionary Units Compare to Other Social Housing?

	421-a	LIHTC	Tenant-Based Section 8	Project-Based Section 8	Public Housing	All Rental Units
Panel A: Building-Level Characteristics						
% Social Units	19.3	89.3	n.a.	94.0	100.0	n.a.
Panel B: Block-Level Characteristics						
Med. HH. Income	$100,043	$42,223	$41,187	$36,899	$23,420	$63,093
Med. Monthly Rent	$2,163	$1,128	$1,189	$964	$553	$1,452
% Poor	17.0	31.4	26.4	33.0	43.7	21.2
% Less than HS	10.8	25.7	26.3	27.6	34.2	19.8
% HS Graduate	13.8	24.9	27.3	25.1	30.9	23.0
% Some College	14.4	23.0	22.2	20.4	22.0	19.5
% College Graduate	33.5	16.7	15.3	17.3	9.4	22.1
% More than College	27.6	9.7	8.9	9.7	3.4	15.7
% Non-Hispanic White	44.8	13.0	19.4	17.7	4.9	32.9
% Non-Hispanic Black	16.9	40.5	30.9	32.0	42.8	23.0
% Hispanic	37.6	40.9	41.6	43.8	47.7	30.6
% Asian	14.6	5.1	5.8	5.9	4.4	11.6
Median Age	33.9	33.0	32.8	39.0	33.8	35.8
% Renters	83.8	90.8	83.3	91.1	97.7	78.6
Panel C: Units by Borough						
Manhattan	5,841	41,473	19,825	17,697	54,871	591,114
Bronx	1,166	47,778	49,851	17,354	40,249	392,117
Brooklyn	3,699	33,482	40,327	16,978	57,317	664,749
Queens	1,038	5,424	10,530	4,271	15,500	448,601
Staten Island	134	4,118	2,968	2,865	4,510	60,654

Notes: This table compares inclusionary units added under 421-a to other social housing units (LIHTC, Section 8, and public housing) as well as to all rental units in New York City on building- and block-level characteristics. All statistics in Panels A and B are means, weighted by counts of residential units. For data details, see Section 5 and Appendix C.

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Table 2: Summary Statistics on 421-a Eligible Buildings, 2003–2015

	Does the Building Provide Onsite Inclusionary Housing?			
	Yes		No	
	Mean	Std. Dev.	Mean	Std. Dev.
Estimated Market Value ($ Millions)				
Total	84.12	274.80	16.48	117.41
Land	9.82	39.41	2.05	20.05
Building	74.30	241.91	14.43	101.28
Total Per Unit	0.536	1.524	0.557	1.498
Tax Rate (p.p.)				
Level	0.31	0.32	0.47	0.81
Size of 421-a Incentive	32.95	28.23	4.74	13.07
Present Value of Tax Savings ($)				
Total	16,107,285	40,975,046	1,238,956	8,486,184
Per Inclusionary Unit	443,782	549,262	126,610	523,299
Number of Units				
Total	105.89	178.21	19.95	85.74
Residential	102.23	175.66	17.48	69.45
Number of Floors	10.49	11.90	4.72	4.93
Rental (vs. Owner-Occupied, %)	0.670	0.471	0.762	0.426
Number of Buildings	581		11,565	
Number of Units	59,393		202,179	

Notes: This table reports means and standard deviations of financial and buildings characteristics of the dataset of developments built from 2003 to 2014 that were eligible for 421-a. See the text of the paper for variable definitions. Appendix Table A3 reports additional summary statistics.

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Table 3: Developer Participation Responses to Variation in 421-a Incentive

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Fixed Effects:	None	Borough			Neighborhood Tabulation Area		
Controls:	None	None	Lot	Lot & Block	None	Lot	Lot & Block
421-a Incentive	4.92***	5.18***	5.58***	5.99***	5.20***	5.87***	6.02***
	(0.30)	(0.54)	(0.64)	(0.69)	(0.65)	(0.76)	(0.74)
N	11,669	11,669	11,647	11,640	7,465	7,450	7,445
Clusters	179	179	179	179	82	82	82
Marginal Effect	0.18***	0.18***	0.19***	0.19***	0.26***	0.26***	0.26***
	(0.02)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
Std. Dev. of Δe_i	0.368***	0.350***	0.325***	0.303***	0.349***	0.309***	0.301***
	(0.023)	(0.036)	(0.038)	(0.035)	(0.044)	(0.040)	(0.037)

Notes: This table reports robustness checks of estimates of the participation effect of the present-value tax-rate differential $\Delta\tau_i$ from providing onsite inclusionary housing under the 421-a exemption. To the baseline specification in Equation 5, Columns 2–4 respective add lot controls from PLUTO and Census block controls from the 2017 ACS and 2010 Census. In Columns 5–7, I replace the borough fixed effects with neighborhood fixed effects and reintroduce the lot and block controls. I always also include fixed effects for year of initial permit issuance. Marginal effects reflect the percentage-point increase in the onsite inclusionary housing participation rate per percentage-point increase in the tax incentive. Standard errors are clustered at the neighborhood level. $^{*} = p < 0.10$, $^{**} = p < 0.05$, $^{***} = p < 0.01$.

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Table 4: Bootstrap Estimates of Citywide Supply Response and Marginal Fiscal Cost

	Exogenous Construction	Endogenous Construction
	(1)	(2)
Supply Response	0.59***	0.60***
	(0.07)	(0.10)
Marginal Fiscal Cost	$1,593,037***	$1,568,194***
	(326,216)	(423,196)
Average Fiscal Cost	$651,974***	$650,714***
	(75,525)	(76,108)

Notes: This table presents citywide supply responses and citywide average and marginal fiscal costs. In the first row, I report estimates of the citywide supply response of onsite inclusionary units to changes in buildings' 421-a incentive. In the second and third rows, I report marginal and average fiscal costs per inclusionary unit per year. In the left column, my estimates are from the baseline approach, which assumes building features are exogenously determined. In the right column, my estimates are from the simulated-instruments GMM approach. The original specification includes fixed effects for borough and year as well as lot and block controls. Standard errors are computed by a cluster-bootstrap at the level of Neighborhood Tabulation Areas. $^{*} = p < 0.10$, $^{**} = p < 0.05$, $^{***} = p < 0.01$.

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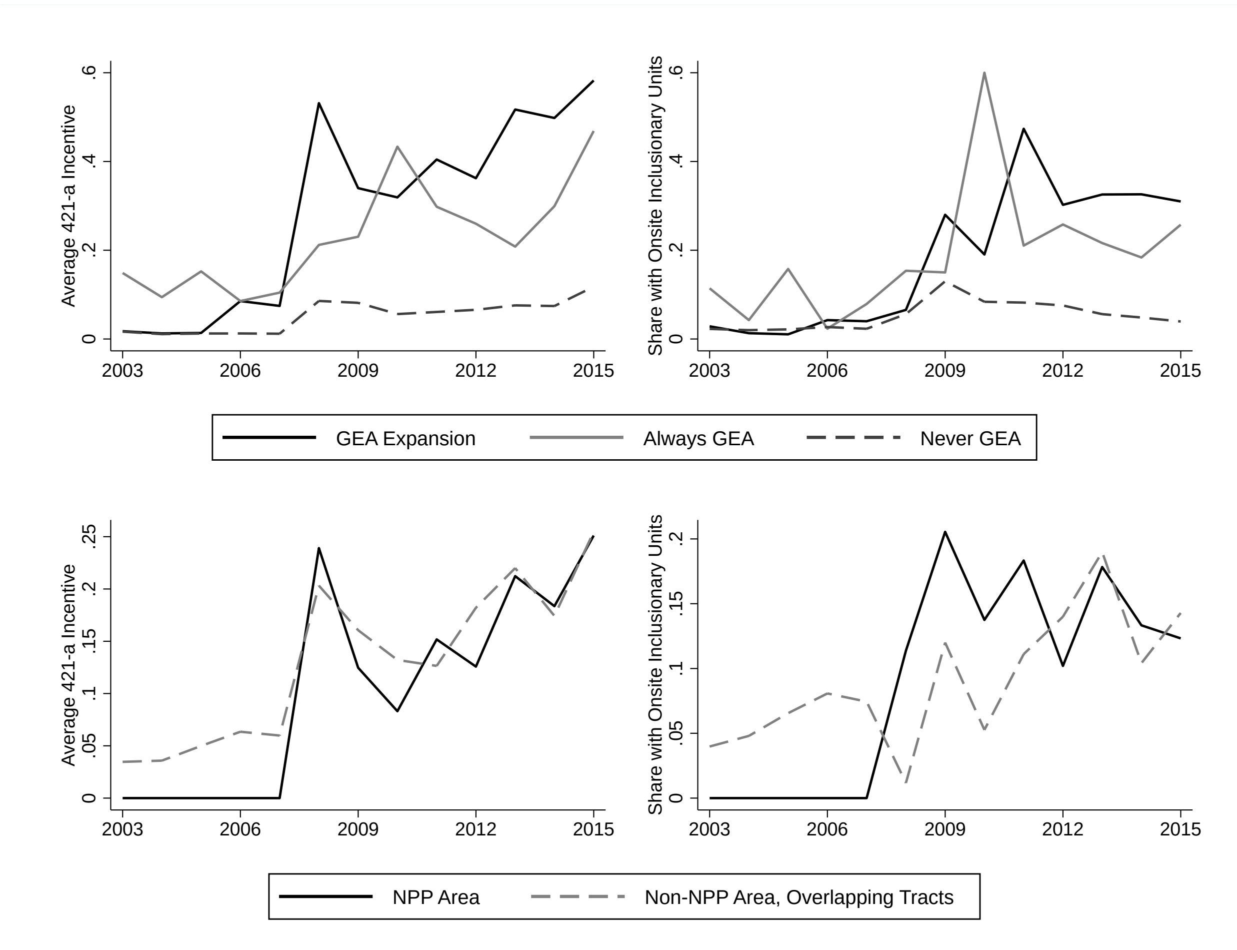
Figure 1: Supply Responses to Two Changes in 421-a Incentives



Notes: This figure plots time series of the average 421-a incentive (left panel) and share of buildings with onsite inclusionary units (right panel), split by regions defined as treatment and control groups. The first and second rows show respectively the GEA and NPP reforms in 2008. For further policy context on the GEA and NPP reforms, see Section 2. The incentive is measured by the present value of the 421-a tax savings as a share of market value.

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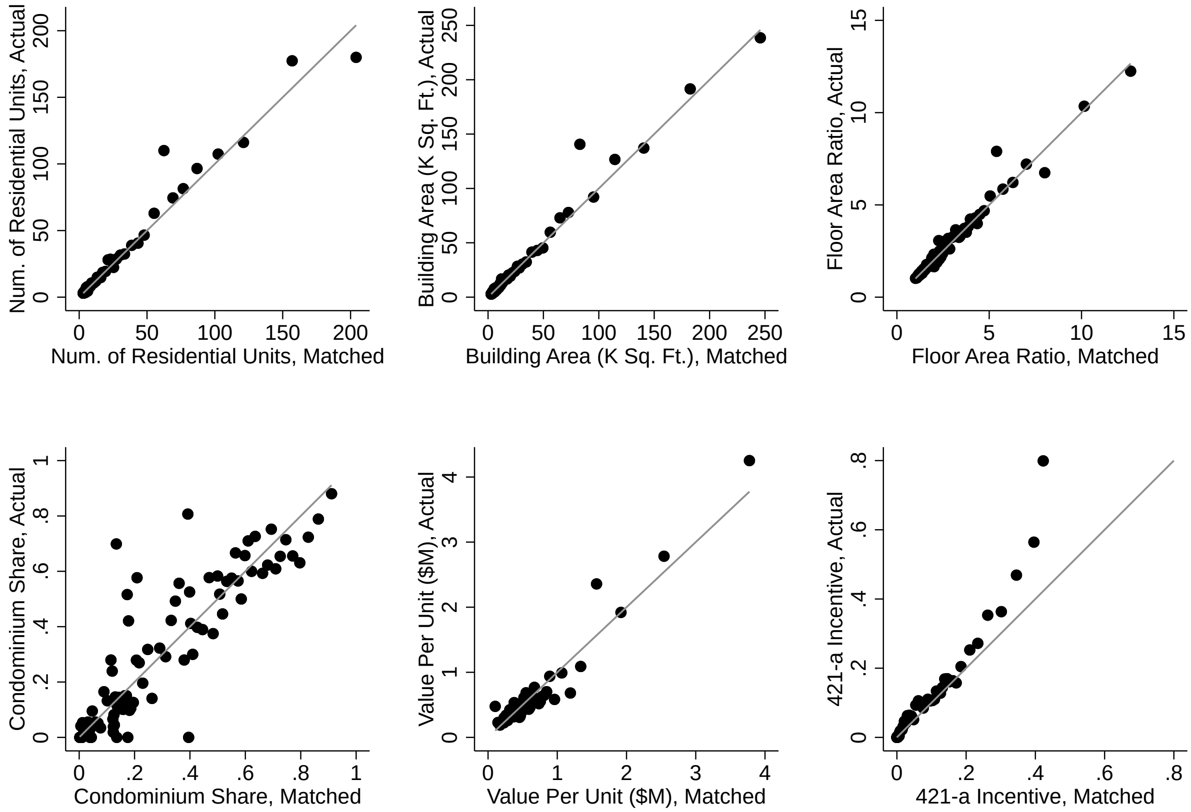
Figure 2: Zeroth and First Stages of Simulated Instrument GMM



Notes: This figure presents binned scatterplots of several endogenous characteristics which compare each building to the average of buildings to which it is matched using lot characteristics. To aid visualization, I drop observations beyond the 1st and 99th percentiles of the simulated characteristic. See Section 7.2 for details on the matching procedure and simulated-instrument GMM approach. I refer to the first five plots as the "zeroth stage," as they evaluate the performance of the matching procedure on physical building characteristics.

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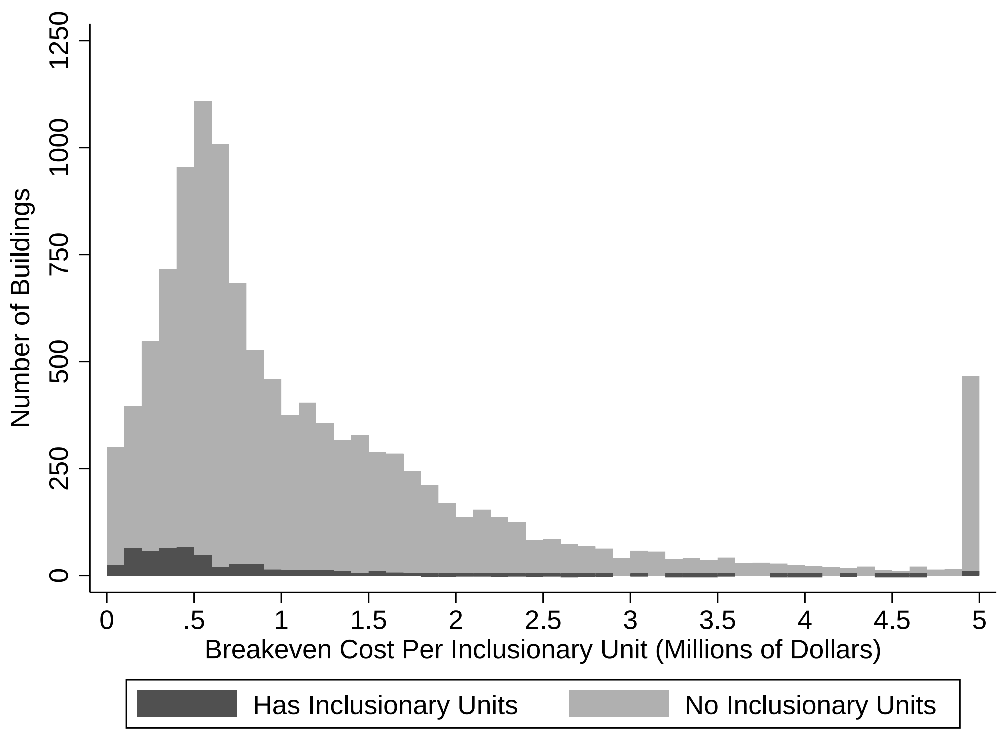
Figure 3: Distribution of Buildings' 421-a Participation Thresholds



Notes: This figure plots a histogram of estimated building-level participation thresholds, expressed in terms of the cost per inclusionary unit. The formula for this value is $-(v_i/\lambda) \cdot x_i\widehat{\beta}$, as derived in Equation 7. To aid visualization, I winsorize the distribution at $5 million per inclusionary unit. I also winsorize at zero eight observations with negative estimated breakevens. The specification includes fixed effects for borough and year as well as lot and block controls. For breakevens as a share of building market value, see Appendix Figure A13.

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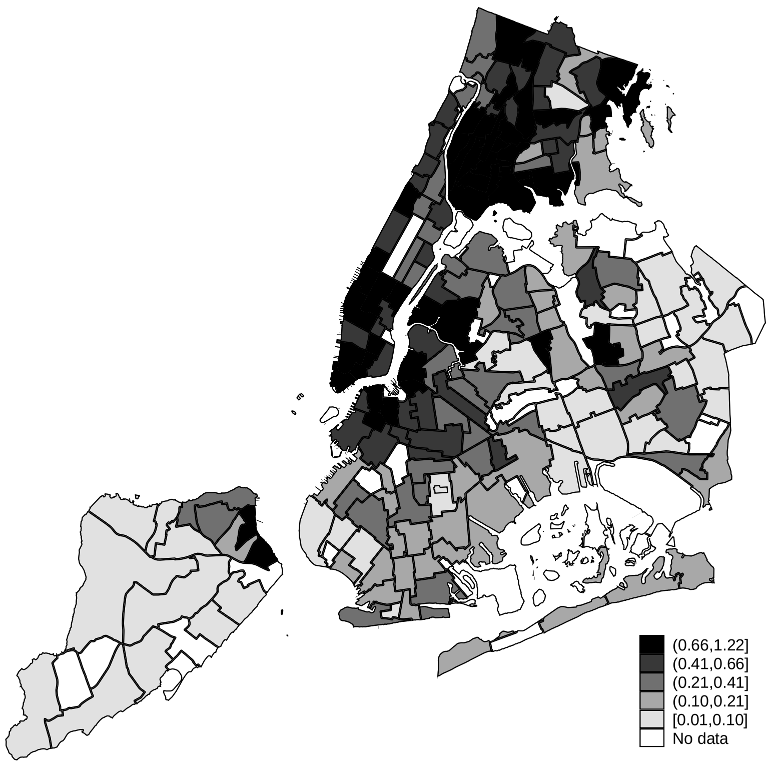
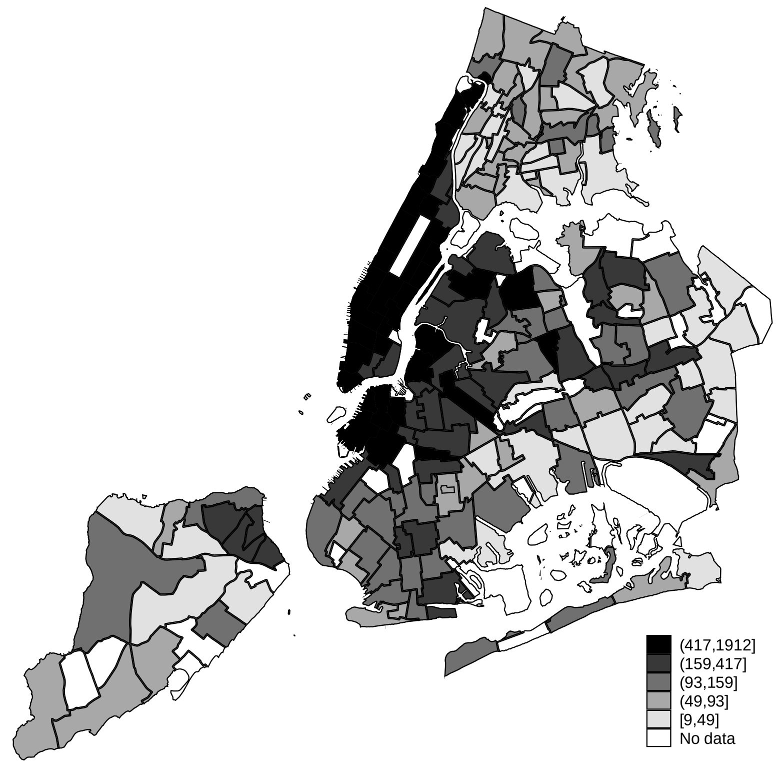
Figure 4: Estimates by Neighborhood

Panel A: Supply Response



Panel B: Marginal Fiscal Cost per Inclusionary Unit



Notes: These figures, in Panels A and B, respectively display estimates by neighborhood of the supply response of inclusionary units with respect to the tax-rate differential and the marginal fiscal cost per inclusionary unit. The units are percentage-point changes the participation rate per 1 p.p. increase in the 421-a incentive (in Panel A) and thousands of 2015 dollars (in Panel B). The estimated specification includes fixed effects for borough and year as well as lot and block controls. For models with neighborhood fixed effects, see Appendix Figure A15. I am unable to estimate supply responses and marginal fiscal costs neighborhoods with no 421-a eligible new development from 2003 to 2015. Cluster-bootstrap standard errors are displayed in Appendix Figure A14.

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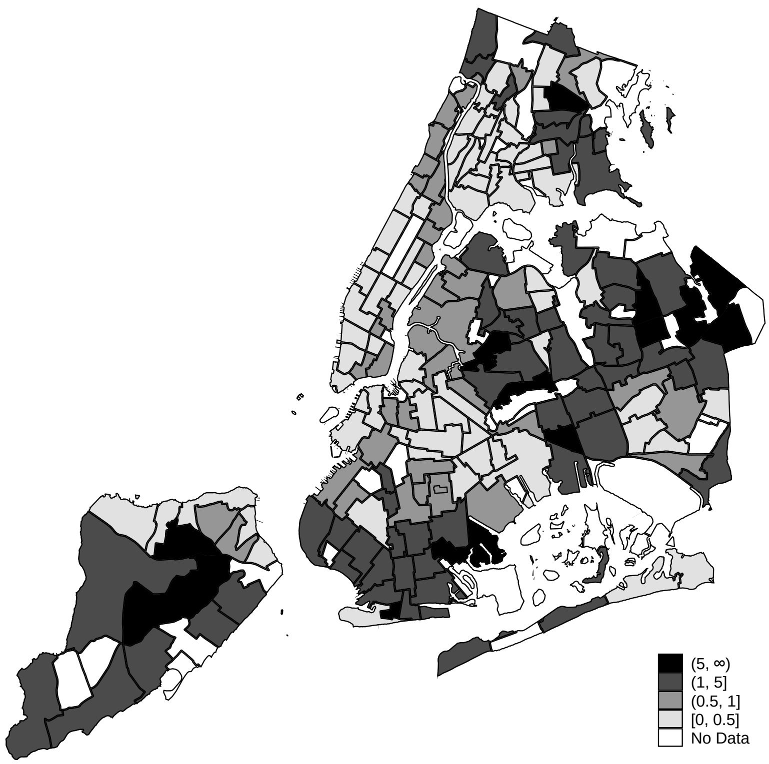
Figure 5: Marginal Value of Public Funds of 421-a by Neighborhood Tabulation Area



Notes: This figure depicts the marginal value of public funds (MVPF) for 421-a in each Neighborhood Tabulation Area. See Appendix Figure A20 for the estimates in the high-WTP scenario.