Housing Affordability, Supply, and Spatial Misallocation

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Abstract

Policymakers in many cities face a dual challenge: housing affordability and supply shortages. In response, inclusionary zoning (IZ) policies offer subsidies and tax exemptions to encourage the integration of income-restricted units into market-rate developments. We examine a long-running IZ program in Seattle to understand how these policies influence where housing is built and the effects of development on these neighborhoods. Although program requirements are uniform, differences in local conditions lead to varied responses from developers and landlords. Using changes in policy over time and detailed rental micro-data, we document a trade-off: in higher-income neighborhoods, rent discounts for subsidized units are larger, but developer participation is more sensitive to reductions in policy generosity. IZ also lowers nearby rents in lower-income areas but raises them in high-income areas, consistent with direct competition in the former and building-driven neighborhood changes in the latter. To interpret these patterns, we develop a quantitative urban model where developers choose where and how much to build, and residents choose among new and existing units. Voluntary IZ programs can expand access to high-quality housing for lower-income residents but may also contribute to gentrification in wealthier areas, resulting in mixed welfare effects.

Keywords: affordable housing; inclusionary zoning; neighborhood spillovers; quantitative urban model; rental housing; public finance; spatial difference-in-differences
JEL Classification: H25, R12, R13, R14, R31, R32, R38

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1 Introduction

With half of renters in the U.S. considered to be cost-burdened(U.S. Census Bureau, 2024), providing affordable housing is a major policy challenge in most large cities. As rents increase, cities have struggled to increase housing supply, pricing out lower-income residents and potentially hampering growth (Hsieh & Moretti, 2019).

Inclusionary zoning policies seek to address both affordability and supply issues. They are a form of supply-side subsidy, where a city incentivizes developers to set aside a portion of low-income units in new, market-rate buildings, typically through tax credits, exemptions, or changes to zoning laws. Proponents claim that IZ can provide affordable units with less market distortion compared to other policies like rent control, while also promoting social and economic integration through mixed-income housing. These policies therefore aim to change the composition of housing supply in both price and quality, and its distribution across space. IZ programs are now the most common form of affordable housing in the United States, with 734 localities in 31 states in 2019 (Wang & Balachandran, 2023). However, there is scant evidence on how these programs influence where developers build, where residents choose to live, how IZ development affects rents and further development in nearby areas, and the overall impact on welfare.

In this paper, we seek to evaluate Seattle's inclusionary zoning program, known as the multi-family tax exemption (MFTE) program. Seattle's MFTE program is a voluntary IZ program started in 1998 that provides developers a 12-year property tax exemption in exchange for setting aside 20% or 25% of units as rent-restricted for income-qualified residents. We consider the program's benefits to MFTE residents, effects on the spatial distribution of housing development, and effects on rents in the surrounding neighborhood.

We find significant variation across neighborhoods in the differentials between MFTE and market-rate rent, with "affordable" rent *exceeding* market rates in some areas. For instance, a 551-700 sq. ft., one bedroom MFTE unit is about \$500 cheaper in downtown but about \$300 more expensive in Rainier Valley than surrounding housing. While this appears counter to program goals, MFTE unit quality (as part of new construction) and restricted rent growth could potentially justify higher prices, making it an attractive but still affordable option compared to similar units nearby. Rent differentials increase with neighborhood income, unit size, and number of bedrooms.

The program must therefore trade off affordability offered to MFTE residents with the breadth of neighborhoods in which developers are sufficiently incentivized to join the program. We illustrate this by looking at programmatic changes. When the City's policy tightens affordability of MFTE units (e.g. lower rent limits, higher administrative costs), developer participation significantly decreases and is constrained to lower-cost neighborhoods. This neighborhood variation suggests that the MFTE program not only changes how much housing is built, but *where* it is built. In particular, it may redistribute lower income households, with potentially large effects on future outcomes (Chetty, Hendren, & Katz, 2016).

We next examine how MFTE development affects its surrounding neighborhoods. Using a spatial difference-in-differences design à la Diamond and McQuade (2019), we find heterogeneous treatment effects: statistically significant rent reductions for rental listings in median income areas, but smaller or even positive effects in higher-income areas. This contrasts with previous studies studying the Low-Income Housing Tax Credit (Diamond & McQuade, 2019; Voith et al., 2022), which we hypothesize reflect developer choices and program targeting. In lower-income areas, MFTE induces new construction, and MFTE units compete directly against surrounding units for lower-income tenants. In higher-income areas, MFTE provides few new net units, but new construction provides positive externalites that raise neighborhood desirability

(Zahirovich-Herbert & Gibler, 2014). Event study estimates support this pattern, showing short-run rent declines followed by longer-run increases, especially in richer neighborhoods.

We supplement our empirical findings with a quantitative urban model to understand how the MFTE program can redistribute housing, rents, and households across space. Our model incorporates key characteristics of both the affordable and market-rate housing markets. First, we explicitly model housing developer choice on both program participation and supply of floor space. Developers respond to policy on an extensive (discrete choice on building and joining MFTE) and intensive margin (continuous choice of floor space), similar to (Baum-Snow & Han, 2024). Second, we incorporate high and low-skill workers and high and low-quality housing into a quantitative urban model (Ahlfeldt, Redding, Sturm, & Wolf, 2015). This market segmentation is critical in allowing lower-income workers access to housing of higher quality or in higher-income areas through the program.

For the next steps of our work, we will structurally estimate our model, enabling us to quantify the MFTE program's welfare effects relative to a counterfactual where the MFTE program does not exist. Without MFTE, residential sorting implies greater sorting between low and high-skill types in the model. With residential amenities, the lack of policy-induced housing supply further decreases building, impling greater sorting between housing qualities as well. We further aim to compare MFTE policy with other common policies, including housing vouchers and a mandatory version of the policy.

We build on a growing urban economics literature that documents the effects of inclusionary zoning programs. The majority of the literature focuses on the Low-Income Housing Tax Credit (LIHTC), a U.S. federal government program that provides tax credits to developers. These papers focus on program effects on neighborhood demographic composition, rental prices, and property values (Baum-Snow & Marion, 2009; Davis, Gregory, & Hartley, 2019; Eriksen, 2009; Diamond & McQuade, 2019). These studies have found that these programs can revitalize low-income neighborhoods while lowering rents and house prices in higher income neighborhoods. Cook, Li, and Binder (2025) evaluates these policies for household welfare and social integration. Our paper is most similar in spirit to Soltas (2024), which evaluates the cost-effectiveness of New York City's 421-a property tax exemption. We ask the inverse question - given Seattle policy, what does developer behavior look like? There are few general equilibrium models of affordable housing (Favilukis, Mabille, & Van Nieuwerburgh, 2022), which emphasizes the role of housing policy in providing insurance to low-income households.

We see three main contributions of this paper. First, our granular rental data allows us to estimate effects on nearby rents, rather than inferring from property values. Second, we empirically show how relatively small policy design choices (i.e. uniform rent affordability requirements and income restrictions) can dramatically change policy effects in view of voluntary developer participation. Finally, more generally, we show how housing policy can induce re-sorting of residents in general equilibrium through changing the spatial allocation of housing.

2 Seattle's MFTE Program

First implemented in 1998, Seattle's MFTE program exempts multifamily rental housing developments from property taxes in return for designating 20% or 25% of units as rent and income-restricted. Rent and income restrictions are based on area median income (AMI) and adjusted for household size. While initially designed to encourage residential development in urban centers, since 2007 the program was expanded to a 12-year program and to promote affordability (Colburn, G. and Collins, D. and Wang, E., 2024). At the state level, MFTE is codified in Chapter 84.14 RCW, which defines the goals of the program as incentivizing urban housing development, including affordable housing, and encouraging urban development and density.

The MFTE program has undergone significant changes and is currently in its sixth iteration (P6), having been reauthorized with amendments five times since inception. Each "program" (P1, P2, etc.) details exact MFTE tenant income limits and percentage of allocated MFTE units per eligible building, the result of political bargaining between developers, housing officials, and city council. For example, in 2011, city councilmembers raised concerns that tax breaks had been awarded to undeserving developers, and a performance audit spurred greater monitoring and compliance regulation.

In 2019, Washington State's Joint Legislative Audit and Review Committee (JLARC) released a statewide evaluation of MFTE. The topline conclusion was while developers created housing using MFTE, it is "inconclusive" as to whether this represents a net increase in developments overall. In response, Seattle's Office of Housing refocused its policy on affordability, tightening rent and income limits, increasing regulatory burden, and enforcing strict comparability of income-restricted and market-rate units in MFTE properties.

Overall, 303 rental properties have participated in MFTE over the program's lifetime. These contribute a total of 33,956 total housing units, of which 7,047 are income-restricted. Currently, 286 buildings have an active MFTE contract with the City and receive tax exemptions.

3 Data

We bring together several rich and novel datasets, including administrative data from the City of Seattle and King County, rental price data from Co-Star, Inc., scraped rental listings from Craigslist, and survey data from the U.S. Census Bureau. The detailed micro-data on both new housing development and existing rental units allows us to estimate how the construction of new affordable housing affects nearby rents using a spatial difference-in-differences approach. In addition, the City's permitting data allows us to examine whether the placement of a MFTE project leads to further housing development in the surrounding area. Finally, by combining these housing data with Census data on employment flows between home and work locations, we build and estimate a quantitative urban model. This model enables us to conduct counterfactual analyses comparing the welfare effects of MFTE to those of alternative policy programs.

3.1 Data on Seattle Multi-family Housing Projects

For MFTE project and unit characteristics, the Seattle Office of Housing has provided the exact geographic locations, application date, housing unit counts, resident demographics, and types of units of all MFTE buildings. To supplement this data on MFTE buildings, we also source publicly available data from the City of Seattle on all building permits from 1990 to the present day. These include the exact geographic location of the project, application date, issuance date, net new housing unit counts, estimated project cost, an indicator for whether the permit was for construction or an addition/renovation, and an indicator for whether the permit is for a multi-family or single-family residence.

Addiitionally, for 2023 only, we observe unit-level data from the Annual Certification Query, an internal Office of Housing report collected from property managers. These detail rents, unit characteristics, rent and vacancy periods, and tenant characteristics.

3.2 Data on Neighborhood Rental Listings and Prices

For data on rental listings and prices, we primarily use data on rental listings scraped from Craigslist, a classified ads website. This data runs from February 2017 through November 2023 for the Seattle metro area, totaling around 150,000 listing-month observations. While landlords' usage of Craigslist may vary across regions and months, studies have employed scraped Craiglist data to study the effects of new housing development, such as their impacts on gentrification and renter displacement (Pennington, 2021). Furthermore, Hess et al. (2021) finds that Craigslist listings may offer a more comprehensive data source for rental housing listings than at least other online platforms, finding that "the disproportionately commercial profile of properties advertised on Apartments.com captures a more socioeconomically selective range of neighborhoods than Craigslist, where both commercial and "mom and pop" landlords are likely to post rental vacancy advertisements."

We supplement these with 2023 point-in-time rental estimates from CoStar. These are timed to match the Annual Certification Query data above, and are broken down by neighborhood, bedrooms, and square feet. This provides exact comparability of observables between MFTE property units and neighborhood units.

In addition, we use data from the Census 5-year American Community Survey for neighborhood demographics, such as median Census tract-level income. Matching MFTE buildings to Census tracts allows us to identify and estimate heterogeneous treatment effects on neighborhood rents and further housing development.

3.3 Data on Household Residence and Workplace Shares and Flows

For estimating our quantitative urban model, we plan to use the Census Bureau's LEHD Origin-Destination Employment Statistics (LODES) data for detailed information on where people live and work at the Census tract and block levels. Compiled through the Longitudinal Employer-Household Dynamics (LEHD) program, LODES data link workers to their employers using administrative records. We use this dataset to obtain employment shares by work location, residence location, occupation, industry, and worker demographics. This provides rich insights into employment flows within and across regions, allowing us to estimate structural parameters such as households' preferences for residence and work locations and high- versus low-quality housing.

4 MFTE Program Trade-offs

We provide descriptive evidence that illustrate the City's trade-offs in its design of the MFTE program. The City makes a multitude of policy choices in its design of the MFTE program, including setting rent limits, income thresholds, and MFTE unit comparability with market rate units in terms of features. These factors influence developer incentives across neighborhoods, leading them to participate only where the amount of exempted taxes outweigh the rent discounts that they are required to provide on MFTE units.

Figure 1 shows that MFTE properties are spread throughout the city, in both high and low income neighborhoods. Figure 2 compares market-rate rents in MFTE buildings, income-restricted rents in MFTE buildings, and neighborhood rents for twelve subdistricts in Seattle.[1] MFTE rent is stable, reflective of

[1]For more comparisons by other margins, such as number of bedrooms and square footage, see Appendix Figure A.4 and Figure A.5.

MFTE policy, and lower than market-rate units in the same buildings. On the other hand, MFTE rents can be similar and sometimes even higher than rents in the surrounding neighborhood. For example, in Rainier Valley, MFTE one-bedroom units (551–700 sq. ft.) rent for about $300 more than comparable market-rate units. Rent differentials increase with neighborhood income, and while MFTE primarily incentivizes studio and one-bedroom apartment program, two-bedroom rent differentials are also higher. These patterns reflect where MFTE is most feasible - not the richest neighborhoods but also not poorest neighborhoods, as MFTE tenants must still meet minimum income requirements, and MFTE units are often higher quality than typical market-rate units. In qualitative surveys conducted by Colburn, Collins, and Wang (2024), developers themselves discuss where they are most incentivized to build:

> "this program operates very much within the market. So where buildings are already feasible to build is where you see the most MFTE activity."
>
> "... you're in Rainier Beach, the overall project is going to be very difficult to pencil, because the market rents aren't there ... a very narrow gap between market and affordable rents would make that MFTE incentive very accretive."
>
> "If you compare some of these rents, there's really no difference. So there's no public benefit being provided at all. Zero, zero, zero. So why not do MFTE? It's a no-brainer"

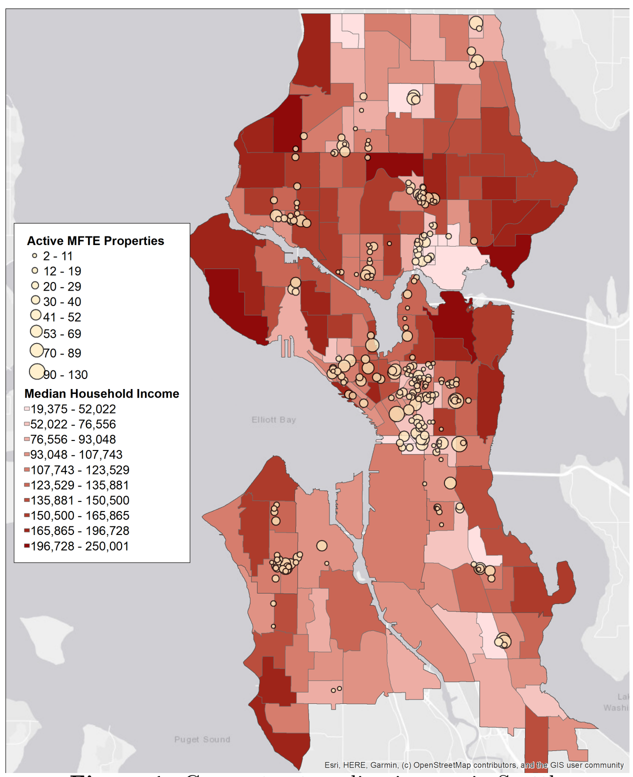


Figure 1: Census tract median income in Seattle

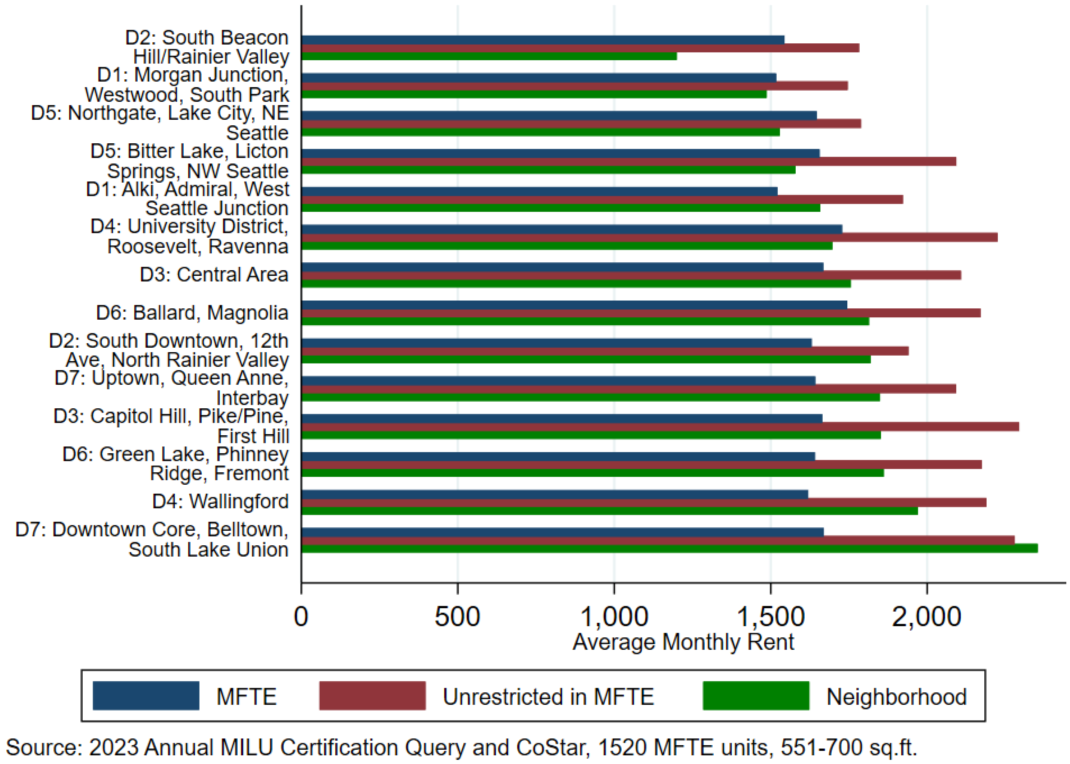


Figure 2: Comparison of MFTE and market rents for 1-bedroom, 551-700 sq. ft. units

4.1 Policy Variation and Neighborhood Heterogeneity

Since the MFTE program is in its sixth iteration, we observe policy variation that demonstrate how developers respond to changes in program design. The City has adjusted MFTE rents, income qualification limits, and unit requirements five times during the program's inception. When setting a lower rent for MFTE units, the City is essentially tightening the affordability of MFTE units, as opposed to setting a higher MFTE rent that might be closer to market rents. Tightening affordability leads developers to build only in poorer neighborhoods, whereas relaxing affordability incentivizes developers to build in a wider breadth of neighborhoods in terms of rents and renter income.

Figure 3 shows the differences in the breadth of neighborhoods where developers participated in MFTE between each iteration of the program (see Appendix Figure A.1 for a comparison of MFTE permitting and market-rate). Generally speaking, the differences between P4, P5, and P6 are that the MFTE program enforced tighter AMI income limits and lower MFTE rents received by developers. In addition, in P6, the City greatly increased the regulatory burden of developers; e.g., the City became more specific about what amenities MFTE developers are required to include in the property's units and the income certification that is required. Previously, MFTE could be assigned to units on lower levels, worse views, etc.. However, in reaction to these "poor doors", by P6 the Office of Housing started enforcing stringent comparability requirements, effectively further tightening affordability requirements.

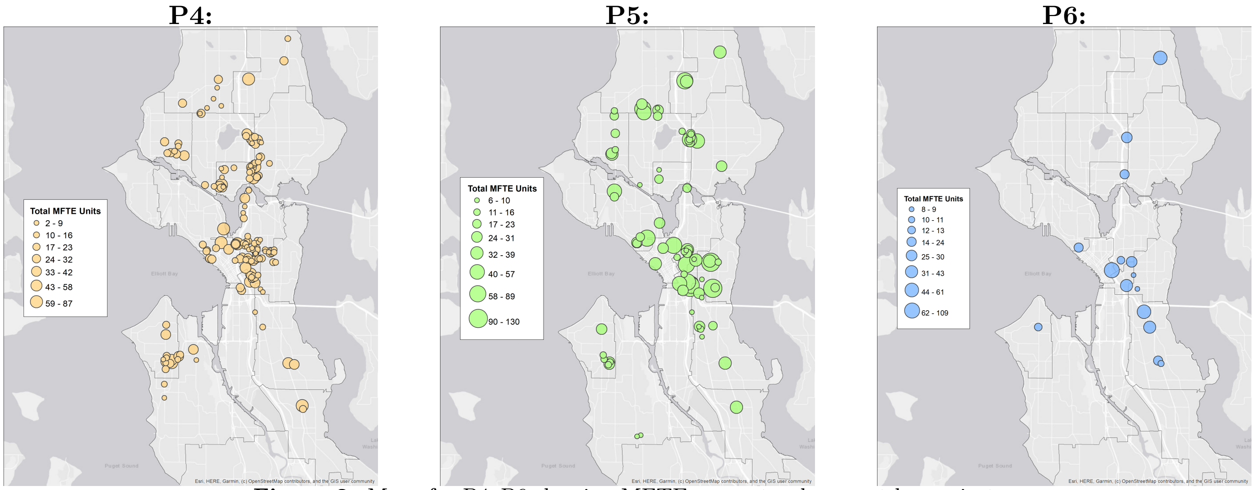


Figure 3: Maps for P4–P6 showing MFTE property placement by project.

Each iteration of the MFTE program represents a "bundle" of policy changes. We summarize the effects of these policies in Table 1. Using data on all MFTE units throughout the history of the program, we show how rents in MFTE buildings decreased during the program's P6 iteration. The first column shows that units in MFTE buildings (both rent-restricted and market rate) in the P6 iteration generally had lower rents. In the second column, we include submarket fixed effects to show that one reason for these lower rents is that developers became more selective about which neighborhoods they placed MFTE properties, choosing ones which had lower market rents. In addition, the third column controls for the size of the unit, and the contrasting sign for the coefficient on the P6 dummy between the second and third columns demonstrate that the lowered rents in MFTE buildings were partially due to smaller units built during P6 as well. In column 4, we regress on square feet directly to show that MFTE units are smaller, but that increased comparability standards seemed to reduce this effect in P5 and P6. Finally in column 5, we present suggestive evidence that vacancy rates for somewhat higher for MFTE units, although this is highly endogenous to market demand.

	Monthly Rent	Monthly Rent	Monthly Rent	Sq. Ft.	2023 Vacancy Rate
MFTE	-602.6***	-579.0***	-521.9***	-31.19***	0.0227**
	(17.33)	(16.27)	(15.41)	(4.744)	(0.00750)
Program=4	-86.77***	-91.36***	51.26***	-79.09***	0.0236***
	(10.44)	(10.01)	(8.512)	(2.941)	(0.00405)
Program=5	10.25	35.38***	123.9***	-48.86***	0.0850***
	(10.92)	(10.34)	(8.454)	(3.120)	(0.00465)
Program=6	-101.4***	-49.76***	25.76*	-39.99***	0.0954***
	(12.76)	(11.88)	(10.63)	(3.870)	(0.00703)
MFTE × Program=4	138.9***	110.9***	115.2***	-1.546	-0.0260**
	(18.30)	(17.42)	(16.43)	(5.261)	(0.00834)
MFTE × Program=5	87.87***	70.70***	47.21**	13.79*	-0.0569***
	(18.94)	(18.00)	(16.72)	(5.491)	(0.00970)
MFTE × Program=6	27.60	-12.88	-34.93	10.52	0.0502***
	(22.02)	(21.22)	(21.21)	(6.855)	(0.0147)
Sq. Ft.			1.825***		
			(0.0203)		
Constant	1677.7***	1671.8***	766.7***	495.9***	0.0674***
	(11.19)	(10.68)	(14.14)	(3.231)	(0.00487)
N	31514	31514	31514	31873	31752
Submarket FE		Y	Y	Y	Y
Bedrooms FE	Y	Y	Y	Y	Y

Table 1: Descriptive regression results showing effects of different program iterations on rental units in MFTE buildings.

Finally, Figure 4 plots the total rent differentials (i.e. savings to residents or costs to developers) with the value of the property tax exemption. Developers have relatively accurate forecast of future rents and are (rationally) placing MFTE buildings only in neighborhoods where the amount of shifted taxes at least outweigh the rent discounts that they must provide for MFTE residents. Most of the points–each one representing a MFTE building–lie below the 45 degree line in the plot of 2023 shifted taxes and total rent differentials between MFTE and market rate rent.

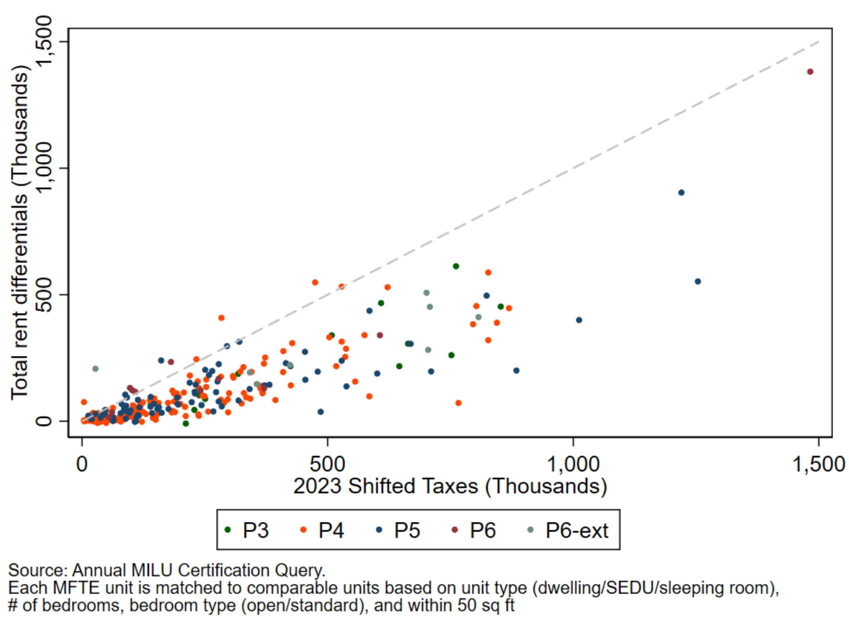


Figure 4

5 Neighborhood Spillovers

5.1 Effects on Neighborhood Rents

5.1.1 Using Spatial Difference-in-Differences

Using a spatial difference-in-differences empirical strategy, we estimate the average treatment effects of placing a MFTE property on surrounding neighborhood rents, captured by the universe of Craigslist listings in Seattle from 2017 through 2023. We find substantial heterogeneous effects by Census tract-level median income. Estimated local average treatment effects (LATE) are statistically significant and negative at median income across Craigslist listings, where income is defined as the Census tract-level median income linked to each Craigslist listing (Imbens & Angrist, 1994). For rental listings in more affluent Census tracts, these negative treatment effects are smaller in magnitude or even positive.

We interpret our estimates as the net effect of introducing a new mixed-income residential building on neighborhood rents, shaped by several theoretical mechanisms. On one hand, such developments increase the overall housing supply and introduce lower-priced, high-quality units intended for lower-income households. These changes are expected to reduce rents by expanding housing availability and increasing competition among landlords serving lower-income tenants. On the other hand, new development may improve local amenities, thereby increasing housing demand and exerting upward pressure on rents over time.

In the absence of an analysis of heterogeneous treatment effects across neighborhoods with varying income levels, we find that the estimated average effect is statistically indistinguishable from zero. This suggests that these countervailing forces discussed above may offset one another in the aggregate. After accounting for heterogeneous treatment effects by income, however, the lower negative treatment effects for more affluent Census tracts can suggest a few possibilities that are based on the mechanisms discussed above. In the short run, more affluent neighborhoods like those in downtown Seattle may have fewer landlords who target the lower-income segment of the market to begin with, so a MFTE project's addition of low-priced, high-quality housing units targeting lower income households may not affect competition substantially. In contrast, the addition of MFTE units in a lower-income neighborhood like Rainier Valley may pressure some landlords targeting lower-income renters to lower their prices.[2] In the long run, a new MFTE building might boost housing demand more greatly in higher-income areas, which increases market rents.[3]

To ensure that we also include any anticipatory effects of households and landlords prior to the lease-up of MFTE properties, our research design specifies the timing of treatment to be the developer's date of application for the MFTE property. To identify treatment effects, we exploit how a development site's exact location within a neighborhood often reflects idiosyncratic factors, such as which parcel was for sale at the time (Diamond & McQuade, 2019). We assume that when the developer applies for a specific MFTE development project, these idiosyncratic factors are uncorrelated with differential changes in rent between our treated and control groups. Our treatment group consists of Craigslist rental listings that are located within a ring of a certain radius (0.3 kilometers) of a focal MFTE building. Our control group are Craigslist rental listings that are within a ring that is further away from the building (between 0.3 and 0.8 kilometers away). We estimate treatment effects by comparing differential changes in rent between Craigslist listings

[2] While our descriptive statistics show that MFTE units in Rainier Valley are priced at $300 more on average than local market rents, the relative higher quality of MFTE units may still increase competition if there are lower income renters who can afford to pay this margin for quality in that neighborhood.

[3] To try distinguishing between these two possibilities, we conduct event studies using the MFTE application date as the event date. We perform one event study for each quartile of Census tract median income. These results are shown section 5.1.2.

located in these treatment and control rings twelve months before and twelve months after treatment. To avoid overlapping control and treated groups for different MFTE buildings that are clustered together, we omit Craigslist listings in these overlapping rings.

We run two specifications for our spatial difference-in-differences, as shown below. For both, we include month-year fixed effects to control for time-varying factors (δ_t), as well as fixed effects for each MFTE building to control for time-invariant effects specific to each neighborhood (α_i). For a month t and Craigslist listing i, Post_{it} indicates whether i is observed before or after treatment and Treated_i indicates whether i is within a treatment ring. We also control for the number of bedrooms in listing i, which is important since MFTE units are primarily studios and one bedroom units.

$$\log \text{Rent}_{it} = \beta_0 + \beta_1 \text{Treated}_i + \beta_2 \text{Post}_{it} + \beta_3 \text{Post}_{it} \times \text{Treated}_i + \gamma \text{Beds}_i + \alpha_i + \delta_t + \epsilon_{it} \tag{1}$$

$$\begin{aligned} \log \text{Rent}_{it} = \beta_0 + \beta_1 \text{Treated}_i + \beta_2 \text{Post}_{it} + \beta_3 \text{Post}_{it} \times \text{Treated}_i + \beta_4 \text{Post}_{it} \times \text{Treated}_i \times \frac{\text{Income}_i}{\text{median(Income)}} \\ + \gamma \text{Beds}_i + \alpha_i + \delta_t + \epsilon_{it} \end{aligned} \tag{2}$$

Since the first specification is a standard difference-in-differences with additional controls, the interpretation is straightforward. In equation (1), the coefficient of interest (β_3) captures the average differential effects of an anticipated MFTE property on the rents of Craigslist listings that are in control rings and treatment rings. Meanwhile, the second specification includes an additional term that captures heterogeneous treatment effects of placing a MFTE project development in the local area. At the median income across listings (where income is defined as the Census tract-level median income tied to each Craigslist listing), the LATE is $\beta_3 + \beta_4$. To further illustrate how to interpret these coefficients, the LATE is $\beta_3 + \beta_4 \times 1.5$ for a Craigslist listing in a Census tract that has 50% higher Census tract-level median income than the median across Craigslist listings.

Our results are shown below in Table 2. We see that our estimate of β_3 is statistically indistinguishable from zero in the first specification. Meanwhile β_3 and β_4 are statistically significant. For rental listings at median income, the MFTE development decreases rents by 3.2% on average, whereas for rental listings located in Census tracts with 50% higher income than the median, MFTE development is predicted to increase rents by 6% on average.

Dependent Variable	(1) $\log \text{Rent}_{it}$	(2) $\log \text{Rent}_{it}$
Treated_i	0.079**	0.077**
	(0.037)	(0.037)
Post_{it}	0.004	-0.000
	(0.029)	(0.031)
$\text{Post}_{it} \times \text{Treated}_i$	-0.024	-0.217***
	(0.052)	(0.082)
$\text{Post}_{it} \times \text{Treated}_i \times \frac{\text{Income}_i}{\text{median(Income)}}$		0.185***
		(0.059)
Beds_i	0.251***	0.251***
	(0.025)	(0.025)
Constant	7.337***	7.340***
	(0.033)	(0.059)
Observations	35,315	35,315
R-squared	0.519	0.522

Table 2: Effect of anticipated MFTE development on log rent of local rental listings. Robust clustered standard errors in parentheses; all specifications include month-year and MFTE building fixed effects.

Overall, we find that placing a MFTE building in more affluent Census tracts tends to have smaller negative treatment effects—or even positive effects—on rents. At first glance, this may seem inconsistent with Diamond and McQuade (2017), who find that mixed-income housing developments funded through the federal LIHTC program increase house prices by 6.5% in low-income neighborhoods and decrease them by 2.5% in high-income areas as they attract lower-income residents (Diamond & McQuade, 2019). However, a key distinction is that our analysis focuses on the impact of mixed-income housing on *rents*, whereas theirs examines house *prices*. In lower-income neighborhoods, the addition of MFTE units—lower-priced, high-quality rentals—can reduce rents by increasing competition among landlords serving lower-income tenants. In contrast, house prices may respond differently, potentially rising if a new development improves neighborhood desirability in a low-income area.

5.1.2 Using Event Studies

As discussed above, we have two possible explanations for why placing a MFTE building in more affluent Census tracts tends to have smaller negative treatment effects—or even positive effects—on rents. In the short run, more affluent neighborhoods may have relatively few landlords catering to lower-income renters, so the addition of lower-priced, high-quality MFTE units may have little impact on market competition. Over the longer term, however, a new MFTE development could increase neighborhood desirability and housing demand more significantly in higher-income areas, leading to upward pressure on rents. To distinguish between these explanations, we conduct event studies using the MFTE application date as the event date. We perform one event study for each quartile of Census tract median income.

For the event studies, we use the same data and definitions of control and treatment rings as we did for the spatial difference-in-differences. As in a typical event study, we include dummies indicating whether a month is a lead or a lag relative to the event date, the developer's application date for the MFTE property. As in the difference-in-differences, we control for bedrooms (Beds_i), MFTE building fixed effects (μ_i), and year-month fixed effects (δ_t).

$$\log \text{Rent}_{it} = \alpha + \sum_{s=1}^{12} \beta_s (\text{Lead } s)_{it} + \sum_{u=0}^{12} \gamma_u (\text{Lag } u)_{it} + +\eta \text{Beds}_i + \mu_i + \delta_t + \epsilon_{it} \tag{3}$$

We begin by estimating the event study model in equation (3) using the full sample, with results presented in Figure 5 below. The findings align with the theoretical mechanisms discussed earlier: the placement of a MFTE building is associated with short-run rent declines due to increased competition among landlords, followed by longer-run rent increases due to increased location attractiveness. Specifically, rents tend to fall modestly between four and ten months after the developer submits a MFTE application, but this effect dissipates thereafter. Although the confidence intervals are relatively wide—reflecting substantial variation across Census tracts—the point estimates are broadly consistent with this pattern.

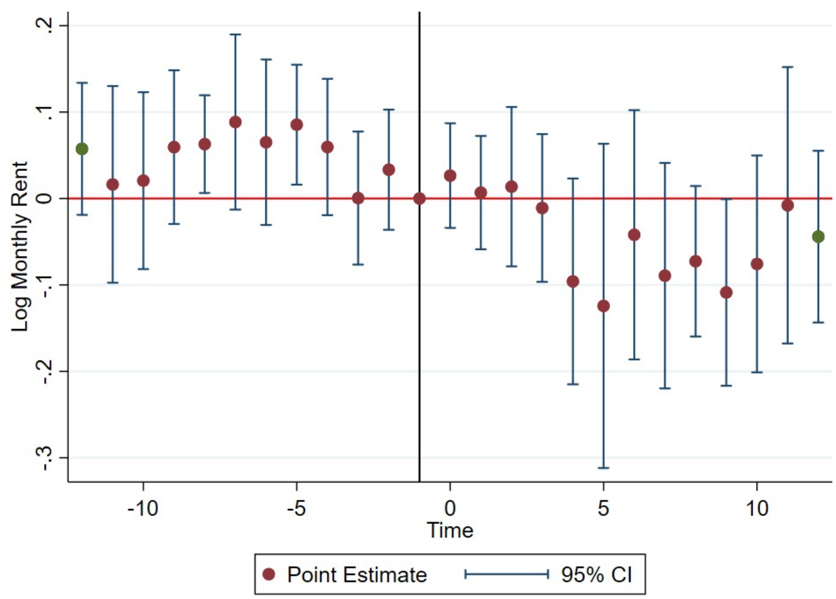


Figure 5: Event study point estimates and their confidence intervals using the full sample of Seattle Craigslist listings not in overlapping treatment and control rings.

Next, we estimate the event study model in equation (3) separately by quartile of Census tract median income. These results are shown in Figure 6 below. In the top income quartile, Craigslist rental listings show only a brief decline in rents—occurring between five and six months after the event—followed by predominantly positive average treatment effects. In contrast, listings in lower-income tracts exhibit more persistent rent declines following the event. These patterns are consistent with the hypothesis that MFTE units exert limited competitive pressure on landlords in higher-income areas, where few landlords target lower-income renters. However, new development in these areas may enhance neighborhood desirability, leading to increased housing demand and upward pressure on rents over time.

Figure 6: Event study point estimates and their confidence intervals using Seattle Craigslist listings not in overlapping treatment and control rings, separately estimated for each Census tract median income quartile.

6 Quantitative Urban Model

We outline a quantitative urban model with housing developers and households. Our goal is to understand how affordable housing policy redistributes households, housing development, and prices across space and the welfare effects of this redistribution. We base our model on Ahlfeldt et al. (2015), with a city embedded in a larger economy with I locations, each defined by residential amenities, productivity fundamentals, and a fixed transport network. In addition, we will use tract-level housing elasticity supply estimates from Baum-Snow and Han (2024), since our policy primarily affects new construction.

The model will have three components. Developers build housing and choose to enter MFTE or not at the time of building. Households choose residence and workplace, consuming housing and a final good. Finally, firms produce a final good in perfect competition.

Our model includes several distinguishing features that are new to the literature. First, our explicit model of the developer's problem provides a micro-foundation for how an IZ program can spur further rental housing development in certain areas in the presence of endogenous amenities, which is consistent with our observed data on clustered permitting activity in Appendix Figure A.1.[4] We explicitly model the developer's problem for choosing between different building options (market rate building, MFTE building, or no building) and their choice of floor space. Local market conditions determine both building types and overall supply, and thus the relative supply of affordable floor space depends on market rate demand.

Second, our model specifies each household's labor type (high- or low-skilled) and includes an idiosyncratic preference for high- or low-quality housing. We also incorporate a housing filtering process, where the quality of housing decays with age. By incorporating these elements, we can simulate counterfactuals to show how the MFTE program improves access to higher productivity or amenity locations and high-quality housing

[4]Zoning laws also dictate where rental housing developers are allowed to build as well, which may be responsible for some of this clustered housing development behavior. In future work, we will conduct a more careful analysis of the City's permitting data to account for this.

for low-skilled (i.e., lower-income) workers—access that might not occur without the program. These gains are important for capturing the full welfare impact of the policy.

6.1 The Supply-side Housing Developer's Problem

Each developer i has a parcel of land in neighborhood j. They make a one-time decision to build, choosing both the type of building b (MFTE, market rate, wait) and parcel floor space q. They choose to do this if discounted lifetime profits outweighs costs (variable and fixed) $C(q, Q)$, where costs depend on both the developer's choice q, and existing floor space in the neighborhood Q.

Market-rate rent and existing housing supply are the key equilibrium objects in determining developer decisions. Developers thus maximize their value function as:

$$V(\mathbf{s}_{it}, \epsilon_{it}) = \max_{b}\{\Pi(b, \mathbf{s}_{it}) + \epsilon_{it}(b)\} \tag{4}$$

, where $\Pi(b, s_{it})$ is the lifetime profit choice in π_{mkt} or π_{MFTE}, or $\beta EV(s_{i,t+1}|s_{it})$ if waiting. In this equation, ϵ_{it} is an unobserved, i.i.d. Type I extreme value error term that represents idiosyncratic characteristics of developers that can contribute to their decisions between choosing to construct a MFTE or market-rate building. Intuitively, this can represent a developer's specific expertise in applying for the MFTE program or some idiosyncratic cost of applying for one over the other.

Developers assume fixed program parameters: MFTE rent (r_t^{MFTE}), set aside a portion of units as MFTE (λ), and subsidy per square foot of a MFTE building s. Program requirements are set at certification. Thus developer profits are simply the present discounted value of rent (some of which is fixed for MFTE buildings) minus costs.

$$\pi_{\text{mkt}}(\mathbf{s}_{it}) = \sum_{\tau=t}^{\infty} \beta^{\tau-t} E_t[r_{i\tau}^{\text{mkt}}]q - C_{it}(q) \tag{5}$$

$$\pi_{\text{MFTE}}(\mathbf{s}_{it}) = \sum_{\tau=t}^{\infty} \beta^{\tau-t} (\lambda(r_t^{\text{MFTE}}) + (1-\lambda)(E_t[r_{i\tau}^{\text{mkt}}]) + s)q - C_{it}(q) \tag{6}$$

Additionally, if we assume a simple convex cost of units $C_{it}(q) = q^{\gamma}$, we can find the optimal number of units from the FOC.

$$\log q_{\text{mkt}}^* = \frac{1}{\gamma - 1}\left(\log(r^{\text{mkt}}) - \log\left(\frac{\gamma}{1-\beta}\right)\right) \tag{7}$$

$$\log q_{\text{MFTE}}^* = \frac{1}{\gamma - 1}\left(\log(\lambda(r_t^{\text{MFTE}}) + (1-\lambda)r_{i\tau}^{\text{mkt}} + s) - \log\left(\frac{\gamma}{1-\beta}\right)\right) \tag{8}$$

Since MFTE rents (r_t^{MFTE}) are essentially fixed at the time of development, this tells us that higher market rate rents increase development through building more floor space (intensive) and choosing to construct more market rate buildings over MFTE buildings or not building at all (extensive margin). Conditional on building a market rate or MFTE building, developers will choose floor space based only on the market rent.

While market rents are ultimately determined in general equilibrium, we make a few illustrative predictions for developers' building decisions (whether they choose to construct a market rate building, MFTE building, or not building) based on potentially rent processes and these first order conditions. We simulate some of these processes in partial equilibrium in Figure A.2 and Figure A.3.

First, suppose that market rent is unchanging or stationary. While this case is not realistic, Appendix fig:a2. shows that we would observe developers choosing building types immediately. In particular, they would switch from MFTE to market-rate as long as the market rent level is higher than the MFTE rent.

Second, suppose that rents are increasing over time. As shown in Figure A.3, some developers may choose to wait, depending on their idiosyncratic characteristics ϵ_{it}. Even if MFTE buildings could be built profitably, developers may delay in anticipation of higher market rate rents so that they can construct a market rate building. The developer's problem becomes an optimal stopping problem in this case.

Finally, consider the case when a development endogenously improves amenities, which increases market rents through discrete, positive shocks to housing demand. While the problem is still an optimal stopping problem, this might induce developers to "rush" to construct market rent buildings in an area when a new rental housing development project is announced. This is because the new development–whether MFTE or market rate–pushes market rent closer to developers' thresholds for choosing the market rate building option. Since we observe in Appendix Figure A.1 that using the City's permitting data that developers tend to build multifamily rental properties in clusters, this case may match the observed data the best. However, we rule out strategic development behavior in this case. Since developers do not observe ϵ_{it}, they cannot strategically anticipate each other's development decisions.

The final case is particularly noteworthy, as it suggests that the availability of the MFTE program may actively stimulate additional rental housing development in the same area. Developers with a relatively high valuation of ϵ_{it}(MFTE) might choose to pursue an MFTE project rather than wait for market rents to rise. Our empirical analysis shows that introducing an MFTE building can generate positive spillover effects on nearby market rents. As a result, even a single MFTE project could enhance the perceived attractiveness of the surrounding neighborhood, thereby encouraging further housing development.

6.2 The Demand-side Household's Utility Maximization Problem

On the demand-side, $\mathbb{H}$ households can choose to live and work among I locations. Each location has total existing floor space $\mathbb{L}$, which can be used residentially or commercially. Each household o lives in location i, works in j, and is of type $s \in \{0, 1\}$, which denotes whether they are low-skill or high-skill workers. They consume floor space l_{ibo} of type (b), paying r_{ib} in rent per square foot. Assume they inelastically supply one unit of labor. Then their utility function is

$$U_{ijbso} = \frac{z_{ijso}}{d_{ij}} \left(\frac{c_{ij}}{\beta}\right)^{\beta} \left(\frac{\xi_{ibso} l_{ibo}}{1-\beta}\right)^{1-\beta}$$

and their budget constraint is $c_{ij} + r_{ib} l_{ibo} = w_{js}$.

As in Ahlfeldt et al. (2015), z_{ijso} is an idiosyncratic, unobserved shock that is specific to individual workers and varies with the worker's blocks of employment and residence. This idiosyncratic shock captures the idea that individual workers can have idiosyncratic reasons for living and working in different parts of the city. Similarly, d_{ij} is a commuting cost that increases with distance between i and j.

Distinguishing features of our model are that the household's utility depends on worker skill level and housing quality type, where housing quality can decay with time. We add in ξ_{ibso} to capture the household's unobserved taste for housing of type b, which can be either high quality or low quality housing. These matter because workers of different skill level have different income and therefore access to different housing quality. By incorporating these components, we will be able to show how the MFTE program enables access of lower-skilled workers to higher quality housing, which may not be possible without the policy.

7 Conclusion

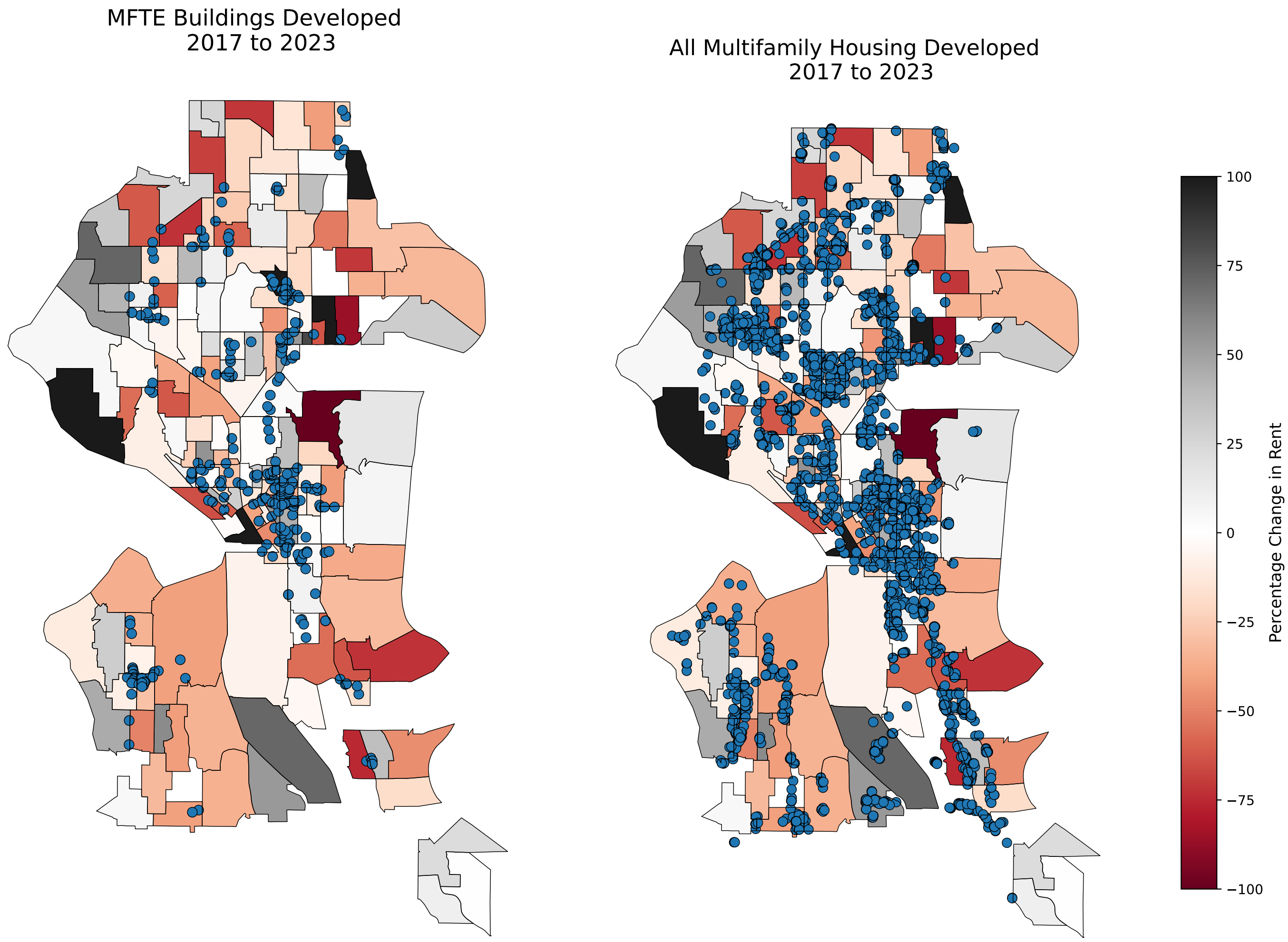
Our paper's contributions to the economic literature evaluating IZ programs include both empirical and theoretical elements.

Empirically, we leverage a novel micro-dataset of Craigslist rental data to directly estimate an IZ program's spillover effects on nearby rents. While we borrow methodologies from the literature on LIHTC, such as Diamond and McQuade (2019), we focus on housing rents on our dependent variable, rather than house prices or rents inferred from property values. Our findings from this causal analysis are consistent with a story of countervailing mechanisms where IZ lowers market rents through local competition in lower-income areas in the short-term, but also pushes rent upwards by improving amenities, especially in more affluent areas. This latter effect can possibly incentivize further housing development by boosting housing demand, but it may also contribute to further gentrification in already rich areas. We also provide descriptive evidence that demonstrates how different policy choices (e.g., tightening or relaxing MFTE rent restrictions) can result in different spatial distributions of developer program participation and housing development.

Theoretically, we specify a quantitative urban model to make sense of these empirical patterns, which can show how an IZ program can redistribute housing, rents, and hosueholds across space. We add the components of a household worker's labor skill level and their taste for housing quality when specifying the household's utility maximization problem. This takes into consideration that part of the benefits from MFTE come from allowing lower-skilled or lower-income households access to housing of higher quality (as partly determined by age). Our explicit modeling of the rental housing developer's problem also provides a micro-foundation for how an IZ program can encourage further rental housing development in the same areas when allowing for endogenous amenities.

For future work, we plan to use the City's building permitting data, dating back to 1990, to examine how the MFTE program incentivizes further local housing development through the channel of endogenous amenities. We will also strengthen the robustness of our spatial difference-in-differences analysis by conducting additional checks, including more rigorous tests of our parallel trends assumption. Furthermore, we will structurally estimate our quantitative urban model to simulate counterfactual scenarios. These will include an assessment of the overall welfare effects of the MFTE program by comparing observed outcomes to a scenario in which the program did not exist. We will also evaluate an alternative scenario in which the City offered housing vouchers instead of implementing MFTE. This comparison will help assess whether the spatial redistribution effects of inclusionary zoning outperform the more narrowly targeted benefits of housing voucher programs.

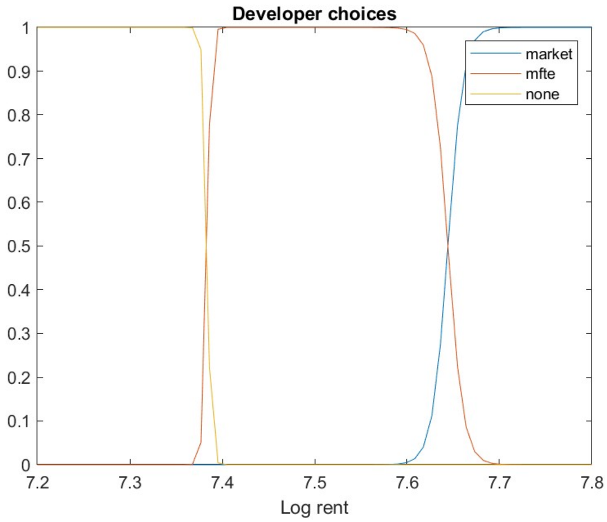
A Appendix



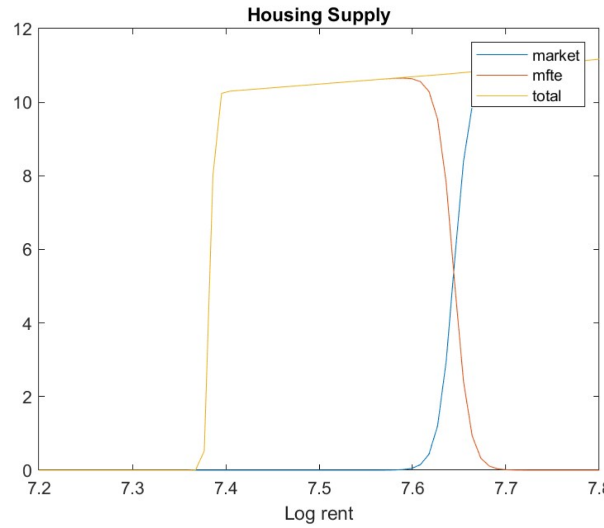
(a) Locations of all MFTE housing buildings constructed from 2017–2023, using permitting data provided by the City.

(b) Locations of all multifamily housing buildings constructed from 2017–2023, using permitting data provided by the City.

Figure A.1: Comparison of multi-family and MFTE housing locations (2017–2023).

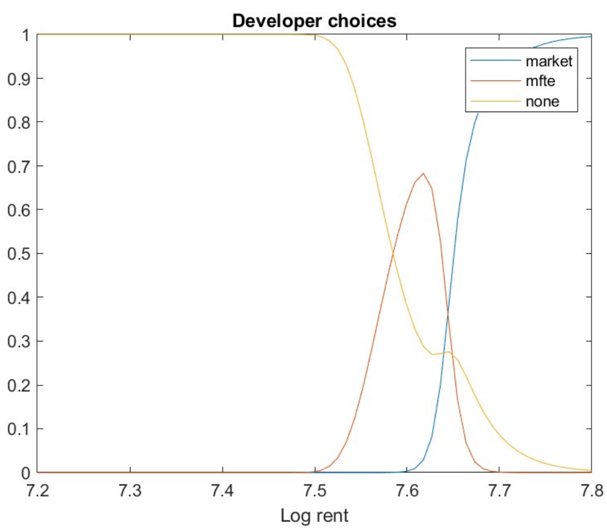


(a) Developers choose between constructing a MFTE building, a market rate building, or no building.

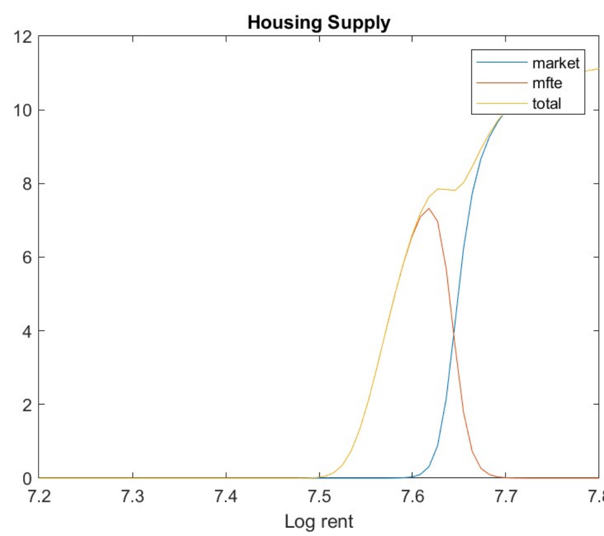


(b) The aggregate housing supply in the market.

Figure A.2: Developers' choices in the scenario where market rents are stationary or not changing. Note that we use simulated data.



(a) Developers choose between constructing a MFTE building, a market rate building, or no building.



(b) The aggregate housing supply in the market.

Figure A.3: Developers' choices in the scenario where market rents are increasing. Note that we use simulated data.

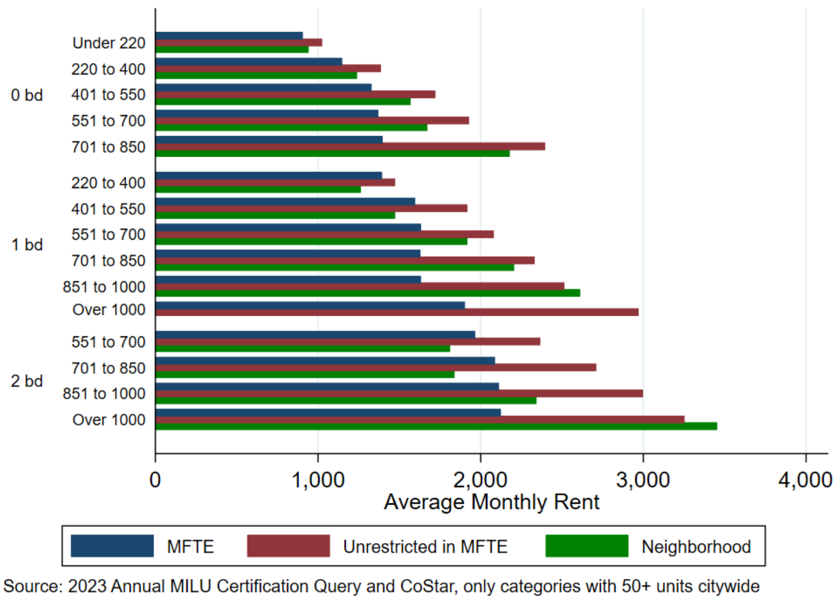
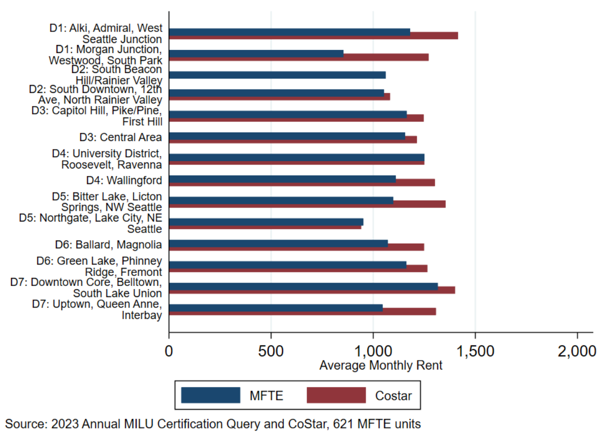
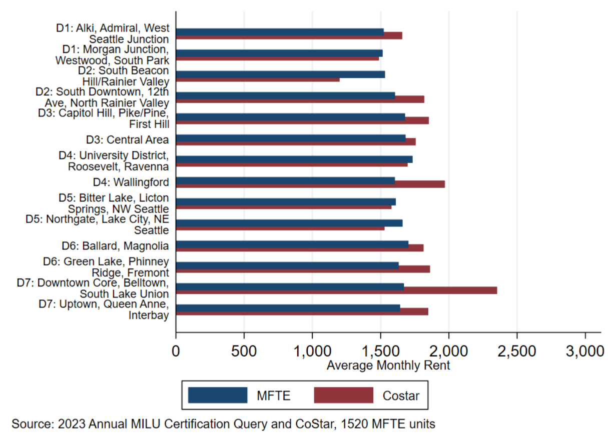


Figure A.4: MFTE housing rents compared to market rents as measured in the CoStar data by number of bedrooms and square footage of units.



(a) MFTE housing rents compared to market rents as measured in the CoStar data by neighborhood for studios.



(b) MFTE housing rents compared to market rents as measured in the CoStar data by neighborhood for one bedroom units.

Figure A.5

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