Working Papers

FEDERAL RESERVE BANK OF BOSTON™

No. 24-1

Report on the Potential Impacts of Property Tax Abatement on Rental Housing Construction in Boston

Patricia Alejandro, Mary Ellen Carter, Denise DiPasquale, Edward Glaeser, Adam Guren, and Paul Willen

Abstract:
Boston's high housing costs reflect a historic failure to build enough units to satisfy demand. Interest rates and construction costs have risen recently, and the flow of new market-rate residential housing projects has slowed. To spur more construction, the City of Boston is considering various policy options. Our committee was asked by Boston Mayor Michelle Wu to assess the market impacts of one of these options: real estate tax abatements. This report presents our analysis of the likely effects on the number of units constructed and the costs to taxpayers of various tax abatement alternatives. We do not recommend which policy, if any, the city should pursue; Boston officials are better positioned to assess whether the benefits of these policies warrant the costs to taxpayers.

JEL Classifications: H2, H71, R31
Keywords: Tax abatement, housing supply, Boston

Patricia Alejandro is a clinical instructor at Harvard Law School. Mary Ellen Carter is a professor at Boston College's Carroll School of Management. Denise DiPasquale (committee co-chair) is an associate in the Department of Economics at Harvard University and the president and founder of City Research. Edward Glaeser (committee co-chair) is the Fred and Eleanor Glimp Professor of Economics and the chairman of the Department of Economics at Harvard University. Adam Guren is an associate professor of economics at Boston University. Paul Willen (Paul.Willen@bos.frb.org) is a senior economist and policy advisor at the Federal Reserve Bank of Boston.

The authors thank Nick Ariniello, Patricia Belden, Deep Biswas, Michael A Cantalupa, Arion Dako, Brian Golden, Jeffrey Goldstein, Reuben Kantor, Brian Kavoogian, Renee LeFevre, Abe Menzin, Young Park, Jerome L. Rappaport, and Matthew Resseger for providing data and comments. They thank Tim Gray, Stephanie Kestelman, and Jamie Murray for editorial assistance. The authors are responsible for the analysis and the conclusions provided in the report.

Edward Glaeser has given paid talks for real estate investment groups and received research support from Tishman/Speyer.

This version: January 2024 **https://doi.org/10.29412/res.wp.2024.1**

1. Introduction

Boston has long been viewed as a tough place to build housing. The physical costs of construction are high. A recent international survey of construction costs finds that Boston is the world's seventh most expensive area in which to build.[1] In the past two years, the environment for building has become even more challenging. Supply chain disruptions during the pandemic and a very tight market for construction labor have increased costs dramatically; a construction price index for New England rose 43 percent from October 2019 to October 2022 and has since plateaued. More recently, from February 2022 to July 2023, the Federal Reserve dramatically increased short-term interest rates to fight inflation. As rates rise, the cost of construction lending and permanent financing increase significantly.

Due to rising interest rates and building costs, construction of residential buildings in Boston has sputtered. As of July 25, 2023, 199 projects comprising a total of nearly 23,000 housing units had been approved by the Boston Planning and Development Agency (BPDA) Board but were not yet under construction. Boston Mayor Michelle Wu asked our committee to assess the extent to which different property tax abatement options could result in approved projects moving to construction.

There is a case for subsidizing new residential units if the mayor believes that the social benefit from affordable and market-rate units exceeds the cost of building those units. The longstanding Inclusionary Development Policy (IDP),[2] which implements affordable housing requirements for new construction, implies that the City of Boston sees value in subsidizing affordable units. Furthermore, due to high construction costs and the rise in interest rates, little residential construction is happening today. If equity concerns make it too costly to delay the production of new units, then a tax abatement might be justified.

If a temporary need to quickly deliver new units justifies a subsidy, then it is logical for any subsidy to be temporary and for its size to be based on the number of housing units created, not on the value of units in the project. Moreover, because a subsidy can be justified in theory does not imply that *any* subsidy program is justifiable. A specific subsidy policy makes sense only if its benefits exceed its costs. Consequently, the primary purpose of this report is to analyze the effective cost per new unit built of different possible tax abatement programs. As analysts, we feel confident in assessing these costs, but only Boston's leaders have the standing to decide how much they are willing to pay, in terms of foregone taxes, to produce more housing quickly. In this report, we provide those leaders with estimates of the number of additional units gained and the cost of providing those units through different subsidy policies. These costs must be weighed against the social value that the City of Boston places on the immediate production of additional housing.

[1] https://www.turnerandtownsend.com/en/perspectives/international-construction-market-survey-2023/

[2] According to the BPDA, the IDP "requires that market-rate housing developments with ten or more units and in need of zoning relief support the creation of income restricted housing through: inclusion of income restricted units within their building (typically 13 percent of a development's units); creation of income restricted units at a location near their building; and or contributing to the Inclusionary Development Policy Fund. These funds are used by the City of Boston Mayors' Office of Housing to fund the creation of affordable/income restricted housing across Boston." https://www.bostonplans.org/projects/standards/inclusionary-development-policy.

We evaluate two main types of programs: (1) uncapped programs that offer a complete or 75 percent property tax abatement for new residential projects that lasts 15 or 29 years, and (2) capped programs that offer a residential tax abatement capped at either $2,500 or $5,000 per unit per year that lasts 15 or 29 years. We use two complementary methodologies. The first is a time series regression analysis that predicts what these policies will accomplish if conditions over the past decade persist in the next few years. Our second approach is a project-level analysis that estimates capitalization rates for every building in the BPDA pipeline, which is the calculation a developer would make when deciding whether to move forward with a project. We then introduce a subsidy and assess which projects in the BPDA pipeline would begin construction under the policy, taking care to match construction costs to current conditions.

Both approaches are imperfect but in different ways. The regression-based approach might overstate the amount of construction that will occur if building costs continue to rise or macroeconomic conditions change. We address this concern by also producing predictions based on a particularly pessimistic forecast for borrowing conditions. The project-based approach might understate the amount of construction that will occur naturally because it does not capture the full returns to developers of the non-residential components of a project that are built in conjunction with the residential units. To counter that possibility, we also produce predictions from this approach assuming a particularly optimistic forecast for borrowing conditions.

The key cost we focus on is the total subsidy cost per additional unit of housing that would not have been built absent the subsidy (henceforth "marginal units"). As an example, consider a subsidy of $5,000 per unit and assume that 4,000 new units would be built with the subsidy. If 2,000 units would have been built without the subsidy, then the effective subsidy cost per unit per year is $10,000. Intuitively, to induce an additional 2,000 marginal units to be built, the City of Boston must "waste" the subsidy on 2,000 inframarginal units that would have been built anyway because it offered the subsidy to all developers who begin construction immediately. To compare policies of different subsidy durations on a level playing field, we focus on a total net present value, estimating the future flows of these costs by assuming a 5 percent discount rate and 2 percent growth rate of prices and rents.

Subsidies that offer either full tax relief or that reduce the tax burden by 75 percent are expected to produce more units and cost substantially more per new unit created because, without the per-unit cap, luxury buildings that pay the highest property taxes receive larger subsidies per new unit created. A cap on the size of the tax abatement reduces the subsidy to luxury buildings and consequently the average subsidy per unit built.

We predict that eliminating taxes on new market-rate rental property entirely will generate at best 1,800 marginal new units in an optimistic scenario. More moderate interventions, such as tax credits per unit ranging from $2,500 to $5,000 per year, are likely to produce fewer than 1,100 marginal new units. The impact of these policies will grow if future interest rates fall. But if interest rates do drop, it is also likely that more projects would begin construction without any subsidy. Our analysis indicates that a residential tax abatement will not induce developers to fully unfreeze the pipeline of approved projects.

We estimate that the net present value of the cost per marginal unit of a full tax rebate for 29 years lies between $295,000 and $414,000, depending on the evaluation method; a 75 percent tax reduction for 29 years costs $255,000 to $417,000 per marginal unit created. The net present value of the cost of a 15-year tax subsidy that is capped at $5,000 per unit per year ranges from $206,000 to $293,000 per marginal unit created, depending on the method and assumptions. A 29-year, $5,000 per-unit subsidy generates more units, but the cost per marginal unit also rises, ranging from $238,000 to $345,000. The estimated costs for subsidies capped at $2,500 per unit per year range from $167,000 to $317,000 per marginal unit created. Notably, policies involving smaller subsidies are not necessarily more cost effective. Although they offer a smaller subsidy per unit built, there are fewer marginal units relative to total units and thus more subsidy is "wasted" on inframarginal units that would have been built anyway.

The smaller, capped tax credits seem more cost effective than the more generous programs. Yet we must stress that this is just the added cost to the government of subsidizing construction and should not be compared with the cost of constructing subsidized affordable housing. If the point of the tax subsidy is just to generate affordable housing, then the cost per marginal affordable unit would be more than $1 million per affordable unit if 20 percent of the units in projects receiving the abatement are affordable. Costs per marginal unit created are high because projects that would have been built anyway also receive the subsidies.

Boston's construction industry is in a difficult position, but improving the situation with a significant tax subsidy makes sense only if the mayor thinks it is wise to reduce future tax revenues by roughly $250,000 to produce an extra unit. There are few alternatives to a tax subsidy that will induce the projects that have already been approved to move forward. The City of Boston could waive the building permit fee or make the fee due on occupancy rather than at the onset of construction; either of these actions would be appreciated by builders, especially smaller builders, but they would be small and largely symbolic. A more meaningful change for the City of Boston would involve reshaping its permitting process so that a far larger number of building projects could be truly "as of right" and approval could take months rather than years.[3] Although permitting reform would make a difference over the next five to 10 years, it would have little impact on the immediate construction decisions for projects that have already been approved.

We present our analysis in the rest of this report. Section 2 discusses the state of Boston's building pipeline. Section 3 introduces a statistical model that connects such factors as rents and interest rates with the probability that any given project will leave the pipeline. Section 4 goes through the existing pipeline and estimates the net returns on investment associated with each project. The distribution of net returns across building projects enables us to predict the impact of different tax subsidies for new construction. Section 5 discusses the rationale for tax subsidies and emphasizes that the appropriate policy will depend on how much the government is willing to pay, in the form

[3] According to the Massachusetts Zoning Act, "'as of Right' means "development may proceed under a zoning ordinance or by-law without the need for a special permit, variance, zoning amendment, waiver, or other discretionary zoning approval." https://www.mass.gov/info-details/section-3a-guidelines.

of tax expenditures, for the benefits of creating more market-rate and affordable units. Section 6 concludes.

2. The Current Project Pipeline

Tables 1 and 2 describe our understanding of the pipeline of construction projects in Boston as of July 2023. This analysis is based data provided by the Boston Planning and Development Agency (BPDA) that contains 606 projects that the agency's board has approved for development since 2013. We distinguish between approved projects, which means they could receive a permit quickly, and permitted projects, which have paid permitting fees and are being built or are ready to start construction. Because the permitting fee is approximately 1 percent of a project's value, builders generally do not pay for their permit until they are ready to begin construction.

	Pipeline			All Projects		
	# Projects	Units	Investment in $bn	# Projects	Units	Investment in $bn
Total	199	22,872	13.9	606	49,229	29.4
– Owner-Occupied	79	5,836	4.4	263	11,910	9.8
– Suffolk Downs	5	5,720	2.9	5	5,720	2.9
– BHA	5	1,931	1.6	17	2,498	2.0
– >25% IDP	33	1,590	1.0	91	4,555	2.6
= Market Rental	77	7,795	4.0	230	24,546	12.1

Table 1. This table outlines the methodology behind the creation of our sample comprising 77 tax-abatement eligible properties. Note that the term "owner-occupied" refers to units occupied by owners in predominantly renter-occupied developments as well as all units (including rentals) within predominantly owner-occupied developments. "Pipeline" refers to projects that have been approved by the BPDA but not yet received a building permit. "All Projects" refers to all projects approved by the BPDA since 2013.

The left-hand panel of Table 1 shows that, as of July 2023, there were 199 projects (containing a total of 22,872 housing units) that had been approved by the BPDA but not yet permitted. The number of units represents 46.4 percent of all units that have been approved by the BPDA since 2013. Seventy-nine of these projects account for 5,836 owner-occupied homes, which means that the average "owner-occupied" project includes 74 housing units. The supply of owner-occupied homes is a crucial part of the BPDA pipeline and can deliver significant numbers of affordable units. For this report, however, we have been asked to focus our analysis on rental projects, largely because any tax abatements for owner-occupied projects would have to go to future owners who are currently unknown. Moreover, rental projects remain the largest single category in the pipeline.

Five of the projects in the pipeline relate to Suffolk Downs, and five are being built by the Boston Housing Authority (BHA). The BHA continues its historic mission of providing affordable housing, but its efforts are not the target of a potential property tax abatement. Suffolk Downs is such an unusual project that anything related to it presumably needs to be handled on an ad hoc basis. In addition, the developer is going to start with the portion of the project that is in Revere and then move to the East Boston portion.

There are 33 projects in which more than one-quarter of the units are designated as affordable. We used this 25 percent cutoff to identify projects intended to provide low-income housing. These projects are likely subsidized by the Low Income Housing Tax Credit (LIHTC) or other policies designed to stimulate the production of affordable housing. While the affordable housing sector provides one source of information about the cost of building housing for low-income residents, it typically does not rely on standard financing and consequently may be less impacted by the recent increases in interest rates. Any proposed policies for this sector must consider interactions with the existing subsidy programs.

We therefore focus on the last and largest category: Rental housing targeted primarily at market-rate tenants. Seventy-seven projects in the BPDA pipeline fall into this category, and collectively these projects could deliver 7,795 housing units, including more than 1,000 affordable units. This total is not huge, so any policy targeting this set of projects is likely to produce only a modest number of units.

In the right-hand panel of Table 1, we show the number of projects approved by the BPDA since 2013, including those that have been permitted and even completed. Since 2013, 606 projects with 49,229 units were approved. Market rate rental projects accounted for 38% of those projects but contained 50% of the approved units.

Table 2 shows the timing of the market-rate rental projects that have been approved and that remain in the pipeline. The first column shows that about 20 projects have been approved each year since 2012, although there was a slowdown in 2015, which was corrected the next year. In most years, the typical project contains about 100 units.

The third column of Table 2 shows the average capitalization rate (or cap rate) of projects at the point of approval. A capitalization rate is defined as net operating income (gross income minus expenses) divided by the purchase price times 100. Capitalization rates capture the return on investment and would typically need to rise if the cost of capital increased. CoStar, a large and widely accepted provider of real estate-related information, regularly provides data on average capitalization rates at the neighborhood level. Consequently, these numbers are not the capitalization rates of the projects themselves but rather the average capitalization rate of buildings in those projects' neighborhoods at the time that they were approved. Capitalization rates reflect the interest rate environment as well as current demand for rental units in Boston.

The next column provides our direct measure of interest rates: the six-month London Interbank Offered Rate (LIBOR), which is a widely used measure of credit market conditions.[4] This rate is quite low during Table 2's early years. It rises after 2015 before plummeting during the COVID-19 pandemic. The last two years in the sample show a sharp rise in LIBOR, which is associated with the monetary tightening that followed increased inflation.

[4] LIBOR was discontinued in 2023, but a comparable rate can be calculated going forward.

The final two columns in the left-hand panel show, respectively, the share of approved projects that were permitted and the share that were permitted within two years of approval. Almost all those approved in 2016 or earlier have been permitted and, of those, at least 60 percent were permitted within two years. After 2016, the probability of permitting within two years fell dropping to less than a third in 2019 and 2020. Even before the pandemic, approximately 10 percent of projects in the BPDA pipeline received permits each quarter, suggesting that the median project typically remains in the pipeline for approximately a year and a half. With the addition of roughly five projects per quarter, or about 20 projects annually, it's reasonable to expect that there would be about 50 projects in the pipeline at any given time, which would represent approximately 5,000 units, given an average project size of 100 units.

	Sample (as of approval)						Pipeline (as of 7/1/2023)				
Year Approved	# of Projects	Mean # of units	Cap Rate	6-mo LIBOR	% permitted	% perm. in 2 yrs	# of Projects	Mean # of units	Δ Cap Rate	Δ rent in %	Cumulative Total
2013	20	182	5.14	0.28	100	65	NA	NA	NA	NA	NA
2014	20	137	5.01	0.24	90	60	2	158	-0.63	23.5	77
2015	11	51	4.82	0.38	91	73	1	15	-0.45	20.8	75
2016	33	107	4.73	0.77	91	67	3	74	-0.23	19.3	74
2017	23	114	4.60	1.36	78	48	5	126	-0.22	15.5	71
2018	19	61	4.49	2.45	79	47	4	47	-0.09	15.8	66
2019	29	96	4.47	2.28	72	31	8	137	-0.02	10.6	62
2020	15	97	4.27	0.61	53	20	7	88	0.14	14.0	54
2021	23	106	4.02	0.17	39	30	14	126	0.45	8.3	47
2022	23	90	4.00	2.65	4	4	22	78	0.41	2.9	33
2023	11	112	4.39	5.18	0	0	11	112	0.04	0.6	11
Total	227	107	4.54	1.39	66	42	77	101	0.17	8.2	

Table 2. This table presents the characteristics of the sample used in our empirical analysis. Capitalization rates and rents are calculated using averages derived from CoStar's neighborhood-level measures. The six-month LIBOR data are sourced from JP Morgan. Changes in capitalization rates and rents are tracked from the point of approval to July 1, 2023.

The right panel of Table 2 shows only projects that were in the pipeline as July 2023. Six of these are from either 2014, 2015, or 2016. We cannot know whether these projects are still active or have been dropped by the developers, but they remain in our data. By contrast, 62 of the projects in the pipeline have been approved by the BPDA since 2019. The remaining columns of this panel show the variables we will use in the next section.

Overall, there is a significant number of units in the BPDA pipeline, especially market-rate rental units. We now turn to two different methods to examine policy options that could help move these projects forward.

3. The Historic Link between Interest Rates, Prices, and Project Initiations

This section presents the analysis from our first methodology, which uses the historical relationship between interest rates, prices, and project initiations to analyze the impact of various real estate tax subsides.

Our empirical methodology stems from the economics of the building decision. A simple view is that construction occurs only if the following condition is met:

(1) Value of Construction to the Developer > Construction Cost + Interest Costs.

For a rental property, the discounted value of the construction depends on the flow of future rents, future operating costs, taxes, and long-term interest rates. A standard simplifying assumption is that net operating income (revenues minus expenses) grows at a constant rate. If there are no taxes, then the standard formula is:

(2) Value of Construction = (Current Rent – Operating Cost) / (Interest Rate – Growth Rate).

If the owner annually pays property taxes that are proportional to the value of the building as of that period, then the formula is adjusted so that:

(3) Value = (Current Rent – Operating Cost) / (Interest Rate + Tax Rate – Growth Rate).

Given this value formula, equation (1) can be turned around to yield:

(1') $\frac{Current\ Rent - Operating\ Cost}{Construction\ Costs + Interest\ Costs} > Interest\ Rate + Tax\ Rate - Growth\ Rate.$

The left-hand side of equation (1') captures the pre-tax return on construction costs during the first year after a project is completed if the building is fully leased up. The right-hand side is known as the market capitalization rate (or cap rate). The equation says that, for a project to make financial sense, the ratio of net operating income to cost must exceed the market capitalization rate. The capitalization rate comprises three terms. The first two terms capture costs, with the interest rate measuring what the developer could earn by investing the same money elsewhere and the tax rate reflecting that this return must be net of property taxes. The final term reflects that any expected growth in the value of the property offsets those costs.

Equation (1') illuminates why increasing interest rates would reduce construction. The interest rate enters twice into the calculation, both in the denominator of the left-hand side, where it impacts effective construction costs, and in the right-hand side, where the long-term interest rate enters and determines the long-run cost of capital. The equation also suggests that a 1 percent change in the long-term rate would be effectively offset by a 1 percent change in the property tax rate, holding construction costs constant. Since Boston's residential real estate tax rate is slightly higher than 1 percent, this implies that fully abating real estate taxes forever could offset only a 1 percent rise in interest rates. The relevant interest rate is a longer-term interest rate such as the 10-year treasury rate, which went up 2 percentage points from the beginning of 2022 to summer 2023, peaked in October 2023 up 3 percentage points, and has since fallen back to about 2.25 percentage points higher than the beginning of 2022.

The growth rate in property values is, of course, not independent of interest rates. If increasing interest rates crowd out new construction, then the future supply of housing in Boston will fall. A reduction in future housing supply should lead to higher future rents.

This equation also motivates our regression analysis examining the construction decision for every project that enters the BPDA pipeline, as described in Tables 1 and 2. The data used in this analysis include market-rate rental projects, as discussed above, but also owner-occupied housing and housing with many units set aside as affordable. We include these additional projects because developers' decision to move forward with them will be motivated by similar forces, and the larger sample size improves the precision of our estimates. Note that the capitalization equation discussed above strictly holds only for rental units. As noted earlier, we exclude BHA projects and Suffolk Downs. All regressions control for the type of project, and our policy simulations focus on predictions only within the market-rate rental category.

Our analysis is based on regressions that predict the decision to build, which we measure as the developer's decision to obtain a permit in a given quarter. The construction outcome equals zero every quarter that the project remains in the pipeline and is not permitted and one in the quarter that the developer pays for a building permit. After that period, the project exits the dataset. Each regression controls for how long the project has been in the pipeline, but we do not report the coefficients on those variables. The likelihood of permitting is low in the first year and increases sharply in years three and four before declining again. Very old projects are typically very unlikely to be permitted. We also control for neighborhood in every regression as well as the number of units in each project, measured using four equally sized bins. Larger projects are more complex, and, as a result, they proceed much more slowly to the permitting phase. We use projects with 17 or fewer units as the base category.

Figures 1 to 3 provide a sense of the timing of the key explanatory variables in the regression analysis. Figure 1 depicts the fluctuations in the Federal Reserve Bank of New York's Global Supply Chain Pressure Index. The index is formed through a statistical analysis of 27 time series of different measures of supply chain pressure, including shipping prices and delays. Figure 1 illustrates that the 2021–2022 period was a challenging time for developers. Figure 2 shows the cumulative change in price from the time of approval to the current date (measured using CoStar data) for the average project that remains in the pipeline. Figure 3 shows the average change in the short-term rates from the date of approval to the current date for the projects remaining in the pipeline.

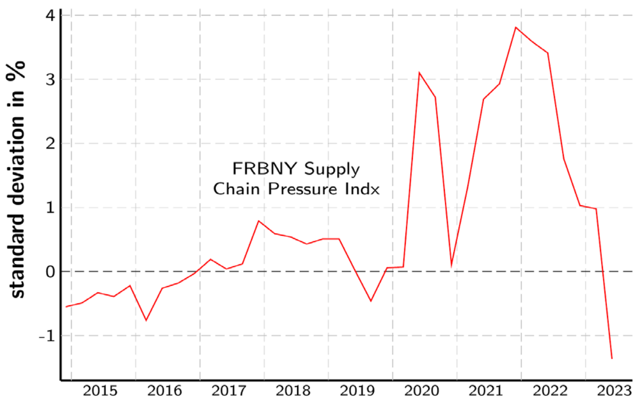

Figure 1. This figure shows the Federal Reserve Bank of New York's Global Supply Chain Pressure Index. Supply chains were a major issue for construction.

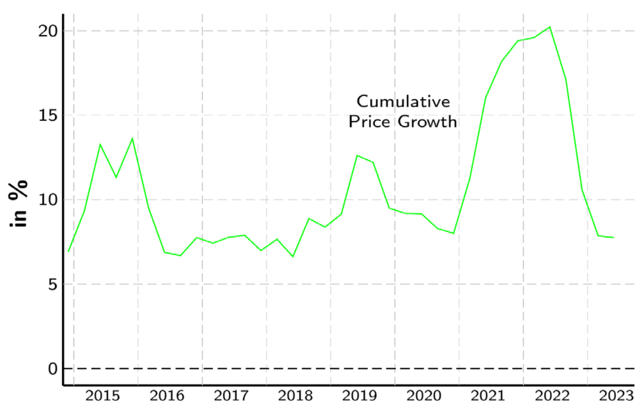

Figure 2. This figure shows cumulative price growth for all projects in the BPDA pipeline relative to the level of prices at the time of project approval. The measure of prices is the CoStar market sale price index at the neighborhood level.

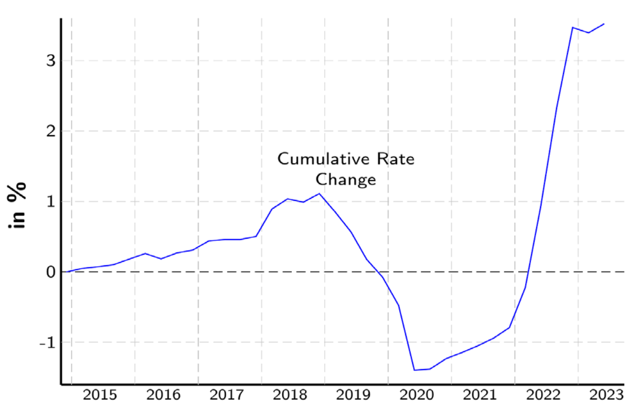

Figure 3. This figure shows cumulative change in short-term rates for all projects in the BPDA pipeline relative to the level of rates at the time of project approval. Short-term rates are defined as the six-month LIBOR.

Table 3 presents our regression analysis. In the first regression, we control for only static characteristics of the building (including number of units and neighborhood) and the number of quarters since project approval. As expected, larger projects proceed much more slowly. In the second regression, we add an indicator variable that takes on a value of one for projects that entered the pipeline after the end of 2019. The coefficient on this variable confirms that progress slowed significantly after the start of the pandemic. In regressions (3) through (6), we drop this variable to focus on the market fundamentals that may explain the decline in permitting after 2019. In these regressions, the coefficients on the number of projects remains significant, and, if anything, the impact of project size strengthens slightly as we add more controls. The coefficients in regression (6) indicate that a 50-unit project has a 50 percent lower probability of being permitted in any given quarter (that is, if a 10-unit building has a 10 percent probability of being permitted, a 50-unit building has a 5 percent probability).

Dependent Variable:	Prob(Permit)					
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
(17,34] Units	-0.2901*	-0.1660	-0.3065**	-0.2730**	-0.2681*	-0.2957*
	(0.1512)	(0.1278)	(0.1479)	(0.1377)	(0.1409)	(0.1607)
(34,71] Units	-0.4906***	-0.4643***	-0.4940***	-0.5073***	-0.5047***	-0.5095***
	(0.1454)	(0.1465)	(0.1377)	(0.1378)	(0.1361)	(0.1489)
(71,832] Units	-0.5735**	-0.5498***	-0.6135**	-0.6523***	-0.6466***	-0.6582***
	(0.2398)	(0.2080)	(0.2435)	(0.2230)	(0.2307)	(0.2307)
Year>2019		-0.7216***				
		(0.0997)				
Cumulative Δ in cap rate in %			-1.065***	-1.622***	-1.471***	-0.8751*
			(0.3695)	(0.2793)	(0.4400)	(0.4477)
FRBNY Supply Chain Pressure Index				-0.1908***	-0.1907***	-0.2053***
				(0.0401)	(0.0405)	(0.0356)
6-month LIBOR in %					-0.0248	-0.1399**
					(0.0724)	(0.0605)
Cumulative Δ in rent per square foot (scaled)						0.2514**
						(0.1029)
Fixed-effects						
Age	Yes	Yes	Yes	Yes	Yes	Yes
Neighborhood	Yes	Yes	Yes	Yes	Yes	Yes
Condo	Yes	Yes	Yes	Yes	Yes	Yes
High IDP percentage	Yes	Yes	Yes	Yes	Yes	Yes
Seasonal	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	4,120	4,120	4,107	4,107	4,107	4,107
Squared Correlation	0.02154	0.02967	0.02378	0.02891	0.02889	0.03130
Pseudo R^2	0.03453	0.04841	0.03973	0.04729	0.04736	0.05100
BIC	2,522.4	2,497.2	2,503.0	2,493.1	2,501.3	2,500.8

Clustered (Quarter & Neighborhood) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 3. This table presents the outcomes of logit regressions that analyze the probability, on a quarterly basis, of a BPDA pipeline project obtaining a permit and leaving the pipeline. These regressions are the basis for the analysis in Section 3. The age effects are quantified in terms of years since approval. For the sake of statistical significance, we include owner-occupied properties and high IDP properties in the sample, even though they are ineligible for tax abatement.

Regressions (3) through (6) include the change in capitalization rate since BPDA Board approval using CoStar's quarterly capitalization rates by neighborhood. We see this variable as capturing changes in both the opportunity cost of cash (which should presumably be city-wide) and changes in expectations about future rent growth (which should differ at the neighborhood level).

The coefficient on this variable is statistically significant and large. In regression (3), we find that a 100 basis point reduction in a project's capitalization rate is associated with doubling the probability of the project being permitted during any given quarter. Equivalently, a 100 basis point increase in the capitalization rate is associated with a 50 percent drop in the probability of being permitted. The coefficient increases in regressions (4) and (5) to –1.62 and –1.47, respectively, but then falls to –0.88 in regression (6) when we control for rent per square foot. Even with this lower coefficient, the capitalization rate still affects the pipeline dramatically.

In the remaining columns, we show that the effect of capitalization rate changes is robust across specifications. The fourth regression controls for the Federal Reserve Bank of New York's Global Supply Chain Pressure Index. This measure is meant to capture the sharp increase in construction costs. The coefficient on the supply chain measure implies that a one standard deviation increase in this index is associated with a 19 percent reduction in the probability of being permitted. As we add further controls in regressions (5) and (6), the coefficient on this variable remains virtually unchanged. The supply chain disruptions matter, but they are less important than the cap rate.

The fifth regression includes both the level of LIBOR and the capitalization rate. The coefficient on the New York Fed supply chain pressure index is negative, as expected, but small and statistically indistinct from zero. In the sixth regression, when we also control for changes in market rents, the coefficient on LIBOR becomes significant. In that regression, the coefficient's magnitude suggests that a 100 basis point increase in LIBOR is associated with a 14 percent reduction in the probability that a project is permitted.

The sixth regression also allows for market rents to affect permitting. We measure rents as the cumulative change in rent in the project's neighborhood since the project's approval, as measured by CoStar. The coefficient on this variable is positive and relatively large. A one standard deviation increase in rents per square foot is associated with a 25 percent increase in the probability of a project being permitted. Including this variable leads the coefficient on the capitalization rate to decline, which suggests that interpreting the rent coefficient is likely to be difficult. In the language of the model, rent should capture current rent, while the capitalization rate captures expectations about future rent growth. Yet the rent variable is correlated with future rent growth, which could explain why the coefficient on the capitalization rate declines when we control for rents. In practice, the capitalization rate is also formed from current rents in the neighborhood, and so it is naturally correlated with growth in neighborhood rents.

Regression (6) is our preferred specification, and we will use it for the historical exercise and the policy simulations that follow. Yet we must stress that, as in most statistical work, there is profound uncertainty. This regression involves both statistical standard errors and other uncertainties introduced by researcher discretion over the choice and form of the variables. Perhaps most importantly, the regression is based on the past decade, and construction costs appear to be much higher today. We use this regression to provide good faith estimates of the results from different policies, but there is little certainty here.

Understanding the Impact of Interest Rates and the Pandemic on the BPDA Pipeline

Our regression analysis enables us to ask what the BPDA pipeline would have looked like without either the supply chain disruptions associated with the pandemic or recent interest rate increases. We assume that entry into the pipeline was not affected by these factors but that the probability of moving out of the pipeline was. This assumption is justifiable if the process of obtaining BPDA approval begins years before the approval is secured.

For our first exercise, we use the coefficients estimated in regression (2), which do not include rates or rent changes but do include time since approval, neighborhood-specific effects, and a dummy for the post-2019 period. Figure 4 shows the results. If we replace the post-2019 dummy with zero, the simulation suggests that the number of projects in the pipeline would have decreased slightly and then remained steady. A pipeline of 50 projects in steady state is reasonable if five projects enter per quarter and 10 percent of the projects are permitted each quarter. Hence, with a pipeline of 50 projects, the flow into the pipeline exactly balances the flow out of the pipeline. That stasis essentially produces the flat line after 2020 in Figure 4.

This simulation suggests that the post-2019 disruptions are associated with 29 extra projects in the pipeline. Because the typical project has slightly more than 100 units, this suggests that Boston is building 2,900 fewer units than we would have expected before 2020.

In our second simulation, we take the coefficients from regression (6) and continue to assume that the flow into the pipeline since the start of the pandemic has been the same as before the pandemic. However, we assume that our two interest rate variables—the capitalization rate and the LIBOR six-month rate—stay at their fourth quarter of 2021 levels. Consequently, this simulation focuses exclusively on the impact of interest rate increases on the pipeline.

The higher flat line shows the effect of that experiment. The growth in the number of projects in the pipeline stops after 2021, leveling off at fewer than 60 projects. The interest rate increases appear to be associated with 17 fewer projects moving forward. If these projects were of average size, then this decrease would represent 1,700 fewer rental units being built. This finding implies that 12 (1,200 units) of the 29 extra projects in the pipeline are not moving due to other factors such as rising construction costs.

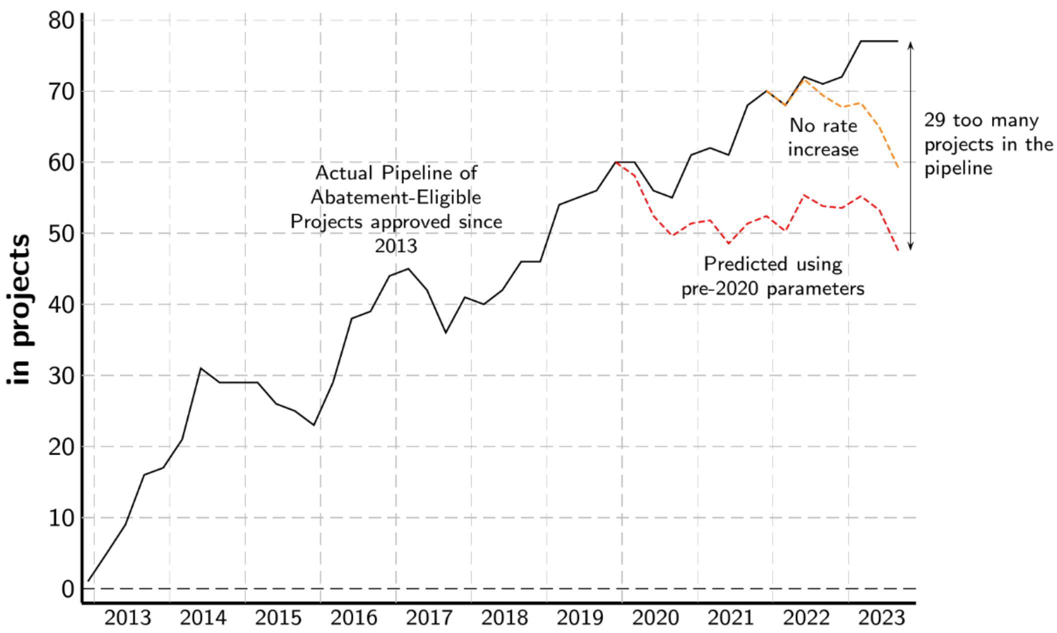

Figure 4. This figure illustrates the progression of the pipeline of tax-abatement-eligible projects in our sample, along with two counterfactual scenarios. In the first counterfactual, we utilize estimates from column (2) of Table 3 and predict the number of permits under the assumption that the pandemic had no impact, specifically setting the post-2019 dummy variable to zero. In the second counterfactual, we employ estimates from column (6) of Table 3 and keep capitalization rates and the six-month LIBOR fixed at their fourth quarter of 2021 levels.

The Impact of Property Tax Abatement on the BPDA Pipeline

We now consider the potential impact of two types of property tax abatement policies. The first policy reduces the tax rate proportionally on all properties. We consider a complete elimination of the property tax and a 75 percent reduction. The second policy is a residential tax abatement capped at either $2,500 or $5,000 per unit per year for 15 or 29 years. If taxes owed on a project are less than $5,000 or $2,500 per unit per year, the project just receives a full tax abatement.

Strictly speaking, we do not include property taxes in regression (6); however, our simulation uses the equivalence between interest rates and property taxes shown in equation (1'). According to the equation, a 100 basis point reduction in the property tax reduces the capitalization rate by 100 basis points, assuming interest rates and rent growth remain constant. This tax credit could reduce future rents, but we assume that the number of projects receiving the credit will be sufficiently small relative to the overall housing market in Boston so that the impact of rents can be ignored.

To model the capped tax credit, we assume that every unit qualifies for an annual flat tax credit of $5,000. Once again, we model this as a reduction in the capitalization rate. To put the tax credit into equivalent capitalization rate units, we divide $5,000 by the current per-unit tax payment and then multiply this quotient by the current tax rate. For instance, if current taxes were $7,500, the $5,000 tax credit would represent a 0.66 basis point drop in the property tax rate, which is equivalent to the capitalization rate falling by 0.66 percent. For projects for which the current tax rate is less than $5,000, we treat the reduction as a 100 basis point drop in the capitalization rate.

As a measure of cost, we calculate the effective tax cost per new housing unit created. The numerator can be thought of as a tax expenditure, which is the total taxes foregone by the government due to the tax abatement policy.[5] Tax expenditure equals the reduction in property taxes relative to the normal rate. The denominator is the number of new (marginal) units created due to the tax abatement, excluding units that would have been built if there were no tax abatement.

We prefer this tax expenditure measure over a measure that focuses on total revenues created because the city also incurs costs when units are built. If property taxes are typically well calibrated to the costs of providing city services to the residents of the associated structures, then the extra tax revenue is not a bonus to the city but rather compensation for the extra services. By contrast, focusing on the total tax revenues associated with different policies essentially assumes that adding new structures does not generate any costs. We are unsure whether the typical costs associated with providing city services to a new rental unit and its occupants are higher or lower than the standard property taxes paid on that unit, but the costs of these services are certainly not zero.

We focus on the net present value of these costs to put policies of different duration on equal footing. We calculate the value by taking the cost of the tax expenditure in the first year of occupancy and then assuming an inflation rate of 2 percent and an interest rate of 5 percent in perpetuity. With these assumptions, we can calculate the net present value of these flows, which are given in the final column of Table 3. Equation (1') holds exactly in the infinite horizon setting and approximately for the 15- and 29-year horizons that we focus on for most of our policy counterfactuals.

We assume that the tax credit will be available for any project permitted by the end of 2025. To estimate the number of units that will be permitted, we use estimates from column (6) of Table 3. To calculate the likelihood of a project being permitted, we need to predict how the explanatory variables in column (6) of Table 3 will change over the next two years. We assume that the six-month LIBOR rate and the New York Fed Global Supply Chain Pressure Index will remain at their Summer 2023 levels until the end of 2025. We also assume that rents will follow CoStar forecasts at the neighborhood level.

Table 4 shows our results. In the top panel, we assume that market capitalization rates will also align with CoStar forecasts. By contrast, in the bottom panel, we more pessimistically presume that capitalization rates will be 200 basis points higher than CoStar forecasts. We see this second panel as potentially capturing the many factors that have inhibited building in Boston in recent years.

Table 4 shows the estimated costs of inducing the construction of a new unit across the range of policies. In our baseline scenario in the top panel of Table 4, we estimate that developers will

[5] The U.S. Department of the Treasury defines "tax expenditures" as "revenue losses attributable to provisions of Federal tax laws which allow a special exclusion, exemption, or deduction from gross income or which provide a special credit, a preferential rate of tax, or a deferral of tax liability." https://home.treasury.gov/policy-issues/tax-policy/tax-expenditures

obtain permits for 3,017 new units absent any policy change, or about 40 percent of the units in the BPDA pipeline. While this number may seem large, it implies a roughly 5 percent quarterly probability of project being permitted, which is very low by historic standards. Ten percent was a more typical number in the 2010s. Figure 5, which shows historic data on interest rates and multifamily construction starts, indicates that interest rates comparable to current levels have not led to the cessation of multifamily construction. However, because the building-cost and interest-rate environment may remain unusually challenging for developers, the bottom panel of Table 4 also shows a scenario in which capitalization rates increase by 200 basis points. In that case, the number of new permits drops by almost 60 percent, leading to levels of permitting comparable to those during the Great Recession.

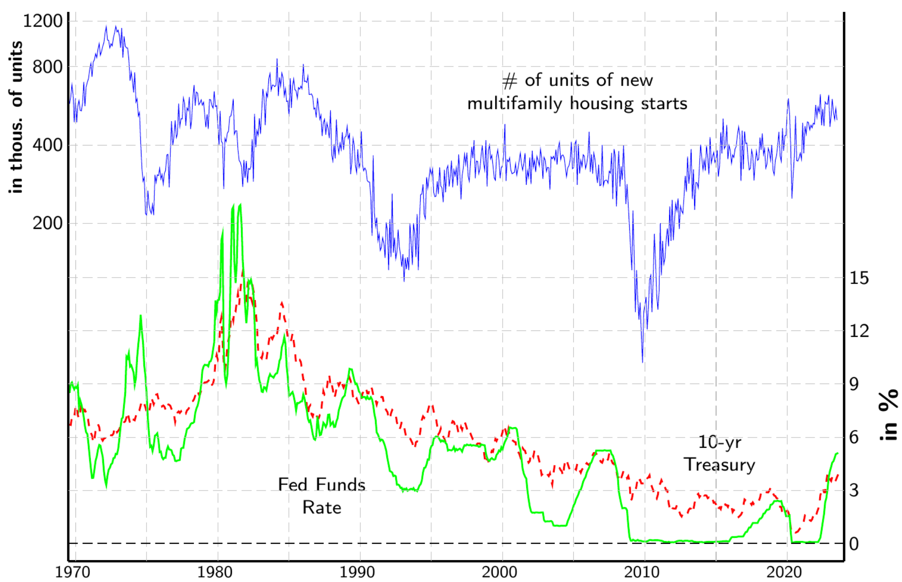

Figure 5. This figure shows multifamily housing starts and two measures of interest rates. Housing starts are from the U.S. Census and are computed by subtracting single-family construction starts from total housing construction starts. The 10-year Treasury and federal funds rates are the constant maturity and effective rates, respectively, reported in the Federal Reserve H.15 release.

In both scenarios, a full tax abatement has the greatest impact on permitting, and the $2,500 capped tax credit has the smallest effect. In the optimistic scenario, estimates of the abatement effects range from 1,808 new marginal units produced relative to baseline with a perpetual full tax abatement to only 426 new marginal units produced when a 15-year, $2,500 per-unit rebate is offered. In the pessimistic scenario, the same two abatement programs generate 584 and 150 new units relative to baseline, respectively. Although the absolute level is much higher in the optimistic scenario, the relative impact of each of the two policies remains similar.

In both scenarios, the full tax subsidy is the most expensive policy per unit created and produces the most units relative to baseline. In general, less generous abatements and shorter durations reduce the cost per unit created. The intermediate policies suggest that per-unit reductions are more efficient than equivalently sized percentage reductions. With the optimistic scenario and a 29-year time limit, the 100 percent abatement generates 1,266 new units, and the $5,000 per-unit abatement generates 1,077. However, the 100 percent abatement costs $372,000 per unit, while the $5,000 per-unit abatement costs $302,000 per unit. The 75 percent tax abatement generates fewer units than the $5,000 per-unit credit (904 versus 1,077) but costs considerably more ($358,000 per unit versus $302,000 per unit). Instead of uniformly applying a 75 percent reduction to all units, the $5,000 abatement provides 100 percent relief for a larger number of more affordable buildings while offering much less relief for expensive luxury buildings. In the pessimistic scenario, all abatement options produce fewer units at higher per-unit costs compared with the optimistic scenario.

			Budget Impact	*Cost Per New Unit*		
Policy	Horizon	(1) # of Units	(2) Net Revenue Loss NPV in $ millions	(3) Marginal Units	(4)=(1)/(3) Total/ Marginal	(5)=(2)/(3) Cost per unit NPV in $ thousands
Assuming Costar forecast cap rates						
No policy change	Infinite	3017	0.0			
100% of Revenue	Infinite	4825	916.8	1808	2.7	507.2
100% of Revenue	29	4283	471.9	1266	3.4	372.7
100% of Revenue	15	3857	265.1	841	4.6	315.4
75% of Revenue	29	3921	324.1	904	4.3	358.6
75% of Revenue	15	3612	186.2	595	6.1	313.1
$5000/unit	29	4094	326.1	1077	3.8	302.8
$5000/unit	15	3731	185.8	714	5.2	260.3
$2500/unit	29	3666	168.0	649	5.6	258.7
$2500/unit	15	3443	98.4	426	8.1	230.8
Assuming Costar forecast cap rates + 2 percentage points						
No policy change	Infinite	1278	0.0			
100% of Revenue	Infinite	1863	352.1	584	3.2	602.8
100% of Revenue	29	1738	190.6	460	3.8	414.3
100% of Revenue	15	1591	108.6	312	5.1	347.8
75% of Revenue	29	1592	130.8	314	5.1	417.1
75% of Revenue	15	1494	76.4	215	6.9	354.8
$5000/unit	29	1664	133.0	385	4.3	345.1
$5000/unit	15	1541	76.9	263	5.9	292.8
$2500/unit	29	1495	68.5	216	6.9	316.6
$2500/unit	15	1428	40.8	150	9.5	272.5

Table 4. This table shows our estimates of the effects of various tax policies using the survival model from column (6) of Table 3. Marginal units are relative to the no policy change scenario. The number of units permitted equals the probability that a project is permitted in the fourth quarter of 2025 times the number of units in the project. Revenue equals our estimates from Section 4 of project-level tax revenue multiplied by number of projects. Per-unit costs are set equal to the per-unit revenue under the base case (that is, with no changes to the tax code). In all simulations, we assume that the six-month LIBOR and the New York Federal Reserve's Global Supply Chain Pressure Index are fixed at their third quarter of 2023 levels and that rents evolve as forecast by CoStar at the neighborhood level. In the top panel, we assume that capitalization rates evolve as forecast by CoStar, again at the neighborhood level, and in the bottom panel, we add two percentage points to those forecasts.

Smaller tax abatements tend to be more efficient. This result arises from two competing forces. First, with a smaller subsidy, the cost to the City in terms of foregone revenue drops. Second, a smaller subsidy leads to fewer marginal units relative to total units, meaning that more subsidy is "wasted" on inframarginal units. In our simulations, the first force tends to dominate, but the second force means that smaller subsidies do not save the city as much as one might expect.

The policy-design challenge lies in the inability to target the subsidy to only marginal projects that would *not* have been built otherwise. Even in the most pessimistic scenario, many units would be built without a subsidy. The 100 percent revenue reduction scenario generates 1,808 marginal units in the more optimistic scenario. We lack the foresight to distinguish, before implementation of the policy, which units would be constructed and which would not. Consequently, the City must extend the tax abatement to all projects, meaning that taxpayers bear the cost of subsidizing all 4,825 permitted units but receive the economic benefits from only 1,808 of them.

Finally, the top panel may overstate status quo production because the near future may be worse than the recent past for construction. By contrast, our more pessimistic exercise generates even higher costs per unit because the extra production generated by the subsidy falls by even more than the status-quo construction level.

4. A Project-level Approach to Projecting the Impact of Taxes

We now turn to a project-level analysis of the potential impact of a tax subsidy on market-rate residential construction in Boston. As discussed above, in real estate development, the standard approach to deciding whether to proceed with an investment is to compare the project capitalization rate—the ratio of net operating income minus taxes to asset value or cost on the left-hand side of equation (1')—with a hurdle capitalization rate. The hurdle capitalization rate on the right-hand side of equation (1') is determined by the cost of capital and expected growth rates of prices and rents. The idea of this approach is to estimate the project capitalization rate for each project from the ground up and determine whether the project will move forward by comparing our estimate to a hurdle capitalization rate rather than estimating permitting rates based on historic trends as in the previous section.

For the BPDA pipeline projects, we estimate both net operating income during the first year of operation and the cost of building the project. We assume that the project is built if the capitalization rate exceeds a city-wide capitalization hurdle. To evaluate the effect of various policies, we estimate how these policies change net operating income minus taxes (moving taxes to net operating income in the numerator of the left-hand side of equation (1')) and ask how many projects move over the hurdle capitalization rate due to the policy. At different hurdle capitalization rates, there will be projects created by the policy and projects that would have been built anyway but still receive subsidies. This approach enables us to calculate the subsidy cost to the City of Boston and the effective tax cost per marginal unit under each policy.

Before we turn to how we estimate costs, net operating income, and taxes and to the analysis of various policies, we highlight a few points about our methodology. First, we do not focus on a single capitalization rate but instead ask how many projects will make it over the capitalization hurdle if that hurdle were to change. We do this because capitalization rates change with macroeconomic conditions. We present several plausible outcomes under various policies and hurdle capitalization rates. We do, however, assume a single capitalization hurdle for all of Boston.[6]

Second, as in Section 3, we focus on how many *extra* units would be built because of a tax subsidy and how much it would cost in terms of subsidy to produce those units. As before, the effective cost per marginal unit equals total subsidy dollars spent divided by the incremental units created by the tax subsidy.

Third, our calculation is limited to the projects currently in the BPDA pipeline. We take the current pipeline and estimate the distribution of capitalization ratios or net operating income to cost ratios. For a range of capitalization thresholds from 3 percent to 6 percent, we then estimate how many projects would be built with a subsidy and how many would be built without a subsidy and calculate the present value tax expenditure and tax expenditure per marginal unit for each policy.

A more dynamic calculation might compare how many future units the subsidy program crowds out or what happens to the land parcel if the project is not started. These are valid questions. In all likelihood, these parcels will eventually be built up with or without a subsidy, and that a subsidy would just pull forward in time the construction. Our procedure of comparing different policies at different capitalization thresholds can be seen as projecting the near future given different possible paths of hurdle capitalization rates.

Finally, the project capitalization rate we estimate is an imperfect measure of the true capitalization rate that a developer would compare with the hurdle capitalization rate. In particular, as described below, our estimates of both total development cost and net operating income are based on typical quality measures for a neighborhood. Our hope is that this will tend to net out (for example, a high-quality building will have both higher cost and higher net operating income), but we cannot be sure.

We first discuss our estimates of building costs, and then we turn to our projections of net operating income. We then discuss the distribution of projects' capitalization rates and estimates of what different tax subsidies would achieve.

Estimating Construction Costs

Construction costs have four main components: hard costs, soft costs, land costs, and financing costs. Hard costs are the costs of building the actual structure from demolition to occupancy, including a contingency for cost overruns. Soft costs refer to all the costs of building not related to shovel-in-the-ground construction. Typical soft costs include surveys and testing, permitting, architecture and engineering, insurance, legal fees, general administrative costs, and a profit for the developer along with a contingency for cost overruns. The land cost includes the cost of acquiring and closing on the land parcel. Finally, the financing costs are the costs of obtaining

[6] Different capitalization rates would be appropriate if we were confident that rent growth was going to be higher in the long run in different neighborhoods. We have no way of accurately predicting rent growth over the next 30 years in different parts of the city.

financing through a mortgage broker and the interest costs during construction and lease-up. As discussed above, these short-term financing costs differ from the long-term cost of capital that needs to be weighed against net operating income. This subsection describes our approach to estimating each cost in turn.

Our hard costs estimates are based on data on 193 completed projects built since 2013. We use the observable characteristics of each project to estimate a linear regression model for hard costs. We then use our estimated regression coefficients to predict hard costs per square foot for the pipeline projects. This entails four steps.

First, we link each completed building with all the permits involved in the construction from the City of Boston's Inspectional Services Department website. We drop permits for electrical, gas, plumbing, excavation, and foundation pouring because these are permits for the costs of an inspection rather than the cost of building. This leaves us with the building permits, which are dominated by the single permit to erect the building along with any amendments to that permit dealing with cost overruns. We do this only for completed projects so that we have the complete costs, including overruns. Since the permit usually costs 1 percent of the hard cost expenditures needed to build the structure, we estimate the total hard costs of the building as 100 times the fees paid for the building permits. We divide this number by the permitted square feet for an estimate of cost per square foot. We drop any permits that are alterations to existing construction (which may not represent the cost of building a new structure), buildings with zero units, and buildings with implausible costs that likely reflect a typo in the permit data. After we eliminate these projects, 193 completed buildings remain.

Second, we merge in characteristics for each of these 193 completed buildings, including the number of parking spaces and building height. Parking spaces are an important cost component because a sufficiently sized parking lot requires podium or underground parking, which raises costs. Height is an important cost component because buildings that are shorter than about 70 feet can be built with wood framing, while taller buildings require steel framing, which is far more expensive.

Third, we estimate a regression for the completed buildings. We regress the cost per square foot computed from the building permit fees on the total number of units in the project; the percentage of units that are part of the City's Inclusionary Development Policy (IDP) program; an indicator variable for whether the building is rental or condos (because some of the 193 buildings are condos); indicators for four quantiles of building height and an indicator for missing height; the number of parking spaces, which is Winsorized to reduce the impact of extreme values[7] and an indicator function that takes on a value of one if we do not know the number of parking spaces; indicator functions for the neighborhood's "IDP zone," which we interpret as a proxy for finish quality (A includes Back Bay, Downtown, parts of East Boston, Fenway, the North End, the South Boston Waterfront, the South End, parts of Roxbury, and the West End; B includes Allston, Brighton, Charlestown, parts of Jamaica Plain, Mission Hill, and parts of South Boston; and C includes Dorchester, parts of East Boston, Hyde Park, parts of Jamaica Plain, Mattapan,

[7] Winsorizing is a standard procedure involving the elimination of outliers from the data.

Roslindale, parts of Roxbury, and West Roxbury); and indicator functions for permit year. The regression fits well and produces intuitive results: The tallest buildings are more expensive, parking adds to costs, and A zone buildings are more expensive.

Fourth, we use the regression to predict costs for the pipeline projects. We obtain 2023 costs by predicting costs as if the permitted year for the pipeline projects was 2021 and then inflating the 2021 costs by 12 percent, which is the increase in the Consumer Price Index (CPI) residential investment price index for New England from 2021 to 2023. Hard costs are then computed for each pipeline project as total square footage multiplied by cost per square foot.

Hard costs account for more than three-quarters of costs for the average project in our data. Hard costs for our pipeline projects range from $400 to $800 per square foot. These cost estimates echo hard cost estimates in discussions with local developers and other industry experts. Furthermore, the heterogeneity across project types and locations in our estimates seems to match the anecdotes these experts and developers shared.

While we tried to capture the variation in hard costs across projects, we assume that, for all projects, soft costs are 12 percent of hard costs. This number is based on conversations with developers and industry experts as well as our analysis of soft-cost data.[8] We did not have enough confidence to include project-specific estimates of soft costs. While we accept that soft costs may be 10 percent of hard costs in some cases and 14 percent in other cases, such variation does little to alter our final projections of the impact of tax subsidies.

We estimate land costs using the City of Boston Assessing Department's 2023 estimates of land value. We regress the assessor's estimate of land value per square foot on indicator variables for the different neighborhoods. This gives us a cost per square foot that differs across Boston's neighborhoods. Land costs are highest in the Back Bay and the South Boston Waterfront and lowest in Mattapan. We multiply this land cost by lot size to get total land costs.

We take this approach instead of simply using the assessing department's estimates of each parcel's land value because many of the pipeline projects contain merged or subdivided parcels for which the assessed land values seem problematic. We believe that our approach likely underestimates the actual cost of land acquisition because buying a parcel typically also involves paying for the structure that sits on the land.[9] We are comfortable with this assumption because these land costs are sunk costs in many cases and because rising interest rates may well have caused land values to decline.

Finally, we estimate financing costs. We assume that a loan covers 60 percent of total development costs (including financing costs) at an interest rate of 6.75 percent. We assume that construction takes two years and that the loan is drawn down evenly over the construction period so that the

[8] Insurance costs in particular have risen dramatically over the last few years. Our method of estimating that soft costs are 12% of hard costs accounts for dramatic soft cost inflation from 2020 to 2022 due to hard cost inflation, but it does not account for recent increases in any specific soft cost line item and may understate the role of rising insurance costs for developers.

[9] The Assessing Department has estimated structure values, but, with merged and subdivided parcels, it is difficult to know which structures are on which parcels.

developer pays one year of interest over two years of construction. We then assume a lease-up period of 10 months during which the developer pays interest. These assumptions are based on our conversations with developers regarding a typical construction loan and construction timeline.

We sum the hard, soft, land, and financing costs to estimate the total development costs. This is the denominator of our capitalization rate calculation. The numerator contains our estimates of net operating income minus taxes paid, to which we turn next.

Estimating Net Operating Income

The aggregate first stabilized year net operating income (NOI) is the sum of rental income from apartments, commercial square footage, and parking minus operating expenses.

To estimate apartment rental income, we organize projects based on unit types determined by (1) the number of bedrooms, (2) whether the apartment falls under the IDP or is market rate, and (3) if the apartment is under the IDP, the maximum fraction of area median income (AMI) required for renter eligibility. The rents we use are based on estimated rents associated with the neighborhood and AMI levels provided by the BPDA.

We were asked by the City to consider a policy that requires 17 percent IDP units, as Mayor Wu proposed in December 2022. Most of the pipeline projects were proposed and approved by BPDA under the current 13 percent IDP requirement. Consequently, for the main analysis, we adjust the share of apartments that are IDP while keeping the count of units by number of bedrooms fixed. We also compare the 17 percent IDP adjustment to the projects as proposed with a 13 percent IDP requirement.

For the computation of projected expense ratios and NOI for parking spaces and commercial space, we conduct a series of regressions using property data from the City of Boston Assessing Department. Importantly, the assessing department collects expense ratios—that is, operating expenses as a fraction of rental income—and estimates them for existing buildings to calculate NOI in its calculation of assessed value. We use these expense ratios to predict the expense ratio for the pipeline projects. All regressions incorporate neighborhood fixed effects and a control for the number of units in the building. Expense ratio regressions consider the number of bedrooms, the relevance of IDP for the unit, and the unit's rent level.[10]

We also include commercial and parking income. We obtain the parking space count and non-residential square footage for commercial space derived from the BPDA dataset. For commercial and parking rental income, we use a regression similar to the one we use for expense ratios together with data on commercial and parking rents from the assessing department to predict commercial and parking rents for pipeline buildings.

[10] We use a similar regression with the assessing department's NOI data to compute an alternative projected rent measure. The results align with those obtained from the BPDA rent measures.

Estimating Taxes Paid

To estimate real estate taxes for pipeline projects, we follow the procedure used by the City of Boston Assessing Department. It estimates a building-level capitalization rate and multiplies NOI by that capitalization rate to determine assessed value. It separately assesses the commercial and residential components of a building and applies a 1.074 percent tax rate to the residential component and a 2.468 percent tax rate to the commercial component. Parking spaces for residential use are taxed at the residential rate, and spaces for commercial use are taxed at the commercial rate.

We estimate the building-level capitalization rate for each pipeline project using the predicted values of a regression that resembles the regression we use to estimate rent, with Assessor's Office capitalization rates on the left-hand side and apartment size, building size, and neighborhood fixed effects on the right-hand side. We then multiply this estimated capitalization rate by our estimated residential NOI to determine residential taxes and by our estimated commercial NOI to determine commercial taxes. To determine taxes on parking, we assume that the share of commercial parking spaces equals the share of commercial NOI in combined commercial and residential NOI. We then multiply by the tax rates to obtain a real estate tax estimate for each completed pipeline project.

The Distribution of Capitalization Rates

We now turn to the distribution of project-level capitalization rates for the BPDA pipeline projects. This distribution determines how many projects would be built absent a subsidy and contributes to the calculation of the effective cost of subsidizing new housing in Boston.

Figure 6 shows a hypothetical distribution of capitalization rates to illustrate the economics of a real estate tax subsidy. The right vertical line shows the capitalization threshold without a tax abatement. The left vertical line shows the capitalization threshold with a tax subsidy. (In actuality, the distribution will shift and the hurdle capitalization rate will stay the same, but it is easier to explain graphically if the hurdle capitalization rate shifts on a fixed distribution.) The red-shaded region on the graph indicates the housing units that would be built without the subsidy. These are the "inframarginal" units. Any subsidy on them is "wasted," as these units would be built without any subsidy. The green-shaded region indicates the extra "marginal" units built because they are subsidized. These are the units that we focus on in evaluating the effectiveness of the policy. Crucially, the cost of building these marginal units in terms of the subsidy depends on the subsidy spent on *both* the marginal and the inframarginal units; for the marginal units to be built, the City of Boston must "waste" subsidy on the inframarginal units. The ratio of the red plus green space to the green space is thus an effective cost multiplier that converts the average unit subsidy into the cost per new units built. As macroeconomic conditions change, this multiplier will also change, and the multiplier depends on the local properties of the distribution of capitalization rates at the margin.

The best case for a subsidy can be made when there are very few units that would be built without the subsidy and many units that would be built with the subsidy. Intuitively, if the distribution of returns on capital is bell shaped, then this ratio is likely to be lowest at the far-right side of the distribution, where few projects naturally clear the hurdle. If interest rates decline, then more inframarginal projects will be built without the subsidy, and the implicit price per subsidized unit will rise because the City of Boston will have to spend more on the inframarginal projects to build marginal projects.

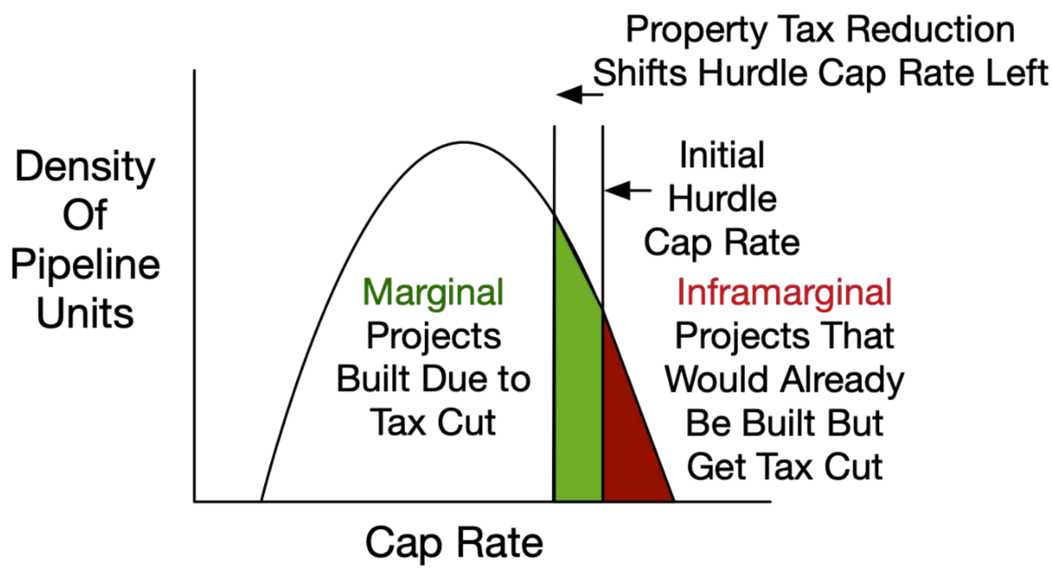

Figure 6. This figure depicts the distribution of project capitalization rates of projects in the BPDA *pipeline. There is a distribution of pipeline projects: some have a high capitalization rate and some have a lower rate, but all would have been profitable before the rise in construction costs (which shifts the distribution left) and the rise in interest rates (which shifts the cutoff hurdle capitalization rate). The right vertical line shows the initial hurdle capitalization rate absent the policy. The shaded-red region indicates the inframarginal projects that would have been built absent the policy. The policy shifts the distribution, but, for ease of clarity, we draw this as a decline in the hurdle capitalization rate. This causes the shaded-green projects to be built.*

Figure 7a shows our actual distribution of capitalization rates (returns on costs). It shows results for 75 rather than 77 projects because we exclude the two residential towers in the Back Bay/South End Gateway project. In our data, this project seems to have an unusually high estimated return on capital, but we suspect that this is largely because we do not have a reasonable estimate of costs for this complex and unusual construction project, which involves renovating the Back Bay railway station and building over the train tracks and Massachusetts Turnpike. Figure 7b shows the distribution of units rather than projects smoothed using a kernel density estimator.

The blocks on Figure 7a show the actual distribution of projects. The block histogram shows a few projects with capitalization rates ranging from 4.0 percent to 5.75 percent. The bulk of the density lies between 2.0 percent and 4.0 percent. This shape implies limited building in the current environment. It also suggests that, if the combination of interest rate changes and subsidy induces developers to obtain permits only for projects currently above 4.0 percent, then this will produce relatively little new construction and have relatively high costs because the distribution is relatively flat over this range. If the intervention, however, leads developers to obtain permits for projects with capitalization rates below 4.0 percent, then the policy will have a large impact on the number of units constructed, and the cost per unit will fall because the number of marginal units will be higher relative to the number of inframarginal units.

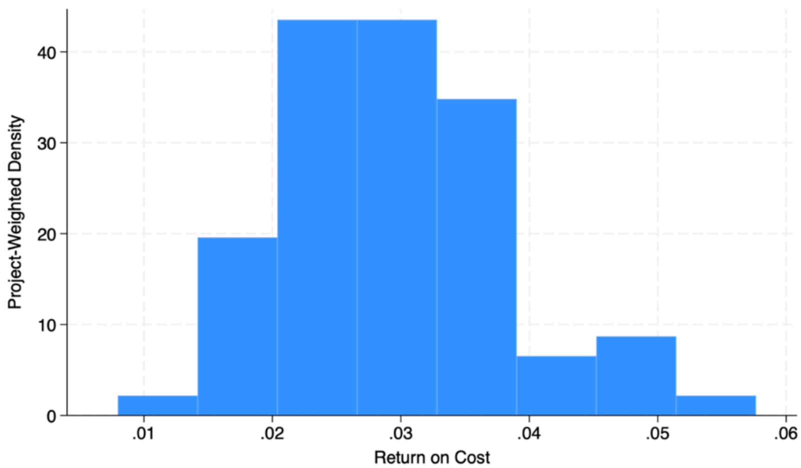

Figure 7a. Empirical project-level histogram of project-level capitalization rates (return on costs). This figure includes an adjustment to 17% IDP.

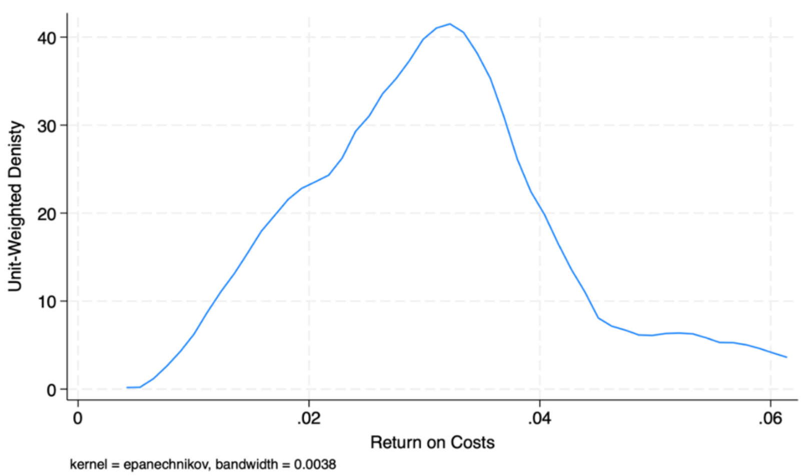

Figure 7b. Empirical unit-level kernel density of unit-level capitalization rate (return on costs). This figure includes an adjustment to 17% IDP.

Why would developers propose projects that have capitalization rates below 4.0 percent? Most of these projects would have had a much higher capitalization rate prior to the dramatic runup in hard construction costs in the wake of the pandemic. Today hard construction costs are a significant headwind for building in Boston. This barrier to building will remain even if interest rates normalize and hurdle capitalization rates fall.

The line in Figure 7b shows the density of a smoothed distribution that is meant to capture some of the uncertainty regarding our measure of capitalization rates. In our policy simulations, we add noise to the estimated capitalization rates, which leads to smoother predictions. The basic logic of this smoothing procedure is that, if we estimate a project that has a capitalization rate of 5.3 percent, then unsmoothed data imply with 100 percent certainty that an intervention moving the hurdle rate from 5.31 percent to 5.29 percent will induce the developer to obtain a permit for that project. In reality, the change will increase the probability of permitting but hardly by such an extreme magnitude. Adding noise reflects our uncertainty about the actual capitalization rates embedded in each project. We add noise by assuming a normally distributed (Gaussian) error around each of our measured capitalization rates with a standard deviation of 50 basis points. This number reflects our view that we are highly confident that the actual return on investment lies within a 200 basis point range around our estimated return on investment.

The smoothed Figure 7b is purely illustrative, and it indicates the form that smoothing can take. Yet it suggests permitting may occur even in the current environment. The figure also suggests that there is a threshold above which the tax cost is likely to be high since the density is flat. In Figure 7b, that threshold is 4.75 percent, not 4.25 percent. We now turn to simulations of alternative policies.

Policy Simulations

As in Section 3, we conduct five experiments with policies that differ in their level of generosity in addition to simulating a no-policy baseline. Our most generous scenario is the elimination of all residential property taxes in perpetuity. We do this to show an upper bound of how much construction the most generous possible real estate tax abatement could stimulate and because it is comparable to the thought experiment in the previous section. Because residential property taxes in Boston are only 1 percent, this extreme intervention still causes only part of the BPDA pipeline—those projects with high capitalization rates that are within roughly 1 percent of the threshold to build—to start construction. We next consider the same elimination of all residential property taxes for 15 and 29 years as well as a 75 percent reduction of residential property taxes for 15 and 29 years. We then turn to capped credits. These capped credits reduce tax payments by either $5,000 or $2,500 per unit per year. If the tax payment without the credit is less than $5,000 or $2,500, the project just receives a full tax abatement. We evaluate these capped credits assuming that they run for either 15 or 29 years. We allow the cap amount to grow with inflation.

We assume that the residential component of all approved projects is considered independently by developers who do a capitalization-rate calculation to decide whether to build. In practice, some of these projects are part of mixed-use developments, and so the capitalization-rate calculation may be for the entire project rather than just the residential component. Unfortunately, we do not have the data to do that calculation with confidence. If the residential component is a loss leader that the developer added to gain BPDA Board approval, we may understate the probability that the building will be built and the impact of the subsidy. This likely explains why some buildings that we estimate to have capitalization rates below what is currently a reasonable threshold have nevertheless started construction. It is unclear whether this would raise or reduce the cost of a subsidy to the City of Boston.

For the elimination of all property taxes in perpetuity, we show results both for unsmoothed and smoothed with normal noise. For that most generous policy, the data are rich enough that results seem only slightly skewed by the idiosyncratic features of projects. For the last four policies, we show only the results with smoothing. In all cases, we show results for capitalization hurdle rates ranging from 3.5 percent to 6 percent. We believe this range captures the possible rates of returns expected by investors. Those rates will differ depending on macroeconomic conditions and on the expectations about future rent growth in Boston. A capitalization hurdle can move from 6 percent to 4 percent either because interest rates fall or because investors become more optimistic about future rent growth in Boston. We will focus on the range of hurdles from 4 percent to 5.5 percent.

Figures 8 and 9 show results for a complete residential tax abatement in perpetuity both unsmoothed and smoothed with normal noise, respectively. Panel A of both figures shows total housing production depending on the capitalization rate hurdle. The lower red line, which will be the same for all subsequent policies we consider, shows that the number of units produced without any subsidy ranges from 130 units when the capitalization hurdle is 6 percent, to 1,469 units when the capitalization hurdle is 4 percent. Without smoothing by adding noise, the number of units produced without any subsidy ranges from zero when the capitalization hurdle is 6 percent to 1,100 units when the hurdle is 4 percent.

The second, higher line in Panel A shows the housing units produced when residential real estate taxes are eliminated in perpetuity. Panel B shows the number of marginal units produced by the subsidy, which equals the number of units produced under the tax abatement minus the number of units produced with no policy. For both the smoothed and unsmoothed methodologies, this number ranges from 1,800 extra units when the capitalization rate is 4 percent to 400 units when the capitalization rate is 6 percent. The amount of new housing generated by the subsidy depends on the capitalization hurdle. If this hurdle remains high, then even this most generous subsidy will generate little new housing. Because residential tax rates are only 1 percent of a property's assessed value, eliminating residential taxes can shift the capitalization rate generated by the project by only slightly more than 1 percent. Consequently, only projects that are within approximately 1 percent of the threshold under no policy will start construction with the policy.

Panel C shows the present value of foregone taxes (measured as a tax expenditure as defined previously) from the subsidy per marginal unit. In this case, we estimate the first-year cost, which divides the reduction in taxes paid by the number of marginal units created. We then use a standard net present value formula and assume that the subsidy, rents, and other prices grow at 2 percent per year and that cash flows are discounted at an interest rate of 5 percent per year. This procedure effectively multiplies the first-year tax saving by 33.33. This is the net present value of the taxes as of the year of project completion (typically about two years after construction starts) not today.

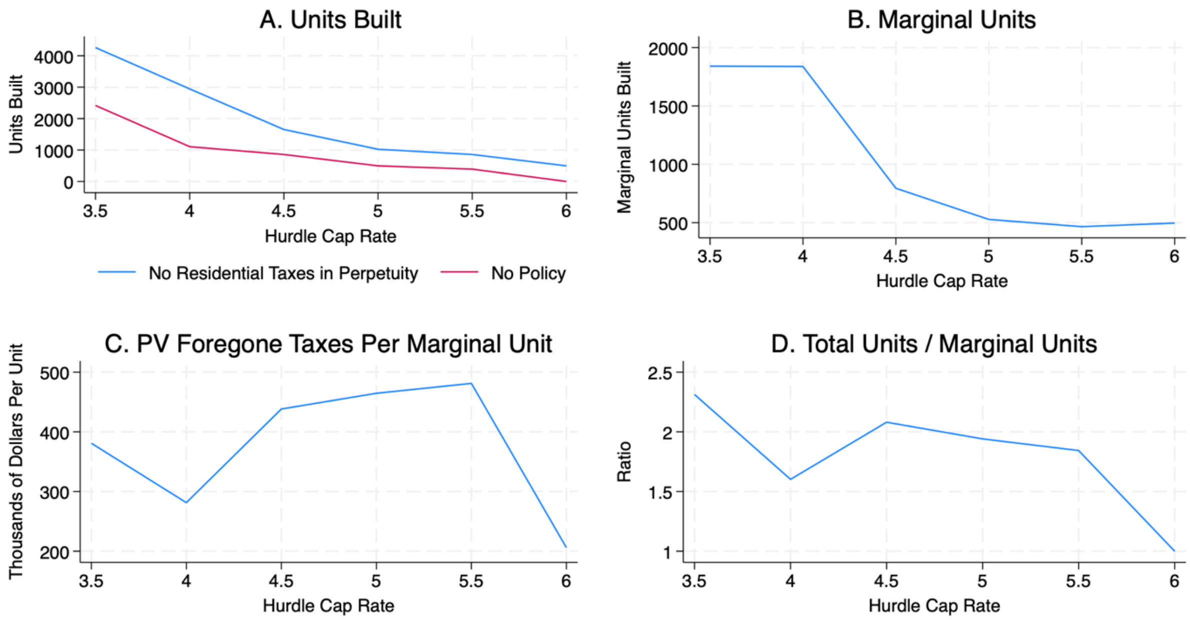

Figure 8. This figure shows results for a full residential property tax abatement in perpetuity without smoothing. The panels show the number of units built, the number of marginal units, the present value of foregone taxes per marginal unit, and the ratio of total units to marginal units built for hurdle capitalization rates from 3.5% to 6 %. This figure includes an adjustment to 17% IDP.

Without added noise, the present value tax cost ranges from about $200,000 when the capitalization hurdle is 6 percent to more than $450,000 when the capitalization hurdle is 5 percent to about $280,000 when the capitalization hurdle is 4 percent. Panel D shows why this cost varies so much. When the hurdle is 6 percent, no units are built without the subsidy, and consequently the marginal cost per unit is the same as the average cost per unit, which is about $6,000 per unit in the first year. At a hurdle rate of 4.5 percent, the ratio of total units to marginal units spikes to 2.1, which again reflects the lumpy nature of the data and why we prefer the smoothed results. At lower capitalization rates, the ratio of total units to marginal units is higher and so is the effective tax cost.

Figure 9 shows the results for the analysis smoothed with added noise, which we use going forward. In this case, the range of tax costs is narrower, starting about $300,000 per unit at the highest capitalization hurdle and reaching $425,000 per unit at the lowest. Notably, the tax cost rises and falls, even though the ratio of total units to marginal units always declines with the capitalization hurdle. This difference reflects the fact that higher-cost projects that will have a high assessed tax value and high tax bill with no policy tend to have modestly higher capitalization rates. As the capitalization hurdle increases from 4 percent to 6 percent, the projects that are built tend to have higher tax bills and thus receive larger subsidies if all residential taxes are eliminated.

These cost numbers are generally smaller than the per-unit costs discussed in Section 3 under the optimistic scenario because the project-level analysis predicts that fewer units would be built absent a policy, with roughly one inframarginal unit per marginal unit for capitalization rates of

4.5 percent to 5.5 percent. By contrast, in Section 3, there were at least three inframarginal units per marginal unit. However, the cost per marginal unit still increases significantly due to the need to subsidize the inframarginal units. This fact shows how the total cost of a tax subsidy program can be several times its apparent nominal cost because the subsidy also goes to inframarginal projects that would been built anyway.

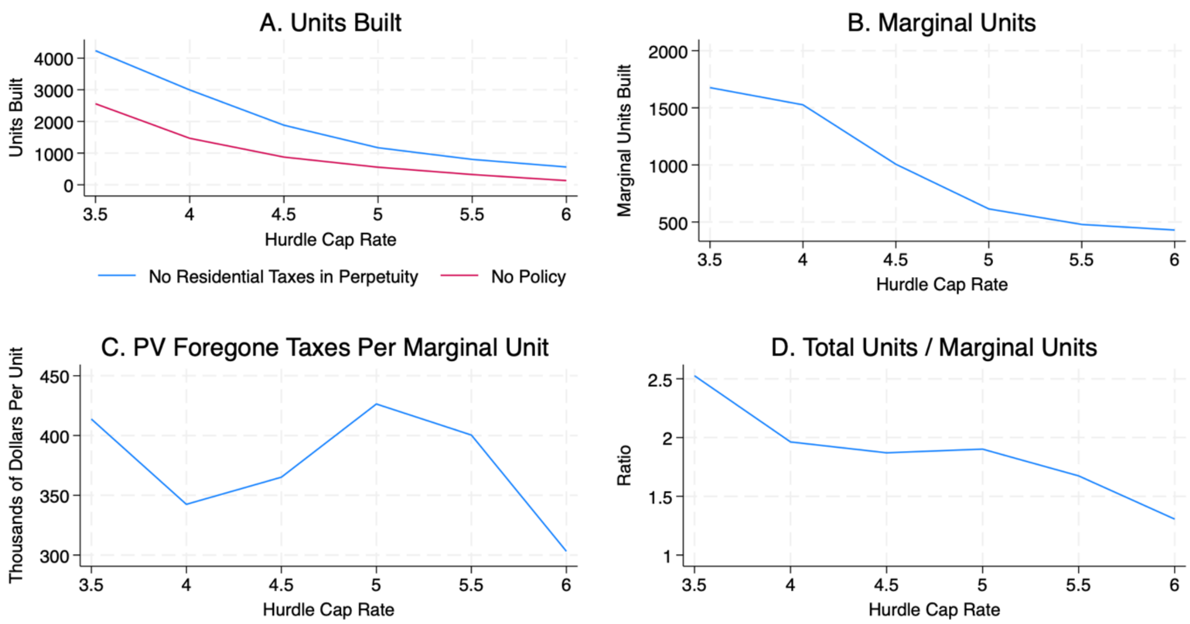

Figure 9. This figure shows results for a full residential property tax abatement in perpetuity with smoothing. The panels show the number of units built, the number of marginal units, the present value of foregone taxes per marginal unit, and the ratio of total units to marginal units built for hurdle capitalization rates from 3.5% to 6%. This figure includes an adjustment to 17% IDP.

Table 5 compares the nine policy options following the same structure as Table 4. Panel A of Table 5 provides results given a more optimistic 4 percent capitalization hurdle. Panel B provides results given a more pessimistic 5.5 percent capitalization hurdle. Appendix Figures A1 through A8 show results across a wider range of capitalization rates spanning from 3.5 percent to 6 percent.

The first row in Panel A of Table 5 shows we estimate that a total of 1,469 units will be produced at a 4 percent hurdle rate. The first row in Panel B shows our estimate that only 323 units will be produced at a 5.5 percent hurdle rate. These predictions are considerably more pessimistic than those discussed in Section 3, where the more optimistic analysis suggests that 3,017 units will be produced. That higher number is in line with past experience of projects moving through the pipeline. Yet these lower numbers are also plausible, given the sharp increase in construction costs and are more in line with the pessimistic analysis in section 3, which predicts 1,278 units would be produced without a subsidy.

The lower rows in the two panels of Table 5 show the marginal units that would be created by the different subsidy programs. Eliminating residential taxes entirely in perpetuity has the largest effect and is predicted to create 1,526 additional units for a total of 2,996 units when there is a 4 percent hurdle rate. This large effect means that the ratio of total units to marginal units is only 2, which is the smallest ratio in the table for a 4 percent hurdle cap rate. Yet, because the policy eliminates all taxes paid on all new units, the effective cost per new unit is $342,500.

			Budget Impact	*Cost Per New Unit*		
Policy	Horizon	(1) # of Units	(2) Net Revenue Loss NPV in $ millions	(3) Marginal Units	(4)=(1)/(3) Total/ Marginal	(5)=(2)/(3) Cost per unit NPV in $ thousands
Assuming 4% hurdle rate						
No Policy Change	Infinite	1469	0.0			
100% of revenue	Infinite	2996	522.7	1526	2.0	342.5
100% of revenue	29	2307	247.3	837	2.8	295.4
100% of revenue	15	1965	136.6	496	4.0	275.4
75% of revenue	29	2077	171.3	608	3.4	281.8
75% of revenue	15	1832	97.2	363	5.0	267.9
$5000/unit	29	2285	194.2	815	2.8	238.2
$5000/unit	15	1950	104.6	480	4.1	217.7
$2500/unit	29	1960	94.7	490	4.0	193.0
$2500/unit	15	1760	53.0	290	6.1	182.7
Assuming 5.5% hurdle rate						
No Policy Change	Infinite	323	0.0			
100% of revenue	Infinite	802	191.8	479	1.7	400.4
100% of revenue	29	596	80.6	274	2.2	294.6
100% of revenue	15	496	40.9	174	2.9	235.6
75% of revenue	29	530	52.9	207	2.6	255.5
75% of revenue	15	455	27.9	132	3.4	211.2
$5000/unit	29	524	49.4	201	2.6	245.8
$5000/unit	15	453	26.9	130	3.5	206.0
$2500/unit	29	436	21.1	113	3.8	186.3
$2500/unit	15	394	11.9	71	5.5	167.4

Table 5. This table shows our estimates of the effects of various tax policies using the project-level analysis that predicts how many projects will be built under a 4% hurdle rate and a 5.5% hurdle rate. This analysis introduces smoothing by adding normal noise to the hurdle rate to create a smoothly increasing probability of construction. The analysis also assumes 17% IDP.

Panel B shows results with a 5.5 percent capitalization hurdle. In this case, the number of extra units produced by the policy falls to 479. Because we predict that only 323 units will be produced without the subsidy, the ratio of total units to marginal units is only 1.7. However, the effective tax cost per marginal unit is $400,000, reflecting that mostly higher-end projects are built when the capitalization hurdle is 5.5 percent.

At the 4 percent capitalization hurdle in Panel A, the number of marginal units produced falls to 837 when the tax abatement is limited to 29 years and 496 when it is limited to 15 years.

Consequently, the ratio of total units to marginal units rises to 2.8 in the 29-year scenario and to 4 in the 15-year scenario. The effective cost per new unit is $295,000 for the 29-year program and $275,000 for the 15-year program. The shorter program does lower the effective cost but by only a modest amount because it increases the ratio of total units to marginal units.

Panel B evaluates these policies at a 5.5 percent capitalization hurdle. The number of extra units produced falls to 274 with the 29-year duration and 174 with the 15-year duration. Yet these numbers are associated with lower ratios of total units to marginal units because the baseline level of construction is predicted to be so low at a 5.5 percent capitalization hurdle. The effective tax cost per new unit is $295,000 for the 29-year duration and $236,000 for the 15-year duration.

The next two lines show the impact of a 75 percent reduction in total property taxes. This naturally produces fewer units at both capitalization hurdle rates and both durations. However, the effective tax cost per new unit of this program is similar, ranging from $211,000 (for a 15-year program and a 5.5 percent hurdle) to $282,000 (for a 29-year program and a 4 percent hurdle). A 25 percent reduction in the nominal size of the tax abatement does not lead to a 25 percent reduction in the program's cost per new unit.

The final four rows show simulations for a $5,000 per-unit capped tax subsidy and a $2,500 per-unit capped tax subsidy. For each program, we consider a 15-year program and a 29-year program. There is a progression from the smallest (a $2,500 cap over 15 years) to the largest (a $5,000 cap over 29 years). It is unclear whether the $2,500 program over 29 years or the $5,000 program over 15 years should be considered the larger program. The 15-year, $5,000 tax credit generates more marginal units at a 5.5 percent capitalization hurdle (130 versus 113) but fewer marginal units at a 4 percent capitalization hurdle (480 versus 490). The $5,000 subsidy over 29 years generates 815 new units at a 4 percent hurdle rate and 201 units at a 5.5 percent hurdle rate. The $2,500 subsidy over 15 years generates 290 units at a 4 percent hurdle rate and 71 units at a 5.5 percent hurdle rate.

The cost per unit is larger for the larger policies, but the difference in effective cost is far less than the nominal difference in tax subsidy. For example, at a 4 percent hurdle, the effective cost per unit of a 29-year $5,000 subsidy is $238,000. The effective cost of a 29-year, $2,500 subsidy is $193,000 per unit. A 50 percent reduction in the subsidy causes the cost per unit to drop by only 20 percent because the ratio of total units to marginal units increases from 2.8 to 4. At a 5.5 percent hurdle rate, the effective tax cost per new unit ranges from $186,000 to $246,000.

If the goal is to subsidize less expensive units, then the capped tax subsidy policies generally outperform the policies that scale with the value of the property. This is unsurprising. A capped tax credit doesn't give a $1 million unit twice the subsidy of a $500,000 unit, but a 75 percent reduction in the total tax bill does.

The $2,500 tax credit is the least costly program, but it generates the fewest units. The full tax abatements are the most expensive, but they do generate more units than any other program. In the middle range, however, the 75 percent abatement appears dominated by the $5,000 capped credit, which is less expensive and produces more marginal units at a 4 percent capitalization hurdle. The $5,000 capped credit over 29 years generates 815 units at a 4 percent capitalization hurdle and 201 units at a 5.5 percent capitalization hurdle. The 75 percent credit generates six more units than the $5,000 tax credit at the 5.5 percent hurdle but more than 200 fewer units at the 4 percent hurdle. At a 4 percent hurdle and 29-year duration, the $5,000 tax credit generates an effective tax cost per new unit of $238,000, while the 75 percent tax cut costs $282,000. At the same hurdle, the effective tax cost per new unit is $268,000 for the 75 percent cut given over 15 years and $218,000 for the $5,000 tax cut over the same time duration.

Overall, the main takeaway from our project-level analysis is that a limited-duration tax subsidy program is likely to create a modest number of marginal units that would not be built absent the subsidy. Indeed, for all policies except the one involving no residential taxes in perpetuity, the marginal number of units created is well below 1,000, even with a low 4 percent hurdle cap rate. However, the key number is the present value of the tax expenditure per marginal unit, which is the effective subsidy cost of building extra units. A limited-duration $5,000 tax credit capped at the total residential tax bill for 29 years is predicted to cost $238,000 per new unit with a 4 percent hurdle rate and $246,000 per new unit with a 5.5 percent hurdle rate,

Comparison of 17 percent and 13 percent IDP

For our main analysis, we were asked by the City to modify the pipeline projects, which were proposed and approved by BPDA under an IDP requirement of 13 percent affordable units, to meet a more stringent 17 percent IDP requirement as proposed by Mayor Wu in December 2022. Figure 10 compares the different policies in Table 5, but instead of showing the number of units produced, the number of marginal units produced, and the present value of foregone tax revenues, it shows the ratio of each metric under 17 percent IDP and 13 percent IDP.

Panel A shows that the number of units produced ranges from 88 percent to 95 percent of the 13 percent IDP value under 17 percent IDP. The number of units declines because to turn a building into a 17 percent IDP building, the developer allocates some market-rate units to IDP, which reduces the building's NOI and makes a marginal building less profitable to construct. (This is smoothed out by adding noise in the figure.) Fewer units are lost under 17 percent IDP with more generous tax abatement policies.

Panel B shows the number of marginal units ranges from 95 percent to 100 percent of the 13 percent IDP value under 17 percent IDP. The number of marginal units does not decrease quite as much as the number of total units and can even rise depending on the number of buildings that are close to the cutoff hurdle rate without a policy change. Moving the IDP requirement from 13 percent to 17 percent can alter the viability of projects near the hurdle rate. Note that, even if the number of marginal units built increases, the total number built declines.

Finally, Panel C shows that the present value of foregone taxes per marginal unit under 17 percent IDP is 87 percent to 92 percent of the present value under 13 percent IDP. The value of foregone taxes falls under 17 percent IDP because the assessing department values buildings for tax purposes based on their NOI. Increasing the IDP percentage reduces the NOI and the taxable amount, and so the tax abatement requires less tax expenditure because the amount of tax abated is lower. This effect is stronger for more generous subsidies.

Overall, we conclude that 17 percent IDP will reduce the total number of units produced by 5 percent to 12 percent relative to 13 percent IDP. However, because the tax revenues absent any policy are lower under 17 percent IDP, the abatement costs the City of Boston less.

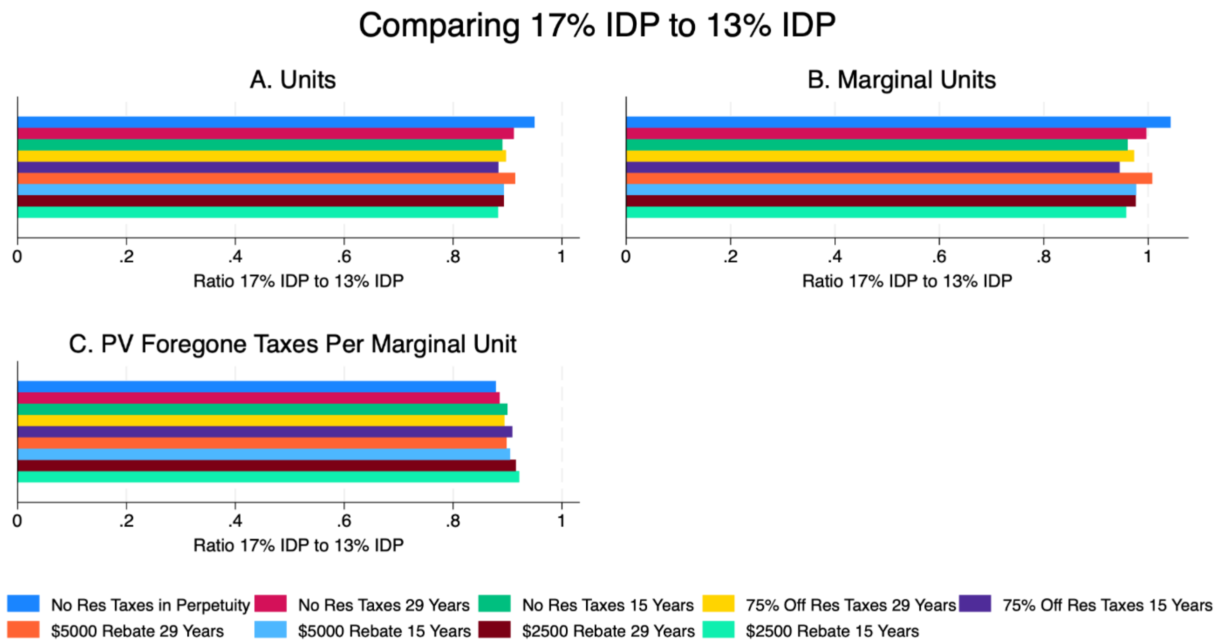

Figure 10. Comparison of 17% IDP to 13% IDP. This figure shows the ratio of 17% IDP to 13% IDP total units produced (panel A), marginal units produced (panel B), and the present value of foregone taxes per marginal unit (panel C) for nine different policies. As described in the main text, we adjust the net operating income of proposed BPDA pipeline projects to a 17% IDP for most of our analysis. This figure compares the 17% IDP adjustment to the projects as proposed when 13% IDP was required. An IDP of 17% delivers 88% to 95% as many total units. The number of marginal units falls by less because many of the units that are not produced are inframarginal. The present value of foregone taxes per marginal unit is about 87% to 92% of the value under 17% IDP because, at 17% IDP, the building is worth less and so taxes are lower and foregone taxes under the tax abatement are lower.

5. A Conceptual Framework for Evaluating Housing Subsidies

High housing prices and high rents in Boston make it difficult for lower- and moderate-income households to thrive in the city. A limited supply of housing leads to high costs and prevents the city from making room for new residents. The lowest-income Bostonians often suffer most from rising rents. Yet, just because Boston's housing is scarce, it does not automatically follow that the public sector should do whatever it takes to produce more housing. In this section, we discuss the conditions that could make a subsidy for the production of market-rate units a sound policy.

Governments subsidize many things, from the buses that traverse Boston's neighborhoods to the solar panels that have sprouted up across the country, and there are two well-accepted justifications for such subsidies. The most common justification for subsidies is that the social benefit of producing a good exceeds its private benefit, and so, without a subsidy, not enough of the good will be produced. Solar panels provide benefits for the entire planet by producing energy without using carbon. Buses may reduce pollution and traffic by taking drivers out of their cars. The second case for subsidies is that they reduce inequality. Hence, bus subsidies can also be justified because they provide benefits for the lowest-income households that could not otherwise afford transportation and help produce a more equitable society. Free and reduced-price school lunches work the same way.

Yet even though a gap between social benefit and private benefit can justify a subsidy, that gap does not justify a subsidy of any size. The size of the subsidy should equal the size of the gap between social benefit and private benefit, which is typically referred to by economists as an externality. Subsidies that are justified based on redistributive motives need to have their costs compared with other, more direct ways of aiding lower-income residents, such as direct cash transfers.

Support for additional residential housing in Boston can be justified both because it addresses the gap between private value and social value and because it serves redistributive purposes. New construction can also generate externalities if there are fiscal benefits from new Boston residents. These benefits could include sales taxes that new residents pay or state income tax revenues that lead the state government to transfer more funds to the City of Boston. Of course, new construction also imposes costs on the city because additional residents require additional services. A more populous Boston may also mean that the City becomes more exciting and that it can reap greater benefits from the agglomeration economies that exist when people collaborate.

Nonetheless, we think that the stronger case for subsidizing housing is that it can make the city more equitable by making it more affordable to middle-income households. While affordable housing is often assumed to mean housing subsidized by programs such as the LIHTC or other federal, state, or local programs, much of the affordable housing stock is provided by the private market. We are not focusing here on the largely subsidized projects where more than 25 percent of the units are affordable but rather on the market-rate projects in the pipeline, which are diverse and range from buildings with per-unit costs of less than $300,000 to buildings in which an average unit costs more than $1 million. The projects also include dedicated affordable units, which typically make up nearly one-fifth of all units that are built. The presence of affordable units suggests that the city values both affordability and the integration of affordable units into higher-income parts of the city.

The fundamental policy question is whether the city values affordable and market-rate housing units enough to justify the tax subsidies discussed in the previous section. Boston's leaders have long shown that they value the production of both affordable units and market-rate units. Former Mayor Thomas Menino initiated the city's Inclusionary Development Policy (IDP) in 2000 with an executive order mandating that 10 percent of all units in projects that contain at least 10 units should be "affordable to moderate-income and to middle-income households."[11] That executive order allowed builders to satisfy this mandate offsite by either providing 50 percent more affordable units or making a cash contribution to the Inclusionary Development Policy Fund currently managed by the Mayor's Office of Housing. Former Mayor Martin Walsh updated the

[11] http://www.bostonplans.org/getattachment/449e3e98-f724-4bbf-a43d-c7c04389ab15

policy in 2015 by dividing the city into three zones and raising the inclusionary requirement to 18 percent for projects in the most expensive parts of the city. Mayor Michelle Wu's December 2022 proposal would further increase the inclusionary requirement in some parts of the city and change the income level targeted for affordable units. But before a subsidy program can be justified, Boston's political leaders must determine the value to their city of new market-rate units and new affordable units.

The essential economics of IDP is that there is usually a gap between the value of new units and the cost of providing units, at least once the project has been permitted. This gap enables the city to require builders to build affordable units. Other policies that take advantage of this gap involve impact fees (more common in California) or require builders to invest in local amenities, which is also commonly part of the approval process for large projects in Boston. The commitment to IDP through three mayoral administrations illustrates the City of Boston's long-term commitment to providing new, affordable housing units to middle- and lower-income residents. We do not question the idea that providing extra affordable units has wider social benefits because it fosters a more diverse city, but it must be political leaders, not technical experts, who judge the dollar value of those benefits.

Recall that the tax abatements reviewed in this report are for market-rate housing for which we assume that projects meet the 17 percent IDP requirement. Indeed, if we saw this only as a program to create affordable housing, the cost per affordable unit would have to be multiplied by the ratio of new units created to new affordable units created. If for each project, exactly 17 percent of the units were affordable, then the per-unit costs in Tables 4 and 5 would have to be multiplied by 5.88. In our optimistic scenarios, the effective cost per new affordable unit would range from $1.07 million to $2.17 million.

The decline in new project construction discussed in the previous sections implies that the surplus associated with the gap between unit value and construction costs has narrowed or disappeared altogether. If the City of Boston thought that these conditions were permanent and it wanted to generate more construction, then officials might consider undertaking a wider study of all the factors that make building in Boston so expensive, including regulatory requirements and labor costs. Reforming the system so that builders cover their own costs would impose far lower costs on residents compared with a permanent subsidy system that is paid for by the city's taxpayers.

The calculations needed in today's setting differ from such long-run analysis. Supply chain issues are waning, and interest rates are likely to decline modestly in the next year. In fact, the Federal Open Market Committee indicated in December 2023 that its members expect roughly two to three rate reductions in 2024 with further reductions in 2025 and 2026. As a result, the crisis is likely temporary, not permanent. A subsidy can encourage building now, even if it does not change the long-run supply of affordable housing. Consequently, the case for a subsidy depends on the value of having new housing soon as opposed to some more distant point in the future. Again, the willingness to pay for such units can be determined only by elected leaders.

This case for the subsidy differs from standard macroeconomic reasoning for encouraging more construction during a downturn. The point of a temporary subsidy is to provide a flow of new affordable units, not to boost construction employment or other macroeconomic outcomes. The high costs of construction in Boston suggest that this sector is not in a slump and that any subsidy to residential construction will only cause costs to rise higher.[12]

The case for a steady flow of new housing units depends on whether these new units will meaningfully ease the pain facing lower- and middle-income Boston residents. The central task of this report is to estimate how many new units will be produced by a subsidy because such an analysis determines the effective cost to the city of a marginal housing unit. The burden on the city's taxpayers is likely to be far smaller if any subsidy is time limited. If the goal of a subsidy is to offset a short-term rise in interest rates, then it would seem illogical for costly subsidies to continue when interest rates fall. One possible model for a subsidy program would involve offering a fixed number of credits allocated on a first-come-first-served basis. Such a structure might encourage builders to move quickly before the subsidy is depleted.

The basic tools of public economics also suggest that, if the benefit comes from the number of marginal units, then the subsidy should also scale with the number of marginal units. This provides logical support for the capped per-unit tax subsidy discussed in the previous section.

Note, too, any temporary policy will generate distortions when it finishes as developers rush to take advantage of the subsidy before it expires. For instance, in analyzing the Car Allowance Rebate System (CARS, or colloquially known as "cash for clunkers") tax subsidy program, Mian and Sufi[13] find that the program pulled demand forward in time to the period when the temporary tax subsidy was offered, but there was a lull in car purchases after its expiration. Thus, the program did not create new net demand. This is not a universal finding from studies of temporary tax subsidies. For instance, Berger, Turner, and Zwick[14] find that in the year following the end of the First-Time Homebuyer Credit, the surge in home sales did not reverse. But the city should expect that developers will try to take advantage of a time-limited subsidy and that construction growth may stall when the subsidy expires.

Why is it so hard to generate new housing in Boston?

The central challenge facing any affordable housing policy is that construction costs in Boston are extremely high. Hard costs comprise more than 75 percent of total project costs for the average project in our analysis in Section 4 and have been growing at an alarming rate. These high costs indicate that construction will occur only with extremely high rents.

---

[12] Our two analyses did not consider these sorts of equilibrium feedbacks from a subsidy policy onto construction costs because these types of feedbacks are hard to measure and because market-rate multi-family construction in the City of Boston only accounts for a small fraction of overall construction employment in the Greater Boston area.
[13] Mian, Atif, and Amir Sufi. 2012. "The Effects of Fiscal Stimulus: Evidence from the 2009 Cash for Clunkers Program." *The Quarterly Journal of Economics* 127(3): 1107–1142. https://doi.org/10.1093/qje/qjs024
[14] Berger, David, Nicholas Turner, and Eric Zwick. 2019. "Stimulating Housing Markets," *Journal of Finance* 75(1): 277–321. https://doi.org/10.1111/jofi.12847

To get a sense of the key role of rising construction costs, consider a hypothetical low-quality, 800-square-foot, one-bedroom, market-rate apartment. Hard costs for the lowest quality low-rise building that can be constructed are currently about $400 per square foot. Adding land costs (in a non-downtown neighborhood), financing costs, and soft costs raises the overall cost to $525 per square foot. Assuming that the 800-square-foot apartment requires about 200 square feet of common space, the unit would cost $525,000 to build, even excluding IDP requirements. Assuming the landlord spends 30 percent of rent on expenses and the developer must cover a 4 percent capitalization rate, the rent on an 800-square-foot apartment must be $2,275 per month for the unit to be worth building. At a 6 percent capitalization rate, the rent must be $3,400. The largest and most important component of this calculation is hard costs, which make supplying market-rate housing that is affordable for most households extremely challenging.

We elaborate on this point in Figure 11 in which we perform an informative counterfactual. The red dotted line shows the hurdle capitalization rate as measured by the average capitalization rate from CoStar. The solid blue line shows the return on capital for projects in the BPDA pipeline, as estimated in Section 4. The latter rate was above the former rate before the onset of the pandemic. Therefore, generally, pipeline projects were built. However, the return on capital has fallen dramatically to the point where it is now well below the hurdle capitalization rate, meaning that most of the pipeline projects are not worth building. The dashed blue line shows that in a counterfactual experiment in which construction costs follow their pre-pandemic course, return on capital would have remained high and above the hurdle capitalization rate, even though the hurdle capitalization rate has risen as interest rates climbed. In short, the main reason for the decline in Boston's residential construction is that construction costs rose by more than 40 percent from 2019 to 2022. Those costs limit the ability of any tax subsidy to generate significant new construction in Boston.

Rising construction costs mean that housing will become even more expensive. The City of Boston has acknowledged that the current planning and development process needs to be streamlined to decrease development time. There are plans for a major overhaul of the zoning code. The tax subsidy options considered in this report would be implemented using Chapter 121B of the Massachusetts General Laws. Under this provision, each project would have a separate agreement with the city for payment in lieu of taxes (PILOT)). Separate PILOT agreements for each project can add time and costs to the process for negotiation, the drafting of documents, and approvals. If the City of Boston moves forward with a subsidy program, it could develop a 121B PILOT template that contains standard terms for all projects applying for the program, including a standard tax exemption. Streamlining the 121B process would reduce the cost of 121B agreements, reduce negotiation and drafting time, and increase transparency on agreement terms.

Tax subsidies are not the only policy options for encouraging development. There are both small and large actions that could encourage housing production. For example, the permitting fee could be reduced or the due date could be shifted from before construction to before occupancy. The City of Boston could undertake a regulatory overhaul that prioritizes "as of right" zoning so that builders know exactly what can and cannot be built. Eliminating the delays and uncertainty about permitting could encourage projects to enter the BPDA pipeline, although that would do little to encourage construction of projects that have already been approved.

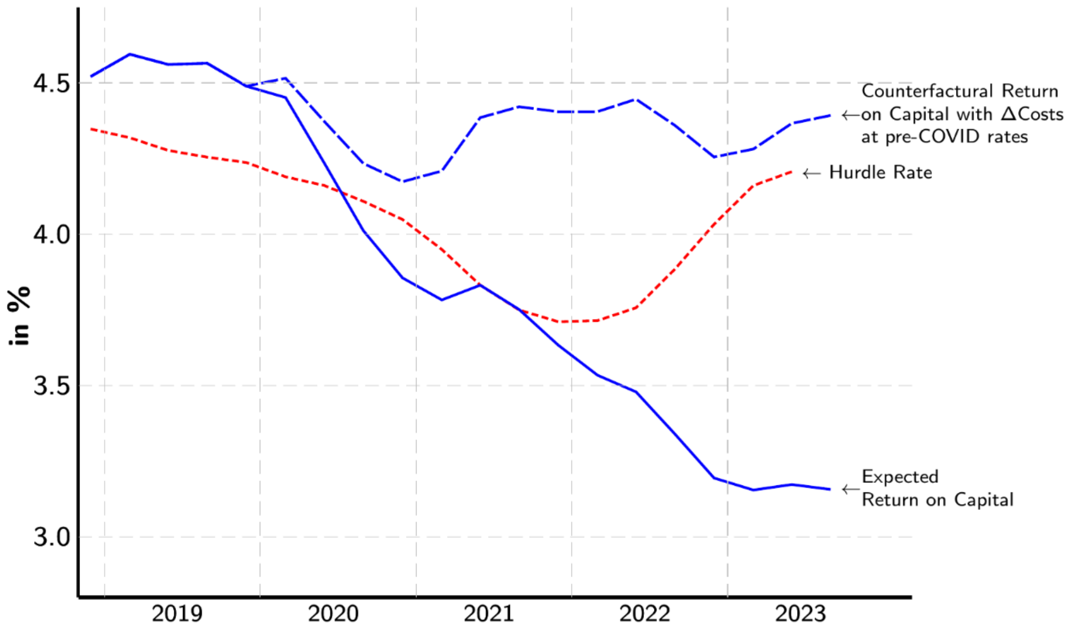

Figure 11. This figure illustrates the sources of temporal variations in expected return on capital based on our data set. The blue line depicts actual returns, while the red dashed line represents the hurdle capitalization rate. As per economic theory, a developer proceeds with a project if return on capital surpasses the hurdle capitalization rate. Up until 2022, return on capital closely aligned with or exceeded the hurdle capitalization rate, but a significant deficit emerged in 2022 and 2023. The blue dashed line shows that had costs counterfactually followed pre-pandemic growth trends, return on capital would have stayed at pre-pandemic levels, highlighting the pivotal role of cost dynamics in the observed deficits.

6. Conclusion

We analyze the impact of real estate tax subsidies on buildings approved by the Boston Planning and Development Agency (BPDA) but not yet built using two different methodologies. Both methodologies highlight that tax subsidies will also flow to projects that would have been built with or without the tax breaks, thus driving up their effective cost. Therefore, the appropriate metric for measuring costs of these subsidies is the cost per *marginal* unit built.

Our estimates of the number of marginal units that would be produced from the current BPDA pipeline with tax subsidies that last 29 or 15 years range from 71 to 1,266 depending on the scenario considered and the generosity of the policy. The most cost-effective subsidy policies investigated are capped per-unit tax credits, which limit the subsidy to luxury buildings that would otherwise have the highest subsidy cost per marginal unit if subsidies were uncapped. The estimated cost of $5,000 and $2,500 capped tax credits for 15 or 29 years are roughly $167,000 to $345,000 per unit depending on the scenario and methods used. These capped tax credits would create fewer units than an unrestricted tax abatement would, but they are more cost effective.

We find that smaller per-unit tax credits are not much more cost effective because, in many cases, smaller credits produce fewer marginal units relative to the stock of units that would be produced without any credits. A subsidy that is too small can be more wasteful than one that is large.

Nonetheless, the estimated cost per marginal unit of each tax subsidy option considered in this report is large. Boston officials will have to weigh the social value of the new marginal units produced against the forgone taxes resulting from the subsidies.

These policies are not a silver bullet. At the current levels of construction costs and interest rates even a full tax abatement in perpetuity could not unfreeze the entire pipeline. Real estate tax breaks can only be so large and thus can provide only a limited incentive to developers in the face of other significant headwinds.

There is considerable uncertainty about the impact of any policy. The actual cost per unit may be lower, but it also may be higher. The macroeconomic environment and interest rates are uncertain; construction costs, rents, and land prices are hard to forecast; and there is considerable uncertainty about how much building would occur absent a policy. In our view, despite this uncertainty, this report captures a reasonable range of potential costs and potential additional units created by the tax abatement options considered.

Boston's construction situation is in a difficult place. The long-run health of the city requires a serious attempt to implement reforms that can make building easier and bring construction costs down. The tax subsidies considered in this report may offer some short-term relief but certainly will not solve the larger problem.

Appendix

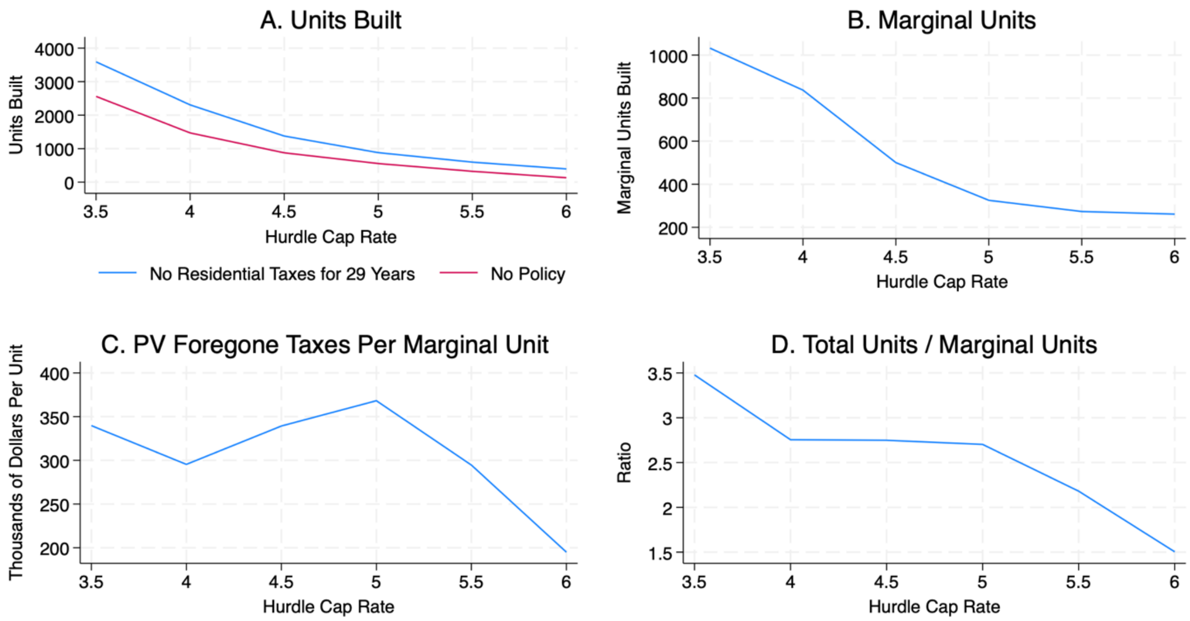

Figure A-1. This figure shows results for a full residential property tax abatement for 29 years with smoothing. The panels show the number of units built, the number of marginal units, the present value of foregone taxes per marginal unit, and the ratio of total units to marginal units built for hurdle capitalization rates from 3.5% to 6%. This figure includes an adjustment to 17% IDP.

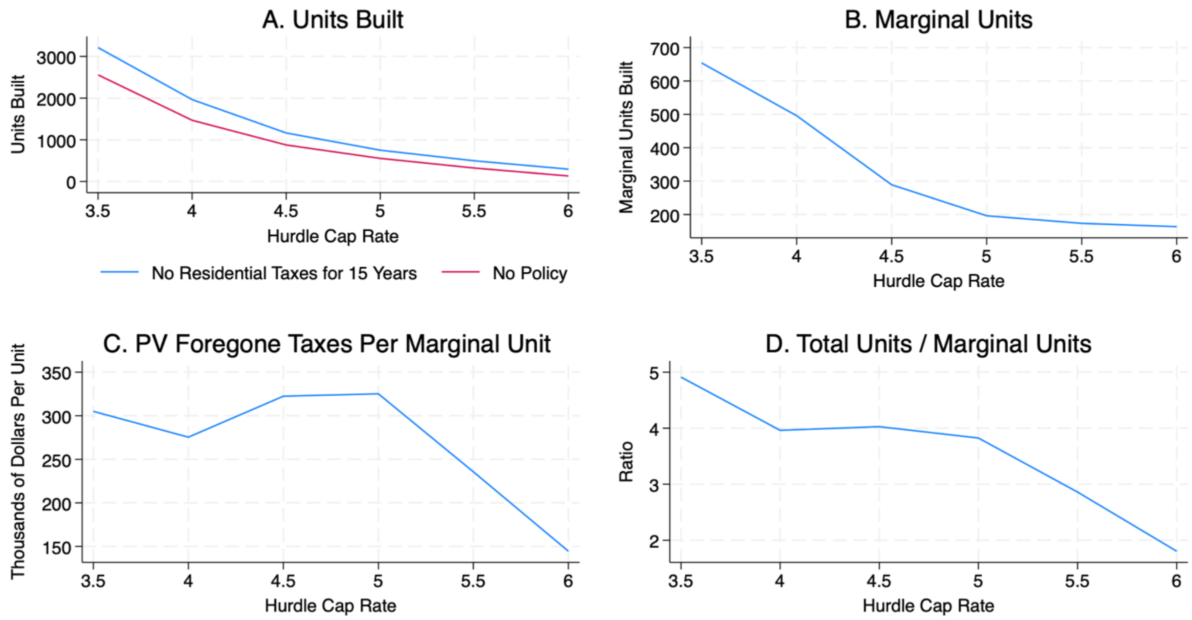

Figure A-2. This figure shows results for a full residential property tax abatement for 15 years with smoothing. The panels show the number of units built, the number of marginal units, the present value of foregone taxes per marginal unit, and the ratio of total units to marginal units for hurdle capitalization rates from 3.5% to 6%. This figure includes an adjustment to 17% IDP.

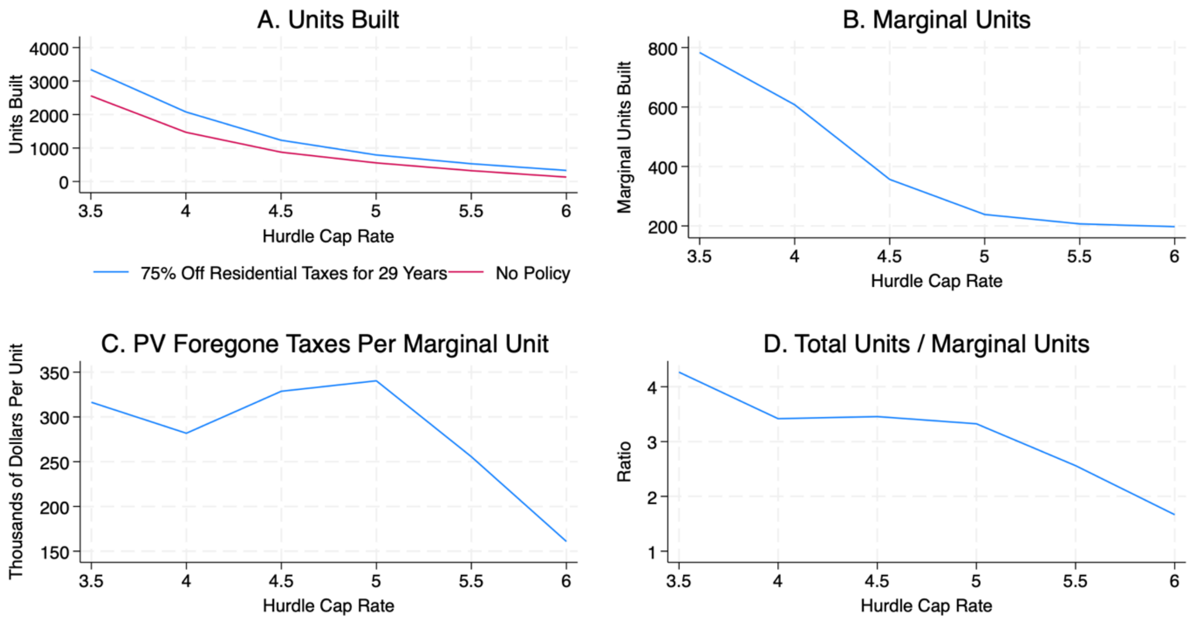

Figure A-3. This figure shows results for a 75% residential property tax abatement for 29 years with smoothing. The panels show the number of units built, the number of marginal units, the present value of foregone taxes per marginal unit, and the ratio of total units to marginal units built for hurdle capitalization rates from 3.5% to 6%. This figure includes an adjustment to 17% IDP.

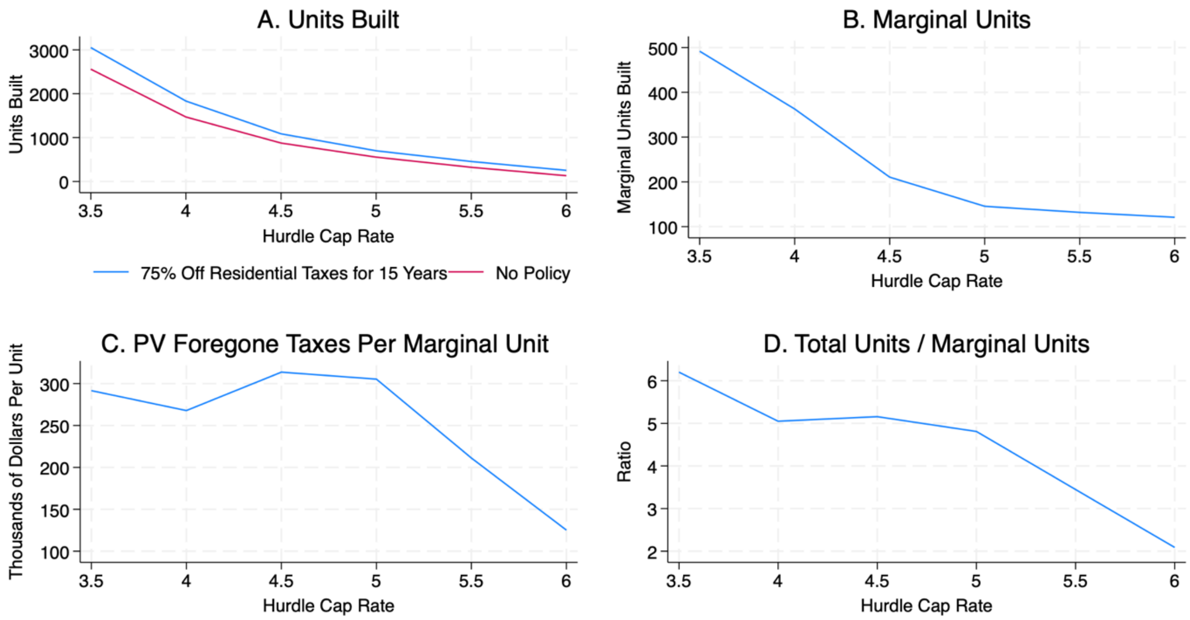

Figure A-4. This figure shows results for a 75% residential property tax abatement for 15 years with smoothing. The panels show the number of units built, the number of marginal units, the present value of foregone taxes per marginal unit, and the ratio of total units to marginal units built for hurdle capitalization rates from 3.5% to 6%. This figure includes an adjustment to 17% IDP.

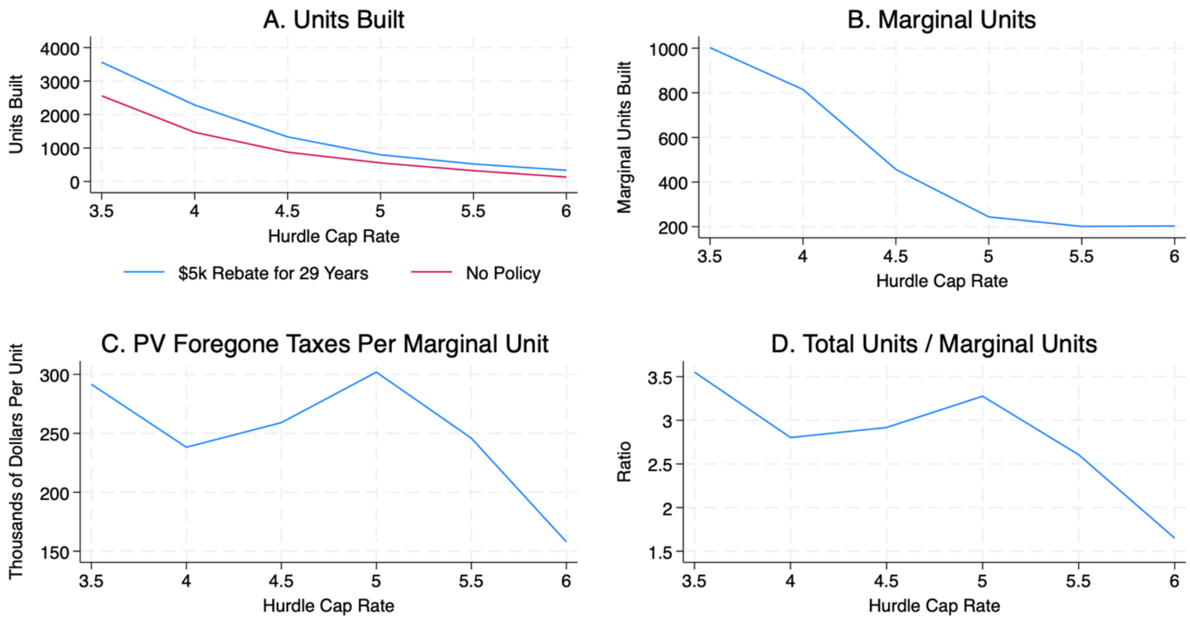

Figure A-5. This figure shows results for a $5,000 tax abatement per unit for 29 years with smoothing. The panels show the number of units built, the number of marginal units, the present value of foregone taxes per marginal unit, and the ratio of total units to marginal units built for hurdle capitalization rates from 3.5% to 6%. This figure includes an adjustment to 17% IDP.

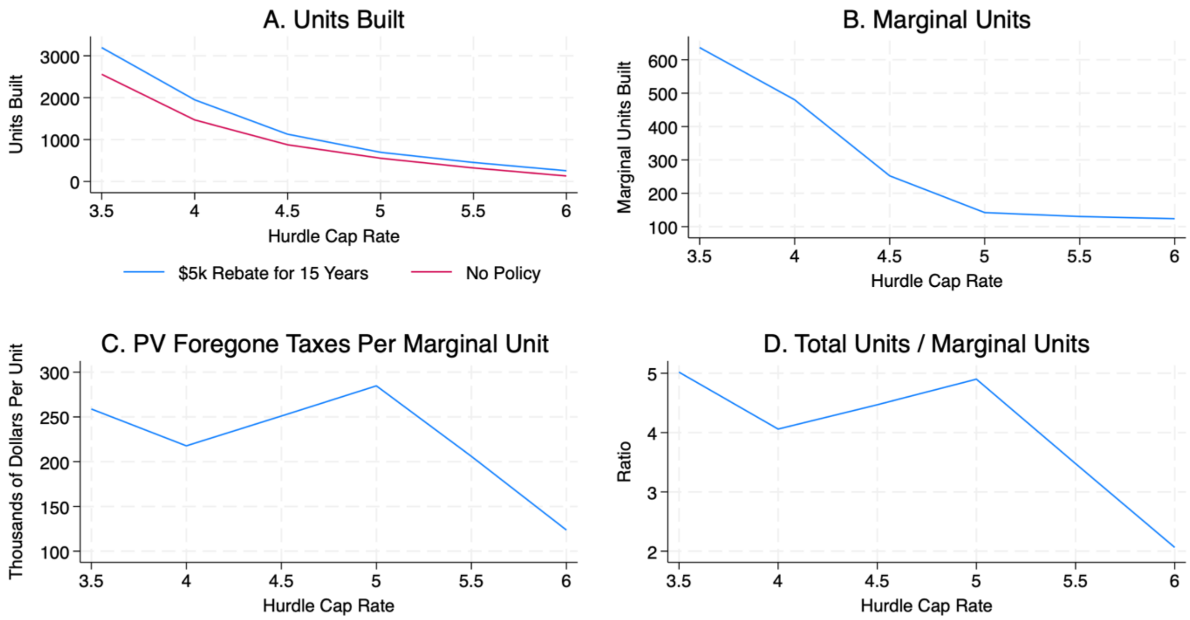

Figure A-6. This figure shows results for a $5,000 tax abatement per unit for 15 years with smoothing. The panels show the number of units built, the number of marginal units, the present value of foregone taxes per marginal unit, and the ratio of total units to marginal units built for hurdle capitalization rates from 3.5% to 6%. This figure includes an adjustment to 17% IDP.

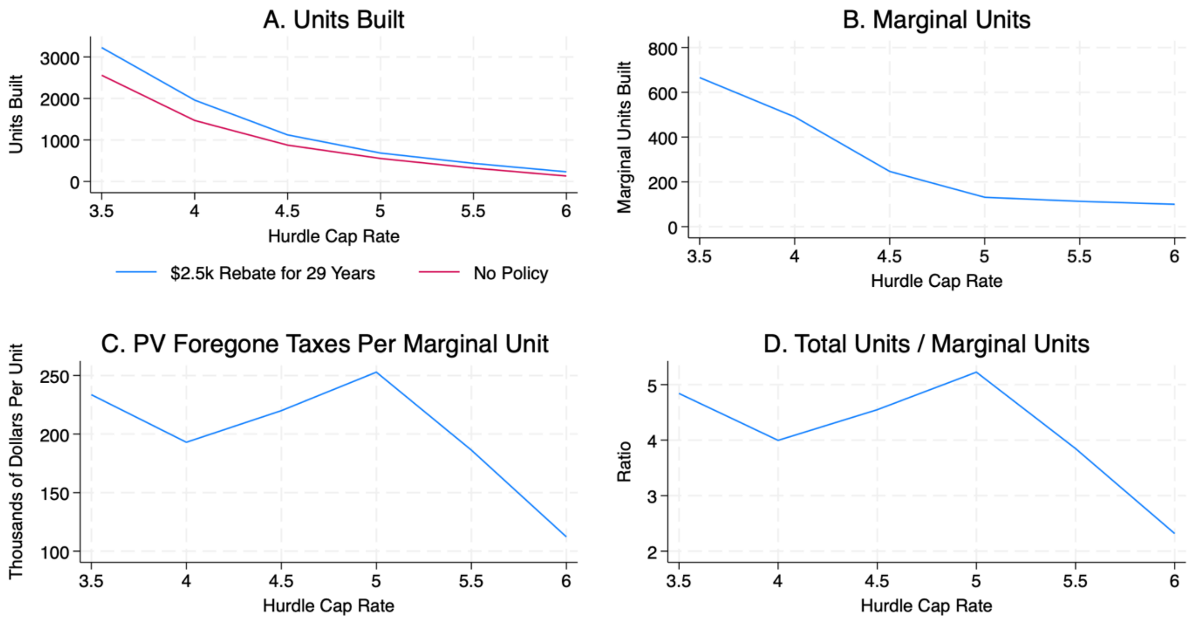

Figure A-7. This figure shows results for a $2,500 tax abatement per units for 29 years with smoothing. The panels show the number of units built, the number of marginal units, the present value of foregone taxes per marginal unit, and the ratio of total units to marginal units built for hurdle capitalization rates from 3.5% to 6%. This figure includes an adjustment to 17% IDP.

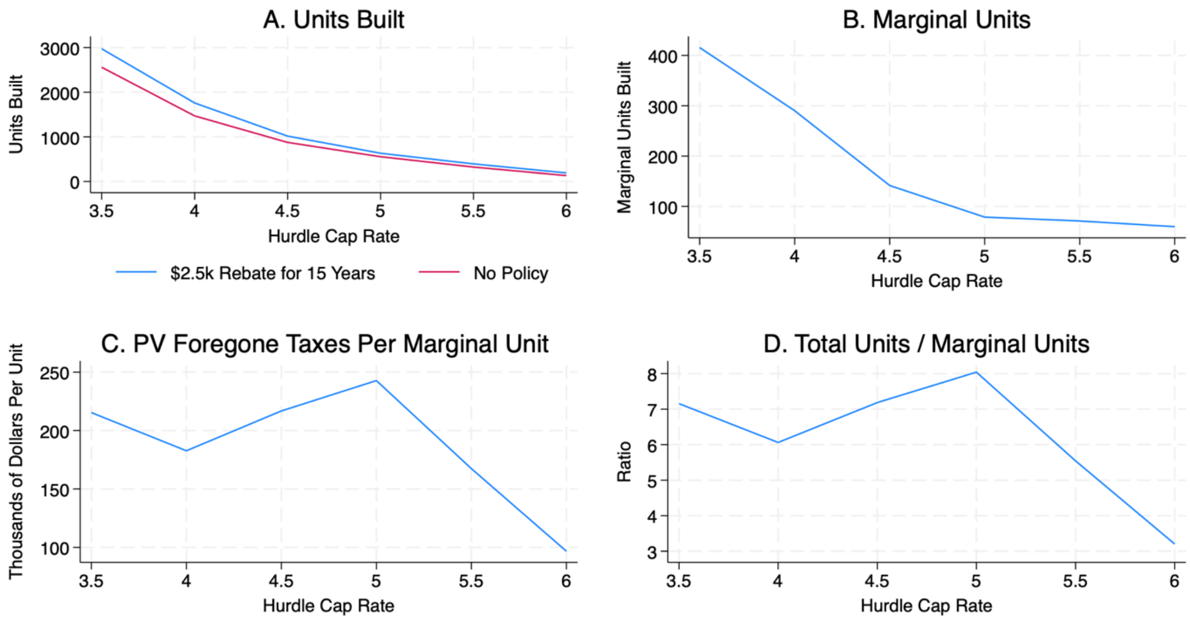

Figure A-8. This figure shows results for a $2,500 tax abatement per unit for 15 years with smoothing. The panels show the number of units built, the number of marginal units, the present value of foregone taxes per marginal unit, and the ratio of total units to marginal units built for hurdle capitalization rates from 3.5% to 6%. This figure includes an adjustment to 17% IDP.