Effects of Transit-Oriented Incentive Programs: Evidence from Los Angeles

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May 10, 2025

Abstract

This paper examines the effects of transit-oriented development incentives on multifamily housing development, using the implementation of Los Angeles's Transit-Oriented Communities (TOC) incentive program as a natural experiment. Introduced in 2017, TOC streamlined the entitlement process for and granted density bonuses to qualifying projects near major transit stops. Using novel, project-level data covering applications, approvals, and permits from 2004 to 2023, I document a sharp increase in development proposals following the program's rollout. However, this increase in applications did not translate into a rise in the rate of new housing supply. The program did shift the composition of new development: TOC projects were more likely to include income-restricted units and be located in lower-income, renter-occupied neighborhoods. Using a structural framework and estimated approval probabilities, I show that TOC enabled projects that would have faced lower approval chances or higher appeal risk under the previous discretionary regime. These findings highlight how procedural streamlining can shift the type and location of urban development, even if aggregate supply effects are limited.

*Stephanie Kestelman: skestelman@g.harvard.edu. I am grateful to my advisors Edward Glaeser, Gabriel Kreindler, Jesse Shapiro, and Winnie van Dijk for their guidance and support. I would also like to thank Lindsey Currier, Rebecca Diamond, Denise DiPasquale, Isaac Dulin, Jamie Gracie, Claudia Goldin, Ingrid Gould Ellen, Jessie Handbury, Brian Higgins, John Eric Humphries, Adam Guren, Myrto Kalouptsidi, Larry Katz, Ben Keys, Ross Mattheis, Abigail Ostriker, Namrata Narain, Rachel Pomeranz, Chris Redfearn, Peleg Samuels, Daniel Waldinger, and participants of the NYU Furman Center Summer Series, the Harvard Labor/Public Workshop, and the Harvard IO Workshop for valuable feedback. I am grateful for financial support from the John R. Meyer Dissertation Fellowship from the Joint Center for Housing Studies, the Chae Family Fund, and the Kenneth C. Griffin Economics Research Fund. Thank you to Jonathan Chiu, Matthew Glesne, and Roy Samaan at the LA Department of Planning for their help with institutional details and data access. Michael Pham and Lydia Qin provided excellent research assistance. All errors are my own.

1 Introduction

High housing costs in major U.S. cities have drawn attention to the regulatory constraints that limit new residential construction. In response, local governments have increasingly turned to policy tools that aim to ease such constraints, including accessory dwelling unit (ADU) allowances, zoning code reforms, and incentive programs tied to public benefits. Among these, transit-oriented development (TOD) incentives—designed to encourage dense housing near public transit—have gained prominence.

This paper studies the impacts of one such policy: Los Angeles's Transit-Oriented Communities (TOC) Incentive Program. Implemented in 2017 following voter approval of Measure JJJ, TOC shifted many multifamily housing developments from discretionary to ministerial approval, altering the approval timeline and probability for projects near major transit stops. Using a novel dataset that links entitlement applications, permits, and parcel-level characteristics, I examine how the shift from discretionary review to rule-based approval affected the quantity, type, and timing of new housing development.

Three key findings emerge. First, the TOC program led to a sharp increase in the number of housing project applications, reflecting the reduced friction of the new approval process. Second, despite this surge in applications, the program had no economically significant impact on aggregate housing supply. Using a border difference-in-differences research design, I estimate that TOC increased the rate of growth in the housing stock by 0.04 percentage points, or 562.01 housing units over 6 years. TOC nearly doubled the number of units proposed on average each year, but had no observable effect on the number of units permitted. Finally, the composition of development changed: built projects were more likely to have some units set aside for low-income tenants. Given the null effect on supply, I interpret this as the policy increasing the number of income-restricted units by decreasing the number of market-rate units. Projects permitted after TOC were also more likely to be located in areas with higher predicted opposition, suggesting that the program enabled projects previously unlikely to succeed under discretionary review.

These results underscore a barrier to increasing housing supply. While easing regulatory barriers like discretionary review can shift where and what kind of housing gets built, enabling more affordable units and development in lower-income, higher-opposition areas, such changes may not expand the overall housing supply. In the case of TOC, the streamlining of approvals increased proposals and affordability, but not the total number of permitted units.

This paper contributes to several strands of urban and real estate economics, particularly research on housing supply restrictions, upzoning, inclusionary zoning, and transit-oriented development (TOD). A substantial body of work has documented how regulatory constraints, such as restrictive zoning and discretionary approval processes, limit housing supply and drive up prices, especially in high-demand, coastal US cities

(Glaeser and Gyourko, 2002, 2018). Studies using tools like the Wharton Residential Land Use Regulation Index (WRLURI) show that cities with more complex permitting systems tend to produce less housing (Gyourko, Saiz and Summers, 2008; Gyourko and Molloy, 2015; Saiz, 2010). In response, many jurisdictions have turned to upzoning to allow denser development. Still, recent empirical findings are mixed: while some reforms increase land values or construction in specific areas (Gyourko, Hartley and Krimmel, 2021; Peng, 2023; Greenaway-McGrevy and Phillips, 2023; Büchler and Lutz, 2024), others show that impacts depend heavily on local implementation and political dynamics (Anagol, Ferreira and Rexer, 2023). Freemark (2020) discusses why upzoning might have mixed results in terms of housing production. Krimmel and Wang (2023) finds that permitting activity fell after the city mandated mixed-income units in projects requesting deviations from the zoning code.

This paper also adds to the literature studying policies that allow greater height or more units without formally rezoning land. Examples of such programs include Los Angeles's TOC, Massachusetts's 40B and MBTA Communities initiatives, and California's HOME Act. Manville, Monkkonen, Gray and Phillips (2023) provides early evidence that Los Angeles's TOC program reduced time to build, illustrating the potential of ministerial pathways to facilitate development. Unlike traditional upzoning, TOC functionally enabled higher-density development by removing key discretionary barriers. Similar to Chatman and Noland (2014) and Bhatt (2024), I find modest effects on housing construction. The TOC program shifted development toward larger and more politically contentious proposals, similar to the Massachusetts 40B projects described by Blanco and Sportiche (2024).

Finally, the paper sheds new light on the impacts of inclusionary zoning requirements by analyzing a program that conditioned density incentives on providing affordable housing. While some studies suggest that such requirements reduce feasibility and uptake (Schuetz, Meltzer and Been, 2011; Been, Ellen and O'Regan, 2019; Mukhija, Boeing, Mattiuzzi and Monkkonen, 2022), I find high rates of TOC take-up on aggregate. The TOC incentives decreased development costs enough to offset the lower revenue stream due to income-restricted units, in line with value-capture frameworks similar to those in Kim (2020). By linking project-level entitlement, permitting, and location data, this paper offers insight into how the approval process, including the administrative costs, opportunity cost of time, and approval uncertainty, changes, what gets proposed, where, and when.

The paper is organized as follows. Section 2 describes my data, institutional setting, and the Transit-Oriented Communities incentive program. Section 3 estimates the impacts of the program on new housing supply. Section 4 discusses whether projects induced by the Transit-Oriented Communities program are observably different from projects approved after discretionary review, and estimates the impact of these projects on nearby property sales. Section 5 concludes.

2 Data and Institutional Setting

Los Angeles is one of the least affordable cities in the United States. Sixty-three percent of Los Angeles residents are renters, with 73 percent of renter households being rent-burdened and 48 percent being severely rent-burdened (Rosen, Angst, Gregorio and Painter, 2020). Moreover, much of the city's new multifamily housing stock requires discretionary approval.

2.1 Data

I construct a linked dataset of project applications, permits, parcel characteristics, and prices. I use these novel linked data to document new facts about real estate development in Los Angeles and to estimate the role of discretion in land use decisions.

Project applications I collected a novel dataset comprising the universe of entitlement applications filed with the Los Angeles City Planning Department between 2004 and 2023. For each application, I observe which body reviewed and decided the case, the application reason (e.g., zoning variance, change of use, density bonus, general plan amendment, Site Plan Review), when the application was filed, whether the case required a public hearing, when the case was decide, and what was the decision.

I measure characteristics of the proposed project, such as whether the application is for multifamily residential and the number of units proposed, using two free-text fields where the applicant can describe the project and the nature of the request. I use a supervised NLP approach, applying a large language model (OpenAI GPT-4o-mini) fine-tuned on labeled LA Planning Department data, to extract unit counts and project characteristics from free-text fields. I trained the model using data created by the LA Planning Department after 2015 to comply with the California Housing Element. The "labeled" dataset lists the number of multifamily, single-family, and income-restricted units, as well as non-residential square footage proposed in a given application. I then group applications into a project-level dataset. I link applications with the same parent case ID, the same appeal ID, the same applicant ID, and with a similar project description. I measure the total time to a decision using the first application date and the final decision date if a decision has been made. A project is "approved" if the final decision is approved. If a third party appeals the project, and the appeal is rejected, I assume the project was approved. I include withdrawn and terminated projects since the decision to withdraw or terminate an application is likely endogenous to whether the project will be approved.

I also observe the minutes from the Planning Commission or Zoning Board hearings for a subset of applications. Until 2020, the City of Los Angeles would record all Commission and Zoning Board meetings. Each audio file discusses one project, so I am able to match the minutes to the application in question. I transcribed the audio files using AutoModelForSpeechSeq2Seq, a pre-trained model in the Python transformers library

(Vaswani, Shazeer, Parmar, Uszkoreit, Jones, Gomez, Kaiser and Polosukhin, 2017; Radford, Kim, Xu, Brockman, McLeavey and Sutskever, 2022). I then decompose the transcripts into sentences using the sent_tokenize function in the nltk Python package. I use zero-shot classification to determine if the sentence discusses any of the following topics: parking, neighborhood change (including gentrification), economic activity, and nuisance (i.e., traffic, noise, pollution, homelessness). If a sentence mentions any of the topics above, conduct polarity analysis using TextBlob's blob.sentiment.polarity package. Finally, I leverage the fact that every meeting participant must introduce themselves to the Commission in order to count the number of people speaking on a particular application.

I focus on applications to build multifamily housing with three or more units. I exclude applications proposing small lot subdivisions or condo conversions.

Permits I compile permit data from the City of Los Angeles Department of Building and Safety. I use the timing of the permit and the parcel number to link grading, demolition, building, and electrical permits. These four types of permits together cover the life cycle of a project. I exclude permits for small alterations and additions, and new development permits that do not add residential units. I restrict my analysis to building permits that add multifamily housing units. I use the work description to measure whether the permitted project has income-restricted units, including whether the project is 100% affordable.

I link the applications and permits using the parcel ID (assessor parcel number), timing of the application and permit, and project characteristics. Since projects can take over three years to be approved, I restrict the merged applications-permits sample to permits issued after 2009. Permits that do not merge to an entitlement are those that were entitled by right, or whose entitlement was approved before 2004. Entitlements that do not link to a permit correspond to projects that have not yet been permitted.

Land use and parcel characteristics Using data from the LA County Assessor, I construct a parcel-level panel dataset that allows me to track land use between 2006 and 2024. The assessor rolls contain property-level information on use and characteristics at the time of assessment. Moreover, it contains parcels that were merged or split during this period. I overlay the LA County Assessor maps to the LA City parcel map to identify properties in the same parcel in the same year (e.g., condominiums), and to identify changes in parcel shape. I use recorded land use to identify broad use (e.g., residential, commercial, industrial), as well as more specific use (e.g., single-family, duplex, store, office, parking). I observe the number of residential units, the number of stories, the number of buildings, and the construction and improvement years. I determine a parcel to be "mixed-use" if the parcel has residential and non-residential uses in a given year (e.g., commercial storefronts in the first floor of an apartment building). I calculate the number of residential units, building age, number of stories,

as well as parcel uses at the time of assessment.

Zoning I map all parcels to the LA Zoning map to determine each parcel's zoning class, height district, and supplemental use district. I then translate those districts and classes into allowed use, maximum Floor-to-Area ratio (FAR), minimum lot size, minimum area per dwelling unit, and minimum parking per dwelling unit. I measure each parcel's area and calculate the maximum number of units as parcel area times FAR, divided by the minimum area per dwelling unit.

Additional variables I measure each parcel's distance to the nearest transit stop using data from Open Street Maps. I also map parcels to 2000 and 2010 Census tracts, neighborhoods (as defined by the LA Times), and City Council districts.

2.2 Real estate development in Los Angeles

Land use in Los Angeles, similar to many cities in the US, is regulated by a zoning code. The zoning code determines what is allowed in a given plot of land (a "parcel"), from the type of use (e.g., residential), to the density allowed (e.g., low density), to the maximum height and required number of parking spaces per bedroom. When a proposed real estate development project fits the standards and regulations stipulated under the zoning code for a given parcel, then that project is considered "by right." Some projects that comply with the zoning code may require additional review to demonstrate compliance with other regulations and guidelines. These types of projects require "ministerial" approval. Finally, if a project proposal does not comply with the zoning code, or if its proposed size or use triggers additional review from City Planning, then the project is deemed "discretionary."[1]

The process to approve differs across by-right, ministerial, and discretionary entitlement applications. By-right and ministerial approval projects are guaranteed approval, as long as they comply with the zoning code and additional guidelines. To secure a building permit for a by-right project, the applicant needs only to submit a building application to the LA Department of Building and Safety (LADBS). Once all relevant departments have signed off on the construction plans, LADBS issues a building permit. Projects requiring ministerial or discretionary approvals face an additional step relative to by-right projects. Here, the applicant files a ministerial entitlement application with the City Planning Department. If the proposed project complies with the zoning code and additional guidelines, then the entitlement application is approved. Once a project is approved, the applicant may submit a building application to LADBS. Both by-right and ministerial approvals can be obtained at the City Planning Department's public counter. In general, neither entitlement type requires review under the California Environmental Quality Act (CEQA), and decisions are not subject to appeals.

[1] Appendix C summarizes LA's entitlement process and compares it to other large US cities.

Figure 1A describes the steps associated with by-right and ministerial review.

All other proposed projects file a discretionary entitlement application. As noted on the City Planning department's website, "[t]hese entitlement requests must undergo [...] formal review to determine if the project is appropriate and suitable for the proposed site". Figure 1B summarizes the review process. During the formal review process, an assigned planner prepares a report that contains City Planning's assessment of the proposed project. Additionally, projects may undergo environmental review under the California Environmental Quality Act (CEQA).[2] The Planning Commission in charge must hold at least one public hearing where the public can share feedback on the proposed project. Property owners and tenants within 300 feet of the proposal's site must be notified of the public hearing with at least 30 days' notice.[3] Once the review is complete, the Planning Commission, Director of Planning, or Zoning Board issues a Letter of Determination granting the entitlement or not. Individuals or organizations can appeal approvals to the City Council, and can sue the city and the applicant to overturn the decision. Absent appeals or lawsuits, the project is now entitled, and the applicant can request building permits from LADBS.

Potential applicants may discuss their plans with city planners before applying for review. These pre-application discussions may influence the size and design of the proposed project and may discourage developers from applying altogether.

In Los Angeles, larger developments that meet the zoning code may still be subject to discretionary review. Site Plan Review (SPR) was designed to assess the impacts of larger developments on the local community and urban environment. SPR is required for multifamily and mixed-use developments that result in a net increase of 50 or more dwelling units and/or guest rooms, or in a net increase of 50,000 gross square feet of non-residential floor area. Even if the parcel allows 50 or more units by right, SPR is required.[4]. As described in Gabriel and Kung (2025), SPR delays approval by 96.6 days on average. Depending on the size of the proposed project, SPR can trigger additional public hearings and environmental review.

2.3 Transit-Oriented Communities Incentive Program

The Transit-Oriented Communities (TOC) Incentive Program aims to increase the supply of housing near public transit. The program was created following the passage of ballot Measure JJJ by Los Angeles voters in November 2016. Measure JJJ requires that many projects seeking discretionary entitlements 1) include a set percentage of affordable housing or pay a fee to an affordable housing trust fund; and 2) meet prevail-

[2]Information on how CEQA applies to discretionary land use applications can be found here (accessed on September 27, 2023).

[3]See the Department of Planning's hearings page. During the formal review process, the applicant may host public forums to discuss the project with the neighbors and gather feedback.

[4]LA City Planning describes the review process in detail on their website here, here, and here (accessed on September 27, 2023)

ing wage and labor standards in their construction (e.g., hire union labor). Notably, while the ballot measure focused primarily on labor standards and affordable housing requirements, the TOC provisions–designed to encourage dense, affordable housing near public transit–were a secondary element.[5]

Program design and implementation The design of the TOC guidelines only took place after Measure JJJ was approved and involved limited public input. Although the Department of City Planning conducted outreach to stakeholders, including neighborhood councils, business groups, and development professionals, the process was not structured to solicit broad-based community feedback. The draft guidelines were released in March 2017 and formally reviewed by the City Planning Commission (CPC) in May of that year. Comments from the CPC were largely favorable, and the guidelines were finalized shortly thereafter. Importantly, the guidelines did not require approval from the Los Angeles City Council, streamlining their adoption and implementation.

TOC combines two key regulatory changes. First, the program offered development incentives to projects that set aside a portion of units for low-income households. These incentives include density bonuses, reductions in required parking, and additional modifications to floor area ratio (FAR), building height, and setbacks. The extent of the incentives depends both on the parcel's distance from transit, the type of transit that determines eligibility, and on the number of units set aside as income-restricted, as well as the income restriction. Mixed-income buildings set aside 8-25% of units to households earning 30-80% of Area Median Income, as determined by the Department of Housing and Urban Development (HUD). 100% income-restricted (often referred to as 100% affordable) were exempt from providing parking.

Second, TOC increases the threshold for Site Plan Review (SPR), a review process designed to assess the impacts of larger developments on the local community and urban environment. Before TOC, SPR was required for multifamily and mixed-use developments that resulted in a net increase of 50 or more dwelling units. After TOC, qualifying projects only trigger SPR if the project would result in an increase of 50 or more dwelling units, absent the density bonus.

Eligibility for the TOC incentive depends on proximity to public transit. A parcel is eligible for TOC if any part of the parcel lies within .5 miles of a major transit stop. Developers seeking to take advantage of the program must undergo a tier verification process to confirm that their site meets the eligibility criteria. Major transit stops include intersections of bus lines with average peak headways of 15 minutes or less, combinations of rapid and regular bus lines, intersections of two rapid bus lines, as well as Metrolink and Metro Rail stations. The most generous density incentives were

[5]Ballot Measure JJJ read: *Shall an ordinance: 1) requiring that certain residential development projects provide for affordable housing and comply with prevailing wage, local hiring and other labor standards; 2) requiring the City to assess the impacts of community plan changes on affordable housing and local jobs; 3) creating an affordable housing incentive program for developments near major transit stops; and 4) making other changes; be adopted?*

granted at intersections involving multiple Metro Rail lines or a combination of Metro Rail and rapid bus lines. Major transit stops change when certain bus routes become more or less frequent, and when a new metro stop opens. I define a "Major Transit Area" as the union of all half-mile-radius buffers around major transit stops, with each Major Transit Area constructed to be spatially disjoint from others (Figure 2).

Not all parcels in Major Transit Areas are eligible for TOC incentives. Importantly, the program only affects lots whose zoning allowed multifamily housing. Lots zoned for single-family, high-density commercial, or intensive industrial were not affected by the program. Moreover, only projects with five or more units can utilize TOC incentives.

Summary statistics Table 1 compares parcels within the TOC eligibility zone to all parcels in LA. Those closer to major transit stops are more likely to be zoned for multifamily residential (37.8 percent), allow slightly higher Floor-to-Area ratio (FAR) in construction, and are more likely to have commercial use.

3 Impact of Transit-Oriented Communities on housing supply

In this section, I leverage entitlement applications data and building permit data to study the impact of TOC on the supply of multifamily housing in Los Angeles.

3.1 Observational evidence

TOC increased the number of multifamily projects proposed and approved, but did not observably change the aggregate supply of new multifamily housing in Los Angeles. Figure 3A plots the number of projects proposed, approved, permitted, and completed in LA in each quarter between 2004 and 2023. The number of projects proposed increased from an average of 54.7 projects per quarter in the years before TOC to 195.6 projects per quarter after TOC. However, the number of projects permitted per quarter increased from 53 to 62.1 projects. Figure 3B shows that TOC also did not significantly affect the number of new multifamily units proposed or permitted. Before the TOC guidelines were issued, LA was permitting an average of 2278 units per quarter. After the incentive program was implemented, the average number of units increased slightly to 2656 units per quarter.

3.2 Reduced form evidence

Research design I estimate the causal effect of TOC on housing supply using a calipered border difference-in-differences design. Difference-in-difference recovers the treatment effect of TOC under the standard assumptions of (i) parallel trends and (ii) no spillovers from treatment onto the control units (i.e., no SUTVA violations). The

border design only requires that the parallel trends assumption hold for geographically close areas. Appendix Figure A.2 shows that parcels near the border of Major Transit Areas (MTAs) were similar before the implementation of TOC.

The no-spillovers assumption implies that changes in application and permitting behavior among treated parcels do not affect outcomes in the control group. Control areas are likely to experience negative spillovers on applications and permits. Developers may shift projects from control areas to treated areas if TOC makes it easier to build in treated areas. Moreover, local residents and city planners may be less likely to approve projects proposed in control areas, arguing that the same project could be built in treated areas. I consider specifications that increase the caliper around the border, which are likely less substitutable with treated parcels. Future work will address additional concerns about spillovers with regression specifications that exclude control units within .25 miles of the MTA border.

Empirical strategy and data The sample of parcels used in the analysis is constructed as follows. First, I measure each parcel i's distance to Major Transit Area j's boundary, $dist_{ij}$. A parcel is inside an MTA if any part of the parcel is within the MTA's boundaries. Parcels not intersecting any MTAs were never treated and are mapped to all MTAs located within a one-mile radius. I then segment the MTA boundaries into 2-mile segments, which allows me to compare parcels in close geographic proximity. A treated parcel can only be assigned to one MTA boundary segment j_k, but a never-treated parcel can be mapped to multiple boundary segments $\{j_k, ..., j'_{k'}\}$. For each parcel i and boundary segment j_k, I measure distance to the border $dist_{ijk}$. I restrict the main analysis sample to parcels within .5 miles (2640 feet) of the segment border. Appendix A.3 plots results for different calipers.

First, I estimate the impact of TOC on housing stock. I leverage the 2006-2023 assessor files to observe the number of units per parcel-year. I add up the number of units on each side of the border for each MTA segment-by-year pair. I exclude MTA boundary segments with fewer than 50 parcels within 1 mile of the border on either side. I also exclude segments with no parcels further than .25 miles (1320 feet). The estimating equation is

$$\begin{aligned} Y_{jkt} =& \alpha_{jk} D_{jk} + \sum_{t=2011}^{2015} \beta_t D_{jk} 1\{Year = t\} + \sum_{t=2017}^{2023} \beta_t D_{jk} 1\{Year = t\} \\ &+ \eta_t + \psi_{jk} + \nu_{jkt} \end{aligned} \tag{1}$$

where η_t are year fixed effects, ψ_{jk} are MTA segment fixed effects, and $D_{jk} = 1$ for the treated size of the border. α_{jk} allows the pre-treatment difference between the treated and control sides to vary across MTA segments. I cluster standard errors ν_{jkt} at the MTA level j to allow for spatial autocorrelation across segments near the same major transit stops.

I also estimate the impact of TOC on applications and permits. I calculate the

daily number of units and projects, both proposed and permitted, in the treatment and control sides of each MTA segment. I then estimate the following equation:

$$Y_{jkt} = \alpha_{jk} D_{jk} + \sum_{t=-8}^{-2} \beta_t D_{jk} 1\{relt = t\} + \sum_{t=0}^{6} \beta_t D_{jk} 1\{relt = t\} + \eta_t + \psi_{jk} + \nu_{jkt} \quad (2)$$

where $relt$ measures years since TOC went into effect on September 22, 2017. I can construct a more precise relative measure of time since I observe filing dates for all applications, as well as permit issuance dates for all multifamily permits issued in Los Angeles, and so can precisely observe applications and permits before and after the policy.

Results TOC had a relatively small impact on housing supply. Figure 4 plots the estimates for equation 1 when the outcome variable is the total number of residential units. The housing stock on the treated side of the border increased by 33.54 units between 2017 and 2023, over a baseline mean of 1654.80 units (2.02% increase, p.val.<0.01). For comparison, LA's housing stock grew by 27,218 units between 2010 and 2016, over a baseline of 1,372,033 in 2010 (1.98% increase).

Figure 5 estimates the impact of TOC on units proposed and units permitted using equation 2, and shows a similar fact: TOC increased the number of units proposed by an average of 27.585 per year (p.val.<0.01), but did not have a statistically measurable effect on the number of units permitted.

TOC increased the flow of income-restricted affordable housing units, though results are noisy and the parallel trends assumption does not hold in every period. Figure 6 estimates the impact of TOC on the number of units in mixed-income (panel A) or 100% income-restricted projects (panel B). TOC increased the number of units in mixed-income buildings by 2.725 per year, from a baseline of 1.539 (p.val.<0.05). This finding differs from Krimmel and Wang (2023), which finds that Seattle's upzoning policy, which required that units be set aside for low-income tenants, decreased new construction. Panel B estimates that TOC had no statistically significant effect on the number of units in 100% income-restricted buildings. Since TOC had no impact on aggregate housing supply, the effect on the supply of income-restricted units can be attributed to a change in the composition of the new supply.

3.3 Discussion

Why did TOC not produce more housing units in aggregate? Figure 7 shows that a large share of units permitted between 2017 and 2023 took up TOC incentives. By the end of 2023, projects using TOC incentives comprised nearly 15 percent of all units permitted between 2004 and 2023, which suggests that the muted supply effects of TOC were not due to low take-up.

The lack of effect is not explained by the effect of Measure JJJ on multifamily development. As described in Section 2.3, Measure JJJ requires that projects seeking general plan amendments or certain zone changes across LA 1) include a set percentage of affordable housing or pay a fee to an affordable housing trust fund; and 2) meet prevailing wage and labor standards in their construction. Each of these requirements increases the cost of developing discretionary real estate projects. Projects using TOC base incentives, however, were not subject to the JJJ requirements.

It is possible that TOC would have increased aggregate supply, had it not been for the COVID-19 lockdowns and the rise in interest rates in 2022. Real estate development faces up-front costs and gestation lags, particularly in Los Angeles and California more broadly. Before a project can be permitted, the developer must at the very least acquire the land and design the project. These pre-construction steps may happen before or after the entitlement has been approved, but they cannot be skipped altogether. Between 2004 and 2016, it took the median project 440 days to receive the building permit once the entitlement application had been approved. If developers filed TOC applications on September 22, 2017 (i.e., the day the TOC guidelines were issued) and applications were approved immediately, then we would observe projects being permitted in late 2018 and early 2019. In reality, 95 percent of TOC applications were filed after March 6, 2018, and 75 percent were filed after February 15, 2019, suggesting that developers needed time to understand the new policy landscape and devise projects. The projects proposed in February 2019 would have faced the decision to permit after March 2020, and might have decided to wait for lockdowns to end or for the federal eviction moratorium to be lifted. Projects approved in 2021 and seeking construction loans in 2022 were no longer profitable due to the higher cost of credit. Table 2 compares projects permitted versus not yet permitted as of 2024. "Not yet permitted" projects were proposed a few months later than permitted projects, on average, suggesting that timing may have played a role in determining the impact of the program.

The timing issue described above was likely exacerbated by TOC's effect on the quality of applications. TOC simplified the approval process for qualifying projects and reduced approval time (Manville, Monkkonen, Gray and Phillips, 2023; Gabriel and Kung, 2025). Applications required fewer documents and plans after TOC than they would have required before. As a consequence, many projects whose applications were submitted were at an earlier stage of the development process. For instance, more applications were submitted with shorter project descriptions or without mention of the number of units proposed (Figure 8). Additionally, "not yet permitted" applications were more likely to have been submitted to confirm TOC eligibility and determine which incentives apply (i.e., applications for "Tier verification"). Table 2 calculates that 42.4 percent of "not yet permitted" applications were for tier verifications, versus 32.2 percent of permitted applications. Tier verifications only require a location, so developers can apply without having a building size, let alone a site plan. If TOC ap-

plications reflect projects at an earlier stage of the development process, then the time between application approval and permit issuance might be larger, further affecting the number of projects deciding whether to build during the COVID-19 pandemic, or after interest rates started to rise.

It is also likely that TOC had no effect on aggregate supply due to the design of the program. Projects proposing to add 50 or more units at baseline (i.e., without density bonus) were still subject to Site Plan Review. Most projects were likely inframarginal to the higher SPR threshold. Moreover, it is possible that the income threshold for affordable units was too low. When deciding whether to build, developers consider the trade-off between lost revenue due to income-restricted units and potential revenue from having more market-rate units. It is possible that the never-built projects would have required rents that were too high in order for the project to be weakly profitable.

4 Impact of Transit-Oriented Communities on housing quality

The previous section showed that TOC did not increase the number of buildings permitted or the average number of units in each building. TOC did shift units from market-rate to income-restricted, which indicates that the incentive program affected the types or locations of units supplied.

TOC streamlined the review process and guaranteed approval for select projects. Units can only be permitted if they are proposed and approved. In this section, I investigate whether the TOC program increased the supply of units that might not have been proposed or approved before the program was implemented.

4.1 Conceptual framework

Suppose the zoning code prescribes a maximum allowable level of a project characteristic, denoted $\bar{x}$, for each location i. Location i is characterized by $\mathbf{z}_i = (z_{i1}, z_{i' \in B(i)})$, which includes parcel use and size z_{i1}, and the use of all parcels i' in the neighborhood $B(i)$. Each location contains a set of incumbent residents–neighbors who live in the neighborhood of $B(i)$–and outsiders, who include all other city residents, potential in-migrants, and future residents.

An absentee developer is randomly matched with a parcel and a proposed project with characteristics x. The developer must decide whether to pursue the project. If $x \leq \bar{x}$, the project qualifies for by-right approval. If $x > \bar{x}$, the project can only proceed following discretionary review and approval. Developers also retain the option to exit without building.

Each actor in the model derives a net payoff from the project. Let $U(x, \mathbf{z}_i)$ denote the utility to outsiders, ε the utility (or disutility) to incumbents, and π the net private return to the developer. We assume that $\varepsilon \sim F(\varepsilon; x, \mathbf{z}_i)$ is private information, with F a

smooth distribution with finite variance, support on $\mathbb{R}$ and $\partial F(\varepsilon; x, \mathbf{z}_i)/\partial x \leq 0$. Assume for simplicity that developers' returns are proportional to the value they generate for outsiders: $\pi(x, \mathbf{z}_i) = \theta U(x, \mathbf{z}_i)$, where $\theta > 0$.

The social value of a project is the sum of incumbent and outsider utility:

$$W(x, \mathbf{z}_i) = U(x, \mathbf{z}_i) + \varepsilon$$

First-Best Allocation In a first-best world with no frictions, a project x is approved if $W(x, \mathbf{z}_i) \geq 0$. This outcome requires full information about both $U(x, \mathbf{z}_i)$ and ε and the ability to coordinate decisions across all agents (Figure 10A).

If there are no subsidies or transfers to developers, some socially valuable projects x will not be built (Figure 10B). Development profits must be non-negative for developers to participate, i.e., $\pi(x, \mathbf{z}_i) \geq 0$. If there are no subsidies or transfers to developers, some socially valuable projects may never be built due to this constraint.

By-Right Approval. Under the by-right regime, a project is approved if $x \leq \bar{x}$ and the developer's payoff is non-negative. This regime removes discretion but may permit projects with $U(x, \mathbf{z}_i) + \varepsilon < 0$, leading to socially suboptimal outcomes (Figure 10C).

Discretionary Approval. Projects that exceed the threshold $\bar{x}$ must go through discretionary review. The adjudicator approves the project if:

$$U(x, \mathbf{z}_i) + \lambda\varepsilon \geq 0,$$

where $\lambda \geq 1$ reflects the adjudicator's weight on incumbent preferences. Developers must also pay a cost c to initiate the discretionary process, and they only proceed if $\pi(x, \mathbf{z}_i) - c \geq 0$. Discretion leads to higher ε among approved projects, but can reduce the number of projects that are profitable (Figure 10D).

When developers decide whether to propose a discretionary project, they consider the probability that the project will be approved. Approval depends on the characteristics of the proposed project x_i and the characteristics of the site where the project was proposed $\mathbf{z}_i$ (including neighbors). Project x is approved according to the following threshold crossing model:

$$1\{U(x, \mathbf{z}_i) + \lambda\varepsilon > 0\}$$

If $\varepsilon \sim F(\varepsilon; x, \mathbf{z}_i)$, then the probability of approval is

$$p_a(x, \mathbf{z}_i) = \mathbb{E}[1\{U(x, \mathbf{z}_i) + \varepsilon > 0\} | (x, \mathbf{z}_i)] = 1 - F(-U(x, \mathbf{z}_i)/\lambda; x, \mathbf{z}_i)$$

This conceptual framework highlights the ways in which discretion can impact the type of housing directly (via approvals) and indirectly (via proposals). Discretion prevents projects of type x that have negative social welfare, and, depending on the

adjudicator's preferences, also prevents some projects that impose costs on incumbents. Discretion also imposes a cost on developers and indirectly affects which discretionary projects are proposed. If the administrative cost c of discretion is low, then discretion should not affect the rate at which projects of type x are proposed in locations of type i. If the adjudicator has the same preferences as the social planner, then discretion should not affect the approval of socially welfare-enhancing projects.

4.2 Estimation of probability of approval

I estimate the probability of approval $p_a(x, \mathbf{z}_i)$ using a sample of discretionary entitlement applications filed between 2004 and 2016, with a first decision issued in 2016 or before. I restrict the sample to projects proposing 3 or more units, or mentioning multifamily housing in the project description. I exclude projects that propose elder or supportive housing units, that propose small lot subdivisions, or that propose conversions into condominiums. Appendix Table B.1 summarizes the data used to estimate $p_a(\cdot)$.

I assume $\varepsilon \sim$ Type 1 EV(σ), so that

$$p_a(x, \bar{z}_i) = \frac{\exp((x, \bar{z}_i)'\beta)}{1 + \exp((x, \bar{z}_i)'\beta)} \tag{3}$$

I estimate β and $\hat{p}_a(x, \bar{z}_i)$ using a LASSO logistic regression model, which imposes an L1 penalty on the coefficient vector. The penalty parameter is selected via 10-fold cross-validation to minimize the out-of-sample deviance. Among the initial set of 123 covariates, LASSO selected 32 predictors with non-zero coefficients.[6] I also conduct this exercise to predict the probability that a case will be appealed. There are two types of appeals. First, applicants can appeal a rejection. Second, third parties can appeal an approval. This second type makes up 94% of appeals in my LASSO estimation sample. I do not observe appeals for projects that are terminated or withdrawn prior to the first decision, i.e., I only observe appeals conditional on the project being denied or approved. I assume that all projects denied or terminated prior to any decision would have been appealed by third parties had those projects been approved. LASSO selected 63 predictors with non-zero coefficients from the same pool of covariates. Appendix Figure B.8 plots the estimated probabilities of approval and appeal among project applications filed between 2004 and 2016. The clear negative

[6]Selected variables: indicators for number of units proposed; indicators for site's Council District; indicator for mixed-use project; indicator for whether the project is mixed-income; indicators for site use in application year (single-family, condominium, industrial, duplex, triplex); zoning in year of application (minimum area per dwelling unit, single-family zoning indicator, medium-density multifamily zoning indicator, high-density multifamily zoning indicator, commercial allowing residential zoning indicator, manufacturing allowing residential zoning indicator); owner-occupied % of housing units in Census tract in 2000, from US Census; % of parcels within 300ft that are duplexes, are residential with 6-13 stories or 14-20 stories, are zoned for low-density residential; % of parcels within 300-1200ft that are commercial, duplexes, zoned for low- or medium density residential, zoned for parking, or zoned for commercial.

correlation between approval and appeal indicates that appeals are an important tool in preventing approval or encouraging applications to be withdrawn. Appendix Figures B.9 and B.10 plot univariate relationships between site and project characteristics, and the estimated probability of approval and appeal.

Appendix Figure B.11 uses comments from public meetings to validate the measures of predicted approval and appeal. More members of the public comment on projects with a lower probability of approval and a higher probability of appeal, indicating that community preferences matter for which projects are ultimately built. Speakers are more likely to mention two sets of concerns: changes in neighborhood character (e.g., neighborhood feel, gentrification, and displacement) and impact on local economic activity, including effects on local jobs and businesses.

4.3 Impact of TOC on probability of approval and appeal

I use the estimated mapping between project and site characteristics $(x, \mathbf{z}_i)$ and probability of approval $\hat{p}_a(x, \mathbf{z}_i)$ to calculate the probability of approval for TOC projects, had they been proposed under the previous discretionary regime. I similarly calculate the predicted probability of appeal. Following the zoning code, I assume that projects proposing 50 or more units require site plan review.

Figure 11 plots the distribution of probability of approval (panel A) and probability of appeal (panel B) for projects permitted before and after the TOC guidelines went into effect. The distribution of probability of approval is nearly identical for projects permitted before and after TOC (Figure 11A). However, the average predicted probability of appeal is slightly higher for projects permitted after the TOC guidelines were issued (Figure 11B).

Table 4 tests whether the distributions plotted in Figure 11 are different. Permits issued after TOC were 0.03 percentage points less likely to be approved and 0.06 percentage points more likely to be appealed, relative to permits issued on or before September 22, 2017 (p.val<.05). Permits that utilized TOC incentives were similar to the average permit issued after September 22, 2017. Still, the t-test is noisier to due the smaller sample size.

The small difference in the probability of appeal is due to differences in project characteristics and project site. Table 3 compares projects permitted on or before September 22, 2017, to those permitted after the TOC guidelines were issued. As discussed in Section 3, projects permitted after TOC were more likely to be mixed-income. Post-TOC projects – particularly those that utilized TOC incentives – were also more likely to build over 50 units, thus requiring Site Plan Review. Compared to permits issued before TOC, TOC permits were more likely to be issued in neighborhoods with more renters, more households with children, lower median household income, and lower rent. As shown in Appendix Figures B.9 and B.10, these project and location characteristics are associated with a higher probability of appeal.

5 Conclusion

The experience of Los Angeles's Transit-Oriented Communities program reveals how land use reform can reshape the supply of urban housing. While the program did not meaningfully increase the total number of permitted multifamily units, it enabled a different kind of development: more income-restricted buildings, often in lower-income neighborhoods with higher expected opposition.

TOC's muted effect on aggregate supply is partly due to timing and partly due to the design of the program. By the time applicants had secured a location and TOC approval, these developers started facing lockdowns, supply chain issues, and rising construction prices and financing costs. The incentives provided by TOC were likely too small to overcome the increase in costs.

Notably, TOC increased the number of project applications, particularly lower-quality ones. Approved entitlements have option value while the incentive program is still in effect. Given the low upfront costs of applying, it is unsurprising that developers would secure some entitlement approval under TOC, even if it expires with the policy in 2026.

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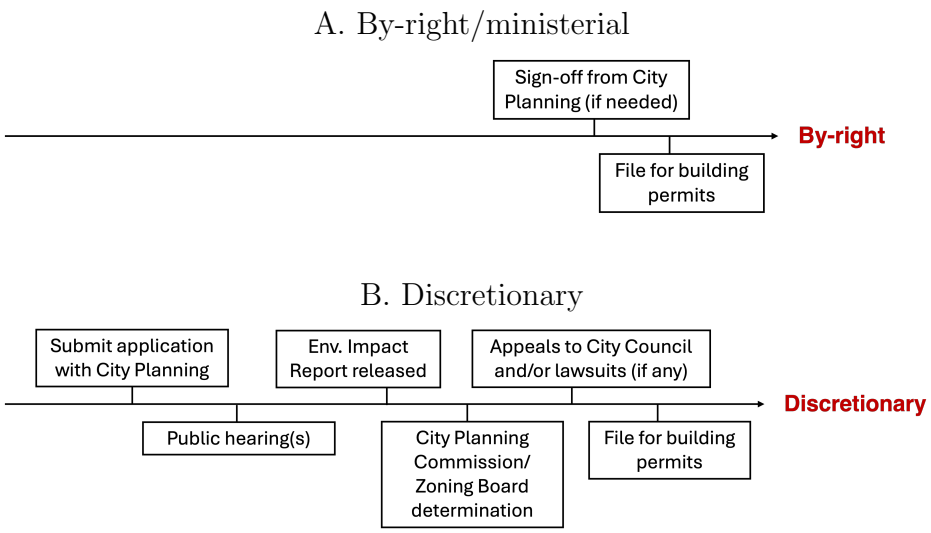
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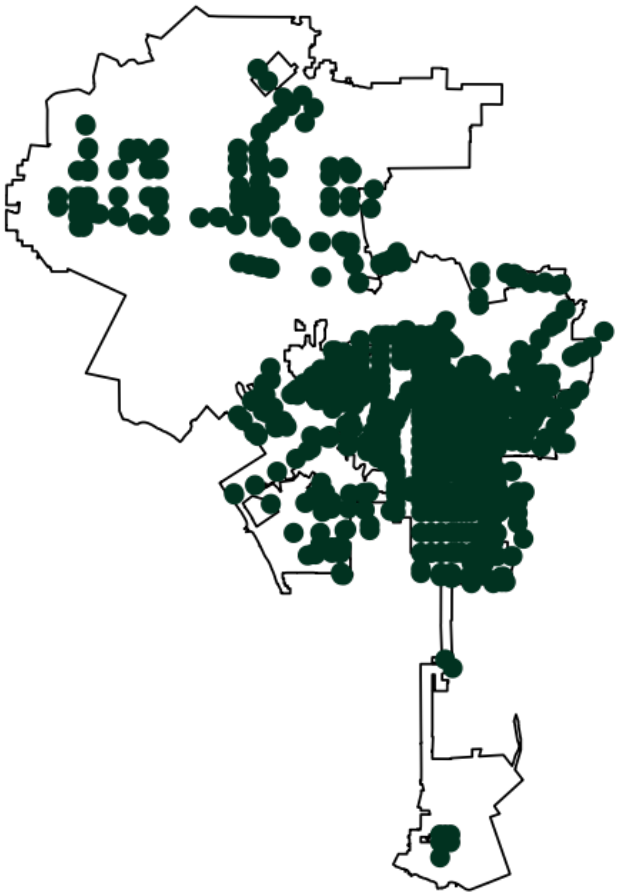
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Figure 1: Review timeline for real estate projects in Los Angeles



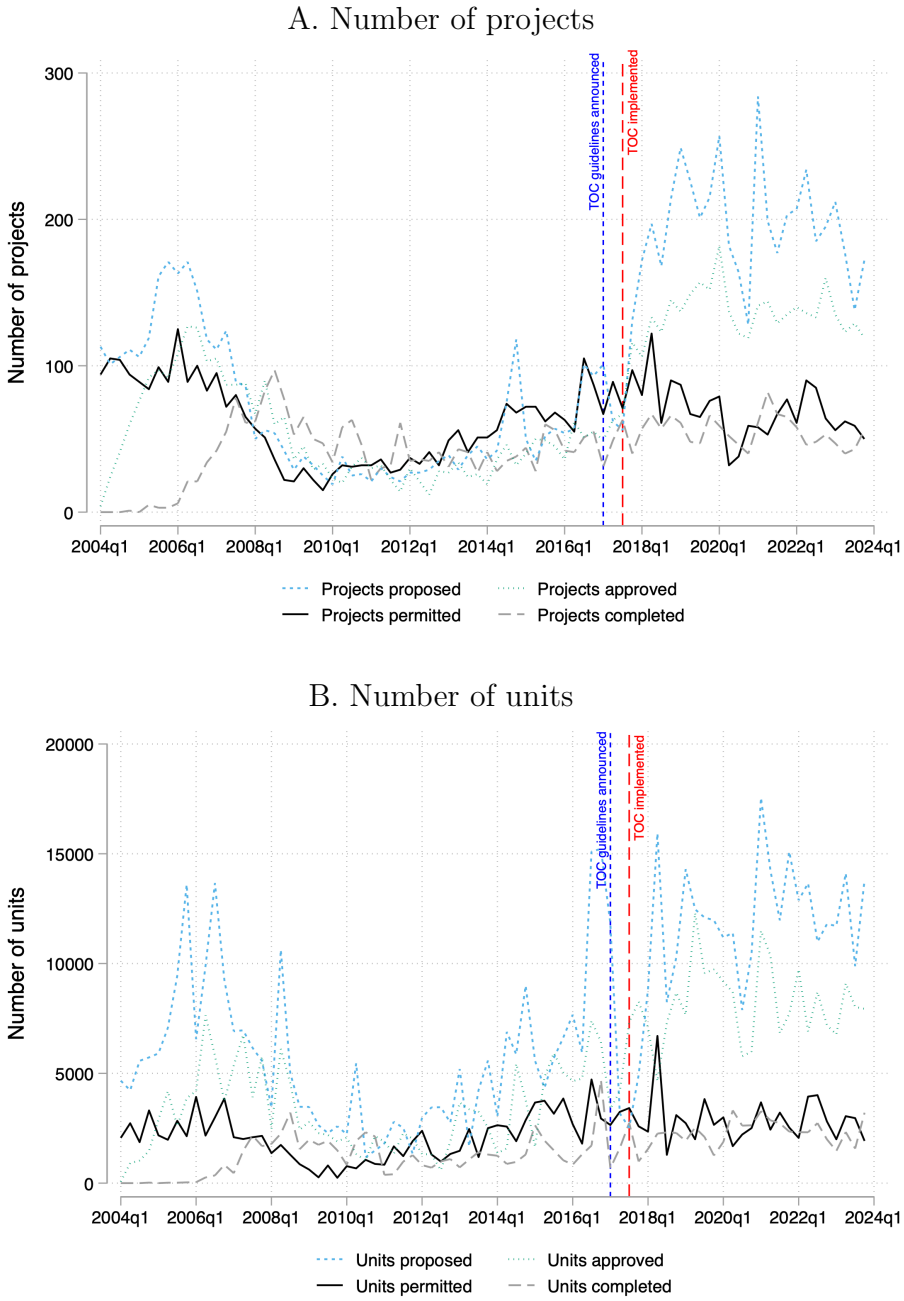
Note: This figure describes the review and approval timeline for real estate development projects proposed in Los Angeles. Panel A describes the timeline for by-right and ministerial applications. Panel B describes the timeline for discretionary applications. Section 2.2 describes the entitlement process in greater detail.

Figure 2: LA Areas within .5 mile of a major transit stop



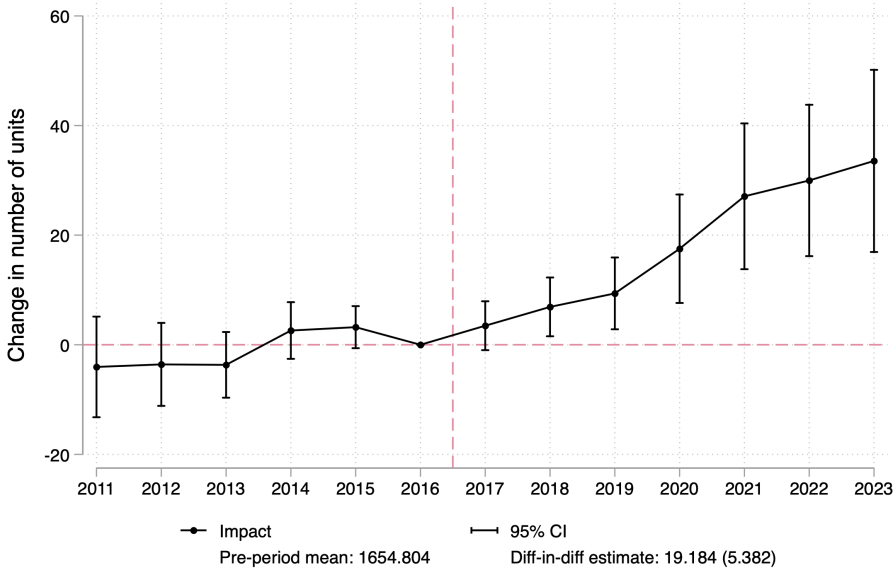
Note: "Major transit stops" include stops at the intersection of bus lines with at least 15 min. average peak headways, intersection of regular + rapid bus stops or two rapid buses, Metrolink stations, and Metro Rail stations. Intersections of two Metro Rail lines, or a Metro Rail line and a rapid bus line, received the largest density incentives. The black line corresponds to the Los Angeles city border.

Figure 3: Flow of new projects and units entitled and permitted, 2004-2023



Notes: This figure plots applications and permits to build multifamily housing in Los Angeles. Proposed projects and units have filed entitlement application(s) in a given quarter. Approved projects and units are proposed projects that were approved by the City Planning Commission, the Zoning Administrator, the Director of Planning, or any of the other reviewers. Permitted projects and units have had a permit issued by the LA Building and Safety Department. Completed projects and units have an issued Certificate of Occupancy. This plot focuses on multifamily projects and permits. I do not observe applications for by-right permits. I identify applications for multifamily projects from the project description and entitlement description in the application. Not all permitted projects require an entitlement application, so the number of applications may be lower than the number of permits. Moreover, if a multifamily project's description contains no mentions of multifamily housing or specific overlays, that project may be excluded from the data. When the number of units proposed is missing from the project description, I impute the number using the maximum number of units allowed by the zoning code. I exclude permits to build new duplexes.

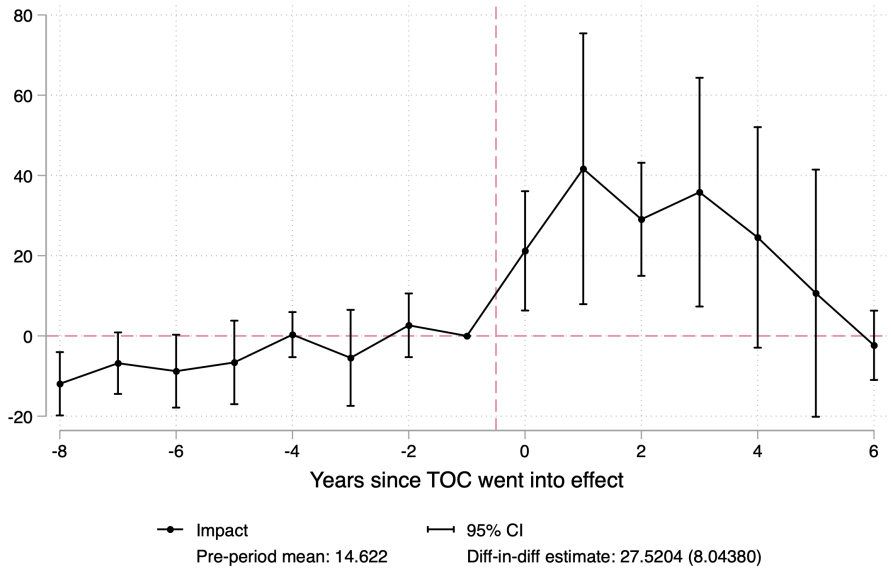
Figure 4: Impact of TOC on housing stock



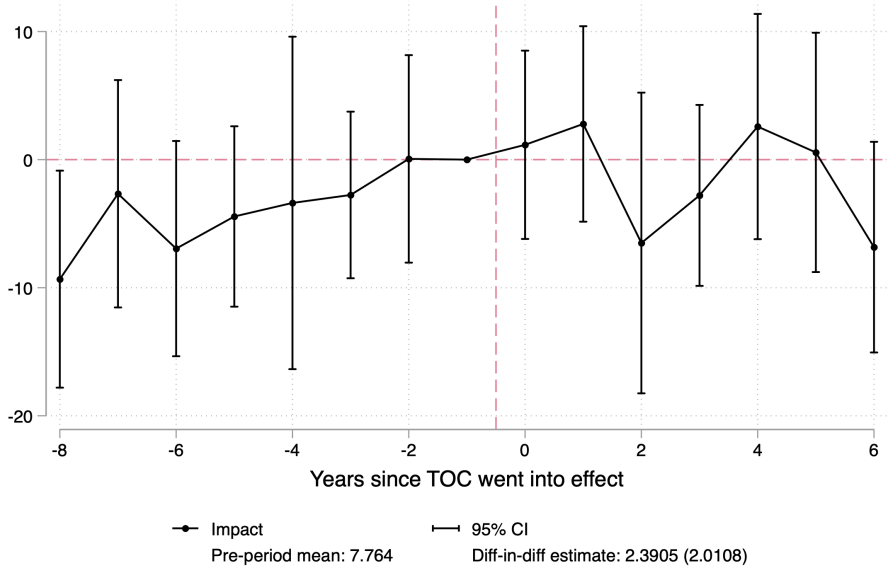
Notes: This figure plots β_t estimates from equation 1. The outcome variable is the total number of residential units, measured at the year-MTA segment-treatment assignment level. Bars correspond to 95% confidence intervals. Standard errors are clustered at the Major Transit Area level.

Figure 5: Impact of TOC on number of units proposed and permitted

A. Units proposed



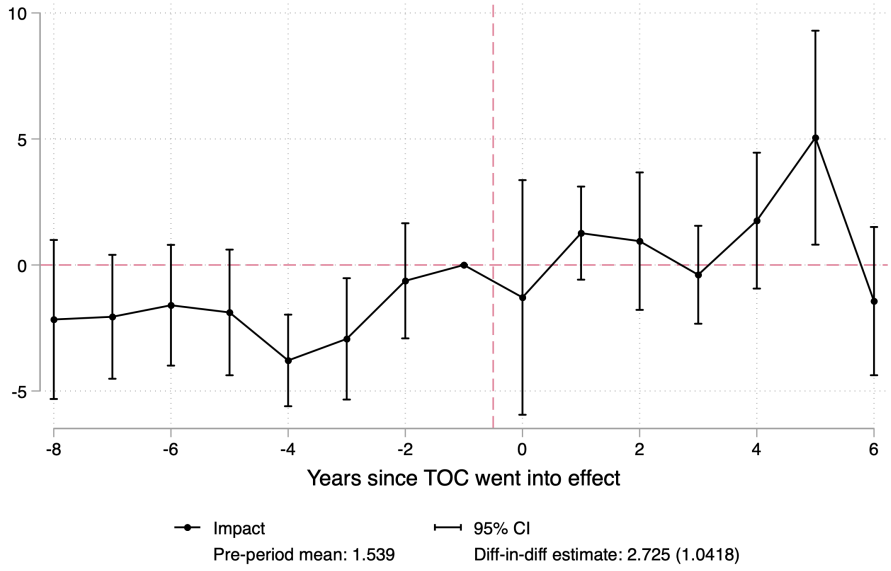
B. Units permitted



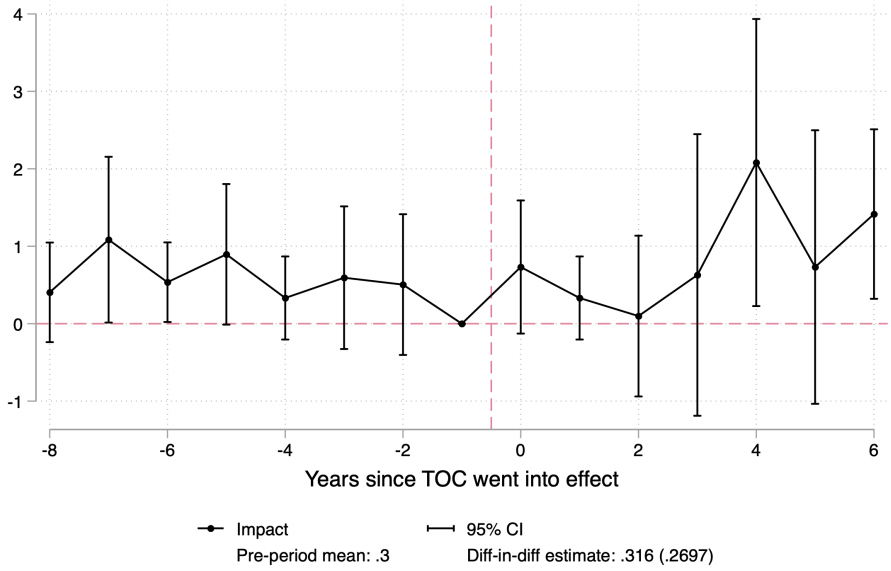
Notes: This figure plots β_t estimates from equation 2. The outcome variable in panel A is the total number of units proposed. The outcome variable in panel B is the total number of units permitted. Both panels measure outcomes at the year-MTA segment-treatment assignment level. Bars correspond to 95% confidence intervals. Standard errors are clustered at the Major Transit Area level.

Figure 6: Impact of TOC on number of units in income-restricted buildings

A. Mixed-income buildings

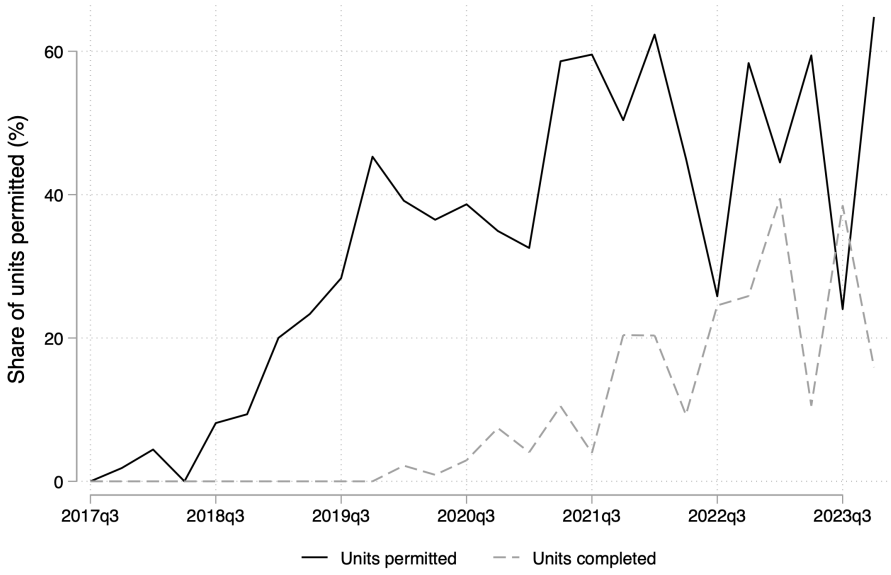


B. 100% income-restricted buildings



Notes: This figure plots β_t estimates from equation 2. The outcome variable in panel A is the total number of units permitted in mixed-income projects. The outcome variable in panel B is the total number of units permitted in 100% income-restricted projects. Both panels measure outcomes at the year-MTA segment-treatment assignment level. Bars correspond to 95% confidence intervals. Standard errors are clustered at the Major Transit Area level.

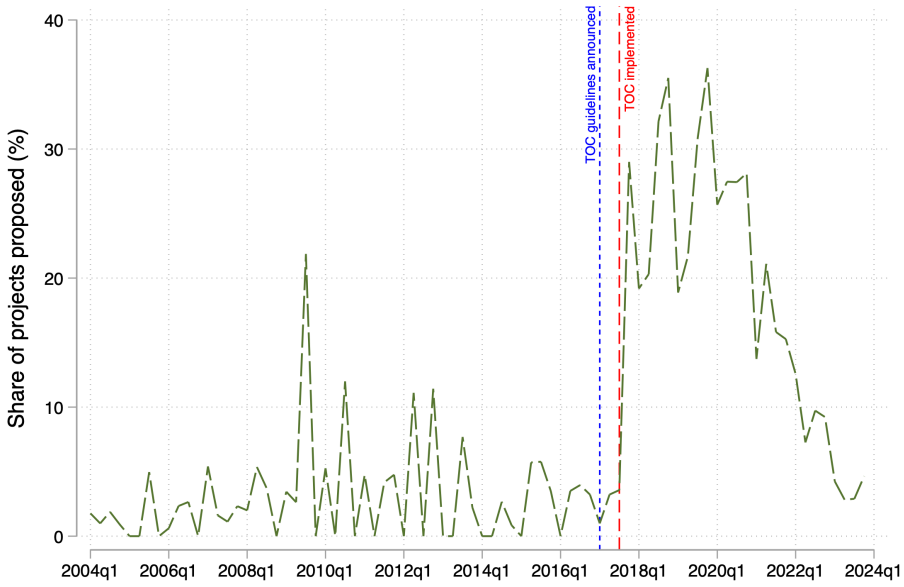
Figure 7: Share of units permitted under TOC



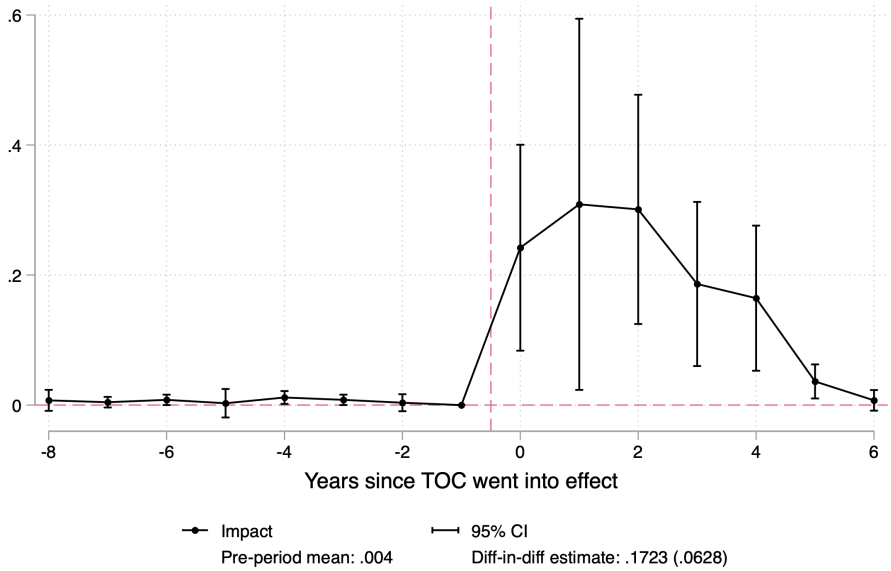
Notes: This figure describes the change in the composition of multifamily projects after the implementation of LA's Transit Oriented Communities incentive program. It plots the share of units permitted and completed that utilized TOC incentives. Permitted projects and units have had a permit issued by the LA Building and Safety Department. Completed projects and units have an issued Certificate of Occupancy.

Figure 8: More applications did not mention a number of units after TOC

A. Share of projects proposed missing info on number of units

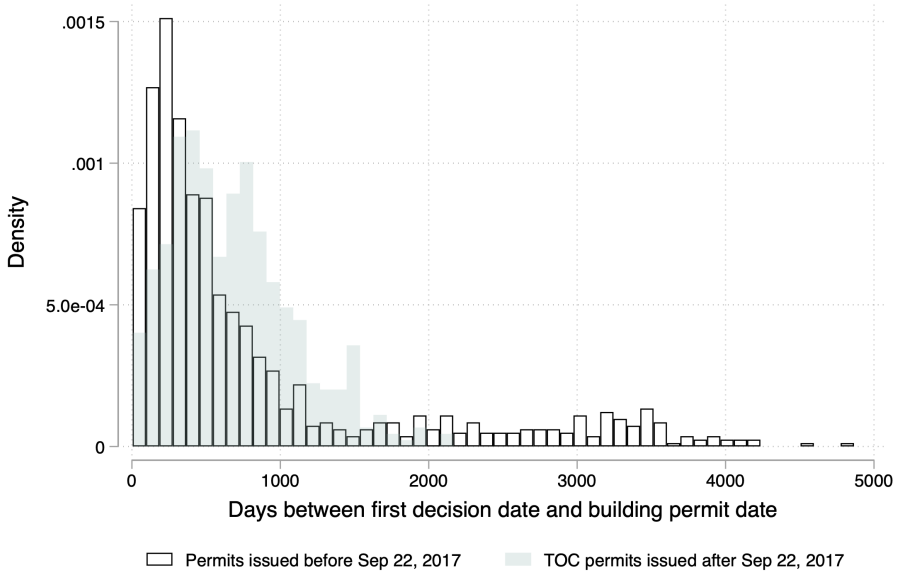


B. Impact on the number of proposed projects missing info on a number of units



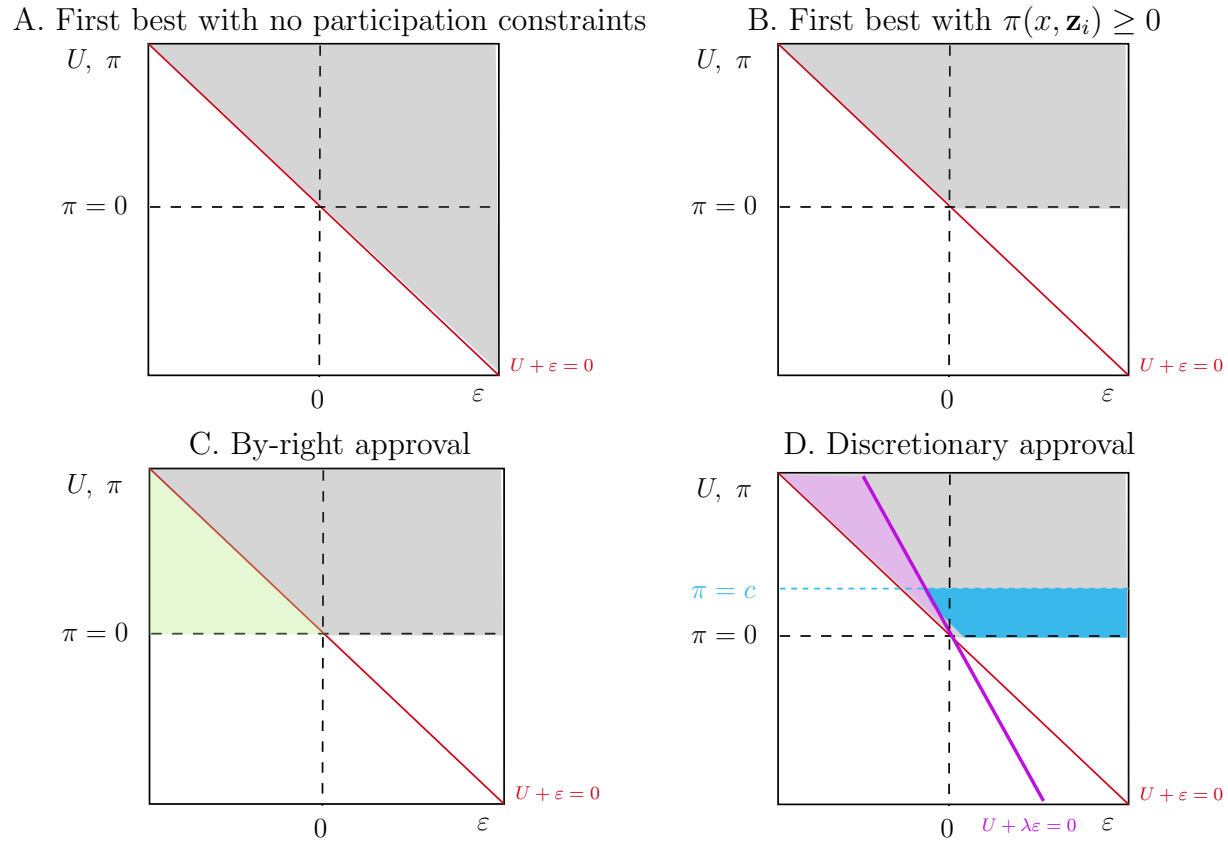
Notes: Panel A plots the share of multifamily projects proposed in each quarter whose project description does not contain information on a number of units proposed. Panel B estimates equation 1

Figure 9: Number of days between first application filing and permit issuance



Notes: This figure plots the distribution of days between the first decision issued on the entitlement application and the date of building permit issuance. Green bars correspond to permitted projects that utilized TOC incentives.

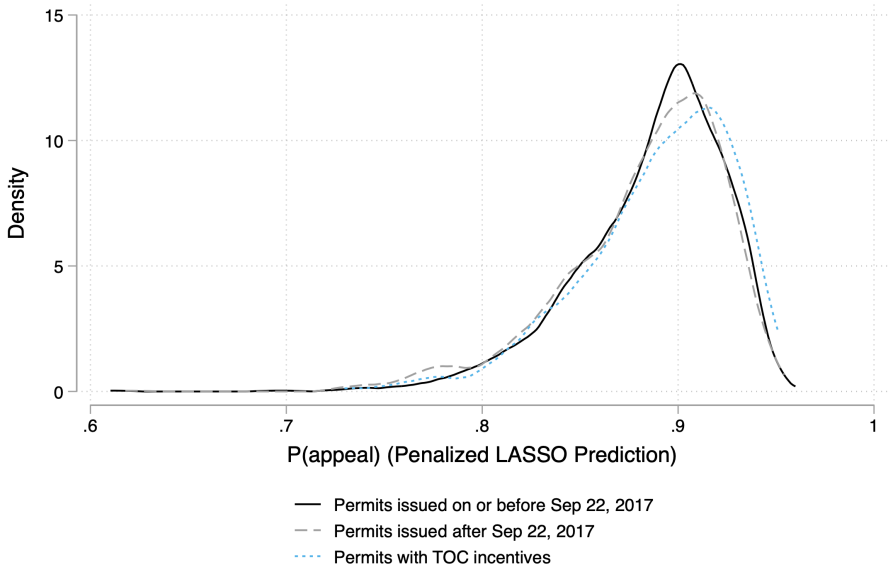
Figure 10: Observed payoffs from project x under alternative approval mechanisms



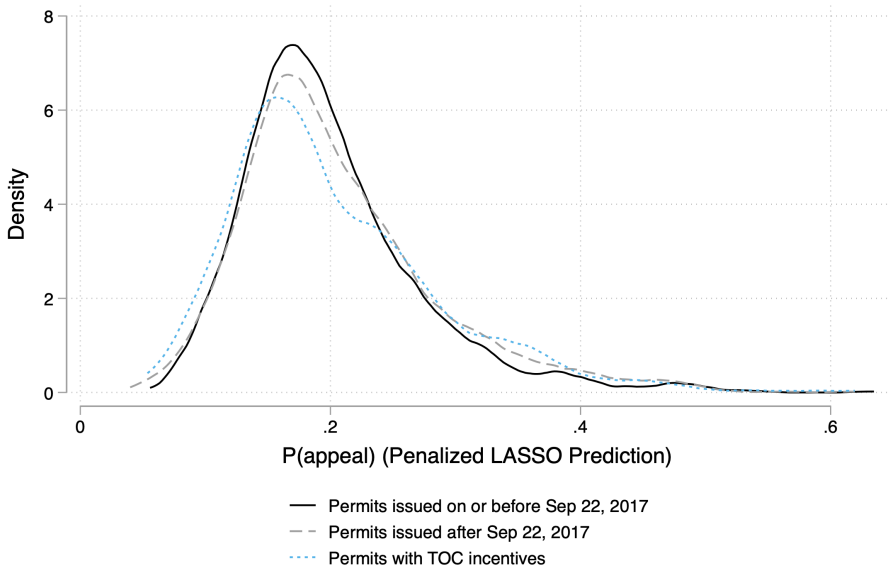
Notes: This figure illustrates how rules and discretion affect whether a given project would be built under the first best, as well as under the by-right and discretionary approval mechanisms. The gray shaded areas reflect the values of U and ε that may be observed under the first best. The green shaded area contains values of ε that may be observed for project x in location i if x is approved under the by-right mechanism. The purple shaded area contains values of (U, ε) that are observed under the first best, but not under the discretionary approval mechanism, due to the change in approval rule. The blue shaded area contains values of $U(x, \mathbf{z}_i)$ that are observed under the first best, but not under the discretionary approval mechanism, due to the effect of the pecuniary cost of discretionary review c on project profitability.

Figure 11: Distribution of probability of approval and appeal before and after TOC

A. Probability of approval



B. Probability of appeal



Notes: This figure plots estimated probability of approval (panel A) and appeal (panel B) given project and site characteristics. The black line corresponds to permits filed on or before September 22, 2017, the date when the TOC guidelines went into effect. The gray dashed line corresponds to the sample of multifamily projects permitted after September 22, 2017. The blue line corresponds to the sample of permitted multifamily projects that utilized TOC incentives.

Table 1: Characteristics of Parcels Near Major Transit

	(1) Within .5 mile of major transit	(2) All parcels
Area (sqft)	11,608.9	15,972.3
	(124,220.6)	(226,487.2)
FAR	1.3	1.2
	(1.5)	(1.5)
Parking requirement per DU	1.5	1.7
	(0.5)	(0.5)
Dist. to nearest high frequency bus stop (ft)	1,363.1	4,833.5
	(1,726.8)	(6,086.9)
Dist. to nearest metro/rail stop (ft)	8,401.7	13,050.6
	(9,695.4)	(13,039.2)
Number of residential units	2.6	2.0
	(11.1)	(9.3)
Median building year	1,940.8	1,948.2
	(23.7)	(23.3)
Share bldgs over 5 stories in 2016	0.1	0.1
Share residential use in 2016	86.9	90.2
Share commercial use in 2016	8.2	5.6
Share industrial use in 2016	2.9	2.4
Share single family zoning	46.9	65.2
Share multifamily zoning	48.2	30.4
Observations	308866	662145

Notes: This table compares the characteristics of parcels within .5 mile of a major transit stop, i.e., affected by the Transit-Oriented Communities incentive program, to all parcels in Los Angeles. Standard deviations are shown in parentheses for continuous variables.

Table 2: Characteristics of TOC projects permitted vs. approved but not yet permitted

	(1) Not yet permitted	(2) Permitted
Share has pre-approval review	41.4	37.9
Share has administrative review	60.1	62.6
Share has Director review	25.9	47.5
Share is 100% affordable	6.4	9.6
Share is mixed-income	38.4	52.3
Share has only Tier verification	42.3	31.2
Year of approval	2,020.5	2,019.7
	(1.8)	(1.6)
Units proposed	45.4	52.2
	(93.1)	(60.3)
Distance to high frequency bus stop	620.8	636.1
	(1,038.9)	(1,051.9)
Distance to rail stop	5,299.9	5,146.9
	(6,146.2)	(5,538.1)
Median hh income (2010-2014 ACS)	42,055.0	40,755.2
	(19,848.6)	(18,456.9)
Median gross rent (2010-2014 ACS)	1,154.9	1,132.0
	(288.4)	(262.7)
Owner-occupied rate (2010-2014 ACS)	21.0	20.7
	(16.8)	(16.7)
Housing density per sqmile (2010-2014 ACS)	8,544.8	8,414.3
	(5,759.6)	(5,262.5)
Observations	2464	522

Notes: This table compares the characteristics of TOC projects permitted by the end of 2024, and those not yet permitted. The sample comprises all TOC applications, both ministerial and discretionary, linked to their permits when a permit has been issued. Standard deviations are shown in parentheses for continuous variables.

Table 3: Characteristics of permits issued before and after TOC

	(1) Issued on or before Sep 22, 2017	(2) Issued after Sep 22, 2017	(3) Permits with TOC incentives
Panel A. Proposed project characteristics			
Units proposed	51.3	48.2	50.2
	(100.0)	(89.5)	(54.0)
Units proposed − allowed	-26.9	-3.9	16.7
	(218.6)	(386.0)	(81.1)
Share has Site Plan Review	23.1	26.3	33.3
Share has income-restricted units	28.2	43.4	73.0
Share 100% income-restricted	2.5	10.4	17.4
Panel B. Characteristics in application year			
Lot area (sqft)	36,151.0	25,809.3	15,946.4
	(92,010.3)	(87,005.5)	(23,478.7)
No. residential units	7.8	4.6	2.4
	(27.2)	(42.5)	(8.5)
Share vacant plot	25.2	16.8	18.7
Share single-family zoning	0.5	0.8	0.2
Share low-density multi-family zoning	17.5	15.9	3.2
Share medium-density multi-family zoning	44.3	35.3	33.5
Share high-density multi-family zoning	14.2	13.6	16.8
Panel C. Characteristics of neighbors within 300ft in application year			
No. single-family properties	2.4	1.6	0.9
	(7.1)	(5.6)	(2.5)
No. multifamily properties	0.5	0.5	0.5
	(0.4)	(0.4)	(0.2)
Share zoned single-family	16.9	12.5	7.6
Share zoned low-density multifamily	17.1	20.3	18.2
Panel D. Neighborhood characteristics (2000 Census tract)			
Med. HH income	35,050.9	32,816.7	28,654.8
	(16,878.8)	(14,638.9)	(11,579.4)
Med. gross rent	717.8	680.0	631.7
	(225.9)	(198.6)	(159.3)
Owner-occupancy rate	25.0	24.4	21.3
	(19.2)	(18.0)	(16.2)
% of HH with children	35.3	38.5	41.9
	(17.9)	(17.5)	(16.8)
Housing density (per sqmile)	7,470.3	7,623.2	8,472.4
	(5,321.7)	(4,934.8)	(5,278.4)
N	1,387	1,339	471

Notes: This table summarizes the characteristics of projects permitted between 2004 and 2023. Column (1) describes projects permitted on or before September 22, 2017. Column (2) describes projects permitted after September 22, 2017. Column (3) describes the sample of permitted multifamily projects that utilized TOC incentives. Standard deviations are shown in parentheses for continuous variables.

Table 4: Post-TOC projects were more likely to be appealed

Outcome	Permits pre- vs. post- TOC			vs. permits utilizing TOC incentives	
	(1)	(2)	(3)	(4)	(5)
	Pre	Post	Difference	Post + TOC incentives	Difference
P(approval)	0.886	0.883	0.003	0.890	-0.003
	(0.038)	(0.041)	[2.277]	(0.039)	[-1.536]
P(appeal)	0.200	0.206	-0.006	0.203	-0.003
	(0.072)	(0.079)	[-2.173]	(0.084)	[-0.812]
Units proposed	53.687	49.023	4.664	49.353	4.334
	(101.762)	(90.207)	[1.245]	(52.399)	[0.877]
N	1323	1313		464	

Notes: This table compares the average probability of approval, probability of appeal, and number of units proposed for permits issued before and after TOC. Columns (1) and (2) describe permits issued on or before September 22, 2017, to permits issued after. Column (3) calculates the difference in means in means between columns (1) and (2). Column (4) describes permits issued after September 22, 2017, that utilized TOC incentives. Column (5) calculates the difference in means between columns (1) and (4). Columns (3) and (5) report in brackets the t-statistic for the difference-in-means t-test.

A Additional details on impacts on supply

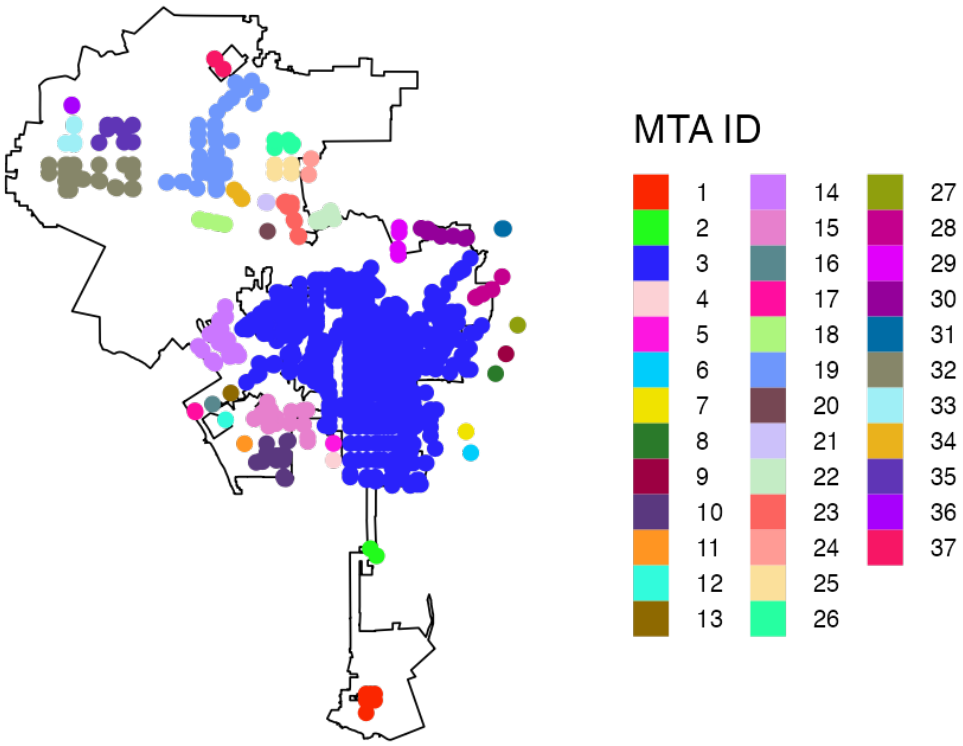
A.1 Major Transit Areas

Section 2.3 describes how only parcels within .5 mile of major transit stops were eligible for the Transit-Oriented Communities incentive program. Major transit stops include intersections of bus lines with average peak headways of 15 minutes or less, combinations of rapid and regular bus lines, intersections of two rapid bus lines, as well as Metrolink and Metro Rail stations. I define a "Major Transit Area" as the union of all .5 mile radius buffers around major transit stops, with each Major Transit Area constructed to be spatially disjoint from others. Figure A.1 enumerates the Major Transit Areas. Due to the shape of LA, some Major Transit Areas have fewer parcels right outside the Major Transit Area boundary. I exclude Major Transit Areas with fewer than 50 parcels outside the border, or with no never-treated parcels further than 660 feet (1/8 of a mile) from the border. I only use the following Major Transit Areas in the analysis: 1, 2, 3, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 29, 30, 32, 33, 34, 35, 36, 37.

A.2 Characteristics of parcels near border of Major Transit Areas

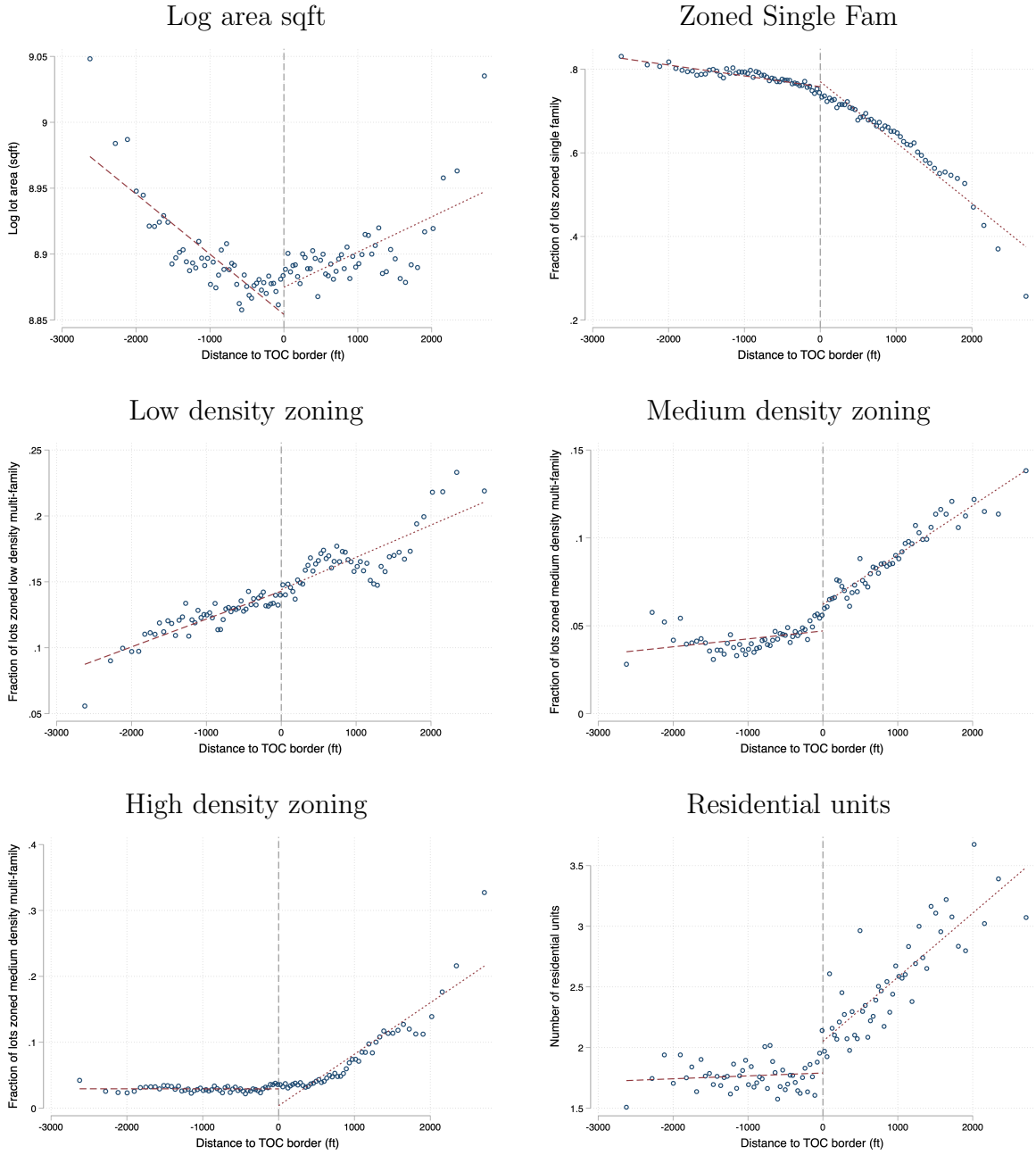
Figure A.2 shows that parcels on the treated and control sides of Major Transit Areas are similar in land use, size and zoning. As the distance to the border increases towards the transit stops on the treated side, or away from the border in the control side, parcel characteristics start to diverge. The figures plot data for all parcels within 2640ft of the border, and include MTA segment fixed effects in order to ensure comparisons of parcels in close geographic proximity.

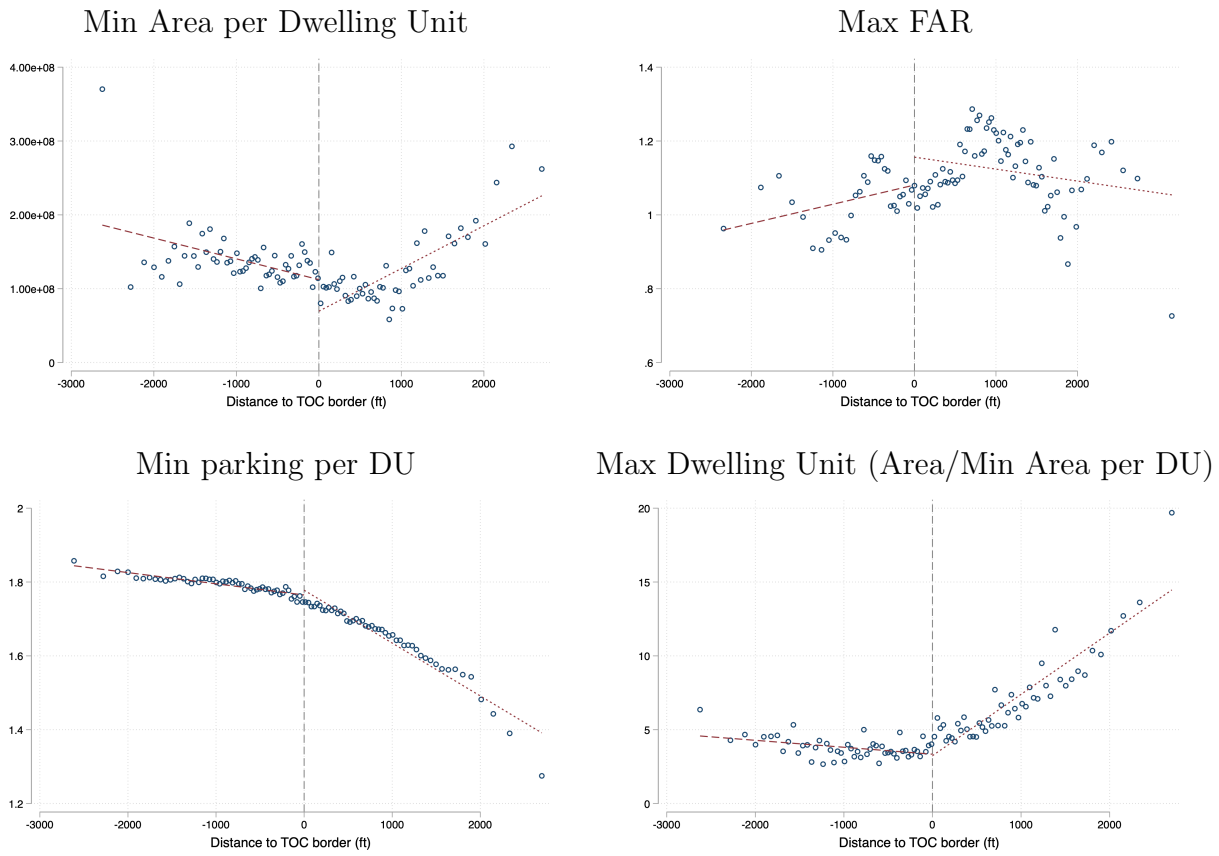
Figure A.1: Major Transit Areas



Notes: This figure enumerates all unique Major Transit Areas constructed using major transit stop files from the Los Angeles Department of City Planning. "Major transit stops" include stops at the intersection of bus lines with at least 15 min. average peak headways, intersection of regular + rapid bus stops or two rapid buses, Metrolink stations and Metro Rail stations. Intersections of two Metro Rail lines, or a Metro Rail line and a rapid bus line, received the largest density incentives.

Figure A.2: RD balance plots, 2016 characteristics, full sample within 1 mile of MTA border

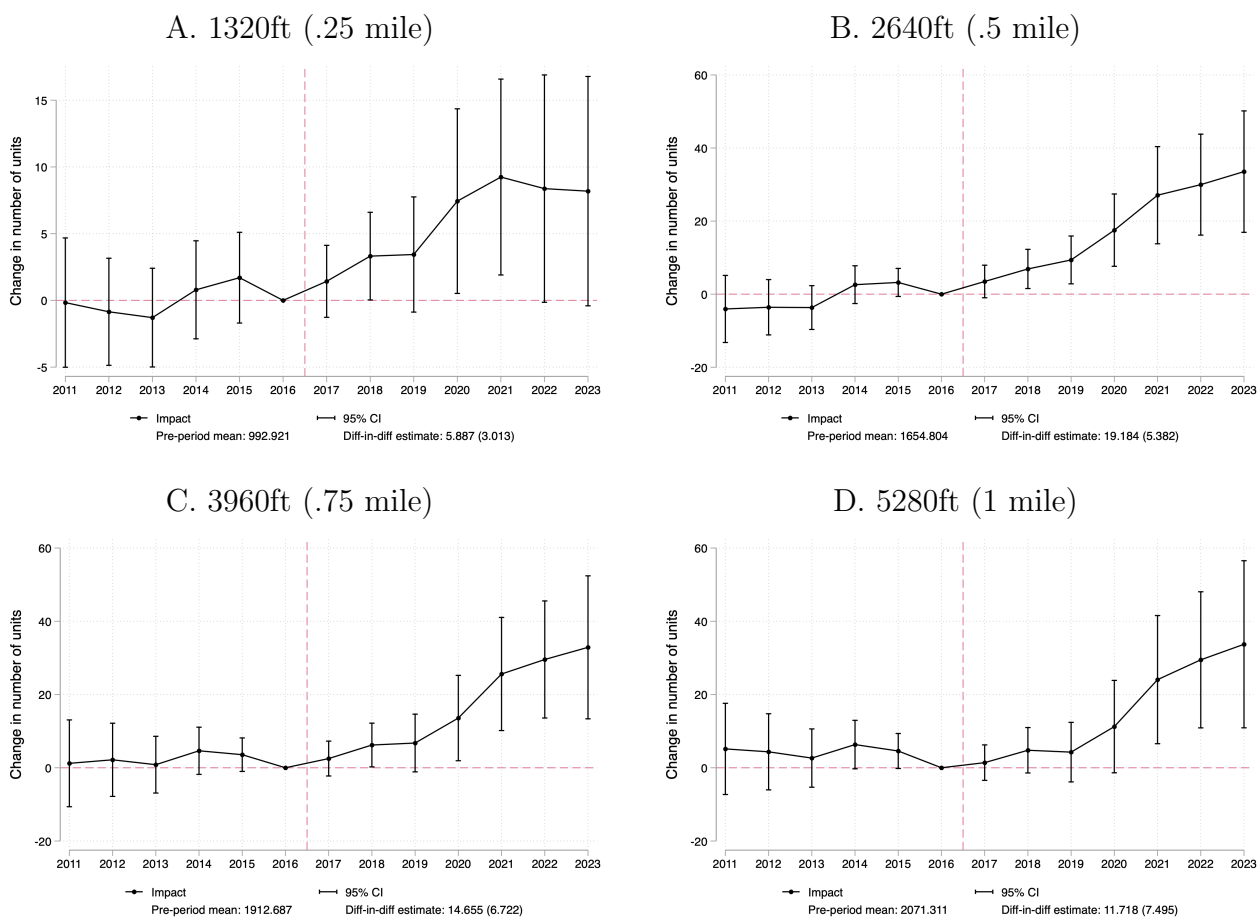




Notes: This figure plots parcel characteristics in 2016, given parcel distance to the border of a Major Transit Area. All binscatter plots control for segment fixed effects.

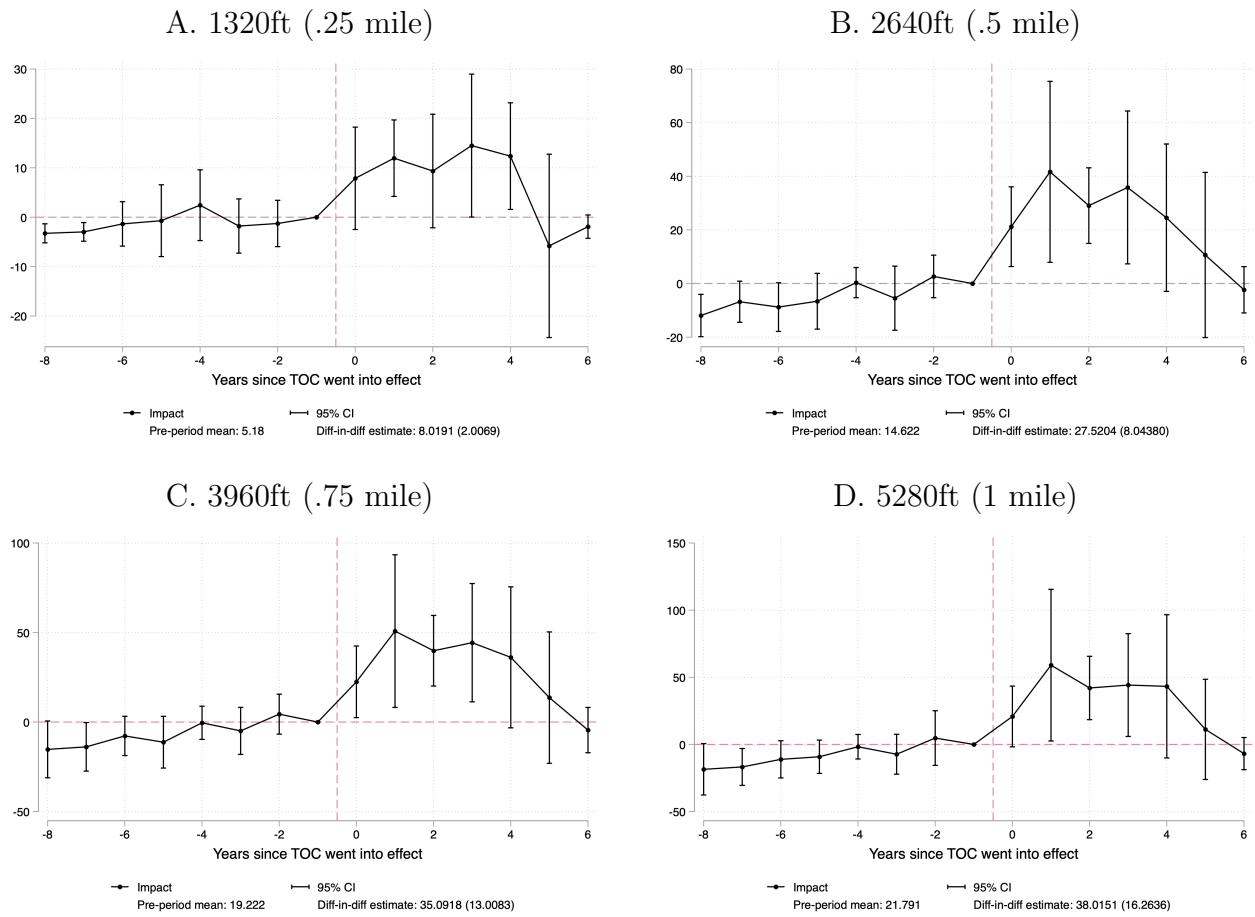
A.3 Robustness to choice of bandwidth in event-study estimation

Figure A.3: Impact of TOC on housing stock (robustness to choice of caliper)



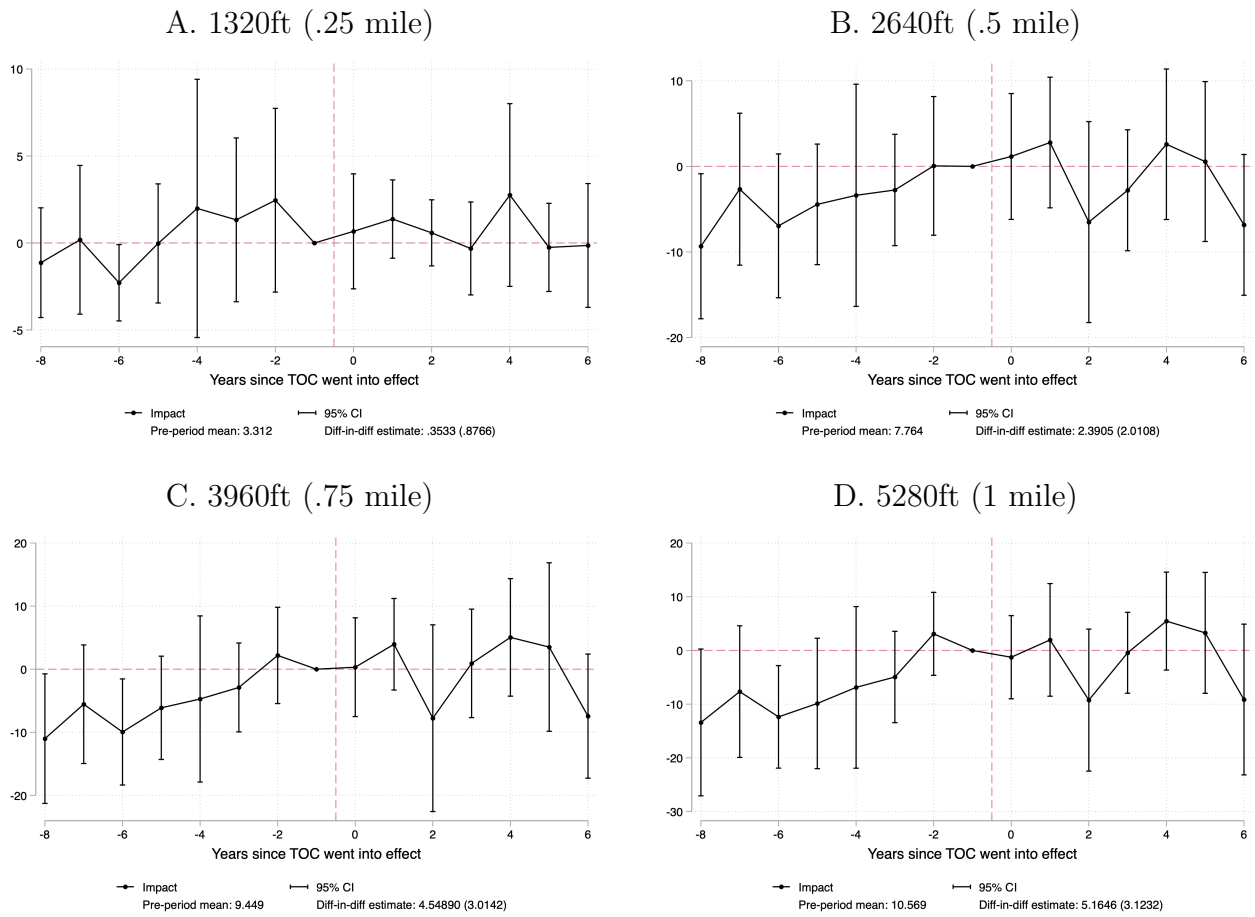
Notes: This figure plots β_t estimates from equation 1, using different calipers for the border difference-in-differences design. Since TOC affected parcels within .5 mile of a major transit stop, I estimate equation 1 using .25, .5, .75, and 1 mile calipers around the MTA borders. Bars correspond to 95% confidence intervals. Standard errors are clustered at the Major Transit Area level.

Figure A.4: Impact of TOC on number of units proposed (robustness to choice of caliper)



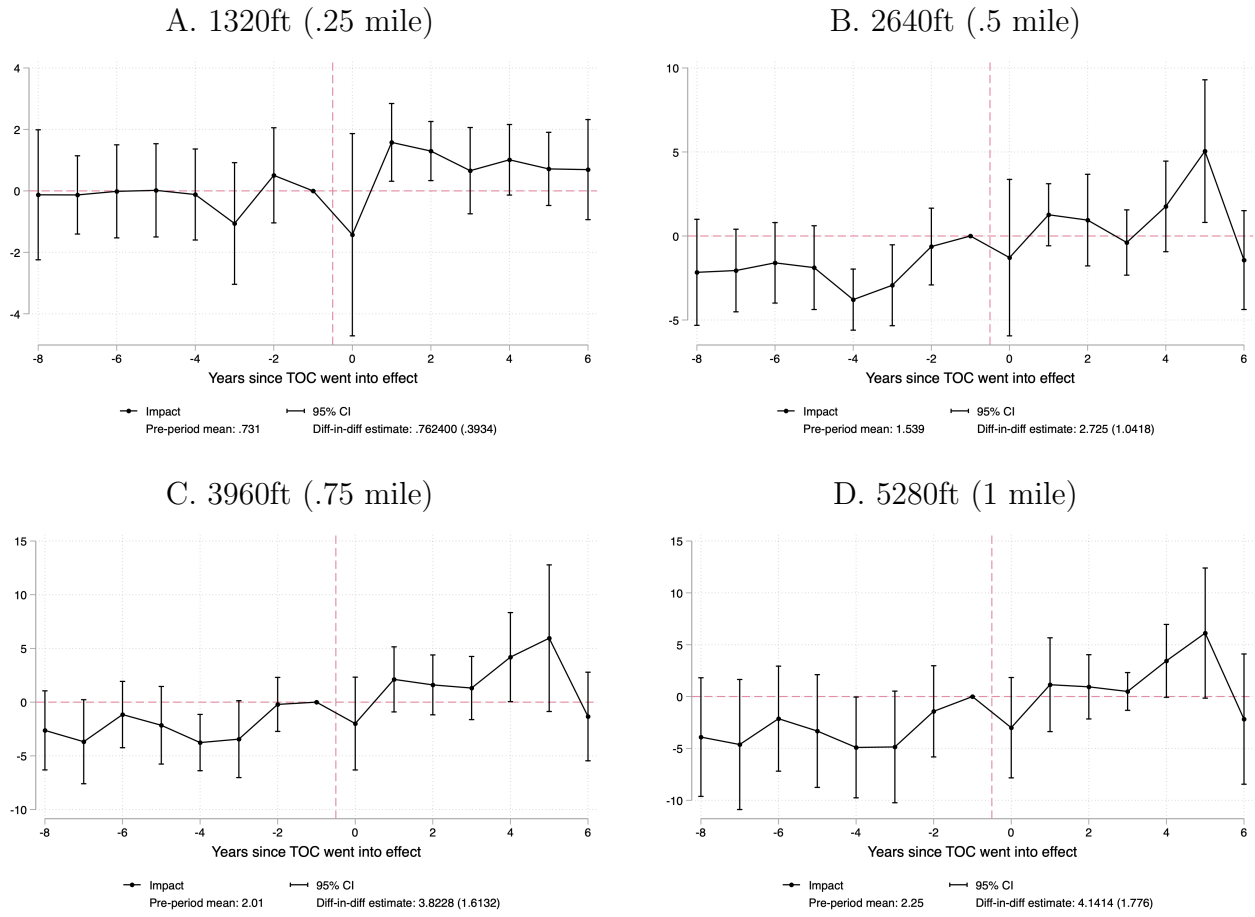
Notes: This figure plots β_t estimates from equation 2, using different calipers for the border difference-in-differences design. Since TOC affected parcels within .5 mile of a major transit stop, I estimate equation 1 using .25, .5, .75, and 1 mile calipers around the MTA borders. Bars correspond to 95% confidence intervals. Standard errors are clustered at the Major Transit Area level.

Figure A.5: Impact of TOC on number of units permitted (robustness to choice of caliper)



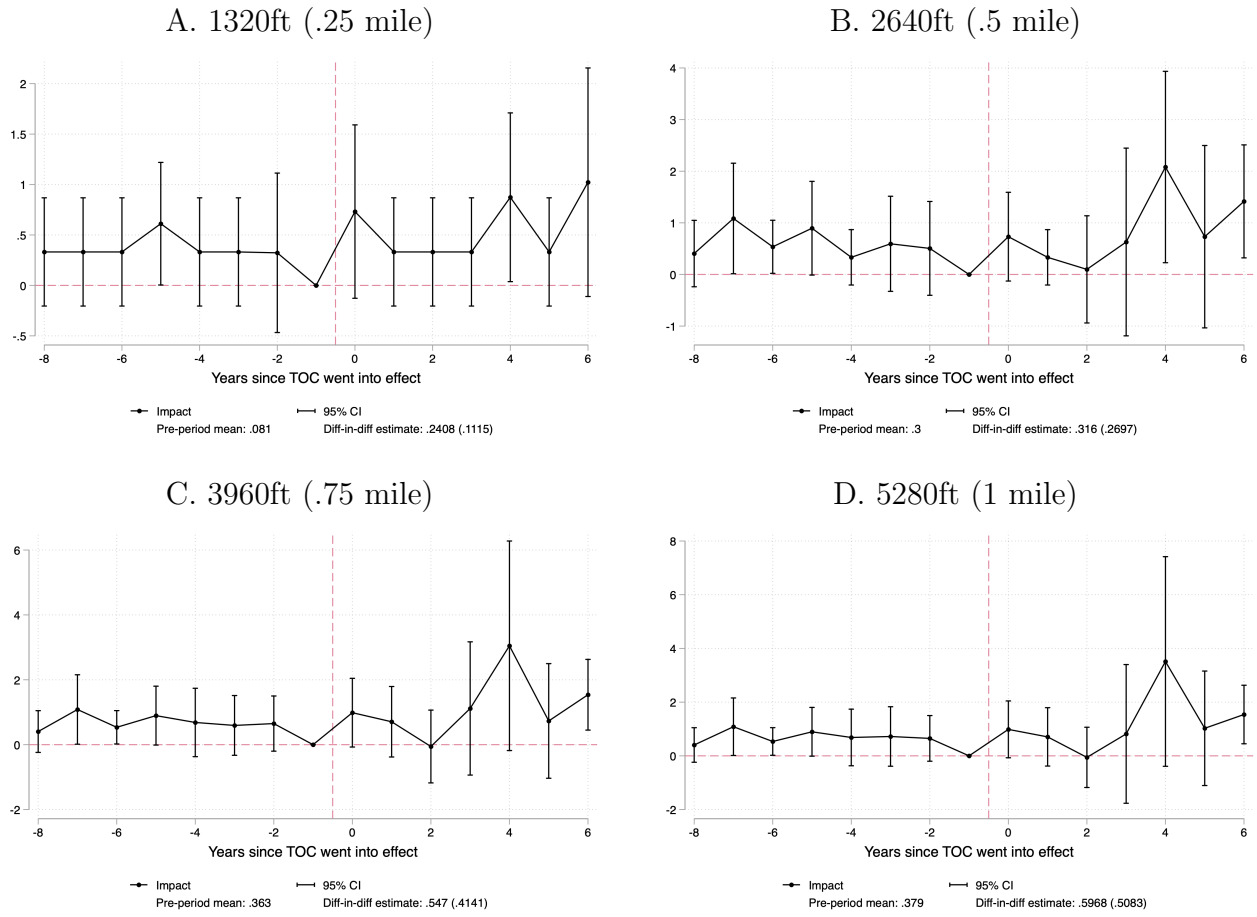
Notes: This figure plots β_t estimates from equation 2, using different calipers for the border difference-in-differences design. Since TOC affected parcels within .5 mile of a major transit stop, I estimate equation 1 using .25, .5, .75, and 1 mile calipers around the MTA borders. Bars correspond to 95% confidence intervals. Standard errors are clustered at the Major Transit Area level.

Figure A.6: Impact of TOC on number of units permitted in mixed-income buildings (robustness to choice of caliper)



Notes: This figure plots β_t estimates from equation 2, using different calipers for the border difference-in-differences design. Since TOC affected parcels within .5 mile of a major transit stop, I estimate equation 1 using .25, .5, .75, and 1 mile calipers around the MTA borders. Bars correspond to 95% confidence intervals. Standard errors are clustered at the Major Transit Area level.

Figure A.7: Impact of TOC on number of units permitted in 100% income-restricted buildings (robustness to choice of caliper)



Notes: This figure plots β_t estimates from equation 2, using different calipers for the border difference-in-differences design. Since TOC affected parcels within .5 mile of a major transit stop, I estimate equation 1 using .25, .5, .75, and 1 mile calipers around the MTA borders. Bars correspond to 95% confidence intervals. Standard errors are clustered at the Major Transit Area level.

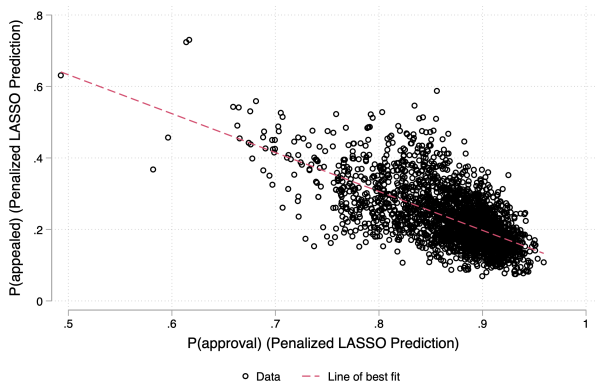
B Additional details on estimation of probability of approval

Table B.1: Characteristics of multifamily projects proposed between 2004-2016

	Mean	SD	P10	P50	P90
Panel A. Proposed project characteristics					
Units proposed	67.27	155.64	4.00	21.00	165.00
Units proposed − allowed	-19.80	274.82	-152.00	-3.00	122.00
Has environmental review	0.77	0.42	0.00	1.00	1.00
Has Zoning Board or CPC review	0.91	0.28	1.00	1.00	1.00
Has Site Plan Review	0.15	0.36	0.00	0.00	1.00
Has income-restricted units	0.13	0.33	0.00	0.00	1.00
Final decision: approved	0.87	0.33	0.00	1.00	1.00
Ever appealed	0.23	0.42	0.00	0.00	1.00
Panel B. Characteristics in application year					
Lot area (sqft)	45242.00	204344.48	6202.80	15595.49	86915.13
No. residential units	11.18	29.79	0.00	1.00	30.00
Vacant plot	0.16	0.37	0.00	0.00	1.00
Single-family zoning	0.03	0.16	0.00	0.00	0.00
Low-density multi-family zoning	0.16	0.37	0.00	0.00	1.00
Medium-density multi-family zoning	0.38	0.48	0.00	0.00	1.00
High-density multi-family zoning	0.16	0.36	0.00	0.00	1.00
Panel C. Characteristics of neighbors within 300ft in application year					
No. single-family properties	2.61	7.45	0.05	0.66	6.26
No. multifamily properties	0.44	0.30	0.04	0.43	0.82
Fraction zoned single-family	0.17	0.27	0.00	0.00	0.63
Fraction zoned low-density multifamily	0.16	0.27	0.00	0.00	0.62
Panel D. Neighborhood characteristics (2000 Census tract)					
Med. HH income	37698.50	19533.20	18680.00	33181.00	62244.00
Med. gross rent	755.39	256.64	504.00	696.00	1130.00
Owner-occupancy rate	25.79	20.35	3.87	21.00	52.61
% of HH with children	31.64	17.24	11.04	28.66	55.65
Housing density (per sqmile)	7773.90	5759.64	1974.46	6079.28	14996.94
N	2,713				

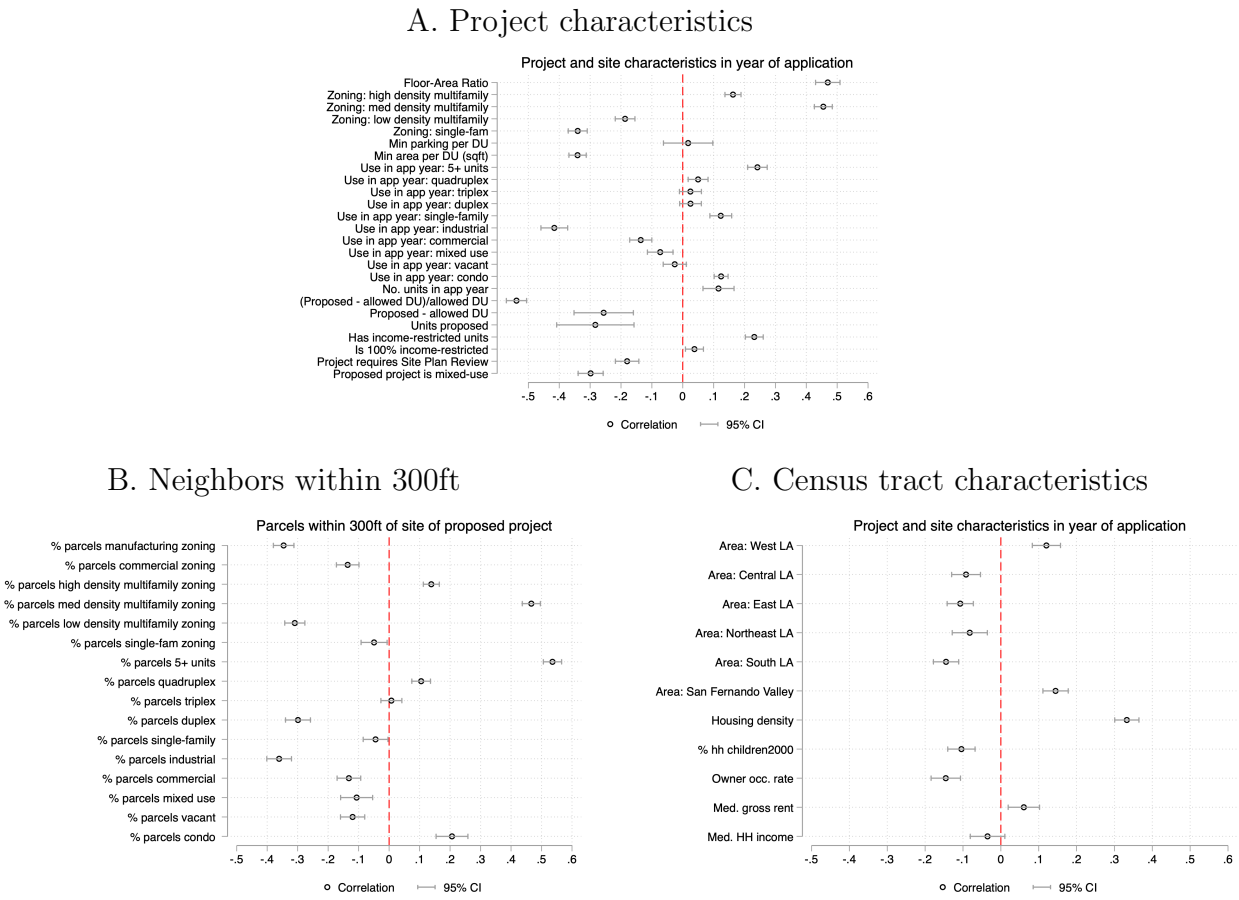
Notes: This table summarizes the characteristics of multifamily projects submitted for entitlement approval between 2004 and 2016. Standard deviations are shown in parentheses for continuous variables.

Figure B.8: Correlation between probability of approval and probability of appeal



Notes: This figure plots project-level estimated probability of approval on the x-axis, and estimated probability of appeal on the y-axis. Section 4 describes the estimation of the probability of approval and appeal.

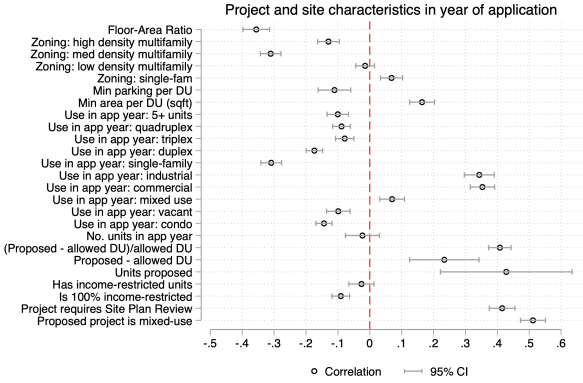
Figure B.9: Univariate relationship between probability of approval and project-site characteristics



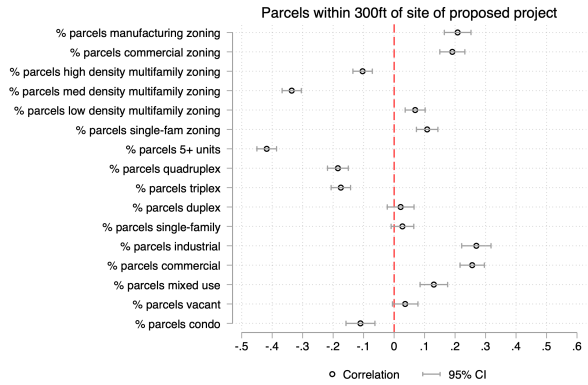
Notes: This figure plots the univariate relationship between probability of approval, predicted by the LASSO logit model, and characteristics of the project and project site. I standardize all variables and regress the standardized probability of approval on the standardized covariates. Census tract characteristics are measured in 2000, while site- and neighbor-level characteristics are measured in the year of application. Bars correspond to the 95% confidence interval.

Figure B.10: Univariate relationship between probability of appeal and project-site characteristics

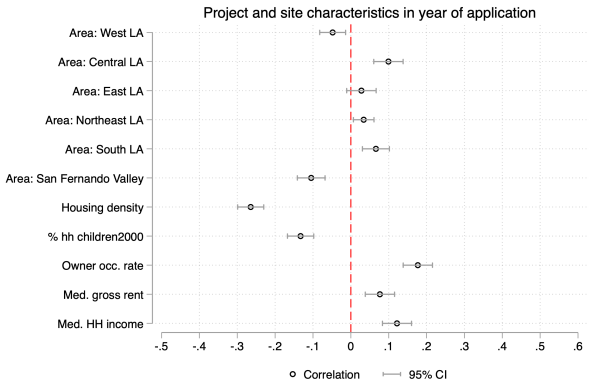
A. Project characteristics



B. Neighbors within 300ft

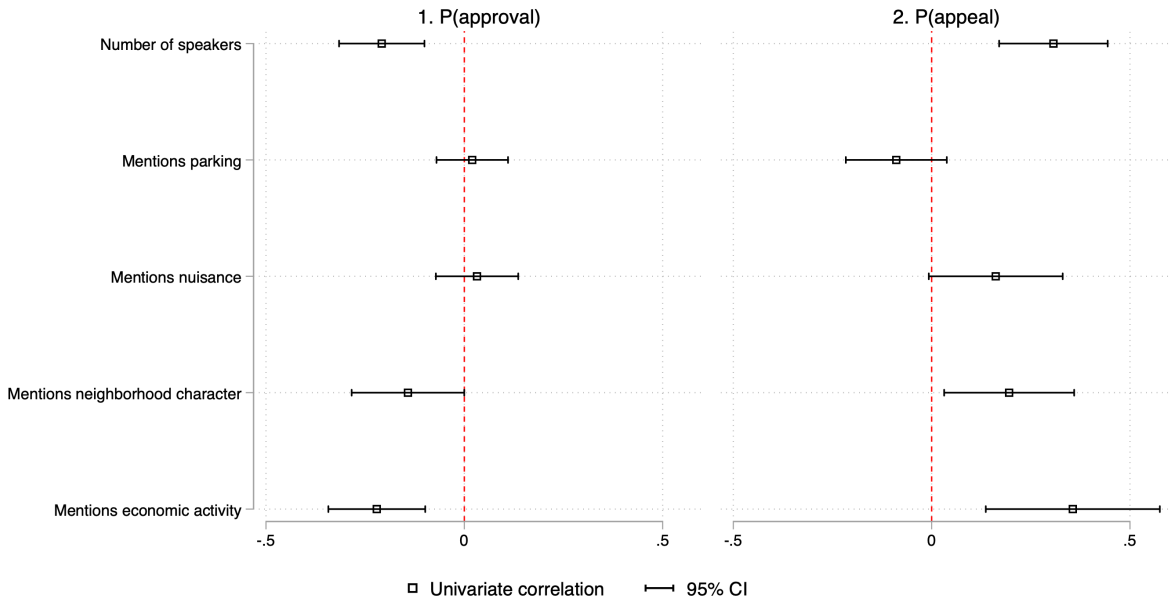


C. Census tract characteristics



Notes: This figure plots the univariate relationship between probability of appeal, predicted by the LASSO logit model, and characteristics of the project and project site. I standardize all variables and regress the standardized probability of approval on the standardized covariates. Census tract characteristics are measured in 2000, while site- and neighbor-level characteristics are measured in the year of application. Bars correspond to the 95% confidence interval.

Figure B.11: Probability of approval and appeal correlate with public comments



Notes: This figure describes the correlation between estimated project-level probability of approval and appeal, and comments made about those projects in public meetings. Each dot corresponds to the coefficient from regressing the probability of approval and appeal on the share of recorded sentences that mention each topic. Bars correspond to the 95% confidence interval.

C Entitlement process across cities

US cities vary in their degree of land use regulation (see Gyourko and Molloy, 2015, for a review). In this memo, I compare how eight large US cities – Los Angeles, CA, New York, NY, Houston, TX, Miami, FL, Minneapolis, MN, Chicago, IL, Seattle, WA, and Boston, MA – govern the development of new multifamily housing. These cities differ in their regulatory stringency, according to the 2008 Wharton Land Use Regulation Index (Table C.2, reproduced from Gyourko, Saiz and Summers (2008)). Saiz (2010) estimates housing supply elasticities for the MSAs in which these cities are located, while Baum-Snow and Han (2023) estimates differences in housing supply within metro areas.

Table C.3 summarizes how these eight cities regulate the process by which new multifamily housing is approved and permitted. Out of the major US cities, Houston stands out for not having a zoning code or a zoning board. However, all cities here include limits on where and how much multifamily housing can be supplied. If a proposed development satisfies the conditions set forth by the zoning code and/or municipal ordinances and/or the parcel's land use covenants, then the proposal is considered "by-right." Otherwise, the project must undergo a review process that varies in requirements and timeline. All cities have a City Planning Commission that determines which projects are by-right and may decide on discretionary requests. Nearly all have some sort of environmental review requirement, which can be used to appeal project approvals.

Table C.2: Regulatory Stringency According to 2008 WRLURI Survey

	Los Angeles, CA	New York, NY	Houston, TX	Miami, FL	Minneapolis, MN	Chicago, IL	Seattle, WA	Boston, MA
Review time for multi-family units (months)	10.33	9.12	8.06	8	6.43	5	2	2
Local Zoning Approval Index (0-18)	3	1	2	2	2	1	2	0
Local Project Approval Index (0-18)	4	2	1	2	2	0	2	1
Local Assembly Index (0-2)	0	0	0	0	0	0	0	0
Density Restrictions Index (0-4)	0	0	0	0	0	0	0	0
Open Space Index (0-1)	1	1	0	0		0	1	1
Exactions Index (0-1)	1	0	0	0		0	1	1
Supply Restrictions Index (0-6)	0	0	0	0	0	0	0	0
Approval Delay Index (avg. months)	12.13	15.27	15.05	8.50	5.21	4.56	7	6.83
Wharton Residential Land Use Regulation Index	2.10	2.39	0.03	0.57		-1.17	0.36	0.18

Notes: Derived from the 2008 Wharton Land Use Regulation Index (Gyourko, Saiz and Summers, 2008). Minneapolis is missing data for some of the questions. None of these cities responded to the 2018 WRLURI update.

Table C.3: Comparison of Entitlement Process Across Major US Cities

	Los Angeles	New York	Houston	Miami	Minneapolis	Chicago	Seattle	Boston
A. Regulatory environment								
Zoning code and zoning board	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Other municipal land use ordinances	No	No	Yes	No	No	No	No	No
Land use covenants	No	No	Yes	Yes	No	Yes	No	No
Parking, density, FAR, height regulations	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City Planning Commission	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Environmental Impact Review	Yes	Yes	Floodplain	Yes	Yes	Yes	Yes	Yes
Requires entitlement approval before issuing bldg permits	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pre-approval meeting encouraged or required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
B. By-right development								
Requires "by-right" certification	Yes	Yes	Yes	Yes	Yes	Yes	Yes	*
Requires geographically specific approval?	No	No	Yes	No	No	No	.	NA
Time to decision	60 days	150 days	30 days	.	60 days	30 days	30 days	NA
Can others appeal the decision or sue?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA
C. Discretionary development								
Requires public hearing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Neighbors notified	300ft	Community Board	250ft	Abutting	350ft	250ft	.	Community Board
Min notification period	30 days	60 days	15 days	30 days	21 days	30 days	15 days	30 days
City Council may have final word	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can the developer appeal the decision?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can others appeal the decision?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table was compiled by the author using information from each city's Municipal Code and Planning Commission web page. Missing data fields correspond to pieces of information that I could not easily find. All pages were accessed between December 22, 2023, and January 6, 2024. This table may contain errors. Note that there may be special cases that do not fit the above table.

* "Small Project Review applies to projects that do not meet the threshold for Large Project Review (they are less than 50,000 square feet of gross floor area) but that are expected to affect the surrounding area and public realm because of size or location" (Source: `http://www.bostonplans.org/projects/development-review/small-projects`))