Preemption of Local Land Use Regulations: Evidence from California's ADU Reforms

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Abstract

How can states preempt local land use regulations to increase housing supply? I evaluate an accessory dwelling unit (ADU) reform in California that set a ceiling on objective requirements for an ADU and established that ADUs satisfying those requirements were permitted by-right. This ceiling initially applied to single-family parcels and was later extended to multi-family parcels. Assembling permit data from Los Angeles and San Francisco, I find that the ceiling led to a 0.3 percentage point increase in the probability an ADU is permitted on a parcel. In a subsample where I estimate the effect of banning parking requirements, the ceiling's effect is twice as large. Comparing homes near new ADUs with homes slightly farther away, I find no reduction in nearby property values and rule out negative effects larger than 2.3 percent. Effects on rents are small and imprecisely estimated.

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1 Introduction

Local land use regulations are a key driver of the high cost of housing (Hsieh and Moretti, 2019; Glaeser and Gyourko, 2002, 2018; Gyourko and Krimmel, 2021; Gyourko and Molloy, 2015). A promising approach to reform involves states preempting local regulations (Glaeser, 2017). Some reforms preempt particular regulations: banning fees, limiting parking requirements, or removing single-family zoning. Another type of reform broadly overrides local authority by specifying the maximum standards a locality may impose on a development. The latter, an instance of what is called *ceiling preemption* in the federalism literature (Buzbee, 2007; National Policy & Legal Analysis Network to Prevent Childhood Obesity, 2010), is promising because localities restrict housing using a wide array of regulations (Zeanah, 2022).

Over the last decade, California enacted reforms to increase construction of Accessory Dwelling Units (ADUs) – self-contained residential units on a lot with a primary residential building. In 2016, California established a ceiling on local regulation of ADUs on parcels with a single-family unit: any ADU meeting the state's objective standards must be permitted. California's reforms are therefore a useful setting to study how states may craft preemption of local regulations to increase housing supply.

Additionally, evaluating the benefits and costs of ADUs is important because of their growing popularity.[1] Proponents argue ADUs can increase housing supply "gently," without drastically changing low-density neighborhoods (Chapple et al., 2017, 2021; Garcia, 2017; Simpson, 2019). However, Glaeser and Tarki (2023) argue that ADUs cannot create enough supply to lower prices. The central compromise of ADUs – that they pose minimal nuisance effects on local homeowners – is also not well-investigated.

I study three questions: (i) by how much did California's regulatory ceiling increase ADU permit approval and why, (ii) whether ADUs decrease the property values of neighboring homes, and (iii) whether increased ADU construction affected rents. Question (i) asks which features of state preemption successfully provide relief from local regulations. It is difficult to answer because the state's regulatory ceiling was accompanied by other pro-ADU policies and a national increase in popularity of ADUs. Questions (ii) and (iii) are key parts of the policy debate regarding ADUs. The fundamental challenge to answering questions (ii) and (iii) is that where ADUs are built is non-random. One is more likely to

[1]ADU permits in Seattle, WA increased by almost 250% from 2019 to 2022, British Columbia's 2023/2024 provincial budget earmarked 91 million dollars toward encouraging ADU construction, and the White House held a panel on how to ease ADU construction (Ionescu, 2023; Depner, 2023; The White House, 2022).

build an ADU where housing demand is growing, and thus ADUs may be built where the presence of renters is set to increase.

To overcome the challenges to (i), I use an institutional detail of California's reforms. The regulatory ceiling initially applied to parcels with a single-family unit in the first wave of reforms and was later extended to multi-family parcels in the second wave.[2] I compare ADU permitting on these parcels before and after these changes. To answer (ii), I exploit both variation in distance to a constructed ADU and the timing of constructions to estimate a nuisance effect. To address (iii), I use that areas with more single-family parcels experienced more ADU construction because the regulatory ceiling initially only applied to single-family parcels. I use the plausibly exogenous supply-side variation caused by the reforms, coupled with an economic model, to estimate the effect of ADUs on rents.

I start by presenting a theoretical model of ADU regulation and construction in a housing market where developers build apartments, renters demand rental housing, and homeowners can build an ADU to benefit from rental income but may suffer nuisance and overcrowding from ADUs built by their neighbors. The model predicts that when homeowners are able to collectively regulate ADU production, they will not build ADUs. Homeowners will build ADUs when this local regulation capability is preempted, building more when developers are supply-constrained. The model also yields two results for estimation. First, the value of a property near versus slightly further away from an ADU differs only in the negative spillovers of density on nearby properties. Second, the effect of increased ADU supply on rents can be recovered from the size of the supply increase.

I then investigate the effect of the regulatory ceiling on ADU permitting. I collect and merge building permit data from Los Angeles and San Francisco to create a novel dataset of ADUs built within those cities. California's permitting reforms in 2016 affected single-family parcels and multi-family parcels differently. On parcels with single-family homes, ADUs meeting state standards both became legal and permits for them were issued without being subject to any further local requirements. Multi-family parcels were not subject to this regulatory ceiling, so legal ADUs on them could still be subject to local requirements. Many pro-ADU policies also passed at the time, such as reforms to fire-sprinkler or parking requirements, applied to both types of parcels.

I find that the probability of an ADU being permitted on a multi-family parcel rose by

[2] Throughout, I use "single-family" to refer to land use, e.g. a parcel with a single-family home. I use "multi-family" parcels to refer to parcels with two-, three-, and four-family units. I exclude areas with large apartment buildings from my analysis.

0.08 percentage points, while the probability of an ADU being permitted on a single-family parcel rose by 0.29 percentage points more. I am unable to test parallel trends with a pre-trends test because few ADUs were permitted before 2016. To validate my finding, I instead use that in 2020, California passed another suite of ADU reforms, including extending the regulatory ceiling to multi-family parcels. Other reforms applied to both single- and multi-family parcels. I find that, after 2020, the probability of an ADU being permitted on a multi-family parcel rose by 0.24 percentage points more than the probability on a single-family parcel, in line with my main estimate. Because ADUs were being permitted prior to the 2020 reform wave, I can quantify this estimate as 160 percent of the probability an ADU was permitted on a multi-family parcel in 2020. I highlight potential mechanisms behind the success of California's regulatory ceiling using original qualitative research on ADUs in California. I interpret my result with interviews of field experts in residential development and contracting. I also interview State Senator Robert Wieckowski, who authored many of California's policy changes studied in this paper.

To help further benchmark the effect of the ceiling, I also provide novel evidence on the causal effect of removing parking requirements using variation in this removal by distance to a transit stop. I find that the regulatory ceiling resulted in an increase in ADU permitting twice as large as the increase caused by removing parking requirements.

I conclude my analysis on permitting with two facts. First, I document substantial bunching in ADU floor size at 1,200 square feet, the size threshold below which the regulatory ceiling protects an ADU. Second, ADU permitting occurs more often in supply-constrained areas. To illustrate this, I use the ratio of home values to home replacement costs as a measure of supply constraints and show that this ratio is correlated with ADU permitting.

Next, I study whether ADUs decrease nearby property values. My estimation strategy is motivated by my theoretical model, which describes how the nuisance effect from an ADU changes in distance to that ADU. I estimate whether the relationship of a property's value to its distance to an ADU changes before and after the ADU is constructed, akin to Linden and Rockoff (2008) and Diamond and McQuade (2019). I find no effect on nearby property values and am able to exclude negative effects larger than 2.3 percent. Given local opposition to ADUs, my model suggests that overcrowding, not nuisance, may be the primary source of homeowners' concern.

Turning to rents, I aggregate the single- and multi-family parcel policy variation to ZIP Code Tabulation Area (ZCTA) level exposure by measuring what proportion of the single-or multi-family area of a ZCTA is single-family. I then use ZCTA-level rent data from the American Community Survey and a linear panel model to estimate the effect of increased ADU construction on rents. Because California's ADU reforms aimed to make single-family areas slightly denser so that they resemble two-, three-, and four-family areas, those multi-family areas are an intuitive comparison group for rent trajectories. To establish a plausible range for the reduction in rents due to ADUs, I use my theoretical model to forecast the effect of the quantity increase in housing due to ADUs on rent prices. My confidence intervals are wide, but my point estimates and model predictions together suggest a half to one percent decline in rents due to ADUs.

This paper extends a robust literature on upzoning and housing supply by providing evidence on when upzoning works and why. This paper's primary contribution is showing that a ceiling on local regulation was a large driver in the success of California's ADU reforms. Previous literature establishes that some upzonings have increased housing supply (Büchler and Lutz, 2024; Greenaway-McGrevy and Phillips, 2023). Other attempts at reform, like California's SB 9 or San Jose's Urban Village strategy, produce a small to null supply response (Dubler, 2022; Gabbe et al., 2021). This paper's finding on ceiling preemption provides evidence that merely legalizing a development is not equivalent to creating a predictable right to build. This is in line with a literature that argues permitting imposes substantial costs to projects "by a thousand cuts" (Bronin, 2023; Mayer and Somerville, 2000; O'Neill et al., 2019; Soltas and Gruber, 2026). This finding adds empirical evidence to a growing literature that studies state preemption of local land use regulations (Infranca, 2019; Stahl, 2021; Harvard Law Review, 2022; Wielga, 2023) and is also of interest to policymakers interested in preemption of local land use regulations.

Additionally, this paper contributes to the literature on the effects of new housing construction, both on rents and nearby property values. It is the first to study the effect of ADUs on rent, contributing to previous literature on the effect of large apartment buildings (Asquith et al., 2023; Li, 2022; Mast, 2023; Pennington, 2021). There is previous literature on the nuisance effect of ADUs; for example, Davidoff et al. (2022) use a cross-sectional estimation strategy that compares newly built homes with ADUs to newly built homes without.[3] They estimate a 3.8 percent reduction in price overall, and a 5.7 percent reduction in high income neighborhoods.[4] Recent work from Brueckner and Thomaz (2024) suggests ADU construction is predicted by proximity to commercial districts and

[3]Regarding the "own-lot" effect, Brueckner and Thomaz (2024) estimate that an ADU raises one's own assessed values by seven to nine percent.

[4]Tanrisever (2025) finds similar effects.

light-rail stations, highlighting drawbacks to a cross-sectional approach. My paper has the advantage of exploiting both cross-sectional and temporal variation in ADU construction. My estimates suggest much smaller nuisance effects.

The rest of this paper proceeds as follows. Section 2 provides background on California's policy changes and Section 3 reviews data. Section 4 introduces a theoretical model that aids in my empirical estimation. Section 5 studies the effect of ADU reforms on ADU permitting. Section 6 investigates whether ADUs harm the property values of their neighbors and Section 7 covers the effect of ADUs on rents. Section 8 concludes.

2 Background

2.1 The Accessory Dwelling Unit

An accessory dwelling unit is a self-contained residential unit on a lot with a primary residential unit. The primary residential unit may be of any type: a single-family home, a duplex, or even an apartment building. In a single-family home or duplex with a large backyard, an ADU might be a detached structure. With less backyard space, constructing an ADU might involve adding a new room on top of one's garage.[5] Crucially, the ADU must be an independent housing unit rather than, for example, a guest bedroom that is open for renters. An ADU generally must have its own entrance, accessible without entering the primary residential unit. Appendix Figure C.1 depicts example detached ADUs, built in California homeowners' backyards (California Department of Housing and Community Development, 2022a).

Since 2016, California's state government has passed a number of pro-ADU policies. Figure 1 displays the total number of issued ADU permits in Los Angeles and San Francisco in single- and multi-family parcels. Prior to 2016, permits were rarely issued in these cities. Since then, the number issued rose sharply, reaching 4,652 in 2022 in my sample.

2.2 California's Reforms

The following paragraphs detail the relevant reforms in 2016 and 2020, drawing from California Department of Housing and Community Development (2022a) and Dubler (2022).

[5]The options for infill differ based on the primary unit. An ADU could be built in the basement garage of an apartment building that sees little need for extra parking spaces. An ADU can be detached or attached to the primary unit, may have its own pathway and porch, or may simply be an extra bedroom converted into a studio apartment.

The 2016 reforms, primarily SB 1069 and AB 2299, addressed two significant barriers to building ADUs. First, the 2016 reforms eased parking requirements. These reforms removed parking requirements for all ADUs within half a mile of a transit stop (California Department of Housing and Community Development, 2018). These applied equally to single- and multi-family parcels.

Second, the 2016 reforms created a state regulatory ceiling for ADUs on parcels with single-family homes: ADUs meeting state standards had to be permitted by-right and localities could not impose additional requirements.[6] In California, local regulatory authorities have strong power over housing construction in their jurisdiction. Prior to the reforms, localities could impose a large array of requirements on ADUs, such as impact fees, setback requirements, aesthetic requirements, etc. The reforms preempted all of this authority on parcels with single-family units:

> *This subdivision establishes the maximum standards that local agencies shall use to evaluate a proposed accessory dwelling unit on a lot zoned for residential use that includes a proposed or existing single-family dwelling. No additional standards, other than those provided in this subdivision, shall be utilized or imposed, except that a local agency may require an applicant for a permit issued pursuant to this subdivision to be an owner-occupant or that the property be used for rentals of terms longer than 30 days.* (California Legislature, 2017)[7]

Local ordinances not in compliance were preempted:

> *When a local agency that has not adopted an ordinance governing accessory dwelling units in accordance with subdivision (a) receives an application for a permit to create an accessory dwelling unit pursuant to this subdivision, the local agency shall approve or disapprove the application ministerially without discretionary review pursuant to subdivision (a) within 120 days after receiving the application.* (California Legislature, 2017)

California's 2016 reforms, which I refer to as the regulatory ceiling, combined two ingredients. First, there was a ceiling on requirements localities could impose on ADUs. There was only one exception: localities could still impose owner-occupancy and short-term

[6] By-right permitting is also known as "as-of-right" permitting or "ministerial" permitting (Planetizen, nd).

[7] I determined the effects of the 2016 reforms on California's Government Code by accessing the code as it was on February 10th, 2017 using the Internet Archive.

rental restrictions. Second, permitting was by-right, meaning a development meeting state standards was not subject to discretionary review (e.g., case-by-case review by a zoning board). This combination differentiates the 2016 reform from a previous 2002 reform which made ADUs by-right (in that they were not subject to discretionary review) but allowed broad local leeway in imposing onerous objective requirements (Dubler, 2022).

Detached ADUs subject to the state law were capped at 1,200 square feet, and an attached ADU to the lesser of 1,200 square feet or half of the primary unit's floor area (California Department of Housing and Community Development, 2018).

The 2020 reforms consisted primarily of AB 68, AB 881, and SB 13. These banned owner-occupancy requirements and lifted impact fees.[8] Furthermore, the wait time for approval of an ADU permit was reduced from 120 days to 60 days. Most important to this paper, however, is that the regulatory ceiling was extended to multi-family parcels. AB 68 reads:

> *Existing law requires ministerial approval of a building permit to create within a zone for single-family use one accessory dwelling unit per single-family lot, subject to specified conditions and requirements.*
>
> *This bill would instead require ministerial approval of an application for a building permit within a residential or mixed-use zone [...].* (California Legislature, 2019)

I summarize the above exposition in a table below. This table only summarizes the reforms relevant to my empirical analysis. For a thorough review of all legislative changes in California over this time period, see Dubler (2022) and Gray (2024).

[8] An impact fee is a fee imposed by local authorities for adding residential density to the area, meant to cover the increased cost to a fire department, police department, local transportation infrastructure, school, etc.

Year	Main Bills	Summary of Reforms
2016	SB 1069, AB 2299	Regulatory ceiling, reduced parking requirements, streamlined conversion, utility and fire sprinkler requirements. *Ceiling only applied to parcels with single-family homes.* *Parking requirements lifted within one-half mile of a transit stop.*
2020	AB 68, AB 881, SB 13	No owner-occupancy requirement, 60 days to respond to permit, banned miscellaneous restrictions, reduced impact fees. *Extends ceiling to multi-family properties.*

2.3 ADUs as Rental Housing Supply

The California Department of Housing and Community Development cites numerous benefits to building an ADU: they are cost-effective, provide extra space for extended family, and serve as housing for the elderly. However, a stated policy goal of ADU reform is increased affordable housing supply (California Legislature, 2017). It is therefore useful to briefly review some facts about the rental characteristics of ADUs.

First, ADUs are frequently rented out. Chapple et al. (2021) conducted a survey of 823 California homeowners who constructed ADUs. They found that 51 percent of ADUs serve as long-term rental units, and a further 16 percent of ADUs house a relative of the primary homeowner at no cost.[9] Only eight percent of ADUs serve as short-term rentals.

Second, proponents of ADUs argue that they contribute to affordable housing supply. Because ADUs "do not require paying for land, major new infrastructure, structured parking, or elevators," they can naturally serve as low to mid-range units for renters (California Department of Housing and Community Development, 2022a).

Third, proponents of ADUs emphasize the ability of ADUs to infill empty space (e.g.,

[9] Furthermore, the median rent of an ADU was $2,000 in Los Angeles, $2,150 in San Diego and Orange counties, and $2,200 in San Francisco. This is generally affordable to the median-income two-person household in these areas.

backyards) in single-family parcels. Therefore, California's approach to formalizing such housing could be appropriate given the prevalence of single-family homes in California and the need for increased housing supply. Estimates from Wegmann and Chapple (2014) argue that in the Bay Area "Flatlands,"[10] ADUs could provide a comparable amount of housing to denser multi-family units. State Senator Wieckowski suggested that adding a unit in a backyard is much easier than getting a large "acre-and-a-half" new housing development.

3 Data

Measuring Residential Areas and Land Use. My sample is single- and multi-family parcels in Los Angeles and San Francisco. I access shapefiles of their parcels (City of Los Angeles, 2024; City and County of San Francisco, 2023). I merge these with each city's assessor roll in 2015 to measure land use information (County of Los Angeles, 2025; San Francisco Assessor-Recorder, 2024). I use the number of units on each parcel to define my sample. I define a parcel as "single-family" if there is one residential unit on it. I define a parcel as "multi-family" if there are two to four residential units on it. A parcel is in my sample if it is either single- or multi-family. To summarize, my sample consists of residential parcels where there are single-family homes, duplexes or triplexes, or townhomes. I exclude high-density residential areas, which typically contain very dense apartments. To study parking requirements, I use spatial data on transit in Los Angeles from Bell (2018) to compute a parcel's distance to a transit stop.

Measuring ADUs. I use building permit data to measure ADU construction. Because I need to measure location and precise timing of ADUs, I am unable to use publicly available aggregations of ADU permits. Instead, I search building permits for text relating to ADUs. Los Angeles and San Francisco regularly publish building permit data, which I access (Los Angeles Department of Building and Safety, 2023; San Francisco Department of Building Inspection, 2023). Each permit contains a description[11], through which I determine whether a permit is for the construction of an ADU.[12] I filter for ADU-related

[10]The Flatlands is a geographic area adjacent to, but not contained in, the areas of San Francisco studied in this paper.

[11]Example descriptions from San Francisco's October 2022 permits read: "bakyard landscape and front porch remodel [sic]," "remodel of (e) duplex: add a new garage, kitchen and bathroom remoel, add new deck, [sic]" and "detached garage: convert to adu. 1 story vertical addition with one bedroom and bathroom."

[12]Each observation also contains a permit identification number, the date issued, the block and lot, coordinates, and a street address.

language, including terms relating to ADUs or the relevant ordinances and state bills.[13] When an ADU is constructed, the date of construction is noted and a completion variable is marked in the permit data, which I use to measure the timing and completion of ADU construction. I geolocate the ADU using the associated parcel number with each permit. I use parcel maps from each city and merge each ADU permit based on the parcel number. The resulting dataset covers 17,191 permits from 2013-2022.[14]

Benchmarking Against Annual Progress Report Data. There is some public data on statewide ADU production from the Annual Progress Report (APR), which compiles information on whether cities are meeting housing construction goals (California Department of Housing and Community Development, 2022b). Unfortunately, this data does not contain precise dates regarding the permit's status (issuance, completion) and only contains the status variable itself in 2021-2022, both of which are critical for my empirical analysis. However, I use the APR data in 2021-2022 to benchmark my data collection. In Appendix Table B.1 Panel A, I report the number of permits issued in each city from my data construction against the number of permits "Approved" or "Complete" in the APR data.[15] The dataset I assemble is comparable to the APR data, and actually estimates more ADUs in each city and year. I suspect this is because the APR data has poorer reporting of permit status. To verify this, in Appendix Table B.1 Panel B, I report permits issued in my data against any permit "Approved", "Complete", or "Pending" in the APR data. Here, the APR data is somewhat comparable, but has thousands more permits in Los Angeles. Overall, this provides some evidence I am accurately measuring ADU permit issuance and construction. However, only my rent analysis requires accurately measuring all ADU permits. It suffices for all other analysis to measure a sample of ADUs permitted.

Property Values. I construct a novel dataset of property sales through the San Francisco and Los Angeles assessor offices. I acquire San Francisco property sales data through correspondence with the office. I match sale information with property characteristics like number of bedrooms using the parcel number of the sale and San Francisco's assessor roll (San Francisco Assessor-Recorder, 2024). I scrape Los Angeles property values

[13] I use other variables, such as a permit category variable, to filter for whether the permit is constructing a new ADU or merely updating its wiring.

[14] I do not extend out to permits after 2022 due to a censoring problem – because permitting takes a long time, only rapidly permitted and constructed ADUs would be available in later years. Hence, I treat 2022 as the last year of my analysis.

[15] I assign my permits to the year in which they were issued. For the APR data, because dates for each status are not provided, I include both approved and completed permits because completion is inclusive of approval. The APR data's year variable comes from the year in which the permit was reported. Of course, to split by city, I constrain to the permits in both datasets that I can geolocate.

using the Los Angeles Property Assessment Information Map (Los Angeles County Assessor, 2023). This service allows a user to search for property information, which includes nearby sales in the last two years.[16] Therefore, I acquire all property sales from 2022 to 2024 in a 1,000-foot radius around every ADU constructed in 2022 or 2023. I scrape the number of bedrooms, square footage, and year built for most of the sales.

Rent and Neighborhood Characteristics. I use Zip Code Tabulation Area (ZCTA) data from the American Community Survey (ACS). I use ACS 5-year estimates of median income, population, median rents, and number of rental units from 2011-2022. All dollar values are inflated to 2022 dollars. I merge the parcels from the parcel data to measure what proportion of the ZCTA has single- versus multi-family land use. I map each permit to a ZCTA and compute the number of ADUs permitted and the number of ADUs constructed in each ZCTA. This results in a panel of 167 ZCTAs.

In Appendix Tables B.3 and B.4, I report summary statistics for my key variables in each year from 2015 to 2022, the key period for my analysis. In 2015, the mean number of ADUs built in a ZCTA is 0.03, which rises to 16.08 in 2022. For context, the average number of rental units in 2015 is 7,846. Noticeably, the mean number of rental units (and mean population) changes sharply in 2020 due to the pandemic.

Supply Constraints. Romem (2017) at BuildZoom, an online marketplace for contractors, constructs an index for the home value to replacement costs of a home. The author builds this index at the zip code level, drawing on data from the American Community Survey, Federal Housing Finance Agency, and the Census Building Permit Survey. They use data from 2011-2015 to construct a value of the ratio in 2016. I use their zip-code level measure as a proxy for supply constraints. To use all zip-codes in California for my analysis on supply constraints, I merge this data with ADU permitting data from Chapple (2021), which covers the entire state but only from 2018 to 2020.

4 Theory

This section builds a model of a housing market with ADUs. The model has two purposes. First, I characterize the conditions under which ADUs are built. I show that ADUs are built in the absence of local homeowner regulation and built more often when rental housing

[16] From the Building Permit Data, I take the parcel number and construction date for every ADU constructed in Los Angeles from 2022 to 2023. Using the service, I build a script using the Python packages Selenium and Beautiful Soup that iteratively enters each ADU-containing property into the service and records the transacted properties within a quarter-mile of it.

is supply-constrained. Second, I derive tools to estimate the nuisance effect of ADUs on neighbors and the supply effect of ADUs on rents. Proofs are in Appendix A.

4.1 Setup

Overview. In a housing market z, there are renters, homeowners, and developers.[17] There are two residential areas, one where homeowners live in single-family homes and one where renters live in apartment buildings.[18] I do not consider tenure choice – no individual can switch from homeowner to renter, or vice versa. Developers supply apartments and the supply of single-family homes is fixed. Homeowners may construct additional rental housing through ADUs on their single-family homes and can suffer nuisance through the presence of renters living in other homeowners' ADUs. Under regulation, homeowners may coordinate their ADU production. Under deregulation, homeowners produce ADUs taking the ADU production choices of their neighbors as given.

Developers. Let $\lambda_r, \lambda_s > 0$ be exogenous parameters reflecting the amount of land for renters and homeowners respectively. Developers build apartments on λ_r, according to a production function $d_r\lambda_r$. Here, $d_r \in \mathbb{R}_{\geq 0}$ is an intensity of housing production and can be thought of as how densely the developers build apartments. Developers face convex costs $\sigma_r \frac{d_r^2}{2}\lambda_r$, where $\sigma_r > 0$ is an exogenous construction cost parameter. Costs include physical costs of materials and labor, but also include the cost of potential government supply constraints or regulation. The density of single-family homes on λ_s is one and the supply is fixed.[19] Developers solve $\max_{d_r}\left[p_r d_r \lambda_r - \sigma_r \frac{d_r^2}{2}\lambda_r + p_s\lambda_s\right]$, where p_r and p_s are the price of rental housing and single-family housing, respectively.

Renters. The renter derives utility from a numeraire good g_r and rental housing consumed h_r. I assume the renter's utility in housing is additively separable from the utility in the numeraire, and the utility from housing is of an isoelastic form: $u(h_r, g_r) = \frac{h_r^{1+\eta}}{1+\eta} + g_r$, where $\eta \in (-\infty, 0) \setminus \{-1\}$.[20] The renter's budget constraint is $h_r p_r + g_r \leq w_r$,

[17] I suppress z in my notation. In my empirical analysis, I take z to be a ZCTA, and it is plausible that people move between ZCTAs in response to increased housing supply. I attempt to correct for this in my rent analysis. This limitation does not affect my other analysis.

[18] I assume that all housing units and land are homogeneous. I include very little spatial richness in the model, which is common in many other models of housing markets with zoning such as the mono-centric city model adapted by Büchler and Lutz (2024).

[19] This assumption, a simplification to focus the model on the construction dynamics of ADUs, is not too far from practice: of the four permits reviewed by the San Francisco Department of Building Inspection in the first half of 2024, three were ADUs and one was an apartment building (Carbonaro, 2024).

[20] The typical parameterization uses the form $\frac{h^{1-\eta}}{1-\eta}$ where η is positive, but my formulation is equivalent. I write it this way to interpret η as the inverse price elasticity of demand in later analysis.

where p_r is the rent price and w_r is the renter's wage. Because the utility function is monotonically increasing in consumption of housing and g_r, the renter satisfies the budget constraint with equality. The renter solves $\max_{h_r,g_r}\left[h_r^{1+\eta}/1+\eta + g_r\right]$ such that $h_r p_r + g_r = w_r$.

Homeowners. There are θ_s homeowners, where $\theta_s > \lambda_s$ (the land allocated to single-family homes). The homeowner makes two decisions: (i) purchase a single-family home or take an outside option (ii) having purchased a home, trade off consumption of a numeraire with ADU production for rental income. The optimal decision in (ii) becomes an input into (i).

Beginning with the former, a representative homeowner i chooses between purchasing a single-family home for p_s to receive utility U_s or receiving exogenous outside option utility $U_{s,0}$. U_s depends on the amenities of the neighborhood A, the disamenities D, consumption of a numeraire good g_s, and a shock $Z \sim$ Expo(1): $U_s = Z(A - D + g_s)$.[21]

The homeowner may choose to construct an ADU with intensity $a \in [0,1]$. Developers could build rental housing at any intensity level d_r because they build apartments. The homeowner's production intensity is instead bounded in the unit interval because only one ADU may be constructed on a parcel. The homeowner faces cost of building an ADU $\sigma_a \frac{a^2}{2}$, where $\sigma_a > 0$ is an exogenous cost parameter. Note σ_a is different from the cost developers face when building rental housing σ_r. While the cost of materials might be similar, σ_a could reflect that homeowners now must spend time marketing their ADU or learning how to rent out a unit. It could reflect distaste from the presence of a renter in the homeowner's backyard.

The disamenity term D represents disutility from residential density, specifically from the presence of renters on λ_s living in ADUs built by other homeowners. For a homeowner i, D is given by:

$$D = O(\bar{a}) + \sum_{j \neq i} (1 - \delta_j) N(a_j), \quad (1)$$

where $\bar{a} := \sum_{j \neq i} a_j$ is the total intensity of ADU production and δ_j is the distance of neighbor j to homeowner i normalized to the unit interval. Note D consists of two effects: $O(\cdot)$ from overcrowding and $N(\cdot)$ from the nuisance of new neighbors. Both O and N have positive first and non-negative second derivative, and $O(0) = N(0) = 0$. Under regulation,

[21] Having the homeowner make a binary decision about single-family housing simplifies the analysis so that I may focus directly on ADU production. The shock Z allows me to begin analyzing the immediate effects of ADUs on prices of the existing stock of single-family homes, leaving changes in single-family home production to future research.

homeowners coordinate and choose the same level of ADU production for the neighborhood: $a_i = a_j$ for all i, j. Under deregulation, the homeowner may not coordinate and optimizes over a_i, treating a_j as given. The homeowner faces budget constraint

$$\overbrace{\sigma_a \frac{a^2}{2}}^{\text{ADU Cost}} + p_s + g_s \leq \overbrace{a p_r}^{\text{ADU Income}} + w_s, \tag{2}$$

where w_s is the homeowner's wage. Because utility is monotonically increasing in the numeraire good, homeowners satisfy the budget constraint with equality. Thus, the homeowner solves

$$\max \left[\left(\max_{g_s, a} [Z(A - D + g_s)] \text{ such that } \sigma_a \frac{a^2}{2} + p_s + g_s = w_s + a p_r \right), U_{s,0} \right]. \tag{3}$$

Equilibrium. I analyze the model under two different equilibrium conditions: one where homeowners may coordinate to set a collective level of ADU production, and one where the homeowners individually determine their level of ADU production.

1. Regulation. The first is the *regulation* equilibrium. Because homeowners already live within the jurisdictions of local governments, local housing regulations frequently reflect their preferences rather than those of renters, who do not yet live there (Fischel, 2004).[22] Prior to state preemption, local homeowners could coordinate their ADU production through zoning policies. Therefore, the first equilibrium focuses on what happens if homeowners are able to coordinate their preferred level of ADU production.[23] In this equilibrium, D is a function of a and homeowners do not take rental price as given because they collectively determine the rental supply from ADUs. Renters and developers optimize, taking prices as given, and markets clear.

2. Deregulation. Second is the *deregulation* equilibrium. After state preemption, homeowners can no longer coordinate to prevent the construction of ADUs. Therefore, homeowners build ADUs only taking into account their own benefits and costs to building an ADU and ignoring spillover effects of those ADUs onto neighbors. Formally, the home-

[22]The development of zoning as an expression of homeowner preferences is not limited to a distaste for renters. Indeed, zoning in the United States also has a history of racial disparity, as documented by Shertzer et al. (2016).

[23]This reflects a collective decision-making process among the homeowners already living in market z, which could take the form of a referendum or a political game between politicians and voters as in Calabrese et al. (2007). For further study into incumbent preferences and land use regulation, see Parkhomenko (2023).

owner optimizes over housing consumption and their personal level of ADU production, taking the ADU production of their neighbors as given and rental prices as given. Renters and developers optimize, taking prices as given, and markets clear.

4.2 Model Results

Characterizing ADU Construction

Model Result 1. *Consider the regulation equilibrium. Let $p_r^*(a)$ denote the equilibrium price of rental housing if the homeowner chooses a as the collective level of ADU production. If the magnitude of the marginal disutility from overcrowding and the nuisance effect is strictly greater than the magnitude of marginal profits from increased ADU production:*

$$\forall a > 0,\ \|\frac{d}{da}D(a)\| > \|p_r^*(a) - \sigma_a a\|. \tag{4}$$

Then, the homeowner sets $a = 0$.

The assumption in this result relates the marginal impact of ADU construction on utility from housing to the profit of an ADU. This assumption is akin to a community deciding that the average profits from an ADU do not outweigh the disutility they would experience from an ADU next door. Prior to 2016, this was the decision often made by many communities in California. In the rest of the analysis, I maintain this assumption.

In the next result, I have the homeowner choose a for only their own level of ADU production, disregarding the spillover impact on their neighbors.

Model Result 2. *Consider the deregulation equilibrium. If the homeowner optimizes over their individual a, the supply curve of total rental housing is given by*

$$p_r\left(\frac{\lambda_r}{\sigma_r} + \frac{\lambda_s}{\sigma_a}\right). \tag{5}$$

This result characterizes supply from developers $p_r\frac{\lambda_r}{\sigma_r}$ and supply from ADUs $p_r\frac{\lambda_s}{\sigma_a}$. Note that each form of supply is increasing in the land allocated to it and decreasing in its construction costs. A natural question is where we will see more supply from ADUs in the rental market. The next result answers what conditions will drive ADU production.

Model Result 3. *In the deregulation equilibrium, areas with rental supply constraints will see* *more ADU production. Formally, the percent increase in rental housing from regulation equilibrium to deregulation equilibrium is given by*

$$\left(1+\frac{\lambda_s\sigma_r}{\lambda_r\sigma_a}\right)^{\frac{1}{1-\eta}}-1. \tag{6}$$

Because η is negative, the above value is increasing in λ_s, σ_r and decreasing in λ_r, σ_a. This aligns with intuition: more land for rental housing or higher costs for ADUs lowers ADU production, and higher cost for rental housing and more land for single-family housing increases ADU production. This is magnified when $|\eta|$ is small, which again lines up with intuition because η is the inverse price elasticity of demand.

The main qualitative prediction of this result is that if developers are "efficient enough" at building housing, then fewer ADUs will appear in the market. In Figure 2, I plot two hypothetical scenarios, one with a low σ_r developer (relative to a high σ_a) and one with a high σ_r developer (relative to a low σ_a), holding all other parameters constant. I plot the supply curves in the regulation equilibrium (where just developers supply rental housing) and in deregulation equilibrium (where both developers and homeowners supply rental housing). In the first scenario, homeowners produce few ADUs. In the second, homeowners produce many ADUs.

Estimating the Nuisance Effect and the Supply Effect

Model Result 4. *The nuisance effect of ADUs on property values can be estimated by comparing properties within the same market z with different distances from neighboring ADUs. Formally, the equilibrium price of single-family housing in deregulation equilibrium can be written as*

$$p_s^* = \frac{U_{s,0}}{\log(\lambda_s)-\log(\theta_s)} + A - O(\bar{a}^*) - \sum_{j\neq i}(1-\delta_j)N(a_j^*) + w_s + \frac{p_r^{*2}}{2\sigma_a}, \tag{7}$$

where p_r^* and a^* are the equilibrium rental price and ADU production.

Model Result 4 shows that differences in distance to an additional density from ADUs can yield estimates of the nuisance effect. In particular, between two properties in the same market z, the overall overcrowding effect they experience $O(\bar{a})$ is the same. However, the distance weights on the nuisance effect will differ. The equation derived in this result motivates my empirical strategy to estimate $N(\cdot)$ in section 6 because I compare property values very near to ADUs to those slightly further away.

Model Result 5. *Let p_r^* be the equilibrium price between renters and developers, i.e., when the supply curve is $\lambda_r \frac{p_r}{\sigma_r}$ in regulation equilibrium. Let h_r^* be the equilibrium quantity of rental housing. Let $p_r'^*$ be the equilibrium price when homeowners may produce ADUs, i.e., when the supply curve is given by Model Result 2. Let $h_r'^*$ be the equilibrium quantity of rental housing in deregulation equilibrium. Then,*

$$\log(p_r'^*) - \log(p_r^*) = \eta \left(\log(h_r'^*) - \log(h_r^*) \right). \tag{8}$$

Intuitively, Equation 8 says that the percent change in housing price is proportional to the percent change in housing supply. A supply shift's effect on the price can be recovered by tracing out the demand curve, which is illustrated in Panel B of Figure 2.

5 The Effect of California's Reforms on ADU Permitting

5.1 The Regulatory Ceiling's Effect on ADUs Permitted

This section estimates the causal effect of California's regulatory ceiling on the probability an ADU permit is issued. Comparing single-family parcels to multi-family parcels is a natural way to study the causal effect of the state's regulatory ceiling on ADU permitting while accounting for the effect of other pro-ADU reforms and confounding demand shocks, as detailed in section 2. In Figure 3, I plot the probability an ADU permit was issued on a parcel by the parcel's type. I produce this figure using a balanced parcel-level panel and taking the mean of an indicator of whether an ADU permit was issued on that parcel in a given year.

This figure provides motivation for comparing single- and multi-family parcels to isolate the causal effect of the regulatory ceiling. Recall that the 2016 legislative changes established the ceiling on single-family parcels alone. The 2020 legislative changes extended the ceiling to multi-family parcels. Hence, if I am measuring the effect of the ceiling, the green triangle-marked line should see a greater increase in slope after the 2016 reforms, and the orange circle-marked line should see a greater increase in slope after the 2020 reforms. This is precisely what we see in the figure: the 2016 changes drive a sharper increase in ADU permitting in single-family parcels and the 2020 changes drive a similar sharper increase in ADU permitting in multi-family parcels.

To quantify the effects of the ceiling, I estimate two difference-in-differences regressions, one for each wave of reforms. Let i index parcels and t time periods. For the 2016 wave, I use data from 2014 to 2020 and estimate

$$\begin{aligned}\mathbb{1}\{\text{ADU Permitted}\}_{it} = \beta_0^{2016} + \beta_1^{2016}\mathbb{1}\{\text{Post 2016}\}_t \\ + \beta_2^{2016}\mathbb{1}\{\text{Single-Family}\}_i \times \mathbb{1}\{\text{Post 2016}\}_t \\ + \text{Parcel Fixed Effect} + \epsilon_{i,t},\end{aligned} \tag{9}$$

where β_2^{2016} is the coefficient of interest. For the 2020 wave, I use data from 2020 to 2022 and estimate

$$\begin{aligned}\mathbb{1}\{\text{ADU Permitted}\}_{it} = \beta_0^{2020} + \beta_1^{2020}\mathbb{1}\{\text{Post 2020}\}_t \\ + \beta_2^{2020}\mathbb{1}\{\text{Multi-Family}\}_i \times \mathbb{1}\{\text{Post 2020}\}_t \\ + \text{Parcel Fixed Effect} + \epsilon_{i,t},\end{aligned} \tag{10}$$

where β_2^{2020} is the coefficient of interest.

I also estimate a dynamic version of the model for two reasons. First, the treatment effect could vary over time, as more people find out about the option of adding more units to their property and decide whether it is economically viable. Second, given that I am studying both rounds of reforms, it is useful to study time-dependent coefficients. Therefore, I estimate

$$\begin{aligned}\mathbb{1}\{\text{ADU Permitted}\}_{it} = \beta_0^{\text{dynamic}} \\ + \sum_{j=2014, j\neq 2016}^{2022} \beta_j^{\text{dynamic}}\mathbb{1}\{\text{Single-Family}\}_i \times \mathbb{1}\{t=j\}_t \\ + \text{Parcel Fixed Effect} + \text{Time Fixed Effect} + \epsilon_{i,t}.\end{aligned} \tag{11}$$

Here, the policy has potentially different effects in each year, where β_j^{dynamic} represents the effect in year j.

I find that the ceiling led to a significant increase in ADU permitting. In Table 1 Panel A, I report the results of estimating Equation 9. Single-family parcels experienced a 0.29 percentage point higher increase in the probability of permitting an ADU after the 2016 reforms. In Table 1 Panel B, I report the results of estimating Equation 10. Multi-family parcels experience a 0.24 percentage point higher increase in the probability of permitting an ADU after the 2020 reforms. In both cases, the estimate of the treatment effect of the ceiling is larger than the coefficient on the post-period indicator, which suggests that the ceiling had a large effect on ADU permitting. In Figure 4 and Appendix Table B.5, I report the β_j^{dynamic} from Equation 11. The coefficients increase sharply after 2016. After the 2020 wave, the coefficients converge back to zero as multi-family parcels become treated as well. In fact, the 2022 confidence interval is centered very close to zero. The peak coefficient is 0.4 percentage points. My analyses in conjunction suggest that the regulatory ceiling led to a 0.3–0.4 percentage point increase in ADUs permitted.

For the first reform, I am unable to quantify a percent increase from the treated group's baseline because very few ADUs were built at all prior to 2016. The 2020 pre-period is just one year because before that, we are in the regime where single-family parcels are already treated. These pre-period issues mean I am also not able to test the parallel trends assumption through a pre-trends test: the pre-treatment coefficients in Figure 4 are mechanically almost zero. That ADU permitting on single-family parcels could be evolving differently than on multi-family parcels is a concern. There could be another policy that affected those parcels differently or different demand changes for ADUs on single- versus multi-family parcels. For example, a 2016 reform easing utility connection requirements for non-detached ADUs affected single-family parcels more. However, the consistency of estimates across both waves of reforms, especially visually in Figure 3, and some qualitative evidence in the following section suggest that I am indeed credibly estimating the effect of the regulatory ceiling.

5.2 Why Did Capping Local Authority Matter?

The regulatory ceiling's significant impact on ADU permitting is consistent with the view that local authority itself is an important constraint on housing construction. Local governments opposed to additional housing, beyond prohibiting it outright, may use design standards, fees, procedural requirements, etc. to increase the cost of construction. California in particular has a byzantine array of local regulations. The City of Sonoma, for example, responded to California's efforts to promote duplexes by requiring that a duplex lot must contain three mature trees (Alameldin and Garcia, 2022). Permitting also adds delays: in my conversation with a field expert who worked in an ADU-specializing contractor office, they mentioned that they regularly expected the process of approval to take multiple rounds. It was standard for a permit to be rejected at least once so that the ADU could be redesigned to be in compliance.

The reform I study differs from reforms that merely upzone an area, legalizing a particular type of housing, or reforms that remove one identified barrier like impact fees. California's reforms established the *maximum standards* by which an ADU could be evaluated and thus ruled out *any* other standards. Qualitative evidence supports this view. A legislative aide in the office of State Senator Wieckowski described the process of removing specific barriers to ADU permitting as a "cat-and-mouse" game with local authorities. Senator Wieckowski described the ceiling feature of the policy – that it capped any further local regulations – as one of the most important features of the 2016 reforms.

The effectiveness of such preemption nevertheless depends on enforcement. Senator Wieckowski emphasized that the state using the law and being willing to challenge local regulations in court was an important component of the reform. Indeed, the California Attorney General did file a lawsuit in early March 2023 against Huntington Beach for illegal barriers to ADU and duplex production (Office of Governor Gavin Newsom, 2023).

5.3 Parking Requirement Removal's Effect on ADUs Permitted

To further benchmark the magnitude of the regulatory ceiling, I estimate the effect of removing parking requirements on ADUs permitted. The 2016 reforms lifted parking requirements within a half-mile of any transit stop. All of San Francisco is within a half-mile walking distance from transit so I focus this analysis on Los Angeles. I compare parcels within a half-mile of transit to parcels just slightly further away.

I define treated parcels as those within half a mile of a transit stop such that some parcels that are a half- to three-fourths mile away around that transit stop are not within a half-mile of any other transit stop. Those further-away parcels are then my control parcels. This is to ensure that control parcels are not themselves treated by some other nearby transit stop and that treated parcels are those that are just a bit closer to a transit stop than control parcels. For a placebo test, I create placebo groups within my treated parcels. I define placebo treatment as being within one-fourth of a mile from a transit stop and placebo control as being one-fourth to half a mile away. Appendix Figure C.2 depicts a map of my treated, control, and placebo zones.

In Figure 5 Panel A, I plot the probability that an ADU is permitted on a parcel treated by the removal of parking requirements (within half a mile of a transit stop) versus a parcel slightly further away. The probability an ADU permit is issued rises more in the treated parcels, which I interpret as the effect of removing parking requirements. The gap between the treated blue-triangle line and the control red-circle line is somewhat constant over time and that there is little change in the gap around 2020.

I use two strategies to address the concern that some other variable is changing as a parcel is further away from a transit stop. First, I conduct a placebo test. In Figure 5 Panel B, I plot the probability an ADU is permitted on a parcel less than one-fourth of a mile away versus a parcel that is one-fourth to a half mile away. The lines are almost exactly on top of each other. Second, I examine ADU permitting very close to the half-mile cutoff for lifting parking requirements. In Figure 5 Panel C, I restrict to years after parking requirements were removed and plot the probability an ADU is permitted on a parcel by distance bins of length 0.05 around this half-mile cutoff. The probability of an ADU being permitted is very steady approaching the half-mile cutoff and then immediately drops as soon as the cutoff is crossed. The magnitude of the effect is exactly the same as Panel A. These patterns support my identification strategy: factors other than parking requirements are not affecting my treated and control groups differently.

To quantify the effect of removing parking requirements and to facilitate comparison to the effect of the regulatory ceiling, I estimate

$$\begin{aligned}\mathbb{1}\left\{\text{ADU Permitted}\right\}_{it} = \beta_0^{\text{parking sample}} & \\ &+ \sum_{j=2014, j\neq 2016}^{2022} \beta_j^{\text{parking sample}} \mathbb{1}\left\{\text{Single-Family}\right\}_i \times \mathbb{1}\left\{t=j\right\}_t \\ &+ \sum_{j=2014, j\neq 2016}^{2022} \gamma_j^{\text{parking sample}} \mathbb{1}\left\{\text{Close To Transit}\right\}_i \times \mathbb{1}\left\{t=j\right\}_t \\ &+ \text{Parcel Fixed Effect} + \text{Time Fixed Effect} + \epsilon_{i,t},\end{aligned} \tag{12}$$

where the $\beta_j^{\text{parking sample}}$ and the $\gamma_j^{\text{parking sample}}$ are the coefficients of interest. In Figure 6, I plot these coefficients. Note that the treatment effect of the ceiling (the green-triangle points) is about twice as large as the treatment effect of removing parking requirements (the blue-circle points). Of course, as multi-family parcels are treated in 2020, the green-triangle points come down to zero, whereas the blue-circle points remain around 0.2 percentage points. In 2017–2020, before multi-family parcels are treated, the effect of the ceiling is twice as high: 0.4 percentage points.

5.4 Evidence of Continuing Regulatory Barriers

I investigate whether there is bunching at the floor size limit under which state preemption applies. An ADU permitted under the state's regulatory ceiling may be at most 1,200 square feet. Local jurisdictions may set rules on ADUs that surpass these size limits. In Figure 7, I plot a histogram of the floor size of permitted ADUs.[24] There is clear visual evidence of bunching at the limit described above, suggesting that ADU owners prefer the regulatory certainty of state standards.

5.5 Supply Constraints Predict ADU Permitting

Next, I test Model Result 3, which predicts that supply constraints on housing predict ADU permitting. To proxy for supply constraints, I follow Glaeser and Gyourko (2018), who use the ratio of home values to construction costs as a measure of the presence of binding regulatory supply constraints. I use a similar measure at the zip code level: the ratio of home values to replacement costs (henceforth, V/R). The intuition is the same: in efficient markets, a home's value should be equal to the cost of replacing it. If Model Result 3 is correct, then areas with a high V/R will see high levels of ADU permitting. In Figure 8, I plot a binned scatter plot of the number of ADUs permitted in a zip code against that zip code's value to replacement ratio.[25]

The V/R ratio predicts ADU permitting, but the relationship is not linear. As the ratio rises from one, the number of ADUs permitted increases sharply but flattens out once the ratio exceeds 2. There are at least two explanations of this pattern. First, the most supply-constrained areas are also places where there is already significant wealth and aversion to renters. Simply put, no one is renting out a backyard unit in Beverly Hills. Second, places with high supply constraints might have multiple binding constraints and thus ADU permitting is constrained by some other binding restriction in those places. Overall, this analysis validates a prediction of my model: the cost of building rental housing through developers σ_r must be high for regulatory changes to spur ADU permitting.

[24] Only the Los Angeles permits contained a floor size variable. For San Francisco, I use the text of the permit description and search for numbers immediately preceding variations of "sqft."

[25] I used data from Chapple (2021) to measure ADUs permitted across all zip codes in California from 2018-2020 in order to include a wider sample of the V/R distribution. Most zip codes in Los Angeles and San Francisco have a very high V/R ratio.

6 The Effect of ADUs on Neighbors

This section estimates whether ADUs decrease the property values of neighboring homes, which I call the nuisance effect. The challenge to estimating the nuisance effect is that the location of ADU construction is non-random. ADUs might be built in areas with less valuable single-family homes or areas about to experience an increased presence of renters. The first could be measured, but the second is impossible. Indeed, if the channel by which ADUs impose a nuisance is through the presence of renters, then this second problem poses a substantial identification challenge to cross-sectional estimation of the nuisance effect. To overcome this, I compare the property values close to the ADU over time to property values just slightly farther away over time. My strategy to use variation in distance from an event site to overcome the non-random placement of events draws from Linden and Rockoff (2008) and Diamond and McQuade (2019).

This strategy also draws on the economic theory shown in Model Result 4. Under the assumptions of my model, a home being slightly closer or slightly further away from an ADU only affects its property value through the nuisance effect. Taking this to the context of ADUs, I limit my analysis to property sales with a certain distance d of a constructed ADU. For property i and time t, let ADU(i) denote the ADU that property i is less than d away from.[26] I estimate

$$\begin{aligned}\log(\text{Price}_{i,t}) = \beta_0^{\text{nuisance}} &+ \beta_1^{\text{nuisance}} \mathbb{1}\left\{\text{After ADU}(i)\text{ Constructed}\right\}_{i,t} \\ &+ \beta_2^{\text{nuisance}} \mathbb{1}\left\{\text{Within } d/2 \text{ of ADU}(i)\right\}_i \\ &+ \beta_3^{\text{nuisance}} \mathbb{1}\left\{\text{Within } d/2 \text{ of ADU}(i)\right\}_i \times \mathbb{1}\left\{\text{After ADU}(i)\text{ Constructed}\right\}_{i,t} \\ &+ \text{ADU}(i)\text{ Fixed Effect} + x_{i,t}^T \vec{\eta} + \epsilon_{i,t},\end{aligned} \tag{13}$$

where $\beta_3^{\text{nuisance}}$ is the coefficient of interest. In my analysis, I take d to be 1,000 feet. Therefore, my treatment group is properties sold within 500 feet of a new ADU. I use the "ring method" of Linden and Rockoff (2008), where I consider a unit to be treated if it is within $d/2$ of the constructed ADU and as not treated otherwise. The intuition behind this strategy is that units closer to the ADU should experience a higher nuisance effect.[27]

[26] I remove transactions of the property containing the ADU. I only keep a sale price if it is within a year on either side of its corresponding ADU construction. I remove prices above the 99th and below the 1st percentile. I remove transactions where the floor area is above the 95th and below the 5th percentile. I finally balance the sample, keeping observations such that ADU(i) has one transaction in each treated/untreated group in each before/after period.

[27] Diamond and McQuade (2019) use a non-parametric strategy, where they allow for property values in an area around an event of interest to be some function of distance from that event. They are able to estimate the empirical derivatives of this function, and thus make fewer assumptions on how distance affects

Results. Because my specification is parametric, I first review some visual (lack of) evidence for the nuisance effect. Figure 9 plots a binned scatter plot of the distance from the construction site and log sale price before and after the ADU was constructed. Panel A uses the entire sample and Panel B restricts to sales near ADUs built in above median income Census tracts. Results are similar between A and B. In the presence of a nuisance effect, the after line should gain a clear upward slope compared to the before line, as being further away from the event site increases property values. However, the relationship remains nearly identical before and after the construction. The uniform confidence bands in the figure largely overlap. This is strong visual evidence that there is no economically significant nuisance effect. An advantage of this analysis is that it does not rely on my parametric assumptions. Hence, even if the effect were not linear as I assume or if the specification of d in the "ring" analysis was incorrect, the figure would still show a potential nuisance effect. Of course, a disadvantage is that it lacks power – only a strong nuisance effect would be so visually clear.

In Table 2, I report the results of estimating Equation 13. Column (1) reports a bare-bones regression, with no covariates or fixed effects. Column (2) adds fixed effects for ADU(i) and (3) adds controls. In the latter two specifications, the coefficient is directionally consistent with a negative nuisance effect but neither statistically nor economically significant. Point estimates suggest a half percent decline in property values and my preferred specification rules out estimates more negative than 2.3 percent.

In Appendix Table B.6, I report the results of estimating Equation 13 on a sample of property sales where ADU(i) is in an above median income neighborhood.[28] The columns report the same specifications as the previous table. My preferred specification rules out 2.8 percent. This is evidence that nuisance effects from ADUs are likely overstated, even in high-income neighborhoods. I also repeat this analysis for above median population neighborhoods in Appendix Table B.7. The results are very similar to Table 2 and do not suggest more negative nuisance effects in high population neighborhoods.

These estimates guide future research into the spillover effects of density. My model predicts that homeowners will coordinate to prevent new construction if the marginal disutility of increased density is greater than the potential profits. The estimation in this section

property values. However, due to sample size constraints, I am unable to use the "empirical derivatives" method and use the "ring method" instead.

[28] I use the median income variable from the ACS. I map ADU(i) to its Census tract and use the 2022 value of median income. I do this separately by Los Angeles and San Francisco, so this subsample consists of above median income neighborhoods in both cities.

shows that the distance-dependent nuisance effect is likely small in the context of ADUs, which suggests that homeowners are primarily worried about the overcrowding in their neighborhood. This finding is reflected in the content of many of the regulations that the state lifted: parking requirements, impact fees, and setback requirements. Therefore, future research on single-family zones could focus on measuring disutility from the overcrowding effect, which is not within the scope of this paper.

Robustness. One note of caution is that I lack as many observations within approximately 50 feet of the ADU, where the nuisance effect would be the strongest. If a nuisance effect were to exist, it is plausible that it ought to only affect the units directly next to an ADU. The confidence bands in Figure 9 become much larger near values very close to zero. To allay this concern, I compute the nuisance effect and vary the distance d that is used to define treatment. Appendix Figure C.3 plots estimates of the nuisance effect for various definitions of the treatment ring, always comparing them to a control ring of properties sold 500 to 1,000 feet away. The point estimates are quite consistent. There is no clear downward pattern in the point estimates as the treatment rings get tighter until about 200 feet, where the coefficients do decrease slightly although the confidence intervals become much larger. This is suggestive evidence that my estimates are accurate, but studying the potential decay of a nuisance effect with respect to distance with more data extremely close to ADUs is a promising direction for future work.

As another robustness check, I restrict to ADUs that are completely new constructions as opposed to conversions of garages or storage sheds. An ADU that replaces an existing structure could beautify the property, so I filter out permits that contain phrases like "reconstruct," "demolish," or "convert." I report the results of this analysis in Appendix Table B.8 and do not find evidence of a nuisance effect.

Furthermore, it could be the case that some other confounder also changes with distance, nullifying the assumption that property values close to versus further away would have moved similarly if not for the construction of the ADU. I report several balance tests in Appendix Figure C.4, which show that relevant property characteristics are not changing by distance to the ADU over time. In particular, I plot the relationship of distance to number of beds, year property is built, and square footage of a house by whether the property was sold before or after the ADU was built. I also plot the distribution of the distance to ADU(i), showing that this is not changing over time. These tests show that the assumptions of my strategy are plausible. Appendix Figure C.5 conducts the same balance tests for the high-income neighborhood subsample.

Alternative Empirical Design. I also report results from an alternative empirical design, following Davidoff et al. (2022). I use my permit data to identify new single-family home constructions in Los Angeles and flag whether those homes are built with or without ADUs. I scrape more property sale data around those constructions in addition to using my previously compiled sale data. This results in a dataset of property sales within 500 feet and one year after a new single-family home construction. I merge in neighborhood data from Los Angeles Times (2017). For property sale i at time t, let Construction(i) denote the corresponding single-family home construction and n(i) the neighborhood. I regress

$$\begin{aligned}\log(\text{Price}_{i,t}) = \beta_0^{\text{new construction}} + \beta_1^{\text{new construction}} \mathbb{1}\left\{\text{Construction}(i) \text{ has ADU}\right\} \\ + x_{i,t}^T \vec{\eta} + \text{Time Fixed Effect} + \text{Neighborhood Fixed Effect} + \epsilon_{i,t}.\end{aligned} \tag{14}$$

I report results in Appendix Table B.9. Column (1) reports a regression without fixed effects and the point estimate is very negative. This estimate becomes much closer to zero in Column (2) and (3) as I add neighborhood fixed effects and control variables, indicating that cross-sectional variation in ADU construction may be correlated with unobserved variables that affect the price of homes. I caution that I lack power: there are only 6 new single-family homes with ADUs relative to 724 new single-family homes without ADUs.[29] While it would have been desirable to implement such a design in my setting, I am limited by my data.

7 The Effect of ADUs on Rents

The ideal experiment would be to take two independent housing markets, assign one to experience a supply-side ADU shock and the other not to and measure the impact of increased ADU construction on rents. The policy I study caused significant ADU construction on single-family parcels, so I approximate the ideal experiment by creating a ZCTA-level measure of treatment exposure. For a ZCTA z, I spatially merge z with the parcels from my parcel data. Then, I calculate how much of the area of the ZCTA has single- or

[29] I am limited to Los Angeles because I can also identify very few new single-family constructions in San Francisco, and none for which I have nearby sale data. For why I find so few observations in Los Angeles, one hypothesis relates to the fact that the permit description variable is cut off after a number of characters, making it difficult to identify whether a new single-family home has an ADU if such information would appear last in the description.

multi-family land use. I then define the proportion single-family S_z as

$$S_z := \frac{\text{area in ZCTA } z \text{ that has single-family land use}}{\text{area in ZCTA } z \text{ that has single- or multi-family land use}}. \tag{15}$$

In Appendix Figure C.6 Panel A, I plot the density of S_z. Single-family land use is extremely common and there are very few purely control areas, but there is sufficient variation in S_z. In Panel B, I map treatment exposure for each ZCTA in my sample.

Given that the ADU reforms I study were meant to transform single-family areas to more resemble two- or three-family areas, already existing multi-family areas serve as a natural comparison group because they were, in a sense, "always treated" with gentle density. Of course, these areas differ in many other characteristics, which is why I use a linear panel model that makes the assumption that those differences are constant over time. I address the assumption that the areas are independent at the end of this section. I estimate a pooled specification given by Equation 16

$$\begin{aligned}\log(\text{Rent}_{z,t}) = \beta_0^{\text{rent}} + \beta_1^{\text{rent}} \mathbb{1}\{\text{Post 2016}\}_t \\ + \beta_2^{\text{rent}} S_z \times \mathbb{1}\{\text{Post 2016}\}_t \\ + \text{ZCTA Fixed Effect} + x_{z,t}^T \vec{\eta} + \epsilon_{z,t},\end{aligned} \tag{16}$$

where β_2^{rent} is the coefficient of interest. I also estimate a dynamic specification

$$\begin{aligned}\log(\text{Rent}_{z,t}) = \beta_0^{\text{rent dynamic}} \\ + \sum_{j=2015, j\neq 2016}^{2022} \beta_j^{\text{rent dynamic}} S_z \times \mathbb{1}\{t = j\}_t \\ + \text{ZCTA Fixed Effect} + \text{Time Fixed Effect} + x_{z,t}^T \vec{\eta} + \epsilon_{z,t},\end{aligned} \tag{17}$$

where the $\beta_j^{\text{rent dynamic}}$ are the coefficients of interest and $x_{z,t}$ is a vector of time-varying covariates from the ACS. Rents are inflation-adjusted to 2022. The ACS changed the top-coding of the variable in 2015 from \$2,001 to \$3,501. Top-coding the later years to match the previous years would remove too much of the distribution of rents. Therefore, I am unable to use rents before 2015 in the same specification with rents after 2015, so I estimate these specifications on my sample of ZCTAs from 2015 to 2022.

Benchmarking using Theory. Aggregation of ADU policy shock to the ZCTA-level is necessary to study rents but decreases my statistical power substantially. I use the result of Model Result 5 to estimate a plausible range for $\beta_j^{\text{rent dynamic}}$ in Equation 17. This also facilitates interpretation of the magnitude of my coefficients.

I start with the baseline rental stock and the median rent price in each ZCTA in my sample in 2015. For each subsequent year, I use (i) an estimate of the price elasticity of demand of rental housing and (ii) the number of ADUs constructed to estimate rents in the next period. I repeat this process forward to build rent price trajectories that contain variation solely from the supply effects of ADUs. I then fit Equation 17 on this dataset to yield plausible estimates for β_j.

Denote the price elasticity of demand for rental housing as $\frac{1}{\eta}$. Recall from Model Result 5, the log change in rents is equal to η times the log change in supply:

$$\log(\text{Rent}_{z,t}) - \log(\text{Rent}_{z,t-1}) = \eta \left[\log(\text{Rental Stock}_{z,t}) - \log(\text{Rental Stock}_{z,t-1})\right]. \qquad (18)$$

I take $\text{Rental Stock}_{z,t}$ to be equal to $\text{Rental Stock}_{z,t-1} + 0.51 \cdot \text{ADUs Constructed}_{z,t-1}$. That is, quantity in a ZCTA evolves only with respect to constructed ADUs. Note that I adjust ADU quantity downward by the proportion of ADUs rented out (0.51). I set $\text{Rental Stock}_{z,2015}$ and $\text{Rent}_{z,2015}$ equal to the true number of rental units and rents from the ACS. Then, I fit this model forward for $t \in \{2016, 2017, 2018, 2019, 2020, 2021, 2022\}$. In this calculation, each ZCTA's rent trajectory is as it would be if the *only change* was the construction of ADUs. I construct my synthetic dataset across $\frac{1}{\eta} \in \{-1.28, -0.71, -0.56, -0.17\}$.[30]

I estimate Equation 17 on the synthetic data:

$$\begin{aligned}\log(\text{Synthetic Rent}_{z,t}) = \beta_0^{\text{synthetic}} & \\ & + \sum_{j=2015, j\neq 2016}^{2022} \beta_j^{\text{synthetic}} S_z \times \mathbb{1}\{t=j\}_t \\ & + \text{ZCTA Fixed Effect} + \text{Time Fixed Effect} + x_{z,t}^T \vec{\eta} + \epsilon_{z,t},\end{aligned} \qquad (19)$$

where the $\beta_j^{\text{synthetic}}$ are the coefficients of interest.

Results. I report results in Figure 10. In Panel A, I plot the coefficients from my dynamic specification in Equation 17 except the left-hand side variable is the number of ADUs con-

[30]My estimates for the price elasticity of rental housing demand $\frac{1}{\eta}$ come from Mayo (1981), which comprehensively reviews estimations of housing demand in the economics literature. Table 1 in that paper reviews prominent estimations of the price elasticity of demand in log-linear models, collecting the estimates from 16 papers. This set covers the smallest and largest estimates of elasticity in the paper and two less extreme estimates. Although these estimates are old, it is reasonable to assume the true elasticity lies somewhere in this range.

structed. There is a clear effect, with a ZCTA going from none to full exposure building 14.1 more ADUs on average every year post-treatment. In Panel B, I plot the coefficients for rents. There is some downward movement, but nothing is statistically distinguishable from zero. A test that all coefficients are jointly zero fails to reject the null with a p-value of 0.1211. My pooled specification estimates a decrease of 0.3 percent but the estimate is not distinguishable from zero. I report full results for my pooled and dynamic specifications in Table 3 and in Appendix Table B.10.

In Figure 10 Panel B, I also plot the coefficients from my theory-based calculation overlaid on the empirical estimates. All of the elasticity values except for -0.17 suggest very small rent effects. The range suggested by the simulated coefficients and my estimated coefficients provide some information on the effects on rents. Because California is likely more inelastic than other places, I find the range of estimates for $\frac{1}{\eta} = -0.71$ and -0.56 most plausible. Those suggest a -0.6 and -0.8 percent decline in rents, respectively.

Parallel Trends and the Pandemic. My estimates capture the causal effect of the ADU reforms on rents if the "parallel trends" assumption holds: that absent the reforms, rents across areas with more single-family land use would have evolved similarly.

As noted, I cannot include pre-2015 observations directly in my main specification because of the ACS's top-coding of rents. However, I check for a pre-trend before 2015 directly in Appendix Figure C.7 Panel A. At least in the 2010 to 2014 period, rents did not exhibit different trends across neighborhoods with different exposure to ADU deregulation. This is some evidence that, absent ADU deregulation, rents would have continued to move in parallel in 2015 and after.

The pre-trend test does not speak to confounding trends that emerge after treatment. One of these threats, suggested by the noticeably higher point estimate in 2021, is that the pandemic affected ZCTAs with more single-family land use differently. This is very plausible given substantial shifts in work-from-home dynamics and location preferences. I therefore estimate my specifications in 2015–2019 and report results in column (3) of Table 3 and Appendix Table B.10. The pooled specification yields a coefficient of -0.0097 (0.0299), slightly more negative than the specification which includes the pandemic years. This may help explain why my model-based estimates are more negative than the empirical specification that includes the pandemic.

I conduct another test by replacing the left-hand side variable in my dynamic specification (Equation 17) with the number of grandparents living with their own grandchildren.

I choose this variable because ADUs are often made to house the elderly. Therefore, this variable could capture confounding changes in demand. I plot the coefficients from this regression in Appendix Figure C.7 Panel B. This test suggests that the pandemic is a concern: there is a sharp drop in the coefficients in 2021.

Housing Market Definition. I take a housing market z as a ZCTA. It is not clear this is the right definition. If I have misspecified the area in which a supply effect from new housing applies, this could bias my estimates. On one hand, there is evidence that supply effects are also quite local and decay with distance rapidly (Asquith et al., 2023). In this case, one would need granular rent data to study rents very close to new ADUs – I lack such data. On the other hand, a market z could be some much larger geographic area, perhaps at the level of the two cities in my sample. If people move across ZCTAs within cities in response to new housing, then rent effects are properly estimated at the city level. However, at the city level, there is very little room to isolate variation in ADU construction. Instead, to address this case, I repeat my simulation exercise in the two cities in my sample.

I take the sum of housing units across ZCTAs and take a population weighted mean of median rents. Then I simulate prices forward using Equation 18. In Appendix Figure C.7 Panel C and D, I plot these simulated prices and report the change between 2015 and 2022 next to each line. The estimates from the moderate elasticity values are very close to the estimates in my ZCTA-level empirical analysis: half a percent to one percent. I also report the actual change in log rent between 2015 and 2022. The growth in rents is about 16 to 19 percent, an order of magnitude larger than the supply effect predictions.

8 Conclusion

This paper presents evidence on the importance of setting a ceiling on local authority in the preemption of local housing regulations. My quantitative and qualitative evidence on the state's regulatory ceiling shows this legal design was a central driver of the increase in ADU permitting California experienced since its reforms. This finding emphasizes the importance of a predictable right to build relative to mere legalization, an important contribution to not just the economic and legal literature on land use regulation but also to policymakers considering reforms to those regulations. I also contribute to the literature on the effects of new housing construction and the policy debate on ADUs, finding no evidence that ADUs impose a nuisance on neighbors and providing some suggestive evidence on rents.

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Table 1: Difference-in-Differences on ADUs Permitted

Panel A: Studying 2016 Reforms (2014-2020)

	(1) ADU Permitted
Post 2016	0.000798
	(0.0000517)
Parcel Single-Family $\times$ Post 2016	0.00291
	(0.0000652)
Constant	0.0000227
	(0.0000198)
FEs	Parcel
SEs	Clustered at Parcel
Num. Obs.	4942630
R^2	0.146

Panel B: Studying 2020 Reforms (2020-2022)

	(1) ADU Permitted
Post 2020	0.00156
	(0.0000917)
Parcel Multi-Family $\times$ Post 2020	0.00238
	(0.000205)
Constant	0.00374
	(0.0000414)
FEs	Parcel
SEs	Clustered at Parcel
Num. Obs.	2824641
R^2	0.257

Notes: This table reports difference-in-differences estimates of the effect of the regulatory ceiling on ADU permit approval. The dependent variable is an indicator of whether an ADU permit was issued on a parcel in a given year. Panel A estimates Equation 9 for 2014-2020, comparing single-family parcels to multi-family parcels. Panel B estimates Equation 10 for 2020-2022, comparing multi-family parcels to single-family parcels. All specifications include parcel fixed effects. Standard errors are cluster robust at the parcel level.

Table 2: Nuisance Effect Estimates

	(1) Log(Price)	(2) Log(Price)	(3) Log(Price)
Near ADU	-0.00909	0.00860	-0.00385
	(0.0152)	(0.0115)	(0.00873)
After ADU Built	-0.0358	-0.0164	0.00182
	(0.0147)	(0.00899)	(0.00769)
Near ADU × After ADU Built	0.0150	-0.00299	-0.000589
	(0.0194)	(0.0139)	(0.0115)
Floor Area			0.000299
			(0.00000933)
Year Built			-0.000765
			(0.000270)
Num. Beds			0.0222
			(0.00239)
Constant	14.39	14.37	15.27
	(0.0191)	(0.00532)	(0.524)
FEs	None	ADU(i)	ADU(i)
SEs	Cluster, ADU(i)	Cluster, ADU(i)	Cluster, ADU(i)
Num. Obs.	10516	10516	10497
R^2	0.00106	0.497	0.700

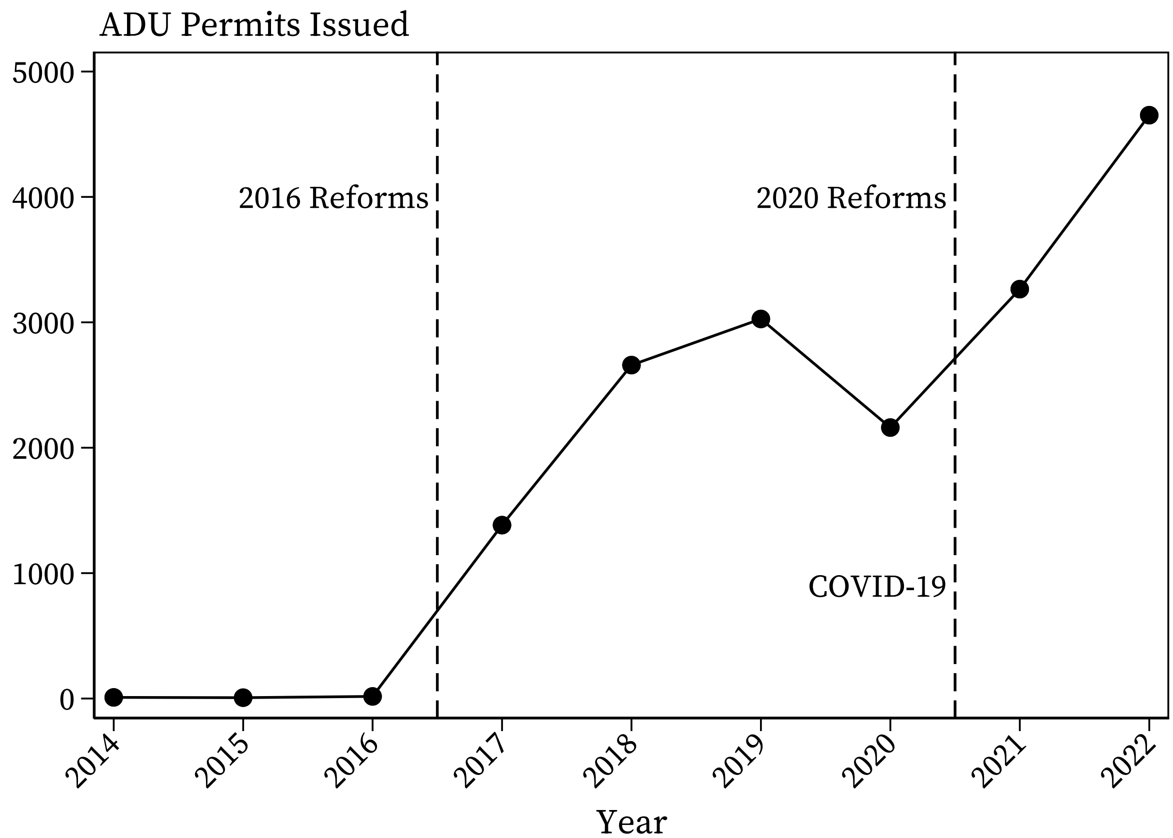
Notes: This table reports estimates of Equation 13. The dependent variable is log sale price for properties sold within 1,000 feet of an ADU and within one year before or after the ADU's construction. Near ADU is an indicator for a sale within 500 feet of the ADU. After ADU Built is an indicator for sales after the ADU was completed. Column (1) reports the regression without covariates or fixed effects. Column (2) adds ADU(i) fixed effects and (3) adds covariates. Floor area is in square footage units. Standard errors are cluster robust at the ADU(i) level.

Table 3: Difference-in-Differences on Rent

	(1) Log(Rent)	(2) Log(Rent)	(3) Log(Rent)
Post 2016	0.119	0.0682	0.0565
	(0.0359)	(0.0415)	(0.0229)
Post 2016 $\times S_z$	-0.0169	-0.00256	-0.00971
	(0.0403)	(0.0523)	(0.0299)
Median Income ($1000)		0.00341	0.00193
		(0.000659)	(0.000736)
Population (1000)		-0.00286	0.00448
		(0.00343)	(0.00291)
Constant	7.431	7.253	7.112
	(0.00432)	(0.157)	(0.116)
FEs	ZCTA	ZCTA	ZCTA
SEs	Clustered at ZCTA	Clustered at ZCTA	Clustered at ZCTA
Sample	Full	Full	Pre-2020
Num. Obs.	1312	1311	819
R^2	0.960	0.966	0.981

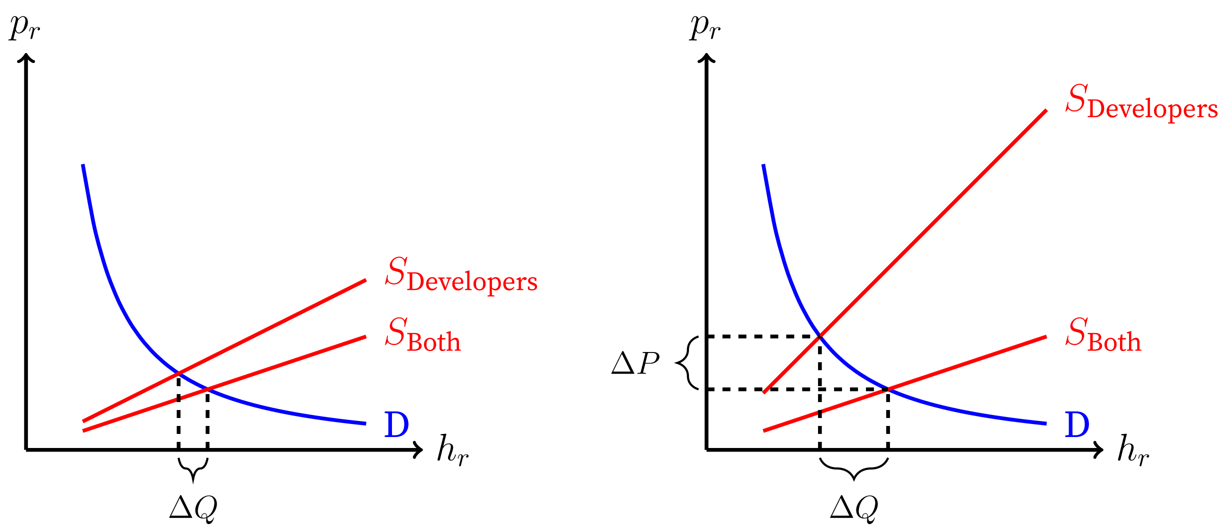
Notes: This table reports pooled difference-in-differences estimates of Equation 16 at the ZCTA-year level. The dependent variable is log median rent. S_z is the fraction of single- or multi-family parcel area in the ZCTA that has single-family land use. All columns include ZCTA fixed effects. Column (1) includes no time-varying controls. Column (2) adds controls. Column (3) restricts to the pre-2020 sample. Standard errors are cluster robust at the ZCTA level.

Figure 1: ADUs Permitted Over Time



Notes: This figure plots the number of ADU permits issued in Los Angeles and San Francisco each year. I restrict to permits issued on parcels in my sample, ones with existing single- or multi-family structures.

Figure 2: Supply Constraints on Developers and ADU Production

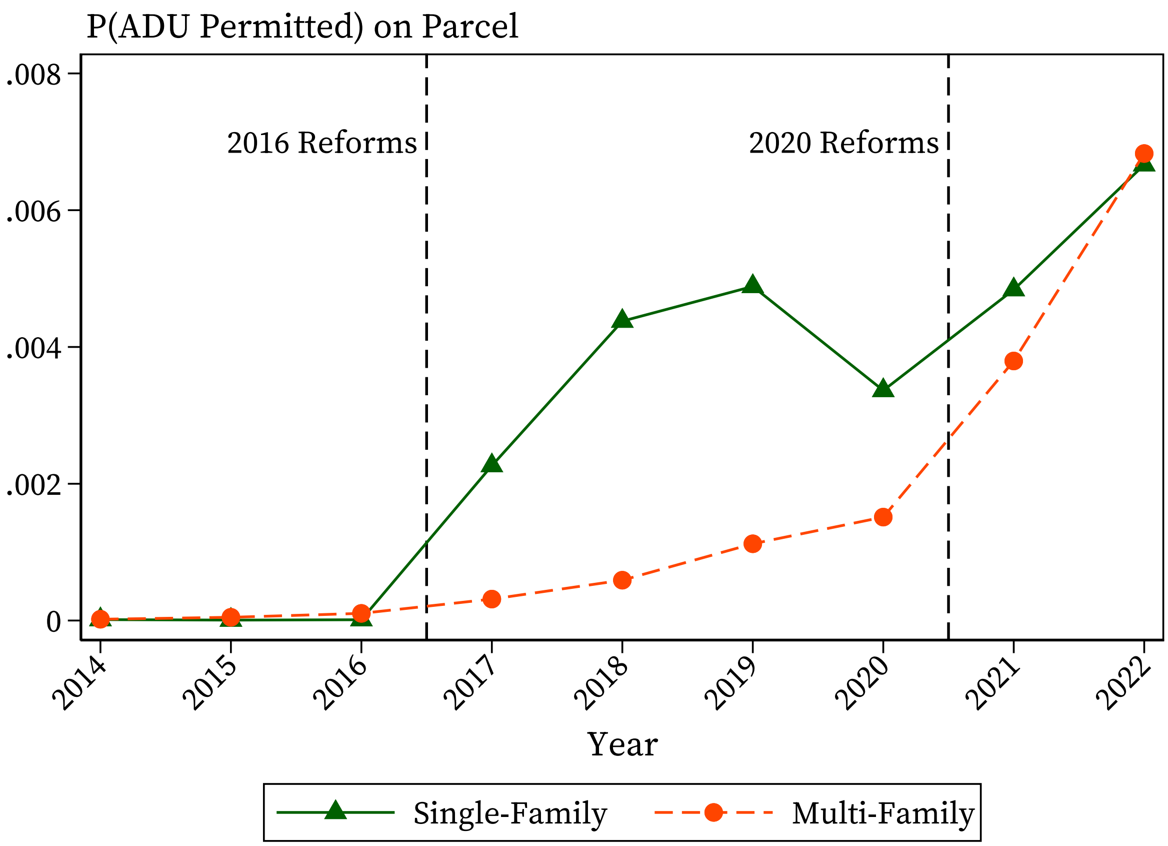


(a) $\sigma_r = \frac{1}{2}$, $\sigma_a = 1$, Few ADUs Built

(b) $\sigma_r = 1$, $\sigma_a = \frac{1}{2}$, Many ADUs Built

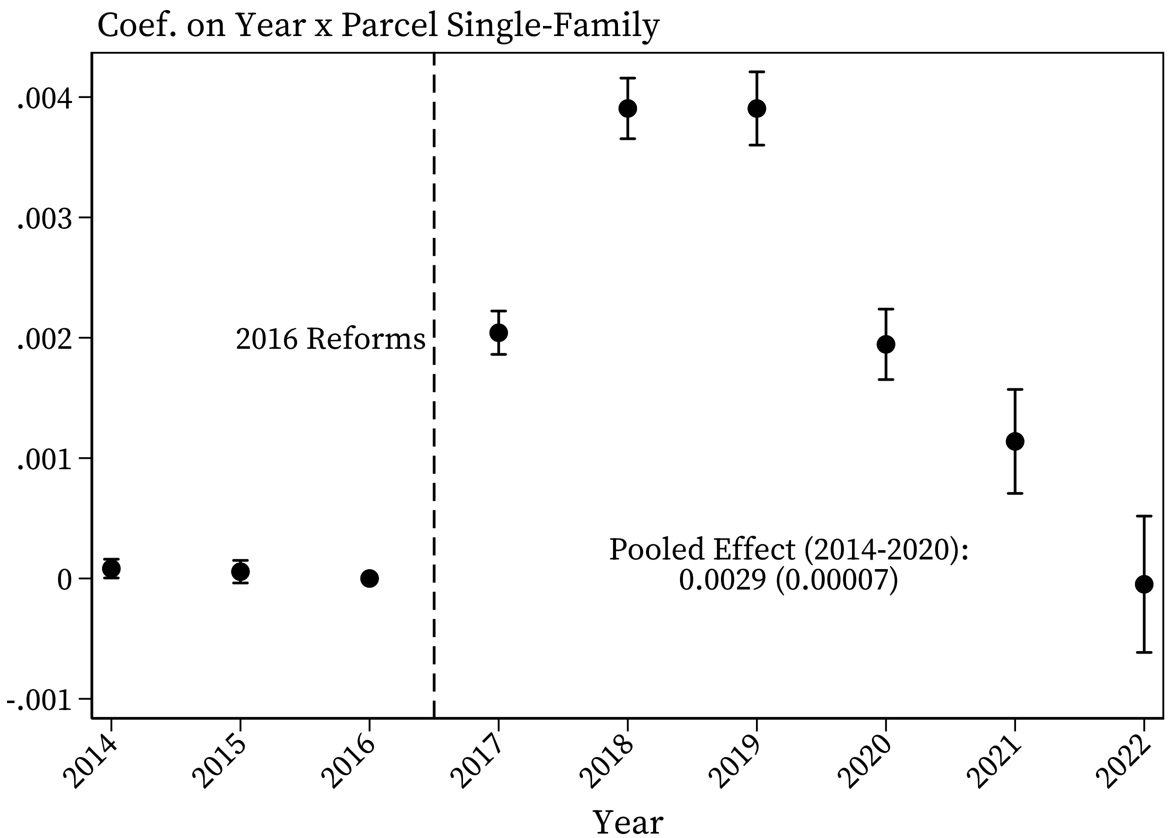
Notes: This figure plots supply curves from developers and from both developers and homeowners. I hold $\lambda_r = \lambda_s = 1$, and set $\eta = -.75$. I vary the values of σ_r, σ_a between the two panels. This is a toy example of the results in Model Results 2, 3, and 5.

Figure 3: Probability of ADU Permit Issued by Single- and Multi-Family Parcel



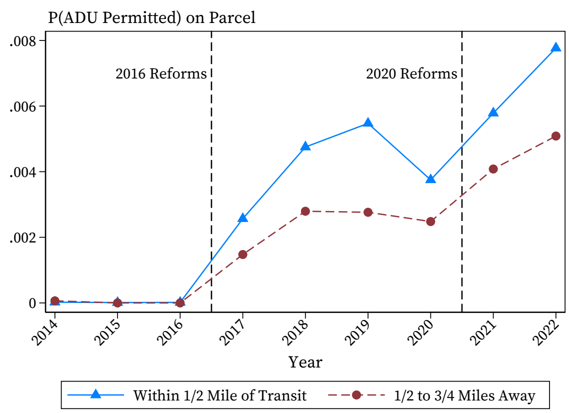
Notes: This figure plots the probability an ADU was permitted on a parcel in each year by the parcel's land use (single-family versus multi-family). I restrict to ADUs permitted on parcels with existing single- or multi-family structures. The green triangle-marked line plots the mean of an indicator that an ADU was permitted that year on single-family parcels. The orange circle-marked line plots the same mean on multi-family parcels.

Figure 4: Event Study Coefficients of the Regulatory Ceiling on ADUs Permitted

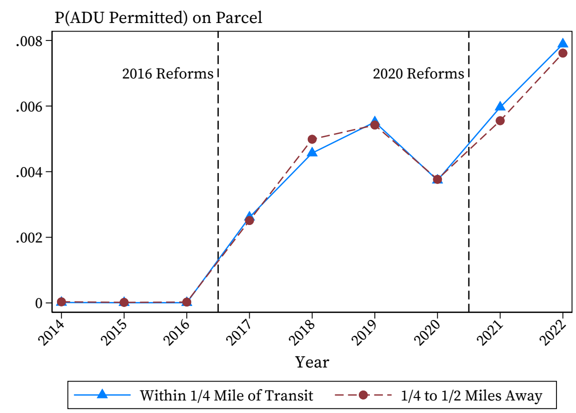


Notes: This figure plots dynamic coefficients from Equation 11. The dependent variable is an indicator of whether an ADU permit was issued on a parcel in a given year. The confidence intervals are at the 95 percent level. The annotation reports the pooled 2014-2020 estimate.

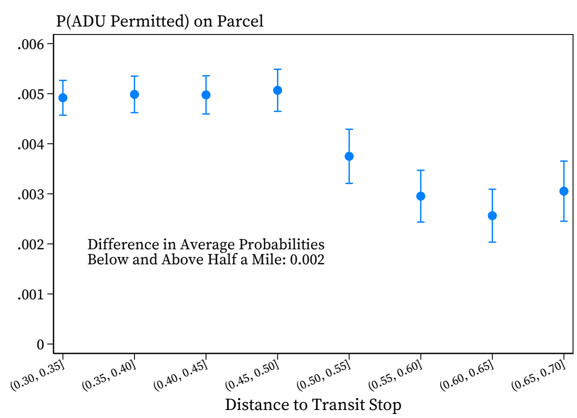
Figure 5: Effect of Preempting Parking Requirements



(a) Permitting by Distance to Transit



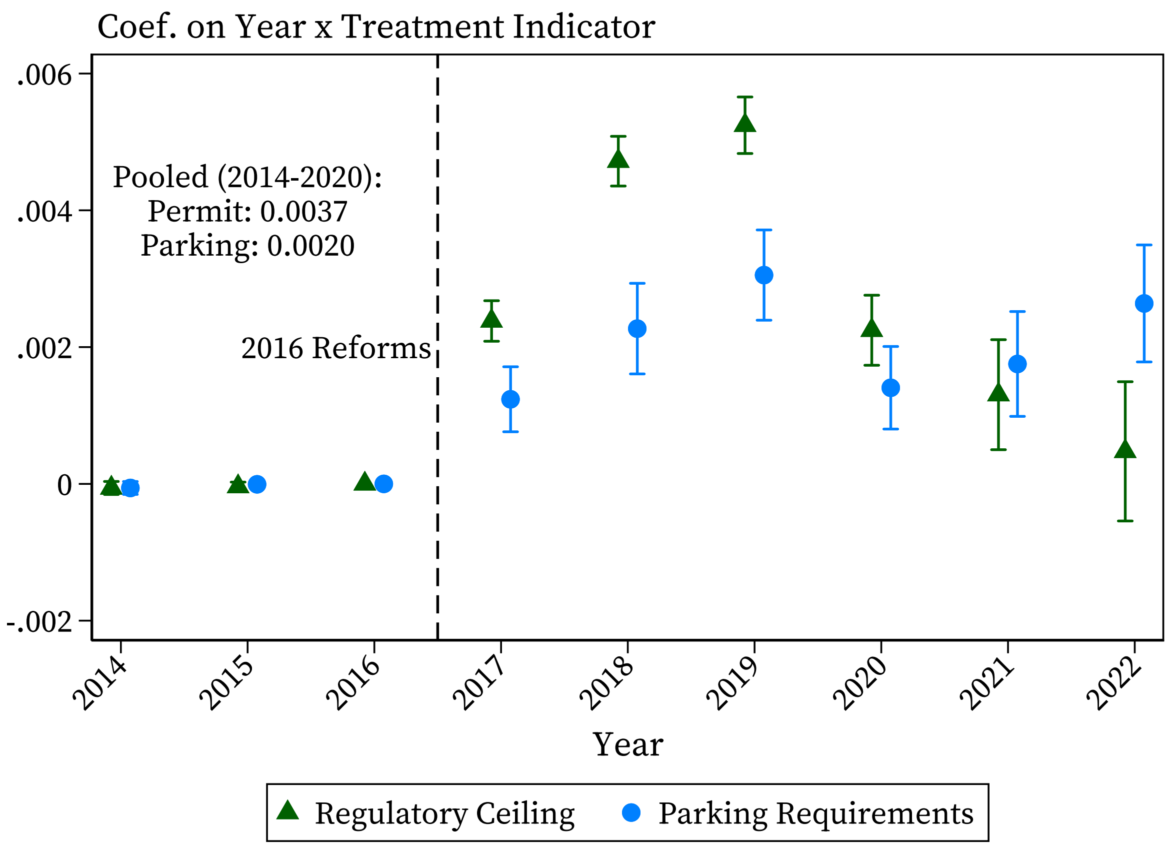
(b) Placebo Test



(c) Permitting by Finer Distance Bins

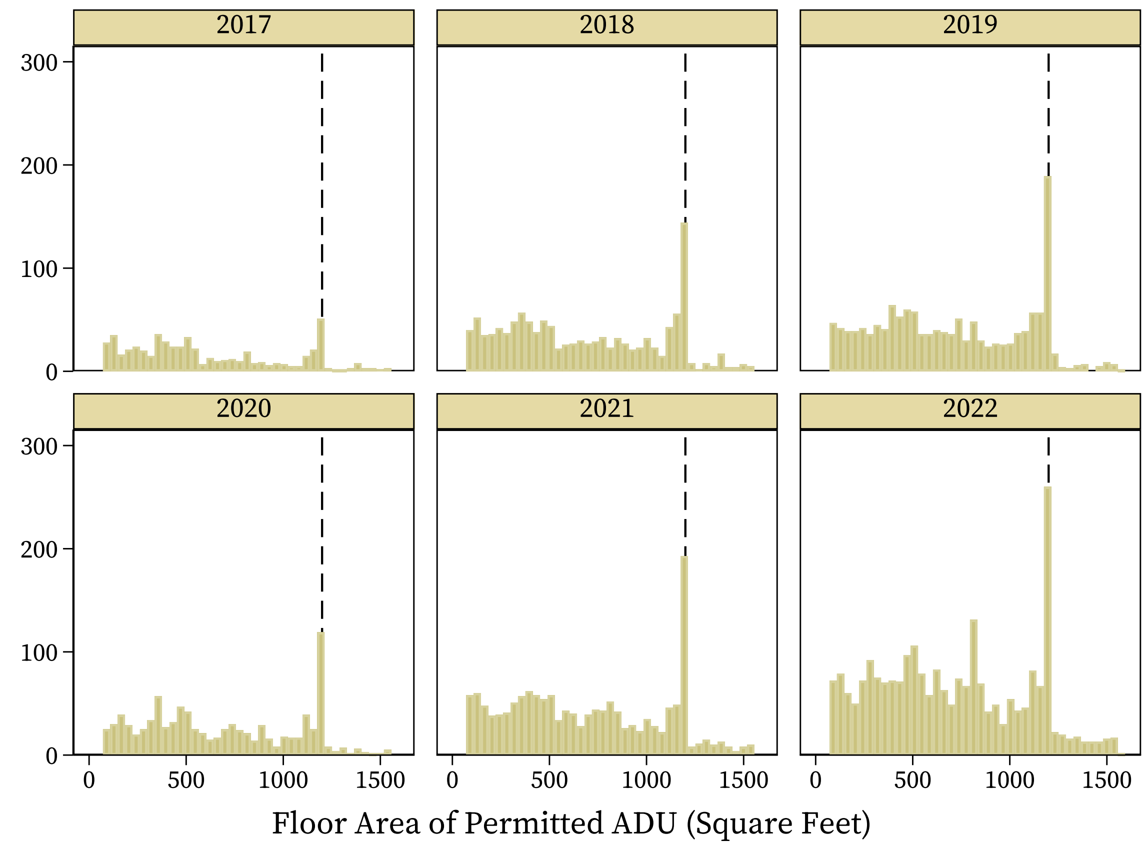
Notes: This figure plots the probability an ADU was permitted on a parcel by distance to a transit stop and year. Panel A compares parcels within one-half mile of a transit stop to parcels one-half to three-fourths of a mile away from the same transit stops. The control group is restricted to parcels not within one-half mile of any other transit stop. Panel B is a placebo comparison within the treated area, splitting parcels within one-fourth mile of transit from parcels one-fourth to one-half mile from transit. Probabilities are estimated by taking a mean of an indicator that an ADU was permitted on a parcel for parcels in a given year and distance group. Panel C restricts the sample to after 2016, once the parking requirement ban is in place. It plots the probability an ADU is permitted on a parcel in a year, measured by taking the mean of an indicator variable within distance bins of size 0.05 miles. 95 percent confidence intervals are given using the standard error of the mean.

Figure 6: Comparing Effect of Lifting Parking Requirements and the Regulatory Ceiling



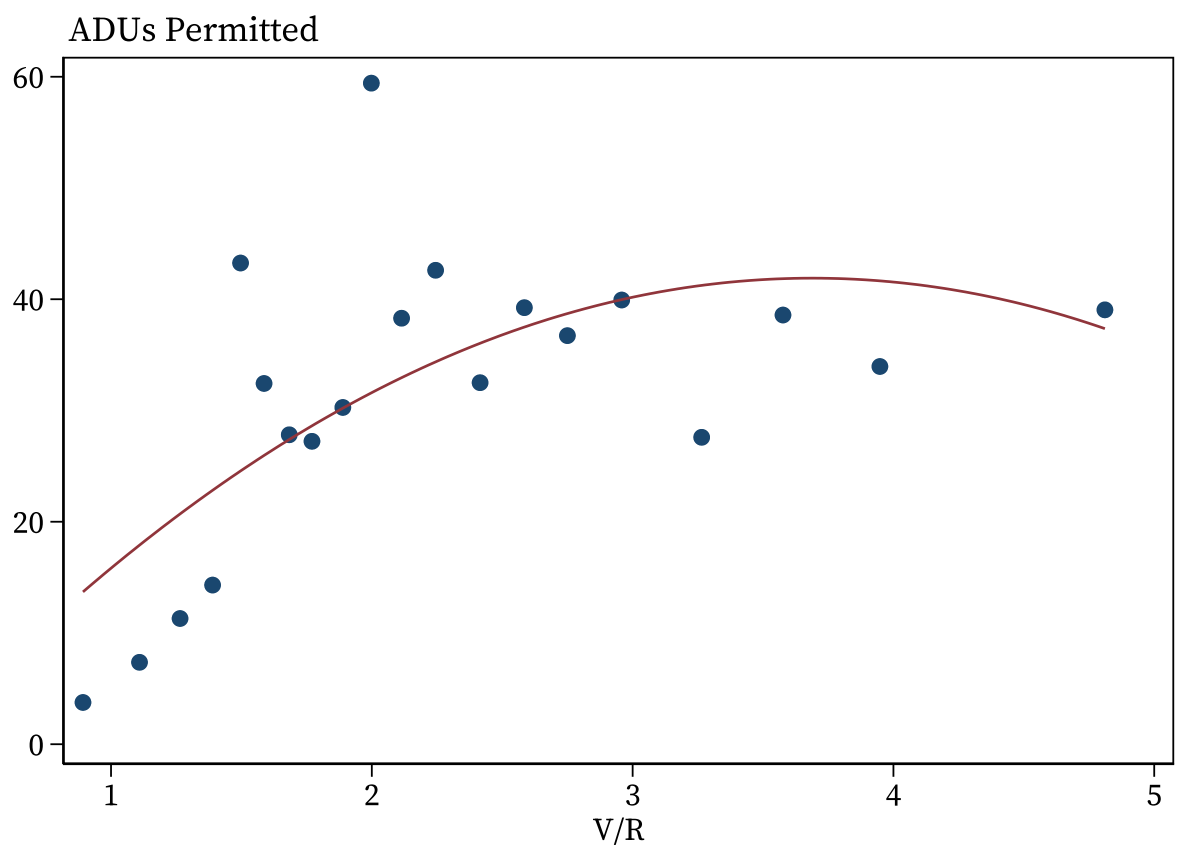
Notes: This figure plots dynamic coefficients from Equation 12. The dependent variable is an indicator of whether an ADU permit was issued on a parcel in a given year. The regulatory ceiling series (green triangles) reports coefficients on single-family parcel by year. The parking series (blue circles) reports coefficients on close-to-transit by year, where close-to-transit means within one-half mile of a transit stop. Standard errors are clustered at the parcel level. Vertical bars are 95 percent confidence intervals.

Figure 7: Histogram of Floor Area by Year



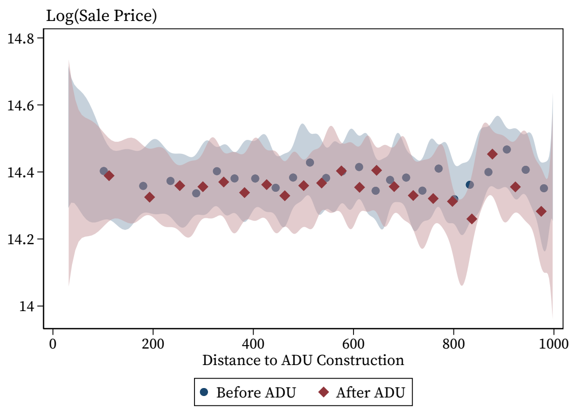
Notes: This figure plots a histogram of the floor area of each ADU permitted in the sample, by year. In Los Angeles, floor area was available as a variable in the raw permit data. For San Francisco, I obtain floor area from the text of the permit description, searching for numbers that precede variations of "sqft." The resulting square footage variable is winsorized at the 5th and 95th percentile. The vertical lines are at 1,200 square feet.

Figure 8: Binned Scatterplot of ADUs Permitted on the Value to Replacement Ratio

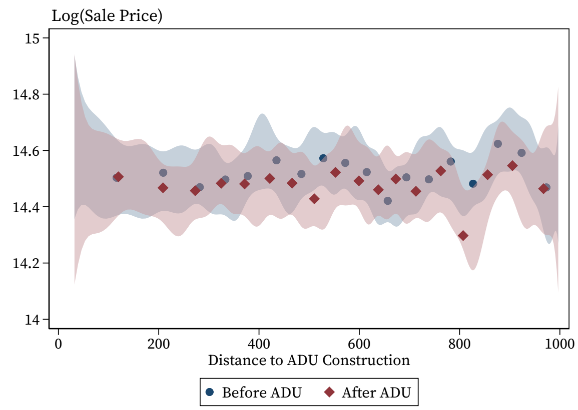


Notes: This figure plots a binned scatterplot and quadratic fit of ADU permits issued in a zip code from 2018 to 2020 against the zip code's ratio of home values to replacement costs, denoted V/R. ADU permit counts are statewide from Chapple (2021), not my limited sample.

Figure 9: Property Values by Distance to ADU, Before and After



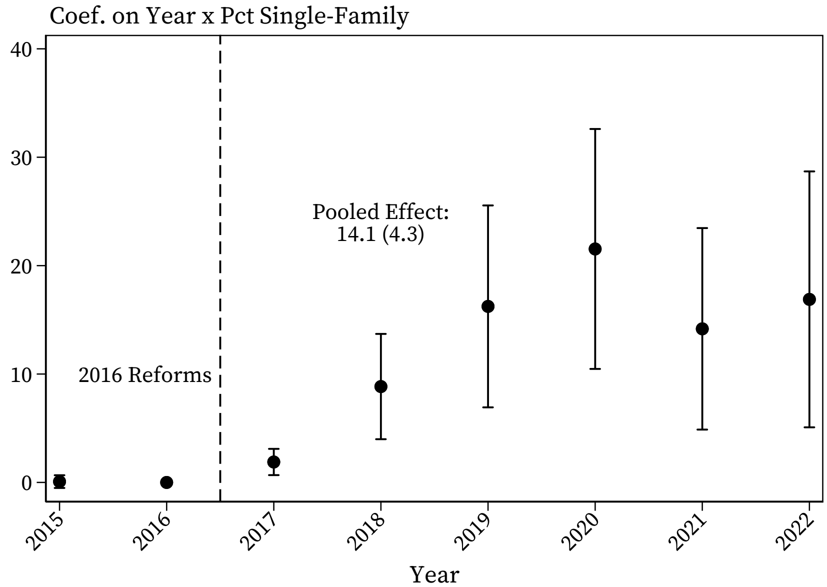
(a) Pooled



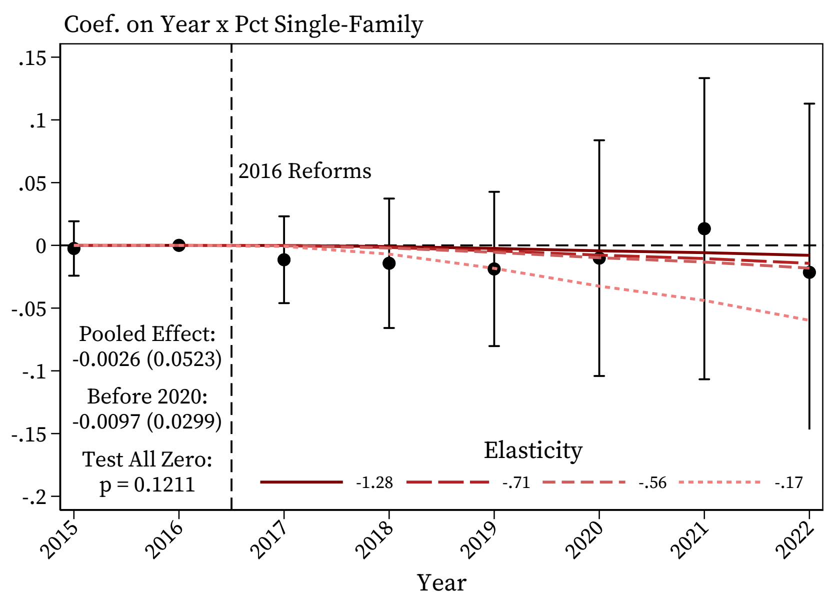
(b) High Income Neighborhoods

Notes: This figure plots a binned scatterplot of the log of sale prices for properties sold within 1,000 feet of an ADU on their distance to that ADU. The plot is split by whether the sale occurred in the year before or after the ADU was built. Panel A reports results for the full sample, while Panel B restricts to ADUs built in above median income Census Tracts. 95 percent uniform confidence bands, estimated with a cubic B-spline, are shown. Bins are selected through IMSE-optimal direct plug-in rule.

Figure 10: ADUs Constructed and Rents in ZCTAs More Exposed to ADUs



(a) ADUs Constructed



(b) Rents

Notes: This figure reports dynamic ZCTA-level estimates relating ADU exposure to construction and rents. The exposure variable is S_z, the fraction of single- or multi-family parcel area in a ZCTA that has single-family land use. Panel A estimates Equation 17 with the number of ADUs constructed as the dependent variable. Panel B estimates Equation 17 with log median rent. Confidence intervals are at the 95 percent level. Specifications include ZCTA and year fixed effects and controls for median income and population. A black dashed line is at $y = 0$. The additional lines in Panel B plot model-implied rent effects from Equation 19 under alternative rental demand elasticities.

A Proofs

Proof of Model Result 1

Proof. Substituting the budget constraint into the objective function in the inner maximization problem, we get:

$$\max_a \left[Z(A - D(a) + w_s + ap_r^*(a) - \sigma_a \frac{a^2}{2} - p_s) \right]$$

It suffices to show that the derivative with respect to a is negative under the assumptions of the model result. Differentiating, we have

$$\begin{aligned}
\frac{d}{da} &= Z\left(-\frac{d}{da}D(a) + p_r^*(a) + a\frac{d}{da}p_r^*(a) - \sigma_a a\right) \\
&= Z\left(\underbrace{p_r^*(a) - \sigma_a a - \frac{d}{da}D(a)}_{(A)} + \underbrace{a\frac{d}{da}p_r^*(a)}_{(B)}\right)
\end{aligned}$$

Because Z is almost surely positive, it suffices to show that (A) and (B) are negative. From the assumption in the model result, we have that (A) is negative. For (B), we must characterize $p_r^*(a)$. Demand for rental housing is given by the first order condition of the renter's problem: $h_r^\eta - p_r = 0$. The second order condition is met because $\eta h_r^{\eta-1} < 0$ because $\eta < 0$. Therefore, the demand for rental housing at p_r is $p_r^{\frac{1}{\eta}}$. The first order condition of the developer's problem is given by $p_r\lambda_r - d_r\sigma_r\lambda_r = 0$, which implies $d_r^* = \frac{p_r}{\sigma_r}$. The second order condition is met because $-\sigma_r\lambda_r$ is negative. The supply of apartments is $\lambda_r\frac{p_r}{\sigma_r}$. Hence, the overall supply of rental housing is given by $a\lambda_s + \frac{p_r}{\sigma_r}\lambda_r$ and the demand for rental housing is $p_r^{1/\eta}$. Because markets clear, we have $a\lambda_s + \frac{p_r}{\sigma_r}\lambda_r = p_r^{1/\eta}$. A closed form expression for p_r is not feasible, but because $p_r^*(a)$ is the solution to the above expression, we have that:

$$p_r^*(a)^{\frac{1}{\eta}} - \frac{\lambda_r}{\sigma_r}p_r^*(a) - a\lambda_s = 0$$

From the implicit function theorem, it follows that

$$\frac{1}{\eta}p_r^*(a)^{\frac{1}{\eta}-1}\frac{dp_r^*(a)}{da} - \frac{\lambda_r}{\sigma_r}\frac{dp_r^*(a)}{da} - \lambda_s = 0 \implies \frac{dp_r^*(a)}{da} = \lambda_s\left(\frac{1}{\eta}p_r^*(a)^{\frac{1}{\eta}-1} - \frac{\lambda_r}{\sigma_r}\right)^{-1}$$

Note that η is negative, $p_r^*(a)$ is non-negative, and λ_s, σ_r are positive. Hence, we have that $\frac{dp_r^*(a)}{da}$ is negative, which shows that (B) is negative. □

Proof of Model Result 2

Proof. We have from the proof of Model Result 1 that the supply from developers of rental apartments is $p_r \frac{\lambda_r}{\sigma_r}$. In the deregulation equilibrium, the homeowner solves:

$$\max_a \left[Z(A - D + w_s + ap_r - \sigma_a \frac{a^2}{2} - p_s) \right]$$

to determine their ADU production. Differentiating with respect to a:

$$\frac{d}{da} = Z(p_r - \sigma_a a) \implies a^* = \frac{p_r}{\sigma_a}$$
$$\frac{d}{da^2} = -\sigma_a Z < 0$$

Hence, the overall supply of rental housing is

$$p_r \left(\frac{\lambda_r}{\sigma_r} + \frac{\lambda_s}{\sigma_a} \right).$$

□

Proof of Model Result 3

Proof. We have from the proof of Model Result 1 that rental demand is $p_r^{\frac{1}{\eta}}$. In regulation equilibrium, $a = 0$, so rental supply is $p_r \frac{\lambda_r}{\sigma_r}$. Setting supply equal to demand, we have $p_r^* = \left(\frac{\lambda_r}{\sigma_r} \right)^{\frac{\eta}{1-\eta}}$. Plugging back into rental housing demand, we have regulation equilibrium rental housing:

$$\left(\frac{\lambda_r}{\sigma_r} \right)^{\frac{1}{1-\eta}}$$

Following the same argument, but using the supply curve from Model Result 2, we have deregulation equilibrium rental housing

$$\left(\frac{\lambda_r}{\sigma_r} + \frac{\lambda_s}{\sigma_a} \right)^{\frac{1}{1-\eta}}$$

The percent increase from the first expression to the second is as desired. □

Proof of Model Result 4

Proof. From the proof of Model Result 2, we have that $a^* = \frac{p_r}{\sigma_a}$. Hence, the homeowner compares $U_{s,0}$ to U_s^*, which is given by $Z(A - D + w_s + \frac{p_r^2}{2\sigma_a} - p_s)$. By properties of the Exponential distribution,

$$\mathbb{P}\left(Z(A - D + w_s + \frac{p_r^2}{2\sigma_a} - p_s) \geq U_{s,0}\right) = \exp\left(\frac{-U_{s,0}}{A - D + w_s + \frac{p_r^2}{2\sigma_a} - p_s}\right)$$

Then, setting housing supply equal to housing demand:

$$\begin{aligned}
\lambda_s &= \theta_s \exp\left(\frac{-U_{s,0}}{A - D + w_s + \frac{p_r^2}{2\sigma_a} - p_s}\right) \\
\implies \frac{-U_{s,0}}{A - D + w_s + \frac{p_r^2}{2\sigma_a} - p_s} &= \log(\lambda_s) - \log(\theta_s) \\
\implies p_s^* &= \frac{U_{s,0}}{\log(\lambda_s) - \log(\theta_s)} + A - D + w_s + \frac{p_r^2}{2\sigma_a}
\end{aligned}$$

Then, substituting the definition of D yields the result. □

Proof of Model Result 5

Proof. From the proof of Model Result 3, we have price in each equilibrium as $\left(\frac{\lambda_r}{\sigma_r}\right)^{\frac{\eta}{1-\eta}}$ and $\left(\frac{\lambda_r}{\sigma_r} + \frac{\lambda_s}{\sigma_a}\right)^{\frac{\eta}{1-\eta}}$. Then, it follows that

$$\begin{aligned}
\log(p_r'^*) - \log(p_r^*) &= \log\left(\frac{\lambda_r}{\sigma_r} + \frac{\lambda_s}{\sigma_a}\right)^{\frac{\eta}{1-\eta}} - \log\left(\frac{\lambda_r}{\sigma_r}\right)^{\frac{\eta}{1-\eta}} \\
&= \eta\left[\log\left(\frac{\lambda_r}{\sigma_r} + \frac{\lambda_s}{\sigma_a}\right)^{\frac{1}{1-\eta}} - \log\left(\frac{\lambda_r}{\sigma_r}\right)^{\frac{1}{1-\eta}}\right] \\
&= \eta\left[\log(h_r'^*) - \log(h_r^*)\right]
\end{aligned}$$

where the last line uses expressions for $h_r'^*$ and h_r^* from the proof for Model Result 3. □

B Additional Tables

Table B.1: Benchmarking Permits to APR by City

City	Permits in 2021	APR in 2021	Permits in 2022	APR in 2022
Panel A: Comparing to Approved and Complete APR Permits				
Los Angeles	3227	3174	4657	3448
San Francisco	213	74	243	37
Panel B: Comparing to Approved, Complete, and Pending APR Permits				
Los Angeles	3227	6506	4657	6746
San Francisco	213	235	243	112

Notes: This table compares permit counts in this paper's permit data against APR data. For both datasets, I constrain to permits I can geocode and split out the counts by year and by city. In Panel A, I report the permits in this paper's data against permits either marked "Approved" or "Complete" in the APR data. In Panel B, I report the permits in this paper's data against permits either marked "Approved", "Complete", or "Pending" in the APR data.

Table B.2: ADU Permitting and Construction by City and Year

Year	ADU Permits Issued	ADUs Constructed
Panel A: Los Angeles		
2014	9	3
2015	5	3
2016	6	4
2017	1,364	152
2018	2,568	863
2019	2,876	1,651
2020	2,095	1,945
2021	3,133	1,926
2022	4,499	2,409
Panel B: San Francisco		
2015	2	2
2016	11	2
2017	19	7
2018	91	18
2019	151	58
2020	66	54
2021	132	68
2022	153	69

Notes: This table reports annual counts of ADU permits issued and ADUs constructed, separately by city and year. Permits are assigned to the year in which the permit was issued. ADUs constructed are assigned to the year in which the permit data record the ADU as completed. Counts are restricted to permits that can be geolocated to parcels in the single- and multi-family parcel sample.

Table B.3: ZCTA Summary Statistics – ADUs and Rental Stock

	Mean	p25	p50	p75	SD	Min	Max	N
2015								
ADUs Built	0.03	0	0	0	0.20	0	2	167
ADU Permits Issued	0.07	0	0	0	0.31	0	3	167
Num. Rental Units	7846.16	3987	7616	10659	5140.75	0	28535	166
2016								
ADUs Built	0.05	0	0	0	0.21	0	1	167
ADU Permits Issued	0.39	0	0	0	1.61	0	13	167
Num. Rental Units	7925.75	4083	7730	10837	5187.85	0	28440	166
2017								
ADUs Built	1.08	0	0	2	1.89	0	12	167
ADU Permits Issued	9.23	0	4	14	12.85	0	73	167
Num. Rental Units	7940.79	4202	7686	10688	5164.85	0	27859	166
2018								
ADUs Built	5.73	0	2	8	8.44	0	51	167
ADU Permits Issued	17.58	0	12	27	22.86	0	149	167
Num. Rental Units	7979.99	4192	7864	10714	5192.03	0	27807	166
2019								
ADUs Built	11.02	0	5	16	15.26	0	95	167
ADU Permits Issued	20.89	0	11	30	25.63	0	131	167
Num. Rental Units	8027.01	4282	7752	11030	5216.69	0	28274	166
2020								
ADUs Built	12.69	0	5	19	18.75	0	131	167
ADU Permits Issued	14.31	0	9	23	17.21	0	98	167
Num. Rental Units	8059.11	4307	7614	11308	5232.76	0	27431	166
2021								
ADUs Built	13.11	0	8	18	16.46	0	87	167
ADU Permits Issued	21.06	0	12	33	25.06	0	149	167
Num. Rental Units	8006.69	4229	7561	11096	5138.54	0	26936	166
2022								
ADUs Built	16.08	0	9	25	19.88	0	93	167
ADU Permits Issued	30.03	0	18	48	33.78	0	169	167
Num. Rental Units	8059.79	4262	7705	11198	5188.57	0	27131	166

Notes: This table reports summary statistics for ZCTAs in my sample, separately from 2015 to 2022. The two variables concerning ADUs are computed from the building permit data. The rental units variable is from the ACS.

Table B.4: ZCTA Summary Statistics – Rent and Covariates

	Mean	p25	p50	p75	SD	Min	Max	N
2015								
Rent	1758.15	1356.98	1605.78	2096.59	572.94	527.23	3728.92	164
Median Income ($1000)	81.16	51.15	75.74	99.51	39.30	15.82	213.08	163
Population (1000)	35.38	21.82	31.91	47.54	20.33	0.30	104.06	166
2016								
Rent	1794.53	1375.44	1643.70	2140.58	592.05	523.11	3869.03	164
Median Income ($1000)	83.80	52.10	76.38	102.64	41.44	15.08	237.98	164
Population (1000)	35.57	21.76	32.30	47.28	20.36	0.49	104.76	166
2017								
Rent	1836.99	1404.66	1728.21	2183.10	578.87	564.73	3880.26	164
Median Income ($1000)	87.12	52.79	78.54	107.42	43.22	15.36	238.03	164
Population (1000)	35.88	22.33	32.51	47.97	20.64	0.44	108.05	166
2018								
Rent	1887.35	1437.59	1783.15	2224.86	591.91	599.05	3890.30	164
Median Income ($1000)	90.63	55.52	80.98	111.77	44.57	17.66	248.25	164
Population (1000)	35.94	22.27	32.46	47.82	20.66	0.55	109.41	166
2019								
Rent	1948.67	1499.00	1839.56	2248.79	605.50	726.89	3854.26	164
Median Income ($1000)	94.46	58.60	83.62	118.81	45.52	24.77	244.95	164
Population (1000)	36.02	21.63	32.80	48.03	20.70	0.43	111.17	166
2020								
Rent	2019.18	1556.50	1884.99	2365.00	639.56	805.11	3958.81	164
Median Income ($1000)	97.27	62.47	86.04	117.68	46.61	23.94	282.69	164
Population (1000)	36.00	21.85	33.20	47.51	20.49	0.44	110.75	166
2021								
Rent	2047.73	1605.46	1915.97	2424.12	628.44	815.42	3781.18	164
Median Income ($1000)	97.83	62.95	88.84	118.30	45.02	24.07	264.24	164
Population (1000)	35.55	21.58	32.78	46.43	20.16	0.50	109.51	166
2022								
Rent	2057.67	1642.00	1923.50	2428.50	604.67	737.00	3501.00	164
Median Income ($1000)	99.04	65.47	89.22	123.42	44.53	24.85	250.00	164
Population (1000)	35.23	21.79	32.37	46.33	19.79	0.56	106.04	166

Notes: This table reports summary statistics for ZCTAs in my sample, separately across 2015 to 2022. All three variables are from the ACS. Rent and median income are in 2022 dollars. Median income and population are in units of 1000.

Table B.5: Event Study on ADUs Permitted

	(1) ADU Permitted	
2014	-0.0000803	(0.0000391)
2015	-0.0000612	(0.0000475)
2017	0.000209	(0.0000676)
2018	0.000455	(0.0000949)
2019	0.000965	(0.000126)
2020	0.00140	(0.000129)
2021	0.00366	(0.000200)
2022	0.00665	(0.000268)
Parcel Single-Family × 2014	0.0000820	(0.0000397)
Parcel Single-Family × 2015	0.0000562	(0.0000478)
Parcel Single-Family × 2017	0.00204	(0.0000919)
Parcel Single-Family × 2018	0.00391	(0.000128)
Parcel Single-Family × 2019	0.00391	(0.000155)
Parcel Single-Family × 2020	0.00195	(0.000149)
Parcel Single-Family × 2021	0.00114	(0.000220)
Parcel Single-Family × 2022	-0.0000484	(0.000289)
Constant	0.0000384	(0.0000220)
FEs	Parcel	
SEs	Clustered at Parcel	
Num. Obs.	6355054	
R^2	0.116	

Notes: This table presents results from estimating Equation 11. The dependent variable is whether an ADU permit was issued on a parcel in a given year. Standard errors cluster robust at the parcel level.

Table B.6: Nuisance Effect Estimates for Above Median Income Neighborhoods

	(1) Log(Price)	(2) Log(Price)	(3) Log(Price)
Near ADU	-0.0154	0.00470	-0.0134
	(0.0212)	(0.0179)	(0.0122)
After ADU Built	-0.0532	-0.0220	-0.00588
	(0.0189)	(0.0127)	(0.0101)
Near ADU × After ADU Built	0.0232	-0.00830	0.00199
	(0.0248)	(0.0200)	(0.0151)
Floor Area			0.000323
			(0.0000100)
Year Built			-0.00106
			(0.000233)
Num. Beds			0.0249
			(0.00322)
Constant	14.53	14.51	15.89
	(0.0224)	(0.00794)	(0.453)
FEs	None	ADU(i)	ADU(i)
SEs	Cluster, ADU(i)	Cluster, ADU(i)	Cluster, ADU(i)
Num. Obs.	6734	6734	6720
R^2	0.00230	0.399	0.684

Notes: This table reports estimates of Equation 13 for properties sold near ADUs in above median income Census Tracts. Column (1) reports the regression without covariates or fixed effects. Column (2) adds ADU(i) fixed effects and (3) adds covariates. Floor area is in square footage units.

Table B.7: Nuisance Effect Estimates for Above Median Population Neighborhoods

	(1) Log(Price)	(2) Log(Price)	(3) Log(Price)
Near ADU	-0.0297	0.000198	-0.0135
	(0.0177)	(0.0139)	(0.0107)
After ADU Built	-0.0388	-0.0241	-0.00214
	(0.0170)	(0.00993)	(0.00869)
Near ADU × After ADU Built	0.0200	0.00451	0.00589
	(0.0232)	(0.0165)	(0.0135)
Floor Area			0.000303
			(0.0000115)
Year Built			-0.00109
			(0.000255)
Num. Beds			0.0195
			(0.00289)
Constant	14.38	14.37	15.89
	(0.0233)	(0.00623)	(0.494)
FEs	None	ADU(i)	ADU(i)
SEs	Cluster, ADU(i)	Cluster, ADU(i)	Cluster, ADU(i)
Num. Obs.	6717	6717	6706
R^2	0.00173	0.490	0.694

Notes: This table reports estimates of Equation 13 for properties sold near ADUs in above median population Census Tracts. Column (1) reports the regression without covariates or fixed effects. Column (2) adds ADU(i) fixed effects and (3) adds covariates. Floor area is in square footage units.

Table B.8: Nuisance Effect Estimates for ADUs Built as New Constructions

	(1) Log(Price)	(2) Log(Price)	(3) Log(Price)
Near ADU	0.000720	0.0102	-0.00302
	(0.0177)	(0.0130)	(0.00971)
After ADU Built	-0.0197	-0.0175	0.00372
	(0.0167)	(0.0102)	(0.00862)
Near ADU $\times$ After ADU Built	0.00756	-0.00577	-0.000431
	(0.0219)	(0.0158)	(0.0129)
Floor Area			0.000292
			(0.0000103)
Year Built			-0.00107
			(0.000212)
Num. Beds			0.0238
			(0.00261)
Constant	14.40	14.40	15.90
	(0.0220)	(0.00587)	(0.411)
FEs	None	ADU(i)	ADU(i)
SEs	Cluster, ADU(i)	Cluster, ADU(i)	Cluster, ADU(i)
Num. Obs.	8253	8253	8242
R^2	0.000350	0.476	0.686

Notes: This table reports estimates of Equation 13 for properties sold near ADUs where the ADU permit does not contain mentions of "re-constructions," "demolitions," or "conversions." Column (1) reports the regression without covariates or fixed effects. Column (2) adds ADU(i) fixed effects and (3) adds covariates. Floor area is in square footage units.

Table B.9: Nuisance Effect Estimates using New Single-Family Constructions

	(1) Log(Price)	(2) Log(Price)	(3) Log(Price)
Has ADU	-0.515	-0.0259	-0.00607
	(0.221)	(0.136)	(0.125)
Floor Area			0.000257
			(0.0000132)
Year Built			0.000222
			(0.0000677)
Num. Beds			-0.0156
			(0.0102)
Constant	14.35	14.35	13.47
	(0.0218)	(0.00951)	(0.132)
FEs	None	Neighborhood, Sale Year	Neighborhood, Sale Year
SEs	Cluster, Construction(i)	Cluster, Construction(i)	Cluster, Construction(i)
Num. Obs.	1558	1542	1536
R^2	0.00909	0.648	0.749

Notes: This table reports estimates of Equation 14. I regress property sales around new single-family home constructions on whether the new home has an ADU. Column (1) reports the regression without covariates or fixed effects. Column (2) adds fixed effects for neighborhoods and (3) adds covariates. Floor area is in square footage units.

Table B.10: Event Study on Rent

	(1)		(2)		(3)	
	Log(Rent)		Log(Rent)		Log(Rent)	
2015	-0.0197	(0.00887)	-0.0148	(0.00874)	-0.0154	(0.00859)
2017	0.0399	(0.0152)	0.0341	(0.0147)	0.0360	(0.0135)
2018	0.0678	(0.0213)	0.0600	(0.0212)	0.0618	(0.0198)
2019	0.106	(0.0271)	0.0938	(0.0258)	0.0966	(0.0255)
2020	0.134	(0.0422)	0.119	(0.0393)		
2021	0.136	(0.0556)	0.117	(0.0516)		
2022	0.173	(0.0612)	0.153	(0.0583)		
2015 $\times S_z$	0.00210	(0.0124)	-0.00249	(0.0111)	-0.00317	(0.0104)
2017 $\times S_z$	-0.0144	(0.0169)	-0.0115	(0.0176)	-0.0126	(0.0164)
2018 $\times S_z$	-0.0160	(0.0242)	-0.0143	(0.0263)	-0.0133	(0.0250)
2019 $\times S_z$	-0.0224	(0.0315)	-0.0188	(0.0314)	-0.0171	(0.0311)
2020 $\times S_z$	-0.0143	(0.0476)	-0.0102	(0.0479)		
2021 $\times S_z$	0.00325	(0.0627)	0.0133	(0.0612)		
2022 $\times S_z$	-0.0314	(0.0694)	-0.0215	(0.0686)		
Median Income ($1000)			0.000806	(0.000538)	0.000304	(0.000663)
Population (1000)			0.00230	(0.00337)	0.00468	(0.00295)
Constant	7.440	(0.00468)	7.291	(0.145)	7.248	(0.117)
FEs	ZCTA		ZCTA		ZCTA	
SEs	Clustered at ZCTA		Clustered at ZCTA		Clustered at ZCTA	
Sample	Full		Full		Pre-2020	
Num. Obs.	1312		1311		819	
R^2	0.975		0.976		0.984	

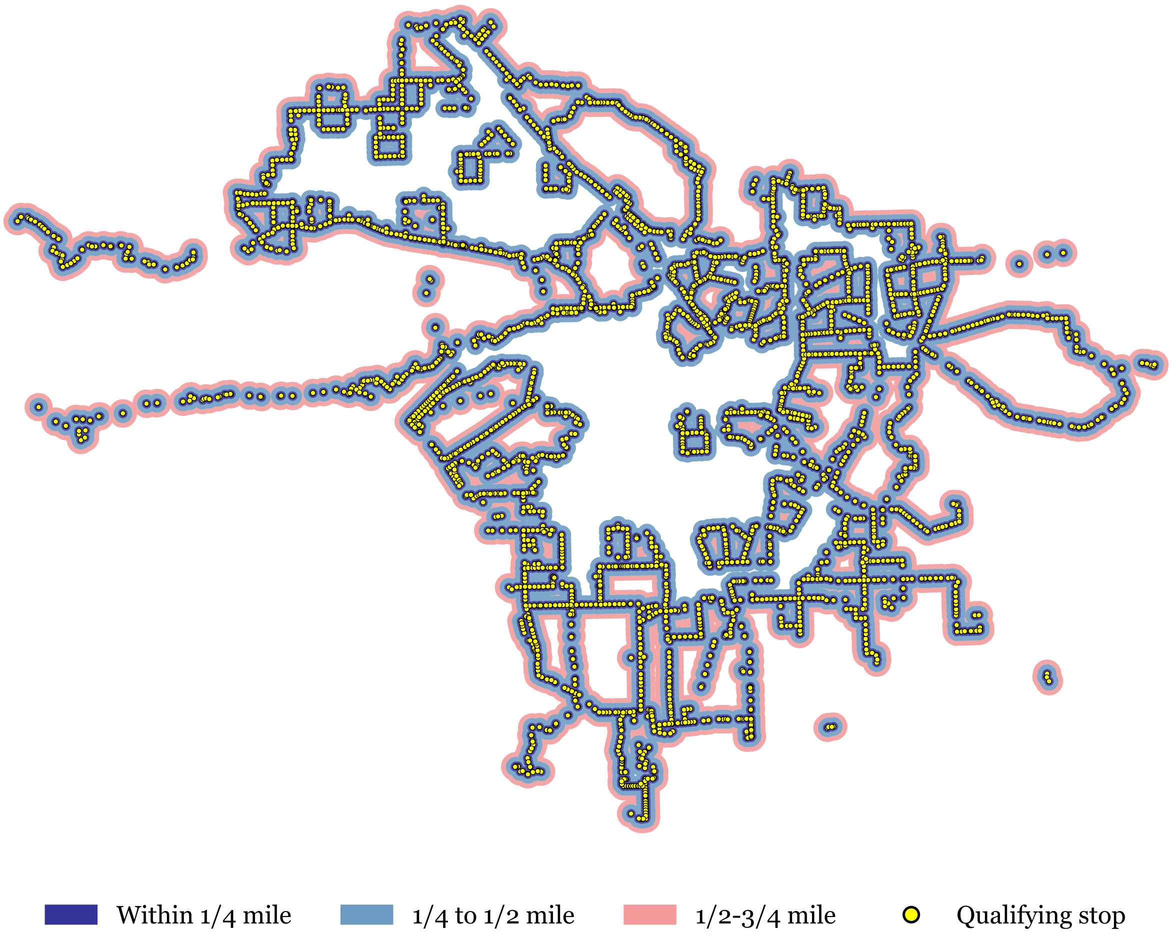
Notes: This table presents results from estimating Equation 17. The regression is run without controls in column (1) and with controls for median income and population in column (2). Column (3) restricts the sample to 2015–2019. There is a ZCTA-level fixed effect and standard errors are cluster robust at the ZCTA level.

C Additional Figures

Figure C.1: Example ADUs in California

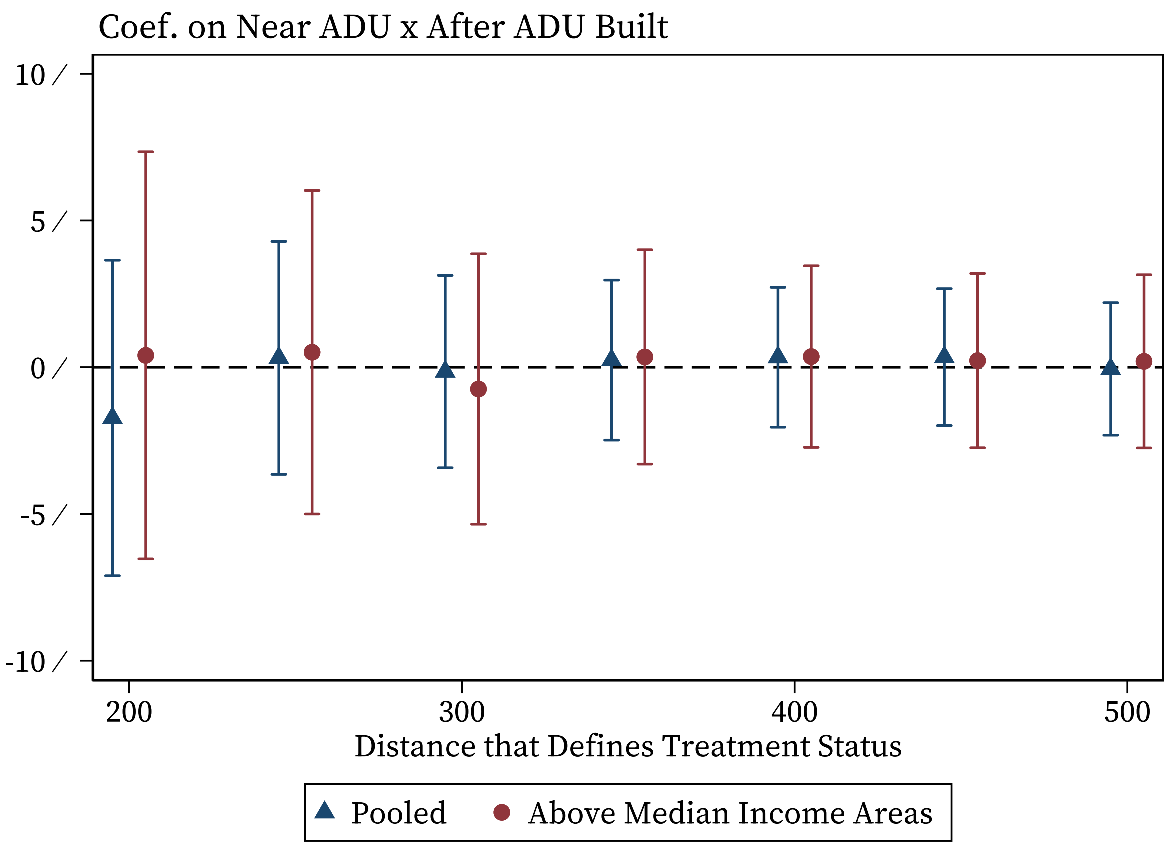
Notes: This figure shows photographs from the California Department of Housing and Community Development (2022a) handbook on ADUs. The photos depict detached ADUs built in backyards.

Figure C.2: Treatment and Control Groups for Parking Analysis



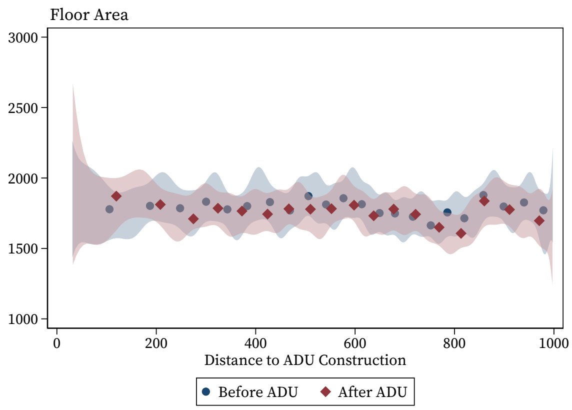
Notes: This map shows the Los Angeles transit-stop buffers used in the parking-requirement analysis. Dark-blue areas are within one-fourth mile of a transit stop, medium-blue areas are one-fourth to one-half mile from a transit stop, and light areas are one-half to three-fourths mile from a transit stop. In the main parking analysis, parcels within one-half mile of transit are treated, while parcels one-half to three-fourths mile away serve as controls. The placebo analysis compares parcels within one-fourth mile of transit to parcels one-fourth to one-half mile from transit. *This figure must be in color to be interpretable.*

Figure C.3: Nuisance Effects for Different Definitions of the Treatment Ring

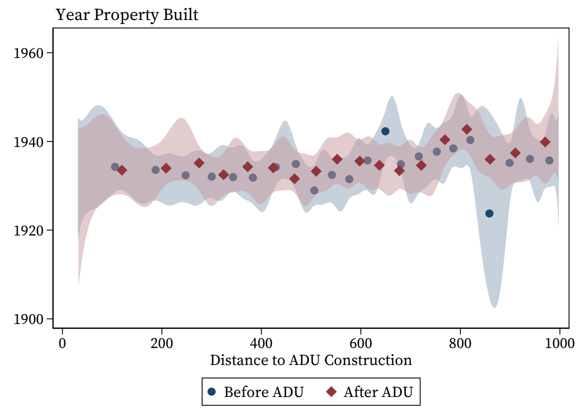


Notes: This figure plots estimates and 95% confidence intervals of the nuisance effect for various definitions of the treatment ring. For each value on the x-axis, I define the treatment ring as properties sold within that distance of a constructed ADU. I am always comparing those treated properties to properties sold 500-1000 feet away from the ADU. My specification is analogous to Column (3) of Table 2, using the same fixed effects, controls, and standard errors. A dashed line is plotted at zero. Units are in percent changes in sale prices.

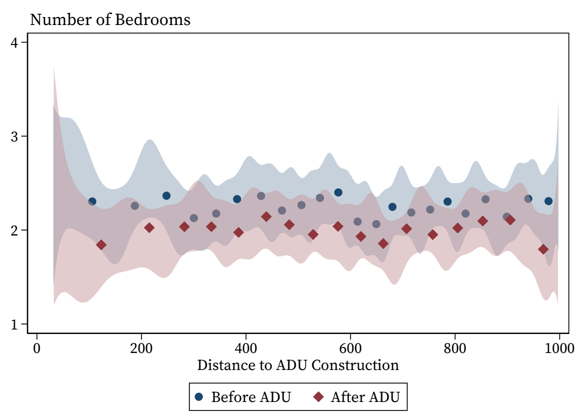
Figure C.4: Nuisance Effect Balance Tests



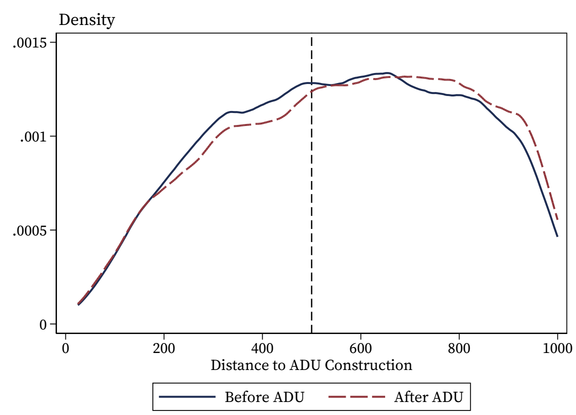
(a) Floor Area



(b) Year Property Built



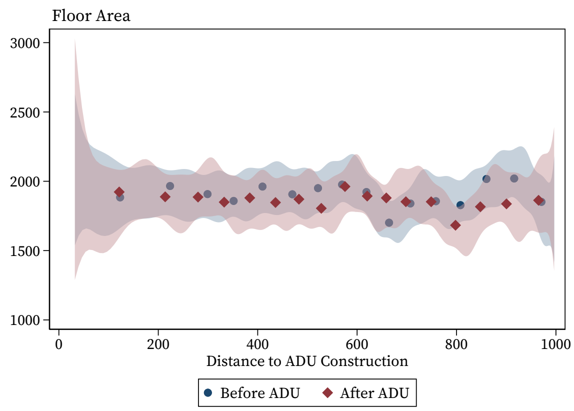
(c) Beds



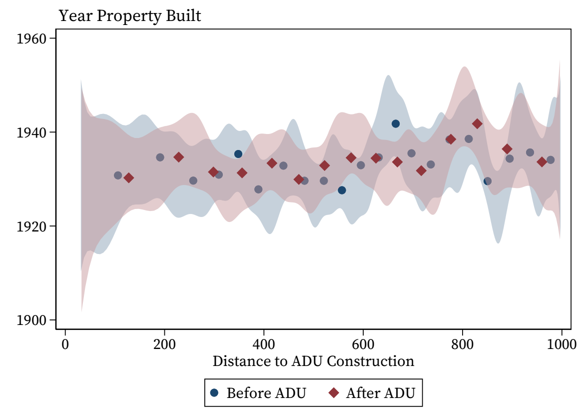
(d) Distance Distribution

Notes: The first three panels of this figure plot a binned scatterplot of three property characteristics for properties sold within 1000 feet of an ADU on their distance to said ADU. The plot is split by whether the sale occurred in the year before or after the ADU was built. Panel A has floor area in square feet as the outcome, B has the year the property was built, and C has the number of beds. 95 percent uniform confidence bands, estimated with a cubic B-spline, are shown. Bins are selected through IMSE-optimal direct plug-in rule. Panel D plots the kernel density of the distance to the parent ADU of property sales by whether the sale occurred in the year before or after the ADU was built. Estimation is done with a Gaussian kernel.

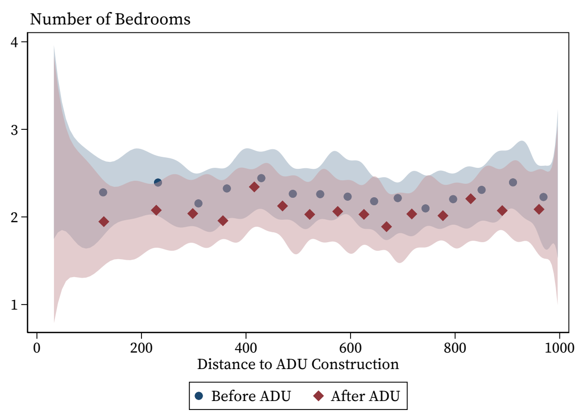
Figure C.5: Nuisance Effect Balance Tests for Above Median Income Neighborhoods



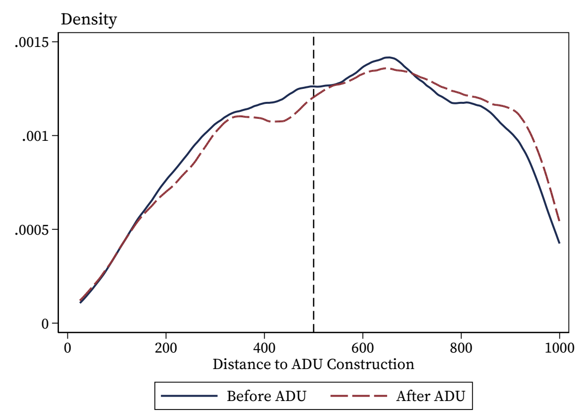
(a) Floor Area



(b) Year Property Built



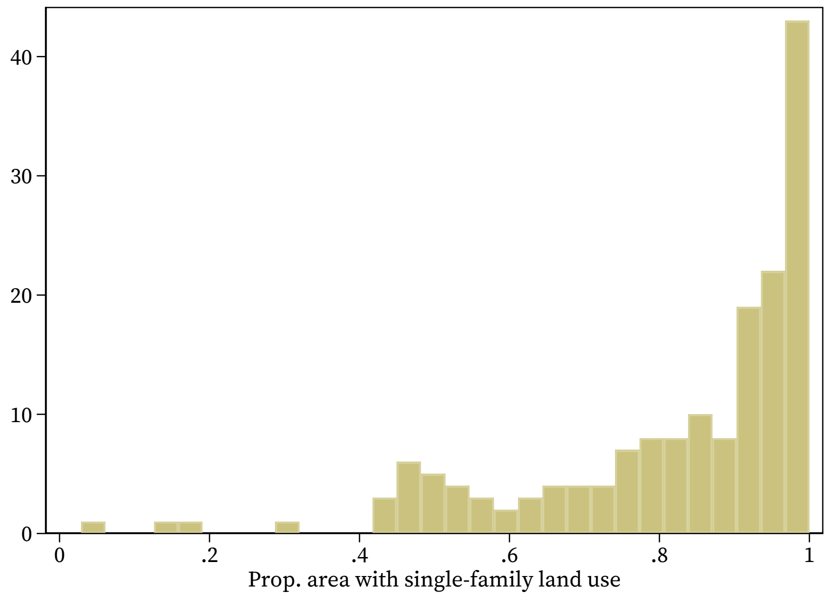
(c) Beds



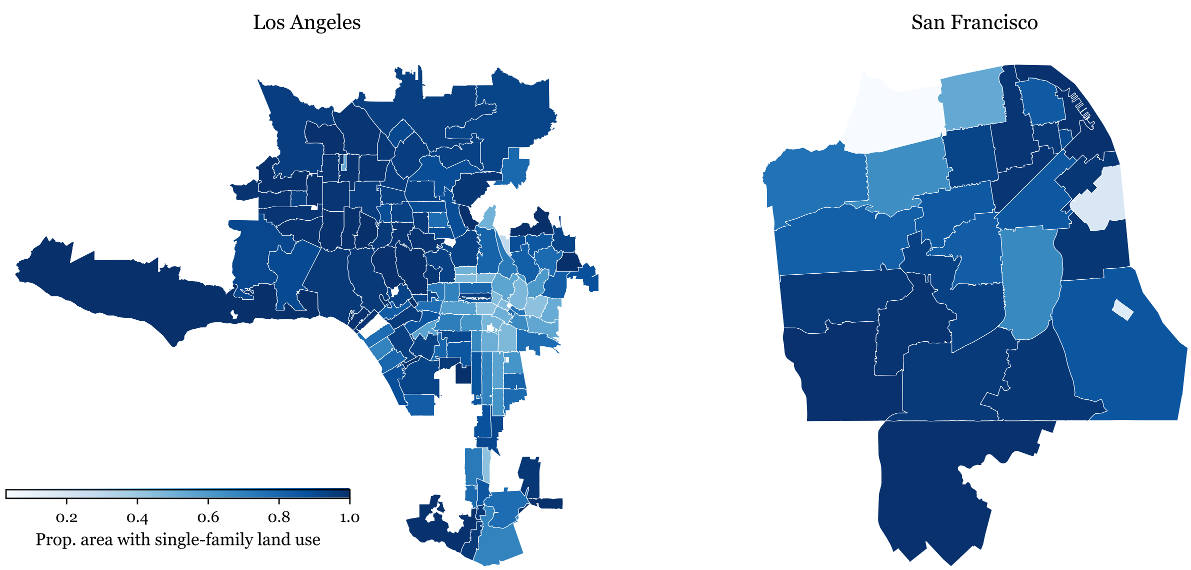
(d) Distance Distribution

Notes: The first three panels of this figure plot a binned scatterplot of three property characteristics for properties sold within 1000 feet of an ADU on their distance to said ADU. This figure restricts to properties near ADUs built in above median income census tracts. The plot is split by whether the sale occurred in the year before or after the ADU was built. Panel A has floor area in square feet as the outcome, B has the year the property was built, and C has the number of beds. 95 percent uniform confidence bands, estimated with a cubic B-spline, are shown. Bins are selected through IMSE-optimal direct plug-in rule. Panel D plots the kernel density of the distance to the parent ADU of property sales by whether the sale occurred in the year before or after the ADU was built. Estimation is done with a Gaussian kernel.

Figure C.6: Exposure Variable for Rent Analysis



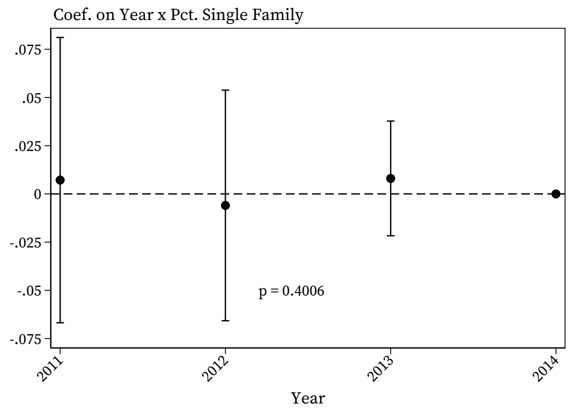
(a) Distribution of Treatment Exposure Variable



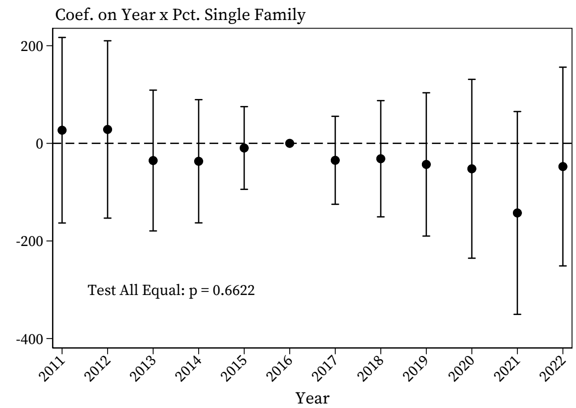
(b) Map of Treatment Exposure

Notes: This figure summarizes the ZCTA-level treatment exposure variable used in the rent analysis. Exposure S_z is the area of ZCTA z with single-family land use divided by the area of the ZCTA with either single- or multi-family land use. Panel A plots the distribution of exposure across ZCTAs in my sample. Panel B maps the exposure variable by ZCTA in each city; darker shading indicates a larger share of single-family land use. *This figure must be in color to be interpretable.*

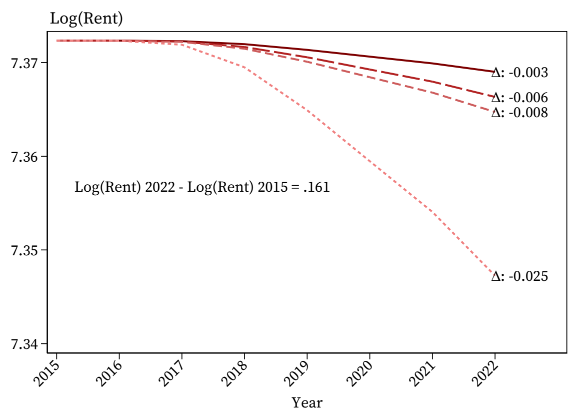
Figure C.7: Supplementary Results for Rent Analysis



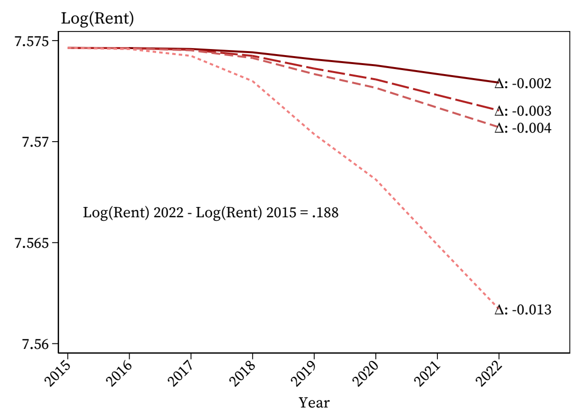
(a) Pre-Trends



(b) Grandparents Placebo



(c) Los Angeles Projection



(d) San Francisco Projection

Notes: This figure reports supplementary checks for the rent analysis. Panel A plots pre-treatment event-study coefficients from estimating the rent specification in the 2011-2014 period, before the ACS rent top-coding change prevents pooling with later years. Panel B repeats the dynamic specification in Equation 17 using the number of grandparents living with their own grandchildren as a placebo outcome. Points in Panels A and B are coefficients on the interaction between year indicators and S_z; vertical bars are 95 percent confidence intervals; p-values report a test of whether all coefficients are jointly zero. Panels C and D plot city-level model-implied rent trajectories for Los Angeles and San Francisco, respectively, using Equation 18. The labels next to each line report the model-implied change in log rent from 2015 to 2022 under alternative demand elasticities; the text inside each panel reports the actual change in log rent over the same period.