Market Power in Residential Real Estate: Evidence from Chicago Rental Properties

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Abstract

This paper investigates the impact of market power in residential real estate. I study this question empirically in the context of the Chicago rental market. To do so, I build a novel dataset that links the universe of market-rate multifamily properties and their owners from 2000 to 2023. Using a staggered event study design, I find that acquisitions of competing properties raise price and reduce occupancy. I then estimate a structural model of rental demand and supply, and I use the estimates to calculate welfare under various policy counterfactuals. These results highlight how market power mediates the effectiveness of urban rental policies and shapes housing affordability in the 21st century.

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1 Introduction

Housing affordability is a major policy concern in urban areas across the United States and around the world. Between 2001 and 2022, the share of American renters who paid more than 30% of their monthly income in rent jumped from 20% to 50% (Joint Center for Housing Studies, 2024). One possible explanation has, at least until very recently, received very little attention: exercise of market power by landlords. US law statutorily exempts nearly all acquisitions of rental properties from premerger notification, which reflects an underlying assumption that such transactions do not raise substantial-enough antitrust concerns to merit ex ante review.[1] The juxtaposition of rising prices and limited antitrust scrutiny raises important questions. Do landlords hold significant shares of economically important rental markets? If so, do they exercise market power by raising prices? What remedies are available?

The exercise of market power in US real estate markets would have important implications for the welfare of American renters. Yet, there is a paucity of empirical evidence on the dynamics of competition among landlords in urban rental markets, and specifically, whether market power exists in this setting. Theoretically, there are opposing channels that landlord size could affect prices through, which have heretofore been difficult to disentangle. Higher market shares might result in substantial efficiency gains that increase consumer surplus (Williamson, 1968). Conversely, landlords might internalize business stealing externalities and mark up rental unit prices above marginal cost. To the extent that market power is a relevant factor in the rental market, standard theoretical approaches that assume perfect competition are unlikely to accurately capture the welfare effects of modern rental policies.

I fill a gap in the literature by studying the role of market power in residential real estate, both theoretically and empirically. A key contribution of the analysis is that I leverage novel property tax and sales data from the Cook County Tax Assessor, which allows me to pierce the corporate veil and link landlords to the full set of buildings they own in the city of Chicago across space and over time. Importantly, this data allows me to examine the full universe of multifamily building sales, and to identify the subset of acquisitions made by landlords of competing properties. I document the effects of these acquisitions on market structure and estimate their impact on prices and vacancies. Finally, I estimate a structural model of rental demand and supply, and I simulate counterfactual equilibrium outcomes under various policy counterfactuals.

This paper comprises several sections, the first of which begins by documenting key facts about how the city's rental stock is differentiated across space. I use a revealed preference approach to determine whether the rental market is segmented by geography and amenities. Using data on mover address histories, I find that renters' preferences for where to live are extremely localized. Approximately one-half of Chicago renter moves occur within one mile of their previous address and the majority of renters remain within the same neighborhood. Importantly, building quality constitutes an added dimension of segmentation, a fact that is corroborated by examining moving patterns across building types. These descriptive facts motivate a

[1] See, e.g., debate among members of the House of Representations as the notification bill was being drafted. *HR Rep No 1373, 94th Cong, 2d Sess 5 (July 28, 1976).*

key insight of the paper: if a city's rental market is segmented, then landlords do not need to own large swaths of property across the entire city in order for prices to reflect large recapture effects. Instead, they may concentrate within segments, provided that renters within those segment are sufficiently inelastic and there is no (or limited) new supply.

That landlords target specific rental segments in order to exercise market power is not merely a conjecture about theoretical behavior. It is a strategy practiced by commercial real estate investors across the country. In Los Angeles, a prominent real estate investment trust (REIT) describes their acquisition strategy as follows:

> *First, we select submarkets that are supply constrained, with high barriers to entry, key lifestyle amenities, proximity to high-end executive housing and a strong, diverse economic base [...] Once we select a submarket, we follow a disciplined acquisition strategy of gaining substantial market share to provide us with extensive local market information, pricing power in lease and vendor negotiations.*[2]

In Chicago, the investor website for one of the city's largest private real estate companies similarly states that they are "focused on the acquisition, development and redevelopment of apartment properties in select supply-constrained submarkets located throughout the United States."[3]

Chicago is the ideal place to investigate this phenomenon. It averaged approximately 0.7 new multifamily construction permits per 1000 residents, putting it at 45th out of the 50 largest metropolitan areas in the country (REJournals, 2024). Regarding the nature of ownership in the city's largest neighborhood by number of rental units, one commercial real estate brokerage noted: "Lakeview has concentrated ownership [...] There are really a handful of property management companies that own most of the properties. Once they buy them, they don't sell. You just don't get inventory creation" (CoStar, 2023).

Building on these insights, I investigate the market structure of each neighborhood in the city. I find that across neighborhoods, landlords typically consolidate ownership through a series of acquisitions, each involving a single or small number of buildings. If this leads to increased internalization of business stealing externalities, the acquisitions will undermine the competitive process. Also, since these acquisitions are usually small, most would be exempt from premerger notification and, as a consequence, effectively escape antitrust scrutiny at their inception. In this context, it is critical for the econometrician to examine the pricing conduct of large landlords by each building they acquire, in order to determine whether they are able to exercise market power and to assess the impact on consumers living in the acquired buildings.

To formalize the intuition stated above, I identify acquisitions of competing properties by landlords in the same neighborhood. Once these competing properties are identified, I calculate the predicted change in the Herfindahl-Hirschman Index (HHI) from each sale using the buyer and seller share in the year before the transaction. I compare how prices and vacancies evolve around the time of an acquisition, for sales with relatively big and small predicted changes in HHI. Using a staggered event study design, I find that prices and vacancies rise sharply for sales with relatively big predicted changes in HHI, consistent with the

[2] See `https://www.douglasemmett.com/our-story`.
[3] See `https://antheuscapital.com/`.

exercise of market power. I exclude renovated properties and use the presence of building amenities as an alternative outcome to rule out that quality upgrading is driving the results. I also explicitly test whether the results are consistent with a weakening of the competitive process or the independent effect of strategic behavior by landlords. To do so, I compare acquisitions by large landlords that occur in markets where they are dominant (i.e. substantial market share) and not dominant (i.e. neglible market share). Measuring the effect of acquisitions in non-dominant markets on prices is instructive, since these transactions do not weaken competitive incentives or reduce rivalry. I report that prices only rise for acquisitions in dominant markets and by contrast, they evolve smoothly through acquisitions in non-dominant markets. These results suggest that prices are unaffected by large landlords except through acquisitions that weaken the competitive process.

These empirical results motivate and inform my structural model of the rental market. The model features renters with preferences over building characteristics. I estimate demand and use the estimates to recover marginal costs and markups from the first order condition of each landlord's profit maximization problem, assuming Nash-Bertrand pricing by multi-building owners. Once I recover the parameters that govern preferences and costs, I use the estimates to simulate the equilibrium response of demand, price, and welfare to policy counterfactuals.[4] First, I investigate market-level responses to unwinding acquisitions of competing properties. Divesting ownership for this set of acquisitions proxies the market-level welfare loss for renters currently living in segments where landlords exercise market power. Under a divestiture order, consumer surplus unambiguously increases as prices decline and additional units come online. Second, I simulate a series of new construction policies. These demonstrate how the effectiveness of housing affordability policies is potentially mediated by the exercise of market power. The price effects of new construction on rental prices depend on the exact design of the policy, and may be realized more slowly under oligopolistic competition. Incumbent landlords with sufficiently large market shares worry more about cannibalizing their own products than losing renters to new buildings with few units. In the special case where these large incumbents also build the newly constructed units, rental prices may rise depending on the number of new units added to the segment, as higher incumbent market shares can lead landlords to increase markups across their buildings.

This paper contributes to a large literature in urban economics on housing affordability. First, it is related to a growing body of research investigating the causes and consequences of imperfect competition and concentration in housing markets (Watson and Ziv, 2024; Costa, 2024; Watson and Ziv, 2021; Cosman and Quintero, 2019; Raymond et al., 2016), as well as algorithmic collusion (Calder-Wang and Kim, 2024). In single-family rentals, researchers have documented a positive correlation between ownership concentration and rental prices (Gorback and Qian, 2024; Gurun, Wu, Xiao, and Xiao, 2022; Austin, 2022). Relative to these papers, I use granular data on individual landlord portfolios to investigate concentration in rental markets,

[4] I choose remedies that encourage competition, and which could realistically be undertaken by municipal policymakers or antitrust authorities at the state or federal government level. For example, see FTC Matter/File Number 201 0108 (Docket Number C-4748) decision and order to remedy consummated acquisitions in violation of federal antitrust laws, specifically Section 7 of the Clayton Act and Section 5 of the FTC Act.

and I provide causal evidence on the exercise of market power using quasi-random variation in landlord acquisitions.

Additionally, I build on a rich literature exploring the relationship between supply-side constraints and housing prices (Howard and Liebersohn, 2021; Gyourko and Molloy, 2015; Glaeser et al., 2005). My results suggest that these constraints may lead landlords to endogenously concentrate in supply-constrained market segments.[5] I also explore how market power might mediate the price effects of new construction (Pennington, 2023). Notably, I focus on these dynamics in the rental market. The U.S. multifamily sector is important to study because "at 40 million renters and a total valuation of over $4.7 trillion [...] even small rent increases can lead to significant transfers from renters to owners" (Calder-Wang and Kim, 2024).

I also add to a growing literature on how certain mergers and acquisitions escape antitrust scrutiny (i.e., Wollmann, 2019), and how these transactions can lead to "stealth consolidation" that harms the competitive process and, by extension, consumers. In the dialysis industry, Wollmann (2024) finds that most nonreportable mergers avoid enforcement, which leads to increased concentration and reduced healthcare quality. In the pharmaceutical industry, Feng et al. (2023) find that prices rise upwards of 50% for mergers below legal reporting thresholds. In the anesthesia industry, Asil et al. (2024) find that rollups consolidate ownership and higher prices.[6] Several papers also document how incumbents use nonreportable acquisitions to deter entry, either though "killer acquisitions" of potential competitors (Cunningham et al., 2021) or through most-favored-nation contracts and refusals to deal (Berry et al., 2019; Baker and Scott Morton, 2018; Boik and Corts, 2016). I investigate this behavior in the context of residential real estate, and I develop a theoretical framework for assessing welfare changes from rental policies under oligopolistic competition.

The remainder of the paper is organized as follows. Section 2 describes the setting and data sources used in the analysis. Section 3 reports descriptive facts. Section 4 presents a model of oligopolistic competition in rental markets, describes the model estimation and reports my parameter estimates. Section 5 simulates equilibrium in counterfactual environments. Section 6 concludes.

2 Institutional details and data

I compile a data set covering years 2000 through 2023, consisting of rental prices, unit characteristics, and importantly, building owners. I also assemble information on individual renter choices and demographic information. This section describes the industry setting, data sources and presents basic descriptive information.

[5] Relatedly, Bourreau et al. (2021) discuss how market structure may affect tacit collusion, and how it may be sustained in the absence of entry.

[6] Rollups are defined as "a series of acquisitions through which a financial sponsor pricesacquisitions in which a financial sponsor consolidates ownership" (Asil et al., 2024). Specifically, the sponsor acquires an initial firm in a given market, which is called the "platform" and then acquires one or more competitors in the same market, which are called "add-ons". Although real estate acquisitions are not typically characterized as rollups, the execution of landlord deals often closely resembles this strategy in practice.

2.1 City of Chicago multifamily housing industry

The city of Chicago has the third largest rental market in the United States (Census, 2021). Multifamily property comprises 30-35% of the $150 billion Chicago residential real estate industry (CCAO, 2021). Similar to other large cities, the majority of Chicago's multifamily housing is market-rate. The city has approximately 1.2 million occupied housing units, approximately half of which are designated as multifamily. These units are occupied by over 1.3 million renters. In the past 10 years, rental prices have risen by 41% (Illinois Policy Institute, 2024). The average rental price is $2,200 per month, with one bedroom apartments averaging $1,880 per month, two bedrooms averaging $2,400 a month, and three- or four-bedroom apartments averaging $3,000 per month (Zillow Research, 2024). Notably, prices and affordability differ widely across the city's neighborhoods, and there is also variability in zoning restrictions, neighborhood amenities, and longstanding racial segregation.

The rental market is comprised of a diverse rental stock. There is large variation in building types, where buildings are categorized by size following the standard taxonomy for multifamily classification in commercial real estate: low-rise, mid-rise, high-rise.[7] Low-rise buildings are defined as apartments with 2-4 units, mid-rise buildings as apartments with 5-49 units, and high-rise buildings as apartments with 50+ units. Low-rise apartments are typically described as the "cornerstone of Chicago's unsubsidized lower-cost rental housing stock" and they make up a "substantial portion of the housing supply in Chicago communities of color, particularly the city's Latinx community" (Depaul IHS, 2021). In Appendix Figure A1, I plot the share of rental buildings by building size. In Appendix Figure A2, I plot the share of rental units by size. While most buildings do not exceed 50 units, these larger buildings still comprise a sizeable fraction of total rental units.

Landlords in this setting typically buy property and build their portfolios through real estate acquisitions. These acquisitions involve the sale and transfer of parcels, through which the landlord gains ownership or control of real property (real estate) or an interest stake in a given property. Unlike other industries, where mergers between large firms are quite common, in real estate the modal transaction takes place over a single parcel. Since 2000, over 75% of all observed transactions were executed over individual parcels, and this includes all cases where a single landlord purchased multiple properties in a given year. In this context, market consolidation necessarily involves multiple transactions per market to concentrate ownership. To accurately characterize certain economically important rental submarkets, analysts may require an understanding of landlord strategy. If this type of consolidation leads to increased internalization of business stealing externalities, it will undermine the competitive process without being detectable through standard merger analysis.

[7] Commericial real estate and lending firms frequently employ this type of taxonomy when marketing buildings to renters and landlords. See Freddie Mac (2024) and Crowd Street Brokerage (2024) for further discussion.

2.2 Investment rental property exemption from US antitrust law

US antitrust law implicitly assumes that rental property transactions do not increase market power, as evidenced by their blanket exemption to premerger notificaton requirements, the most frequent application of antitrust law under Rule 802.5 of the Hart-Scott-Rodino Antitrust Improvements (HSR) Act.[8] The HSR Act requires non-exempt firms to participate in the US premerger notification program to notify the FTC and the DOJ of their proposed transactions. Howevever, the FTC exempted investment rental property assets from the program in 1996 on the basis that "the Commission believes that [...] the acquisition of investment rental property assets [was] unlikely to violate the antitrust laws".

In a growing literature on prospective merger review, researchers have identified that exempted deals can significantly weaken competition in segmented industries. In particular, Wollmann (2024) examines premerger notification exemptions on the basis of transaction size, and examines their impact on antitrust enforcement and merger activity. Using an abrupt increase in the US exemption threshold, the paper finds that among newly-exempt deals, antitrust investigations fall to almost zero while mergers between competitors rise sharply. The blanket exemption for investment rental properties from premerger notification effectively means that mergers and acquisitions among landlord competitiors are not currently examined or assessed by the DOJ or the FTC under any circumstances prior to their completion. This exemption presents two distinct concerns. First, the agencies have no ability to detect harmful deals. Second, since landlords transfer billions of dollars in ownership rights each year, this type of consolidation may play a role in increasing market concentration and, in turn, affecting markups and housing affordability.

As discussed in Section 2.1, the nature of consolidation in residential real estate raises an additional complication for identifying anticompetitive behavior. Specifically, market consolidation by landlords typically involves a number of small acquisitions in order to concentrate ownership. This essentially means that for a given anticompetitive acquisition, while the buyer market share is sizeable, the seller market share may be close to zero, such that both the value of the transaction and the predicted change in concentration may not reach the standard reporting thresholds. This is in constrast to modal mergers and acquisitions in industries like autos, which take place between large rival firms. Thus, even if residential real estate were not expressly exempt from pre-merger notification, many transactions would likely be exempt on the basis of size, and as a consequence, effectively escape antitrust scrutiny at their inception.

While rental property acquisitions may have historically escaped antitrust scrutiny, several recent, high-profile antitrust cases demonstrate the existence of real estate practices where the effect "may be substantially to lessen competition, or to tend to create a monopoly," which is prohibited under Section 7 of the Clayton Act. For example, in March 2024, Plaintiffs and the National Association of Realtors reached a $418 milion settlement to address "an anticompetitive agreement that resulted in home sellers paying

[8]Text from 16 CFR 802.5, HSR Act (requiring firms to file premerger notifications with Federal Trade Commission and Antitrust Division of Department of Justice): Acquisitions of investment rental property assets shall be exempt from the requirements of the act. [...] "Investment rental property assets" means real property that will not be rented to entities included within the acquiring person except for the sole purpose of maintaining, managing or supervising the operation of the real property, and will be held solely for rental or investment purposes.

inflated commissions to real estate brokers across the country" (PR Newswire, 2024). More recently, in August 2024, the Justice Department sued RealPage algorithmic pricing software for "enabling landlords to share confidential, competitively sensitive information and align their rents" (Office of Public Affairs, 2024). This paper argues that the coordination channel is sufficient but not necessary for landlords to be able to lessen competition in the rental market. Traditional internalization of business-stealing externalities under oligopolistic competition in segmented rental markets can affect prices and occupancy in similar directions to tacit collusion.

2.3 Data sources

My primary source of data is information on the universe of tax parcels that I obtain from the Cook County Assessor's Office (CCAO). The CCAO assesses the value of all residential and commercial properties in Cook County for the purpose of determining property taxes. I assemble several CCAO datasets that are maintained and updated yearly by the Data Department. The parcel database provides a complete, historic list of every tax parcel in the county. Each parcel has a unique PIN number, which specifies its address and the type of structure located on the parcel. From this data, I identify the set of multi-family buildings in the city of Chicago. I also identify the "neighborhood" that each building is located in. There city is divided into 77 administrative neighborhoods.[9] They are used for planning purposes, and their associated boundaries are salient to both renters and landlords. I demonstrate this assertion empirically in Section 3 of the paper.

Ownership In order to evaluate market power in this setting, it is necessary to determine ownership and ownership changes for each building in the city. This is a non-trivial task. Multi-family buildings are often purchased under a limited liability company (LLC) rather than an identifiable human or company name. An LLC is a business structure that shields an owner's personal assets from their business's liability. Further, it is common practice for the set of buildings in a landlord's portfolio to be purchased under multiple LLCs. I circumvent this issue by leveraging a unique feature of the tax records. Specifically, the parcel database provides the mailing address where the property tax bill for each parcel is sent. The mailing address is the same across buildings owned by a single landlord, even if the buildings are registered under various LLCs. Therefore, I am able to assign a unique owner id to every building that is connected by either a common owner or mailing address for each year of the sample. I identify the exact timing (i.e. year-month-day) of ownership changes using an independent list of parcel sales and dates recorded by the CCAO. Finally, I omit all public and affordable housing buildings from the sample. I identify these buildings from city, state, and federal-level administrative records and low-income housing property lists. This allows me to construct a *building* $\times$ *quarter* panel of market-rate rental properties and owners from 2000 to 2023 for the entire city.

[9]The neighborhoods are officially called "community areas". The boundaries of the community areas are fixed; they do not change over time. They were defined in 1920 by University of Chicago sociologists Robert E. Park and Ernest Burgess, in collaboration with the Chicago Department of Public Health (Seligman, 2004).

Prices I obtain data on rental unit prices from a large rental analytics company, which ingests millions of rental listings each year from various apartment listing aggregators, and systematically parses them to identify the following unit-level information: address, price, number of bedrooms, square footage, and building amenities. I supplement these data with targetted data collection of historical listings from rental companies operating in Chicago using the Internet Archive. I follow Pennington (2023) and take daily snapshots of historical rental listings over time, before extracting all available property and unit-level information. I combine all of the listing data together, and calculate the mean price for each unit at the level of *building* $\times$ *quarter* $\times$ *number of bedrooms*. Collecting this type of data is critical for a number of reasons. First, I am able to observe changes in prices over time at the building-level. I can therefore examine how changes in building ownership affect prices in the acquired buildings. Second, to the extent that in equilibrium, different types of landlords and renters use different platforms to advertise and search for apartments, collecting data from multiple platforms provides more comprehensive coverage of prices across segments. Put another way, the various sources of prices may altogether "capture different segments of the housing market" (Pennington, 2023).

Vacancies I measure building vacancies using the Infutor Historical Consumer Data, which provides address histories for over 200 million residents in the United States. Diamond et al. (2019) show that these data closely match Census tract records, reporting 1.1 adults per adult counted in the Census and performing well within age groups. I identify renters as people living at addresses that are classified as rental properties in the CCAO data. First, I calculate the net number of vacancies in each building b $\times$ quarter t as the total number of moves in, $m^b_{i,t}$ minus the total number of moves out, $m^b_{o,t}$. Next, I impute the total number of building vacancies per quarter by calculating the cumulative sum of net vacancies: $\sum_{t_{min}}^{t} \left(m^b_{o,t} - m^b_{i,t}\right)$.

Other building measures I collect information on the exact number of units in each building from the parcel database provided by the CCAO. Obtaining data on vacancies and units allows me to calculate market shares. Next, I obtain detailed information on quality upgrading from the City of Chicago Building Permit Records. This dataset contains the universe of permitted renovations for the city and provides details on the building address associated with the permit, permit application date, estimated cost of the project, and project details. If a building address has a permitted renovation in a given quarter that exceeds $1000 in estimated cost, I infer that there has been a substantive improvement in its quality. For each building in each quarter, I also construct a set of indicators for whether certain amenities are present in the building based on the text of the rental listings data.[10]

Table 1 provides a snapshot of the rental stock by neighborhood, from tax year 2014-15. There is substantial heterogeneity in the rental stock across neighborhoods, in terms of the number of buildings, units, and

[10]I impute the presence of an amenity by checking whether it is ever included in a listing for a unit located in the building. The amenities are: stainless steel appliances, granite countertops, furnished, laundry, doorman, clubhouse, fitness facilities, garage.

landlords. The largest neighborhood in the city (i.e. the neighborhood with the largest number of renters), Lakeview, has 6,276 landlords, whereas the smallest neighborhood, Riverdale, has only 22. These measures immediately reflect variation in the size of the neighborhoods and the density of the rental stock by neighborhood. They also motivate further investigation of the buildings within each neighborhood. To the extent that the rental market is segmented geographically or along other dimensions, a landlord could internalize recapture effects without owning property across the entire city. Instead, they could concentrate within a single neighborhood or over a specific building amenity mix, and the number of buildings they would need to own in order to obtain a sizeable market share would be at least an order of magnitude smaller than it would be for the entire city.

Table 1: Snapshot of rental stock by neighborhood in tax year 2014-15

	Count	Mean	Std. Dev.	Minimum	Maximum
Rental buildings	146733	1905.60	1779.70	22	7617
Rental units	580485	7538.80	6851.40	482	33413
Landlords	109123	1566.80	1431.60	22	6278

Notes: Each observation is a neighborhood (i.e. one of 77 official admnistrative boundaries) in Chicago in tax year 2014-15. My full sample covers 2000-23. For each neighborhood, "Rental" buildings counts the number of multifamily buildings. "Rental units" counts the number of units occupied by renters. "Landlords" counts the number of building owners.

Before summarizing the acquisition activity, I should note that the city of Chicago does not systematically track the universe of multifamily buildings or owners in the city, making this type of analysis impossible before now. The value of using the data collected by the tax assessor is that it is necessarily comprehensive. Because it is used to calculate property taxes for the entirety of Cook County on a yearly basis, the data is carefully maintained and consistent over time. In particular, one can verify the accuracy of this approach to identifying and accounting for rental properties by comparing the total number of rental units covered in the assessor data with the total number of rental units reported in the Census. In Appendix Table A4, I show that the ratio of rental units reported in non-overlapping ACS 5-Year Estimates from 2005-09, 2010-14, and 2015-19 are consistently within 5% of the same totals constructed from the CCAO data.[11]

2.4 Sample construction

I defer a complete discussion of the research design to Section 3 and simply describe the sample construction and data below. For the reduced form analysis, I use a sample of building acquisitions matched separately to

[11] The 2000 Census does not contain total rental units and it is not possible to accurately impute units from the other variables reported in the data. Because the ACS 5-Year Estimates are only available for 2005-09 onwards, I omit comparison of the data from 2000-04. The tight link between units reported across sources for the majority of the sample is reassuring.

the price and vacancy data.[12] I begin with 75,644 acquisitions, which cover all multifamily building types that span the period 2000-2023 and exclude any acquisitions where the building has another sale within the preceding or succeeding 8 years. This allows me to clearly examine pre-trends for eight quarters in the event study design, without contaminating the pre- and post- periods of two consecutive sales. I drop any acquisitions that have a permitted renovated in this sale window, in order to plausibly isolate the pure effect of market power from any quality upgrading channels. I then match the acquisitions separately to prices and vacancies for the reduced form analysis. I arrive at 65,119 acquisitions from 2000-2020 that I match to vacancies, and 19,196 acquisitions from 2014-2023 that I match to prices.

Table 2: Summary statistics

	Count	Mean	Std. Dev.	Minimum	Maximum
Price sample					
Year	6,692	2018	2.86	2014	2023
Rental price	6,692	1495.30	869.58	403.69	14205.70
Building units	6,692	9.91	24.35	1.00	373.00
Horizontal acquisition	6,692	0.21	0.44	0.00	1.00
Buyer share x 100	6,692	2.11	5.82	0.00	41.86
Vacancy sample					
Year	360,044	2010	5.83	2000	2020
Vacancies	360,044	0.27	1.94	0.00	111.00
Building units	360,044	4.38	13.18	1.00	694.00
Horizontal acquisition	360,044	0.05	0.23	0.00	1.00
Buyer share x 100	360,044	0.09	0.77	0.00	36.87

Notes: The unit of observation is a building-quarter. "Rental price" refers to the average unit price in a given building. "Vacancies" refers to the cumulative sum of net vacancies (moves in − moves out) in the building up to quarter t. "Building units" measures the number of rental units in each building. "Horizontal acquisition" is an indicator for whether a building is acquired by a competing landlord at any point in the sample. "Buyer share" refers to the market share of the acquiring landlord.

First, I construct an unbalanced panel of prices at the building-quarter-number of bedrooms level. I restrict this sample to acquisitions where I am able to observe at least one rental listing for the same building-number of bedrooms in the pre-period and in the post-period. The price panel is unbalanced due to the sporadic timing of when rental units become available relative to the building acquisition date. The key identifying assumption is that conditional on *building* $\times$ *quarter* characteristics, the missingness of the data

[12] I drop a small number of sales where the timing of the acquisition does not line up with changes in the ownership data.

is not correlated with the treatment and prices. My final price sample includes 1,009 acquisitions over 32 year-quarters. Second, I construct a balanced panel of vacancies at the building-quarter level. I do not require at least one vacancy on either side of the acquisition, since the count of vacancies is itself the outcome of interest. My final vacancy sample includes 12,448 acquisitions over 95 year-quarters.

Next, I assign each acquisition in each quarter to a submarket, as outlined in the next section. Using the ownership data, I calculate the market share for each buyer and seller in each quarter. If a buyer does not own any property prior to the acquisition, they are assigned a zero share. For every market and quarter, I observe a set of building acquisitions along with prices, vacancies, and market structure.

In Table 2, I display the summary statistics for each sample at the building-quarter level. An example of an observation is a 36-unit, 3-story courtyard apartment in 2015 Q1. The average rental price is approximately $1,495. The average number of units in the price sample is 10 and over twenty percent of the sample are building-quarters from horizontal acquisitions. The average number of units in the vacancy sample is 4 and 5% of the sample are building-quarters from horizontal acquisitions. The average buyer in the price sample is slightly larger than in the vacancy sample, though there is substantial variation in buyer size across both samples. I turn to a detailed description of the market structure in Section 3.

3 Descriptive analysis

In this section, I describe the key patterns in the data that inform my model and subsequent analysis. I first discuss market structure, before examining how prices and quantities change following acquisitions of competiting properties.

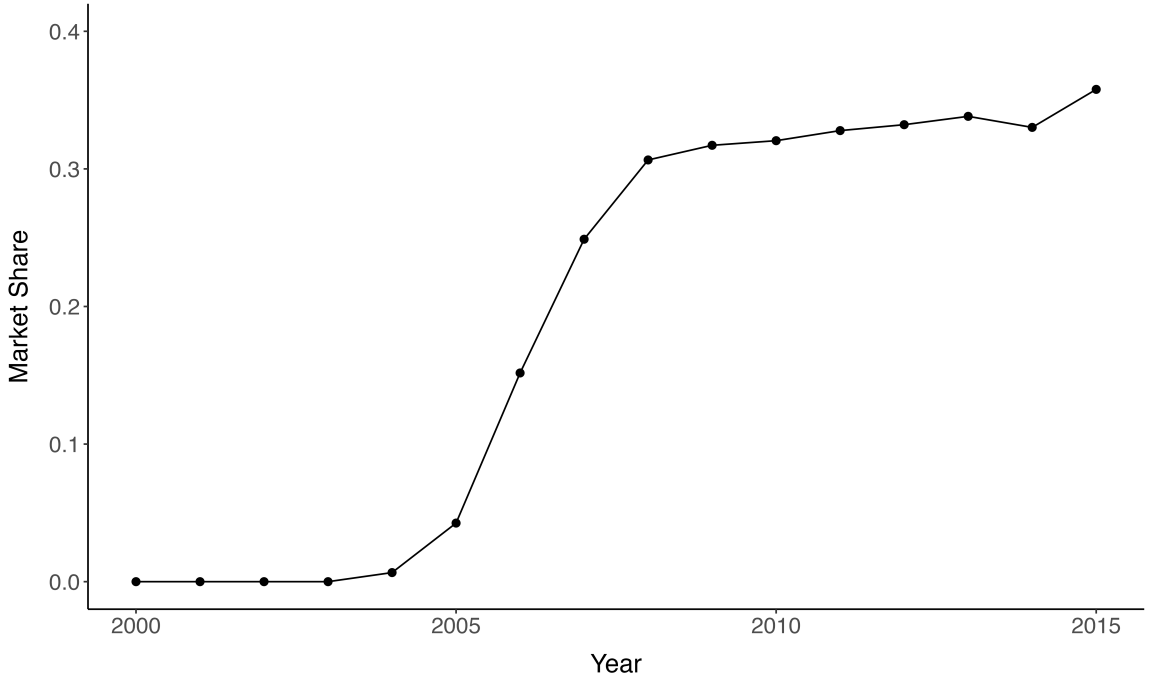
3.1 Market structure

I start with a motivating example from a single neighborhood in the city of Chicago. Specifically, I examine the market share of the largest landlord in Hyde Park, the neighborhood where the University of Chicago is located. Most students and faculty live in Hyde Park, making it a well-defined geographic segment with boundaries that are particularly salient to renters. In Figure 1, I plot a time series of the market share of the landlord. Starting in 2005, Mac Properties' market share jumped by over 20%, during a swift period of consolidation. By 2015, they owned nearly 40% of the neighborhood's total units.

A sizeable market share, while compelling, does not necessarily equate to concentration or the exercise of market power. However, the example is instructive with respect to the nature of consolidation in residential real estate. During the 2005-08 consolidation period, Mac Properties acquired 62 new buildings from 17

unique sellers. Indeed, the Chicago rental market rarely features standard mergers between larger firms, where two firms combine portfolios. Even large-scale acquisitions, where one firm buys the entire portfolio of another firm, are relatively infrequent; most acquisitions take place over individual buildings.[13] The consequence of this type of acquisition behavior is that even when the acquirer share is substantial, the predicted HHI changes are often close to 0 since the target share can be as small as $1/N$, where N is the number of units in the market.[14] The key is that regardless of whether the acquisition meets the standard monetary or $\widehat{\Delta \text{HHI}}$ thresholds for anticompetitive acquisitions set by the DOJ, if the acquirer has market power, we should expect to see them raise prices in the acquired building following a sale.

Figure 1: Market share of largest landlord in Hyde Park neighborhood



Notes: This figure plots the share of units owned each year by the landlord Mac Properties in the Chicago neighborhood of Hyde Park. Hyde Park is the neighborhood where the University of Chicago is located. Mac Properties is owned by Antheus Capital, a private real estate investment firm based in New Jersey.

Geography The type of concentration exemplified by Mac Properties will be particularly concerning vis-à-vis market power if the rental market is segmented. Segmentation occurs when renters have strong locational preferences over geographic areas, or if they are tied to a location for various reasons (e.g., search frictions, high moving costs, etc.). I use a revealed preference approach to investigate the extent to which renters have heterogeneous preferences over space. From the Infutor Historical Consumer Data, I calculate

[13] Sometimes buildings are also sold in small groups, a sale process known as "bulk sales".

[14] Recall that the predicted HHI change, which I refer to going forward as $\widehat{\Delta \text{HHI}}$, is calculated as $2 \times$ *acquirer share* $\times$ *target share* in the time period preceding the sale. For a more comprehensive discussion of the calculation, please see Section 3.2.

the distance from origin address to destination address for over 1 million within-Chicago moves between 2000 and 2020.

I find that renters' preferences over where to live are extremely localized. I plot the distribution of renter move distances in Appendix Figure A5.[15] Over one-half of Chicago renter moves occur within 1 mile of their previous address, and the likelihood of moving further away decays rapidlly with each additional mile. In Appendix Figure A6, I plot the fraction of total renter moves that occur between each pair of neighborhoods in the city. In most neighborhoods, between 40-70% of all renters who move from a given address relocate to another address within the same neighborhood. These findings are consistent with evidence from Piazzesi et al. (2020), who examine online housing search behavior. They document the prevalence of local demand from *narrow searchers* in every segment, who only look for housing in a handful of similar segments. Further, the idea that some housing submarkets are highly local or even segmented is often reflected in models of residential sorting (e.g., Pennington, 2023; Asquith et al., 2021; Diamond and McQuade, 2019).

These results also augment the findngs from recent studies on renter mobility and tenure. Past research has tended to focus on the extensive margin of renter mobility (i.e., the absolute rate of renter moves, and the relative rate of renter moves and homeowner moves). Within this context, renter moves in the past decade are at a historic low, compared to previous decades (Redfin, 2024; U.S. Census Bureau, 2017). The Census also generates mobility and migration statistics with respect to between-county and beween-state moves. The patterns documented above suggest an important role for spatial proximity in overall mobility choices *within* cities.

Building quality Building quality represents a second dimension of market segmentation. Quality is particularly salient to renters because they are contractually obligated not to modify their rental units. The Building Owners and Managers Association (BOMA) typically assigns one of three class ratings to commercial properties in a city as a proxy for quality: "A", "B", or "C".[16] The class ratings are used to market buildings to distinct landlord and renter types. Aside from geography, the ratings depend on each building's amenities and certifications. Since I do not have access to the Chicago building class schema, I use building size as a proxy, where size refers to low-rise (2-4 units), mid-rise (5-49 units), or high-rise (50+ units) buildings.

Size creates a naturally occuring constraint on the possible set of available amenities in any given building. High-rise buildings typically can accommodate large amenities like a pool or a clubhouse, whereas low-rise

[15] A renter move refers to a move by an individual between two distinct addresses associated with a multifamily property, as designated by the CCAO.

[16] Buildings under various schema may be assigned a "D" rating, although this classification is not officially sanctioned by BOMA. These buildings are either vacant, deteriorating in condition, or located in particular areas with low rents or inconsistent tenancy (Core Logic, 2017).

buildings cannot. Certain amenties like views of the lake or overlooking a park are also exclusive to high-rise buildings on account of their height. However, even the types of amenities that are more amenable to small dwelling spaces, like high-quality construction materials (e.g., granite countertops or stainless steel appliances), are less likely to be found in low-rise apartments in Chicago, as I show in Appendix Figure A7.

If buiding size is a salient characteristic to renters, it should also show up in renters' moving patterns. In Appendix Figure A8, I show that conditional on moving within the same neighborhood, 70-90% of individual moves occur between buildings of the same size. While there is some movement between low-rise to mid-rise buildings and mid-rise to high-rise buildings, there is comparatively little movement between low-rise to high-rise buildings, and vice versa.

3.2 Measuring concentration

A natural extension of the previous discussion is to determine how concentrated the rental submarkets in the city of Chicago are. I measure concentration by calculating HHI within each *neighborhood* $\times$ *building size* submarket in the city, where building size again refers to low-rise (2-4 units), mid-rise (5-49 units), or high-rise (50+ units). These submarket definitions approximately follow the definitions in Calder-Wang and Kim (2024), where they define rental submarkets by neighborhood and building class.

I let a building's relevant submarket includes every market-rate building located in the same neighborhood and with the same building size. I measure a building's market share as its share of rental units relative to the total number of units in the submarket. To measure HHI, I assume that a rental market submarket M includes many landlord portfolios $L \in \mathcal{L}(M)$, where $\mathcal{L}(M)$ is the set of portfolios in M. Each portfolio is defined as a set of one or more buildings b, which have a collective owner. Formally,

$$HHI_M = 10,000 \times \sum_{L \in \mathcal{L}(M)} \left(\sum_{b \in L} s_{bM} \right)^2$$

where s_{bM} is b's market share within M. An HHI of 10,000 reflects a monopoly segment where one landlord owns all of the buildings. An HHI closer to 0 instead reflects a segment that has many small, independent buildings owners. In Appendix Figure A9, I plot the distribution of HHI across *neighborhood* $\times$ *building size* submarkets for the year 2021. I include all submarkets with over 500 rental units and at least five distinct multifamily buildings. For example, if there is only one high-rise buildings in a neighborhood, I consider that segment to be missing. There are 160 submarkets included in the resulting plot. Approximately 10% of all submarkets have an $HHI \geq 1500$, which represents the threshold for a moderately concentrated

marketplace, according to DOJ guidelines.

Among the submarkets that are at least moderately concentrated, all are comprised of either high-rise or mid-rise buildings. This is consistent with the fact that there are fewer buildings in these submarkets, and each building's units accounts for a larger fraction of the total submarket units, relative to an individual building in the low-rise submarket. For an individual landlord, it requires significantly less coordination to buy up a series of high-rise or mid-rise buildings in a way that leads them to capture a large share of the market.

U.S. Horizontal Merger Guidelines clarify that M&A activity that substantially increases concentration is likely to be anticompetitive in absence of offsetting efficiencies (US Department of Justice and Federal Trade Commission, 2010). This motivates scrutiny of cases where a large target and a large acquiring firm operate in the same industry. While there are rarely formal mergers between landlords in the Chicago rental market, there is an analogous type of activity that occurs when landlords compete and acquire properties in same submarket. The relevant variation for assessing the incidence of market power in this setting then is not the absolute value of HHI in a submarket, but rather, the relative magnitude of changes in concentration following transfers in building ownership.

All else equal, building sales that have a larger predicted change in concentration should lead to greater incentives for the acquiring landlord to increase prices or restrict output, conditional on the market being sufficiently concentrated. Thus, I proceed by calculating the predicted change in HHI from each building sale in my sample. Following Brot et al. (2024), I use units rather than occupancy to define concentration because changes in building units are less likely to be highly correlated with changes in building quality or prices in the short-run. Formally, I calculate the predicted HHI change derived solely from an acquisition as:

$$\widehat{\Delta \text{HHI}} = 2 \times \left(\sum_{b \in L^a} s_{bM} \right) \times \left(\sum_{b \in L^{t,a}} s_{bM} \right)$$

where the set of buildings owned by the acquirer is given by L^a and the set of buildings sold by the target to the acquirer is given by $L^{a,t}$.

In order to classify the previously calculated predicted HHI changes as relatively large or small, I order the predicted HHI changes by size - largest to smallest - and calculate the inflection point in the distribution of changes. I classify all sales with a predicted HHI change that is larger than the inflection point as big (this ends up being approximately 5% of all sales). The remainder of sales are classified as small. The average predicted HHI change among the small sales is approximately 0.0005. The average predicted HHI change among the big sales is approximately 5.

3.3 Prices

With these predicted HHI changes in hand, I use a staggered event study design to estimate how acquisitions of competing buildings affect prices and occupancy within the rental market. The estimating equation is given by:

$$y_{bt} = \delta_b + \eta_t + X_{bt}\gamma + \sum_{\tau=-T}^{T} d_{bt}^{\tau}\alpha_\tau + \sum_{\tau=-T}^{T} d_{bt}^{\tau} Big\widehat{\Delta \text{HHI}}\beta_\tau + \epsilon_{bt}$$

where y_{bt} denotes price or occupancy in building b in quarter t. δ_b and η_t denote quarter and building fixed effects, respectively, and X_{bt} refers to the vector of time-varying building covariates (i.e. amenities) in the price sample. d_{bt}^{τ} represent dummies for values of τ, which denotes event time measured in quarters. To capture the role of market power, I interact the quarter-to-sale dummies with an indicator $Big\widehat{\Delta \text{HHI}}$, which takes a value of 1 if the predicted HHI change from each building sale is larger than the aforementioned inflection point, and 0 otherwise. Given the sample period, I pool all observations from $\tau \leq -8$ and $\tau \geq 8$ together and restrict attention to the two years before and after each building sale. The coefficients of interest are on the final set of interaction terms and the standard errors are clustered at the building sale level.

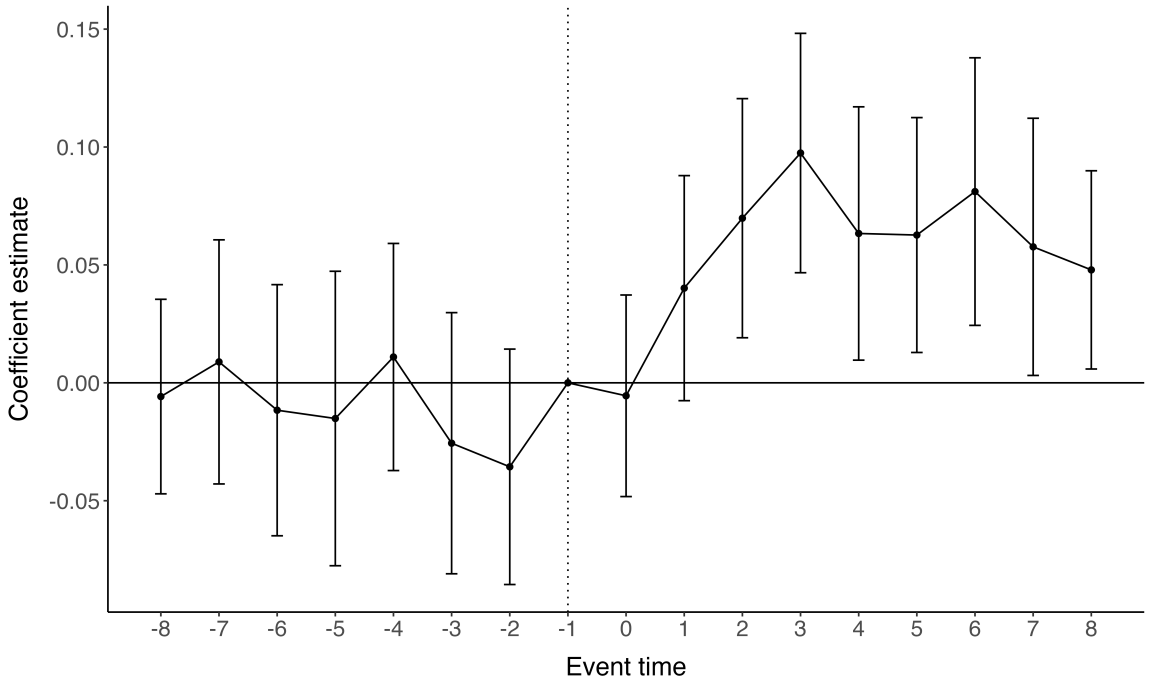
Figure 2 reports the price estimates from the staggered event study, specifically, the coefficients on the final set of interaction terms from the estimating equation above. Causal interpretation of the staggered event study requires that there are no shocks to y_{bt} that coincide exactly with the timing of the building sale. I investigate the plausibility of this assumption in the event study results; if there are any building changes that occur gradually and that are correlated with both unit prices and sale timing, it is likely that this would show up as differential pre-trends.

The price event studies shows that the average difference in the percent change in rental unit prices for building sales with big and small predicted HHI changes is stable in the quarters preceding a move. In the quarters following a sale, the average difference in the percent change in rental unit prices changes sharply and positively for building sales with a big predicted HHI change. The lack of pronounced pre-trends is consistent with the identifying assumption.

Quantitatively, I estimate an event study jump of approximately 5-10 percentage points, as seen in Figure 5. The estimated magnitudes and significance are similar. This translates to around a $50-$100 price increase. The jump in the event study after the sale provides initial evidence of the importance of market power in driving differences in prices across rental market segments. The effect emerges between one and two quarters on average after a sale. This timing is consistent with the acquiring landlords waiting for existing

tenant leases to expire or for them to move out, and then immediately marking up the listing price for their newly vacant units. If landlords were not exercising market power, we would expect no difference in prices between building sales with big and small predicted HHI changes. In Appendix Figure A8 I report the results of the efficient robust estimator from the imputation procedure in Borusyak et al. (2024). The estimates are quantitatively smilar to my main results.

Figure 2: Prices increase following large $\widehat{\Delta \text{HHI}}$ acquisitions

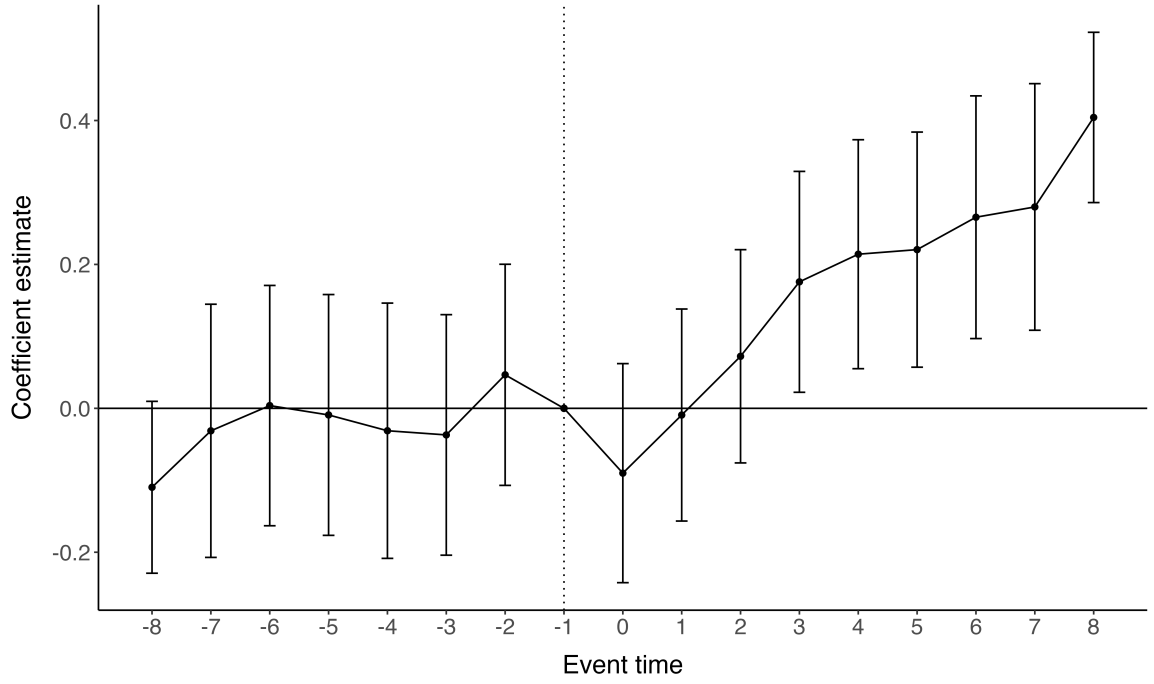


Notes: This figure plots estimates of β_τ obtained from equation (4) against event time. β_τ is normalized to zero in $\tau = -1$, which is marked with a vertical dashed line. All observations from $\tau \leq -8$ and $\tau \geq 8$ are pooled together. Standard errors are clustered at the building sale level.

3.4 Vacancies

In this section, I analyze the effect on occupancy of building sales that are predicted to lessen competition. As detailed in the data section, I construct a measure of building vacancies from the Infutor data. This allows me to compare occupancy from building sales with large and small predicted HHI changes. As with the price regressions, I investigate the plausibility of the identifying assumption by examining the pre-trends in the event study. In Figure 3, vacancies before building sales with big predicted HHI changes exhibit very similar pre-event trends as those before building sales with small predicted HHI changes. Vacancies after big sales increase by approximately 0.1-0.4 units relative to vacancies after small sales. The difference again emerges several quarters after the sale.

Figure 3: Vacancies increase following large $\widehat{\Delta \text{HHI}}$ acquisitions



Notes: This figure plots estimates of β_τ obtained from equation (4) against event time. β_τ is normalized to zero in $\tau = -1$, which is marked with a vertical dashed line. All observations from $\tau \leq -8$ and $\tau \geq 8$ are pooled together. Standard errors are clustered at the building sale level.

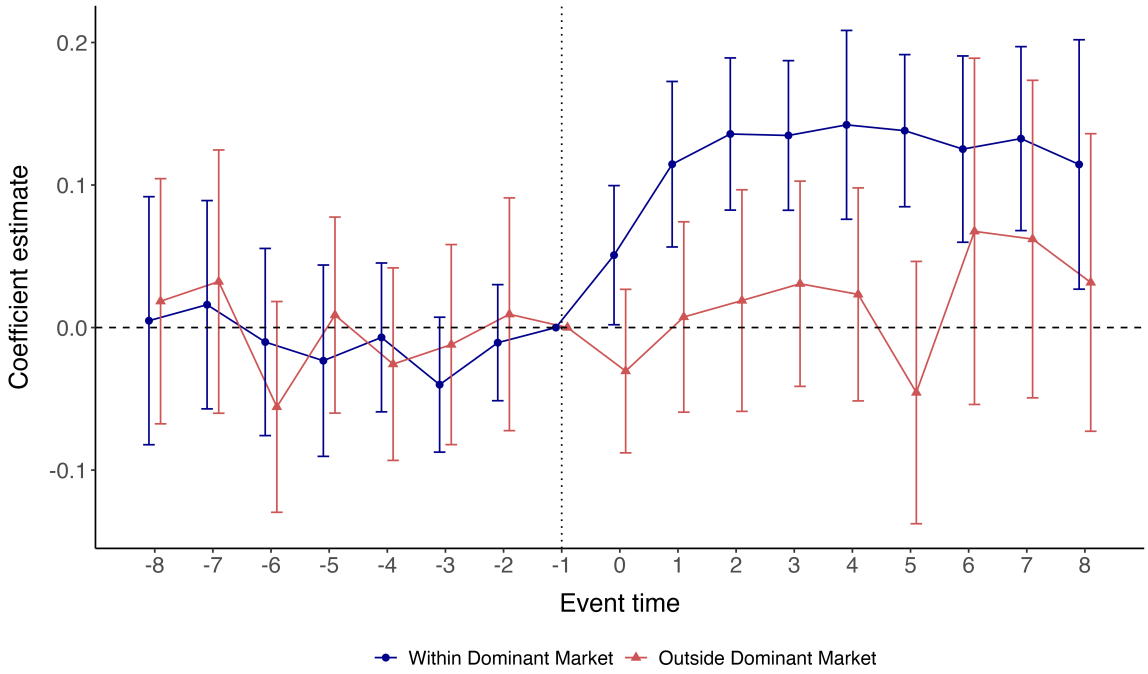
3.5 Ruling out alternative mechanisms

One potentially confounding explanation for these results would be the case where big landlords are better able to identify and purchase buildings with units that are under-priced relative to the market rate. In this case, once purchased, landlords would increase prices to be commensurate with the rest of the segment, resulting in a similar jump at precisely the time of the building sale. This type of behavior has a testable implication: big landlords that are engage in sophisticated search should be equally successful at discerning buildings with under-priced units across segments. Therefore, we should see the price effects show up equally regardless of whether the landlord has a large market share in the segment or not. On the other hand, if the price increases are driven by landlords exercising market power, they should only be able to increase prices in segments where they have a large market share.

In Figure 4, I implement an empirical test of the abovementioned phenomenon by examining price-setting behavior by large landlords who operate in multiple markets, at least one of which they do not plausibly have market power in. I subset to the set of landlords that ever own at least 1% of a given market segment in the city. I flag a sale as occurring *within dominant market* if the landlord has at least 1% of the market share in a segment and *outside dominant market* otherwise. I report that the largest price hikes by

these big landlords are concentrated among sales where they are dominant in the relevant segment, and can plausibly exercise market power, while prices evolve smoothly through acquisitions in non-dominant markets. As deals in non-dominant markets do not affect the structure of ownership and, by extension, do not reduce rivalry, measuring their effect on prices reveals whether the aforementioned price increases following acquisitions are due to a loss of competition or merely the independent effect of strategic behavior by landlords. The observed pattern coheres with the idea that prices are unaffected by large landlords except through acquisitions that weaken the competitive process, as opposed to one where large firms are more effective at identifying under-priced units.

Figure 4: Prices only rise following acquisitions when landlord is dominant in market



Notes: This figure plots separate estimates of β_τ obtained from equation (4) against event time, for big landlords when they acquire buildings within or outside of their dominant market. Only landlords that operate in both types of markets are included in the test. β_τ is normalized to zero in $\tau = -1$, which is marked with a vertical dashed line. All observations from $\tau \leq -8$ and $\tau \geq 8$ are pooled together. Standard errors are clustered at the building sale level.

Although I remove renovations from the main specifications, it could still be the case that building sales with large predicted HHI changes are more likely to undergo non-permitted renovations in a way that disproportionately increases unit costs and rental prices at exactly the time of a building sale. Using the amenity indicators from the rental listings data, I run a modified version of the main specification to test for whether there are significant differences in the likelihood of observing any amenities listed after sales with big

and small predicted HHI changes.[17] A discontinuous jump in amenity listing likelihood at *t=0* would suggest that large landlords are making subsequent upgrades to units in their acquired buildings without permits, in a way that discernibly improves their quality. I start by estimating the following difference-in-difference equation:

$$y^a_{bt} = \delta_b + \eta_t + Post_{bt} + Post_{bt} \times Big\widehat{\Delta \text{HHI}}_{bt} + \epsilon_{bt}$$

where y^a_{bt} takes a value of 1 if amenity a is ever present in the rental listing for a building in a given quarter, and 0 otherwise, δ_b refers to the building fixed effect, η_t refers to the quarter fixed effect, and $Post_{bt}$ is an indicator for the post-sale period and $Post_{bt} \times Big\widehat{\Delta \text{HHI}}_{bt}$ is an interaction term that takes a value of 1 when the observation falls in the post-sale period and the sale has a big predicted HHI change. β is the coefficient of interest, which captures the difference in the likelihood of an amenity being listed after a sale with a big predicted HHI change, relative to a sale with a small predicted HHI change.

In Appendix Figure A9, I report the β_{bt} coefficients from the sample where renovated buildings are included (dark green), and again in the sample where renovated buildings are excluded (light green). In the sample that includes renovated buildings, laundry, granite countertops and fitness facilities are more likely to be listed after big sales relative to small sales. However, none of the coefficients are significantly different from zero once we exclude the renovated buildings from the sample. Furthermore, in Appendix Figures A10, I report the coefficients from the event study specifications for each type of amenity in the non-renovated building sample. The fact that no amenities are significantly more likely to be available after big sales relative to small sales is reassuring.

3.6 Robustness to market definitions

Using the city's 77 administrative neighborhoods to define the submarkets is an obvious first pass, but the empirical results are also robust to using alternative market definitions. To show this, I implement a data-driven approach to identifying geographic segmentation within the city's rental market, using a series of statistical tools adapted from network theory.[18]

Consider each administrative neighborhood in Chicago as a *node* in a city-wide housing network. I count the number of moves between each pair of neighborhoods observed in the Infutor Consumer Address History; these are the *edges* of the network.[19] I then use a community detection algorithm to recover the

[17]The test assumes that advertising for amenitized assets is comprehensive. This seems reasonable, since building owners are incentivized to advertise available amenities in order to attract prospective tenants.

[18]Some work in labor and urban economics has recently started using this approach to partition labor and real estate markets using job and residential mobility networks (Nimczik, 2024; Ziff, 2024).

[19]For expediency, I use the full movers' sample to estimate the model, but it could be re-estimated in discrete time periods (i.e., 5-year

latent "community membership" of each neighborhood in the rental market. Intuitively, neighborhoods with similar densities of moves between them are grouped into the same segment.

In Appendix Figure C1, I map the recovered segments. From information just on the number of moves between neighborhood pairs, and without any additional information about the characteristics of the neighborhoods like race or income, this revealed preference approach recovers 26 geographically contiguous segments in the rental market that subsume the original neighborhoods. In Appendix Figure C2, I show that renters who move within these geographic segments relocate to another address within the same segment between 60-80% of the time. In Appendix Figure C3 and Appendix Figure C4, I recalculate the predicted HHI changes and re-run the staggered event study regressions using submarkets defined by these 26 segments instead of the 77 administrative neighborhoods. Interpreting these results, I conclude that the building sales driving the results are identified as large irrespective of the exact geographic boundaries used to define the submarkets. To the extent that consolidation of large landlords extends across neighborhood boundaries, widening the definitions of the submarkets may actually improve precision at identifying relevant sales.

4 Model

In this section, I present a model of the rental supply and demand. I will use the estimated model parameters to simulate equilibria under various counterfactual policies.

4.1 Demand

I model renters' decisions as a multinomial discrete choice problem across differentiated rental properties, following the literature in McFadden (1977); Bayer, Ferreira, and McMillan (2007); Calder-Wang (2021). Each renter r decides whether to rent in building j from among all rental buildings J in a submarket m and in year t. Renters can also opt to live in the outside option $j = 0$. They derive utility from the building's characteristics. They also derive disutility from price. The total utility from living in building j in market t is given by the following:

periods).

$$U_{rjt} = \alpha p_{jt} + \beta x_{jt} + \xi_{jt} + \epsilon_{rjt} \tag{1}$$

Here, p_{jt} denotes the monthly rent in building j. α denotes the consumer's taste for log of price, p_{jt}. x_{jt} denotes the vector of observable attributes of the building. These include building age and dummy variables for building amenities, including granite countertops, stainless steel appliances, laundry, and whether the unit is furnished. Parameter β denotes the mean taste for each building characteristic. Next, ξ_{jt} denotes an i.i.d. product-specific preference shock. Finally, ϵ_{ijt}, denotes an i.i.d. preference shock specific to the choice and renter. Renters can also consume the outside good, whose mean utility is normalized to 0 zero without loss of generality, so that renters receive only $u_{i0t} = \epsilon_{i0t}$. This specification yields the familiar logit choice probabilities for each renter. The probability of renter i choosing to live in $j \in J_t \cup \{0\}$ is:

$$s_{ijt} = \frac{e^{\alpha p_{jt} + \boldsymbol{X_{jt}}\boldsymbol{\beta} + \xi_{jt}}}{1 + \sum_{j' \in \mathcal{J}^t} e^{\alpha p_{j't} + \boldsymbol{X_{j't}}\boldsymbol{\beta} + \xi_{j't}}} \tag{2}$$

The probability of choosing the outside good, s_{ojt} is obtained by replacing the numerator in equation (2) with one and the denominator. This setup assumes that static, unit demand closely approximates the actual renter decisions made and that renters are price takers. In practice, some renters do rent multiple units but in most of these cases they only rent a small number of units at a time.

4.2 Supply

On the supply side, I assume landlords, indexed by f, play a static, full information, simultaneous move pricing game each year. Each landlord f chooses the price for every building j in their portfolio, J_f^t, with the objective of maximizing firm profit, which equals

$$\pi_{ft} = \sum_{j \in J_f^t} (p_{jt} - mc_{jt})\, s_{jt} M_t \tag{3}$$

where mc_{jt} denotes marginal cost and M_{jt} denotes submarket size.[20] Observed prices form a Nash equilibrium to the pricing game. I assume a marginal cost mc_{jt} is associated with each building in a given quarter, which I parameterize as a function of observed characteristics x_{jt} and an unobserved shock ω_{jt}:

[20] I use the number of units and number of vacancies to compute the total number of renters per submarket per year. I compute the maximum value for each submarket over the sample and set market size equal to twenty percent above this figure.

$$ln(mc_{jt}) = x_{jt}\gamma + \omega_{jt} \tag{4}$$

where ω_{jt} is i.i.d. over buildings and time. The first order conditions from the firm's problem will be used in conjunction with the estimated demand system to solve for marginal costs for each product. Marginal costs will then be used to compute markups and for estimating equilbrium prices and quantities in the counterfactual analysis. Presently, the pricing first order condition for building k is:

$$s_{kt} + \sum_{j \in J_f^t} (p_{jt} - mc_{jt}) \frac{\partial s_{jt}}{\partial p_{kt}} = 0 \tag{5}$$

We can see how consolidation impacts price in Equation (5). First consider a market where *f* owns a single building *j*. At this point, the firm chooses p_j such that $(p_j - mc_j)\frac{\partial s_j}{\partial p_j} - s_j = 0$. In equilibrium, increasing the price in j has two offsetting effects at the margin: first, it allows the firm to earn positive profits on renters who choose to live in *j* at the price p_j, second, it reduces the demand from renters for *j*. Next, suppose that the firm acquires a rival building *j'* in the same market. In this case, increasing the price in *j* leads to the internalization of business stealing externalities (Wollmann, 2024). Specifically, some renters will divert to *j'* which is now owned by *f*. Mathematically, this is reflected in the fact that the left-hand side of the equation now includes an additional term: $(p_{j\prime} - mc_{j\prime})\frac{\partial s_{j\prime}}{\partial p_{j\prime}}$.

Notably, due to the fact that indirect utility is a function of the logarithm of price, the implied elasticity is roughly constant and the markup over building k is a function of the price at every building j in firm f's portfolio J_f^t (Nevo, 2000). We can see this by writing out the full system of first-order conditions as follows:

$$\boldsymbol{p_t} = \underbrace{\left[\left(\mathcal{H}_t \left(\boldsymbol{D}(\boldsymbol{p}) \right) \odot \boldsymbol{\Omega}_t(\boldsymbol{p}) \right)^{-1} \left(\boldsymbol{S} + \mathcal{H}_t \left(\boldsymbol{D}(\boldsymbol{p}) \right) \odot \boldsymbol{\Omega}_t(\boldsymbol{p}) \right) \boldsymbol{D}_t(\boldsymbol{p}) \right]}_{\boldsymbol{\eta}_t(\mathcal{H}_t, \boldsymbol{S})} \boldsymbol{mc}_t \tag{6}$$

where $\boldsymbol{D}(p)$ represents the vector of demand for all products at a given price. $\boldsymbol{\Omega}_t(\boldsymbol{p})$ represents the delta matrix, where $\boldsymbol{\Omega}_{jkt} = \partial s_{jt}/\partial p_{kt}$. $\odot$ represents the element-wise (Hadamard) product between the ownership matrix $\mathcal{H}_t$ and the delta matrix. $\boldsymbol{S}$ represents the diagonal matrix of product shares, s_{jt}. $\boldsymbol{\eta}_t\left(\mathcal{H}_t, \boldsymbol{S}\right)$ denotes the markup implied by the ownership structure for a given demand system $\boldsymbol{D}_t$.[21]

My assumption of Nash-Bertrand pricing to maximize firms' profits rules out cartels or other changes

[21] I borrow this system notation from Calder-Wang and Kim (2024).

in conduct over the sample period. Assuming a static Nash equilibrium in prices will yield inaccurate marginal cost estimates if firms are becoming more or less collusive over time. While RealPage software and several large property management companies are currently under investigation for facilitating coordinating between landlords in various cities, I assume that this is not a prevalent issue in this setting, as evidenced by the low penetration rate of RealPage in Chicago (Calder-Wang and Kim, 2024).

4.3 Estimation and Results

Demand To estimate the demand system, I rely on the market share inversion proposed by Berry (1994) using the following equation:

$$ln(s_{jft}) - ln(s_{0ft}) = \lambda_j + \lambda_t + \alpha_j ln(p_{jft}) + \beta x_{jt} + \xi_{jft} \tag{7}$$

The left-hand side of equation (7) is a straightforward transformation of the data, and the right-hand side is linear in parameters to be estimated - λ_j, λ_t, β, α_j - and an error term.

I calculate s_{jt} by transforming the number of building units and the number of vacancies observed for each building in the sample into a measure of occupancy. There are two relevant considerations for this transformation. First, total building occupancy is a function of baseline occupancy, which depends on how target and realized occupancy rates for landlords vary with building size. Second, the number of people per bedroom in an apartment varies with the propensity of different renter income types to live independently or with roommates. I start by assigning a baseline number of occupants to each building, which is standardized by building size category. I then scale the number of vacancies based on the ratio of population in renter-occupied housing units to total units rented for each tract from the ACS 5-year estimates for 2010-14. Note that changes in the ratios from alternative years do not in any way drive the results. For example, using the ratios from the ACS 5-year estimates for 2015-19 or 2020-24 has an almost imperceptible effect on the estimated parameters.[22]

Since firms know ξ when they set p, prices are endogenously determined in equation (7), so OLS estimates of α will be biased. I estimate the parameter using price variation induced by acquistions with large predicted changes in concentration. Our price instrument equals the product of a dummy for whether the $\widehat{\Delta \text{HHI}}$ of the sale is relatively large, and a dummy for $t \geq t_{sale}$. The intuition behind the identification strategy is straightforward. In the previous section, I showed that following the acquisition of buildings with the largest $\widehat{\Delta \text{HHI}}$ in the sample, the price and occupancy of rental units rise and fall, respectively, compared to

[22]This is primarily due to the fact that the geographic distribution of ratios does not change substantially across sample periods.

remaining acquisitions. The relative changes reflect sensitivity to price, which maps to the α. The instrument is reasonably uncorrelated with building-quarter specific demand shocks, given the local nature of the markets, the selection of multifamily buildings, and the timing of the acquisitions.

Table 3: Demand and marginal cost estimates

Panel A: Demand estimates		
Variables	Parameters	Estimates
Log price	α	-3.046
		(1.252)
Mean beds	β_1	0.6862
		(0.2812)
Stainless steel appliances	β_2	0.0972
		(0.0334)
Granite countertops	β_3	0.0435
		(0.0175)
Furnished	β_4	0.0509
		(0.0278)
Building fixed effects	λ_j	Yes
Quarter fixed effects	λ_t	Yes
Number of building-quarter observations	110,851	
Panel B: Marginal cost estimates		
Variables	Parameters	Estimates
Constant	γ_0	6.1600
		(0.0030)
Mean beds	γ_1	0.1878
		(0.0015)
Stainless steel appliances	γ_2	0.0993
		(0.0065)
Granite countertops	γ_3	0.0742
		(0.0066)
Furnished	γ_4	0.0100
		(0.0108)
Number of building-quarter observations	100,478	

Notes: This table reports recovered demand and marginal cost estimates. The unit of observation is a building-quarter. Standard errors are clustered at building-sale level.

Panel A of Table 3 reports the demand estimates. The *Estimates* column corresponds exactly to equation (7). I find that renters dislike higher prices, as expected, with α = -3.046. Standard errors are clustered at the building-sale level, and the price coefficient is significant at the 5% level. The sign of the price coefficient is

unchanged across specifications (e.g., including building or building and quarter fixed effects), which I report in Appendix Table A11.[23] Within buildings, renters on average like buildings with a higher average number of bedrooms, and units with stainless steel appliances, granite countertops, and furnished accomodations.

Marginal costs Rearranging the Nash pricing condition yields estimates of marginal costs that are a function of only prices and shares (both of these are data) along with estimates of the price coefficient and the individual purchase probabilities (both of these are recovered from the demand system above). Specifically, taking the derivative of the profit of firm f with respect to price and solving for marginal cost for each observation yields,

$$\left(\frac{\partial s_{kt}}{\partial p_{kt}}\right)^{-1}\left[s_{kt}-\sum_{j\in J_f^t} p_{jt}\frac{\partial s_{jt}}{\partial p_{kt}}-\sum_{j\neq k\in J_f^t} mc_{jt}\frac{\partial s_{jt}}{\partial p_{kt}}\right]=mc_{kt} \tag{8}$$

The present estimation of demand does not rely on supply-side moments, which I form independently from the firms' first-order conditions with respect to prices. I am able to check that the profit margins implied by the model parameters are consistent with industry averages reported in survey data. Given the recovered parameters, the model predicts profit margins of between 32.6 percent and 78.4 percent for mid- and high-rise building owners, which is in line with mean values reported by institutional investors in administrative data (IRS SOI, 2018) and financial disclosures (RealPage, 2016).

Finally, after I recover the marginal costs, I take their log values, rearrange terms and solve for the additively separable error term, ω. γ is estimated via least squares, since $E[\omega|x,j,t]=0$. Plugging β and γ into the price equation yields an estimate of the distribution of ω. Table 4 reports estimates of γ. The addition of stainless steel appliances or granite countertops to a building's amenity set translates to a 7 to 9 percent increase in marginal cost. Also, the presence of more expensive structural features, including a larger average number of bedrooms, adds significantly to cost.

5 Counterfactual analysis

In this section, I use the estimated model paramters to explore the efficacy of antitrust enforcement and new construction policy. This dual approach allows me to identify the benefits of promoting competition in the rental market.

[23] I rely on estimates from column 3 for the remainder of the paper because accounting for *building* × *quarter* variation in price sensitivity is important for identification.

5.1 Divestiture order

To start, I study the effects of a divestiture order, in which large landlords are required to divest from completed acquisitions of competing properties. Critically, this order *would not* affect the vast majority of acquisitions, especially those transacted by traditional "mom and pop" landlords.[24] Ultimately, unwinding the competing acquisitions reduces the ability of large landlords to internalize business stealing externalities. The divestiture order eliminates recapture effects, which is noteworthy for renter welfare.

Antitrust divestitures are referred to as a *structural rememdy*, wherein the FTC or the DOJ faciliates a one-time fix to alledgedly anticompetitive behavior by "modifying the competitive landscape" (Debevoise & Plimpton, 2022).[25] The property could be divested to an incumbent third party landlord or a new entrant. Thinking through the ideal characteristics of the divestiture buyer is beyond the scope of this paper, but I recognize the practical importance of choosing a landlord that is able to successfully navigate the daily operations and organizational demands of the residential real estate industry.

It is worth considering for a moment how feasible a divestiture order would be in this setting. The nature of consolidation in a given industry largely determines feasibility. If there is a high level of complexity in the firm's consolidated operations, such an order may be difficult to actualize. However, in residential real estate, the costs of unwinding are fairly minor. The business activities of the firm would change primarily through the price-setting behavior studied thus far. There might also be relatively minor changes to other activities such as building maintenance or payroll.

Table 4: Unwinding acquisitions reduces expenditures and prices

	Ownership structure		
	Single-building	Divested	Observed
Total expenditure per year	284,907,111	291,924,695	312,808,231
Expenditure change relative to observed	27,901,120	20,883,536	-
Average price per month in divested buildings	1331.87	1332.08	1474.75
Price change relative to observed	142.88	142.67	-

Notes: This table reports the total expenditure and average price changes from a divestiture order for the top five most affected submarkets in the city, as measured using the sum of total predicted HHI changes from competing acquisitions.

To operationalize the divestiture counterfactual, I start with the observed ownership structure of every submarket in the city in 2023. I identify the most recent transaction for each multifamily building, and

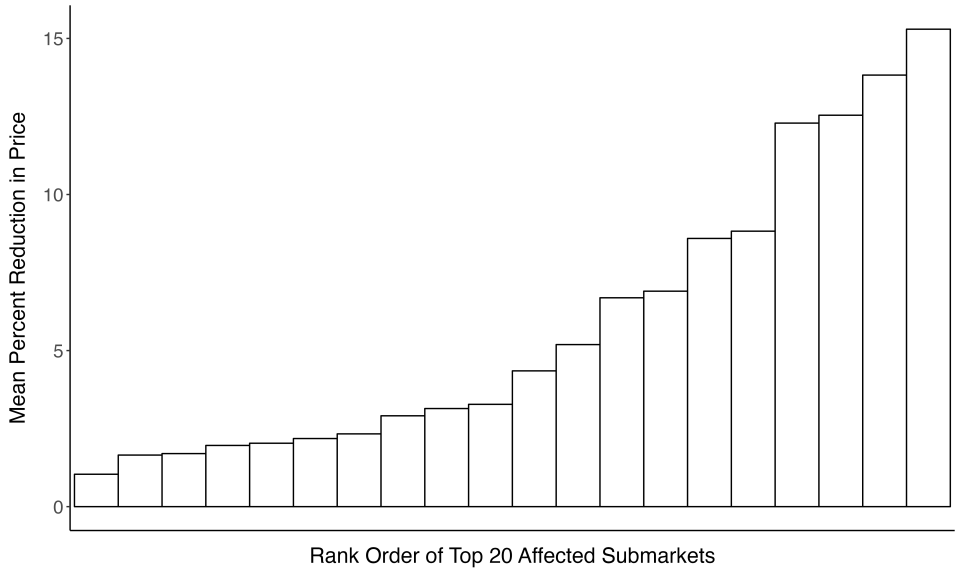
[24] Recall that I only flag 5% of the acquisitions in my sample over the past 20 years as having a relatively large predicted change in concentration.

[25] This policy stands in contrast to *behavioral remedies*, which entail actively monitoring or limitating the conduct of the firm over a period of time.

flag the set of buildings where the associated acquisition had a large predicted change in concentration. I re-assign each flagged building to a new, independent owner, and I simulate counterfactual equilibria under the new ownership structure in the ten most affected submarkets in the city, as measured using the sum of total predicted HHI changes. Table 5 reports the result in terms of annual expenditure differences from unwinding acquisitions relative to the observed ownership case. It also reports the results from an additional simulated equilibria: single-building ownership, where every building has an independent owner.

The first scenario, unwinding ownership, approximates the market-level welfare loss for renters if they are currently living in segments where landlords are able to internalize recapture effects. After unwinding the acquisitions, consumer surplus unambiguously increases as prices decline and additional units come online. The total reduction in annual expenditures from unwinding is approximately $20 million.

Figure 5: Simulated rental price reductions in divested buildings, by submarket



Notes: This figure plots the mean percent reduction in price from a divestiture order, for divested buildings in the top twenty most affected submarkets in the city, as measured using the sum of total predicted HHI changes from competing acquisitions.

Given the difficulty in interpreting the scale of these figures - since aggregate expenditure across submarkets depends on each submarket's size and the total number of affected acquisitions - I also report how equilibrium prices in divested buildings change on a per-unit basis. Specifically, I calculate the average price difference per unit-month in the set of divested buildings. The divestiture order leads to a 10% reduction in prices on average, or over $100 per month.

The simulation also helps to clarify the nature of consolidation in the Chicago rental market. First, almost all of the gains from unwinding obtain from a small set of neighborhoods. In Figure 5, I plot the mean

percent reduction in price by submarket among the top 20 most affected submarkets. Three-quarters of these submarkets are located in neighborhoods adjacent to the lake, including Kenwood, Hyde Park, Near North Side, and Lake View. The lakefront is associated with key lifestyle amenities, such as views of the lake and access to the lakefront trail, and unlike other neighborhood features, it has no discernable substitutes. In general, this pattern coheres with the acquisition strategy outlined in this paper's introduction, whereby landlords target supply-constrained submarkets that have relatively inelstic aggregate demand and few (or zero) available substitutes for key anchor amenities.

Second, simulated prices in the acquired buildings span the full range of the equilibrium price distribution. This suggests that there may be distributional consequences from an unwinding order. If relatively lower-income renters are sorting into targetted buildings in higher-income neighborhoods, then they may be made immediately better off through the divestiture policy.

5.2 New construction

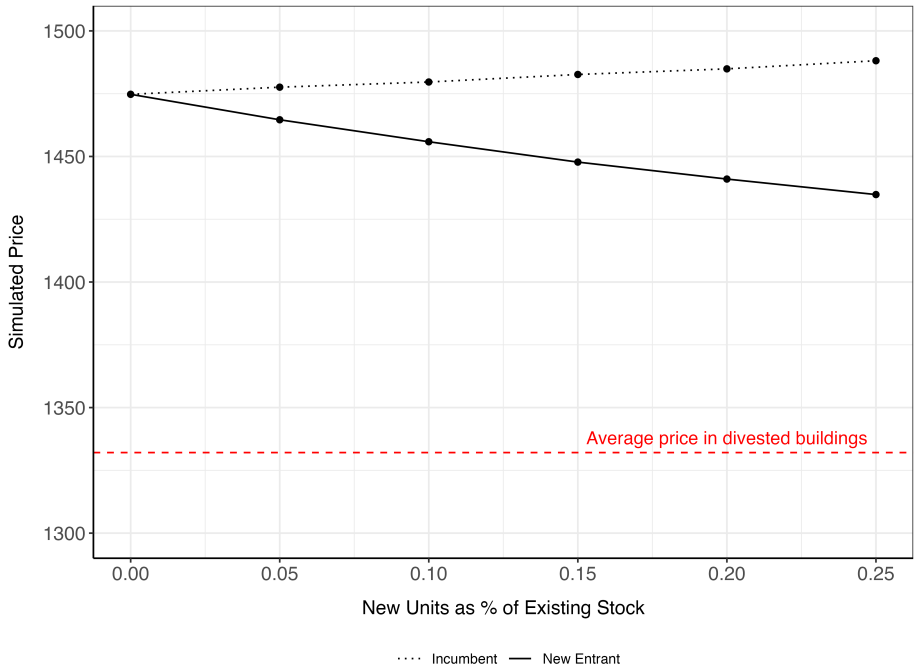
Next, I examine how new construction affects prices under oligopoly. In many industries, high profits will attract rivals that undercut existing prices. Entry can theoretically serve as a safeguard against sustained market power. However, entry in the Chicago rental market is severely limited for two main reasons. First, new construction is expensive and developers may need to rely on government subsidies and grants in order to make development profitable. This is challenging because it requires coordination, significant resources, and sophistication around applications. Second, zoning often reserves properties for single family use. Long and protracted fights around zoning changes can involve city council hearings and neighborhood approval, which can be difficult to achieve in certain parts of the city. These factors create substantial barriers for new units to be constructed in the market.

I consider two counterfactual scenarios where zoning restrictions are relaxed such that the number of new units in each neighborhood can be increased in increments of 5% relative to the total number of units in the market.[26] In Figure 6, I plot the the average change in the price of target buildings (i.e., acquired buildings whose sale had a relatively large predicted HHI change) under two distinct policy scenarios. In the first case, each added increment of units is owned by a different owner, to avoid unintended consolidation. For the exercise, I focus on the top five most affected submarkets, as measured using the sum of total predicted HHI changes from competing acquisitions. I stack the neighborhoods and report the average effects for ease of interpretation.

[26]The exercise is conducted putting aside the practical issue that landlords may endogenously concentrate in places where zoning is particularly restrictive.

In equilibrium, the mitigative effects of new construction on high rental prices depend on the market structure under oligopolistic competition. As depicted by the solid black line, prices fall relatively slowly, even after new units equivalent to 25% of the existing stock are added to each segment. In concentrated segments, incumbent landlords with sufficiently large market shares worry more about cannibalizing their own products than losing consumers to new buildings, especially ones with few units. The number of new units that need to be constructed to put downward pressure on equilibrium prices is substantial.

Figure 6: Simulated price equilibria from counterfactual new construction policies



Notes: This figure shows the results of constructing new rental units in each of the five most affected submarkets, as measured using the sum of total predicted HHI changes. I simulate the addition of new units in 5% increments relative to the existing stock. The solid black line considers the case where each set of units is owned by a new entrant, while the dashed line considers the case where each set of units is owned by the incumbent with the largest market share in the submarket. Both lines plot the average change in price in target buildings, (i.e. acquired buildings whose sale had a relatively large predicted HHI change). This change is benchmarked against the average building price following from the divestiture order considered in section 5.1.

Next, I compare the case where each set of units is owned by the incumbent landlord with the largest market share in each submarket. This could occur immediately, from the start of the new construction, if the landlord is also a sophisticated developer. In practice, incumbent landlords may be incentivized to acquire the newly constructed units or merge with the new entrant, since monopoly profits are always greater than two times duopoly profits. As depicted by the dashed black line, incumbent landlords internalize recapture effects from the additional units, increasing the relative markup on their existing units. This leads to higher

equilibrium prices in the target buildings, which are increasing in the number of new units added to the existing stock.

The takeaway from this exercise is nuanced. New construction is a fundamental lever that policymakers can pull in order to ease pressure from excess demand.[27] However, careful attention should be paid to the structure of the relevant market or submarkets in which the policy is being designed. In particular, the simulation shows the importance of targetting new construction strategically and ensuring that cities foster competition among developers and landlords, instead of allowing immediate and persistent consolidation.

6 Conclusion

In this paper, I study the role of market power in residential real estate. I explore this question empirically and theoretically in the context of the Chicago rental market. I start by building a novel dataset that links the universe of market-rate multifamily properties and their owners from 2000 to 2023. I then use a staggered event study design to investigate the evolution of prices and occupancy around the time of a sale. Consistent with the exercise of market power, I find that acquisitions of competing properties raise price and reduce occupancy. I rule out that other mechanisms such as strategic purchasing or quality upgrading explain these results.

These facts raise the question as to whether and how renter welfare is affected by market power in equilibrium. I answer this question by estimating a structural model of rental demand and oligopoly supply, and using the estimates to predict equilibrium responses to two policy counterfactuals: (1) unwinding horizontal acquisitions and (2) new construction. The divestiture policy unambiguously increases consumer surplus through lower prices and additional rental units. On the other hand, under oligopolistic competition, the effectiveness of new construction depends on its scale and design. In particular, prices fall slowly under oligopolistic competition, relative to a single-building owner benchmark. Further, allowing incumbent landlords with market power to build new units may lead to higher prices, due to internalized recapture effects.

Taken together, these results have profound implications for rental markets and policy design, and reflect the importance of accurately measuring and characterizing the relationship between market power and housing affordability in contemporary urban rental markets. Real estate transactions exempt from prospective merger review in supply-constrained submarkets consolidated hundreds of billions of dollars in output across the United States just since the Great Recession. Similar numbers could obtain abroad,

[27] For example, Watson and Ziv (2021) consider a counterfactual up-zoning policy in New York City within a model of monopoly power in the rental market. They find that targetted up-zoning at zoning-constrained buildings reduces markups on policy-unconstrained units and generates new units through increased competition.

since rental market consolidation is rising worldwide. More work is needed to quantify the distributional consequences of market power in residential real estate, and to assess how it affects residential mobility and urban inequality. This is left to future research.

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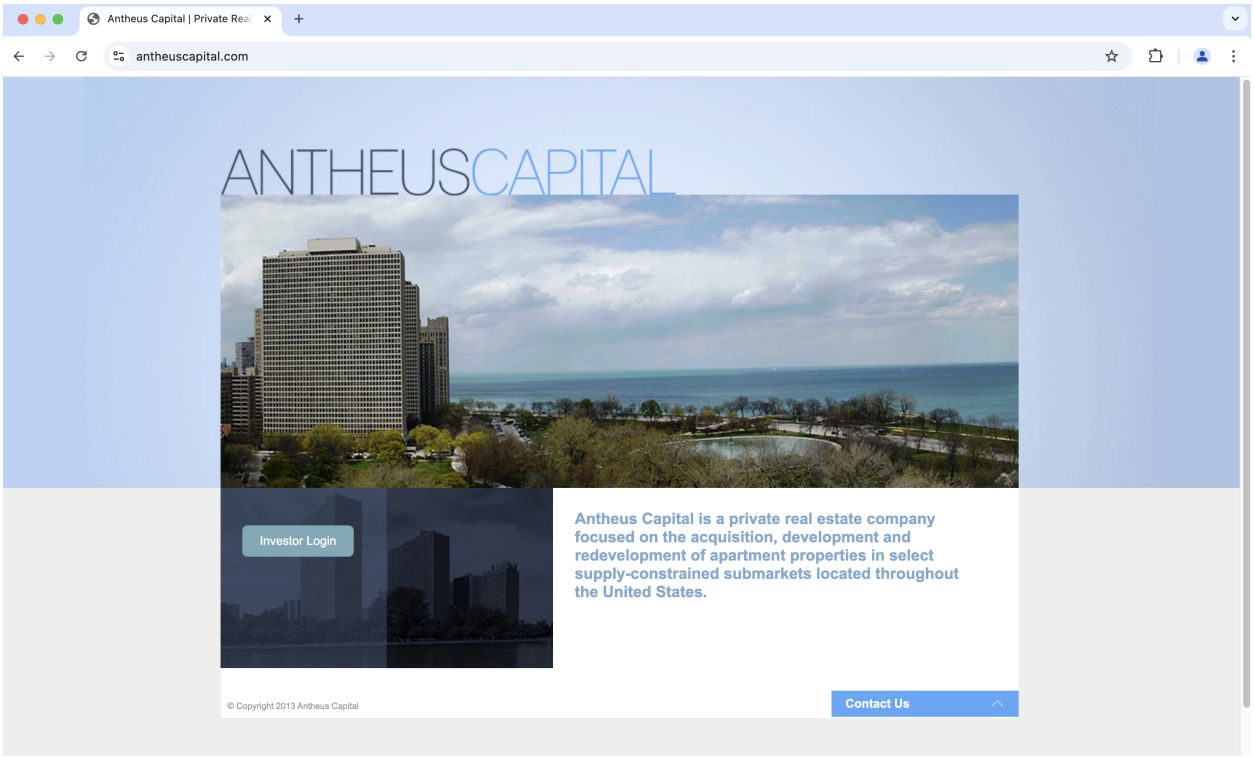
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Appendix for "Market Power in Residential Real Estate: Evidence from Chicago Rental Properties"

Appendix A. Tables and Figures
Appendix B. Data construction
Appendix C. Robustness to market definitions
Appendix D. Model estimation procedures

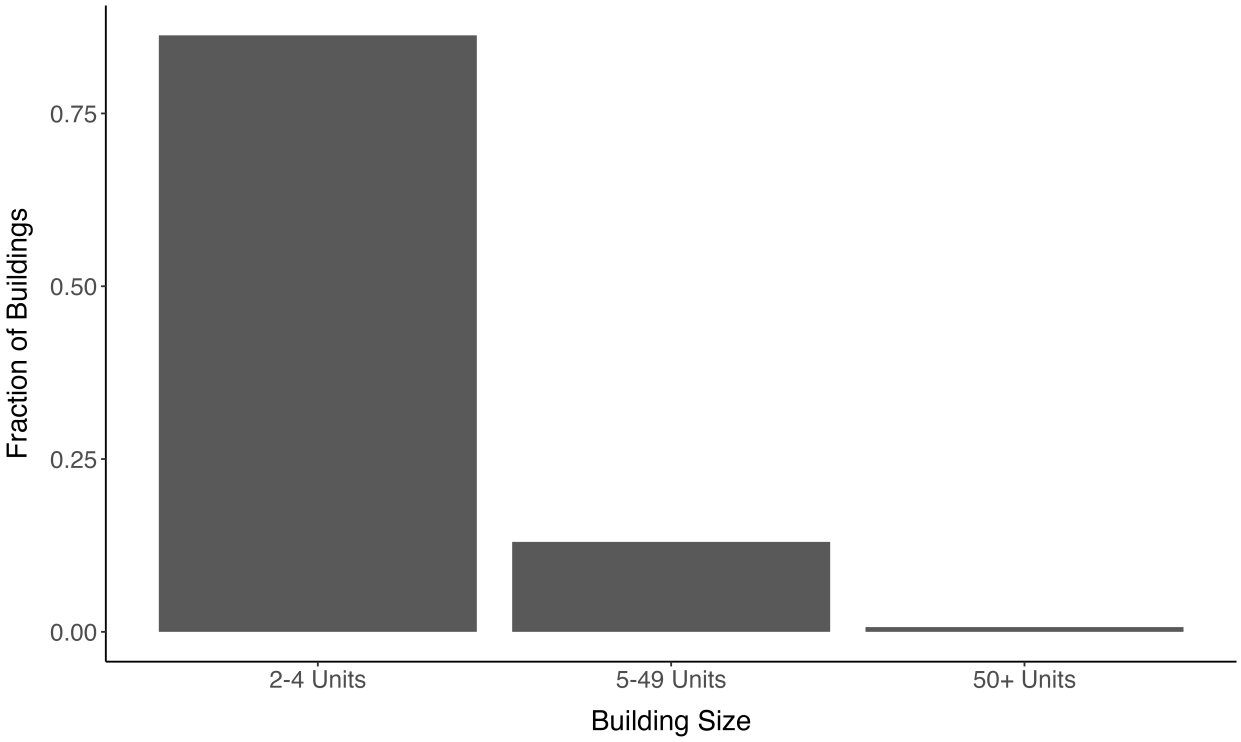
Appendix A. Figures

Figure A1: Acquisition strategy of large commercial real estate investor in Chicago



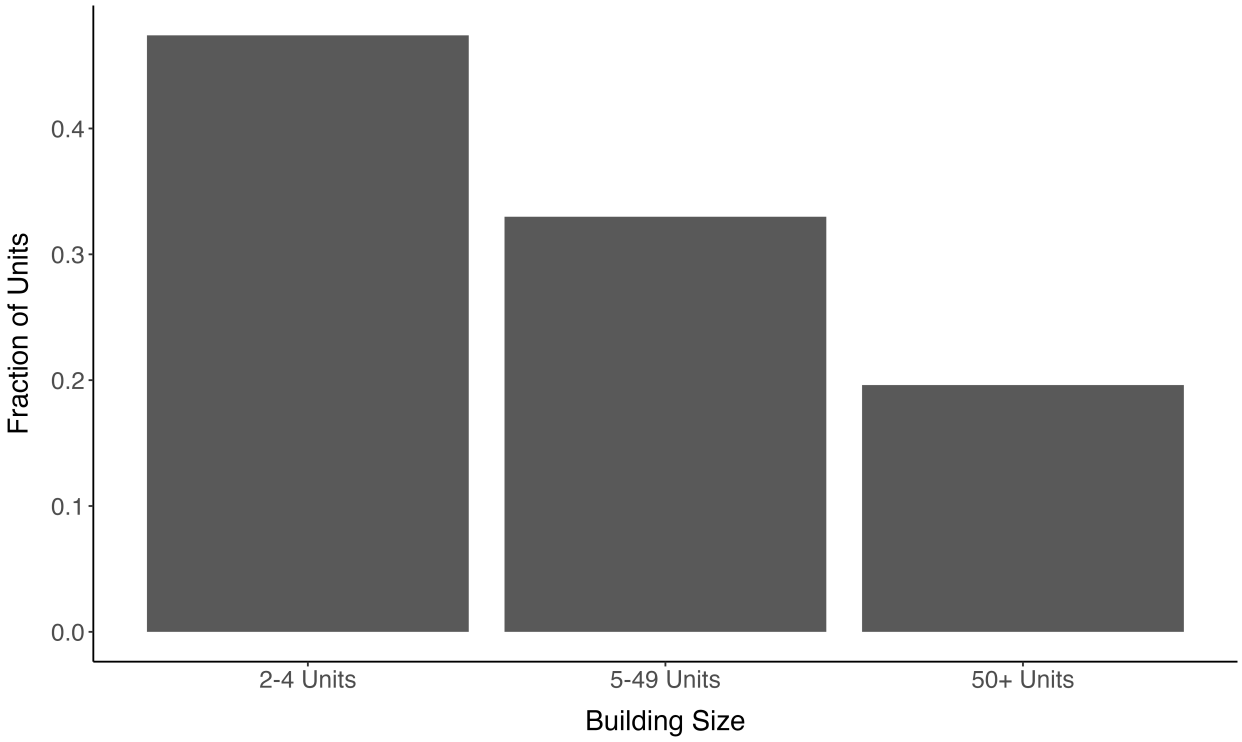
Notes: This is a screenshot from the investor website of Antheus Capital, a large commercial real estate investor in Chicago. The company targets "supply-constrained submarkets located throughout the United States."

Figure A2: Fraction of rental *building* stock by building size



Notes: This figure plots the fraction of rental buildings in the city of Chicago by building size in tax year 2019. Each rental building is identified by its association with a multifamily land parcel in the Cook County Tax Assessor parcel database.

Figure A3: Fraction of rental *unit* stock by building size



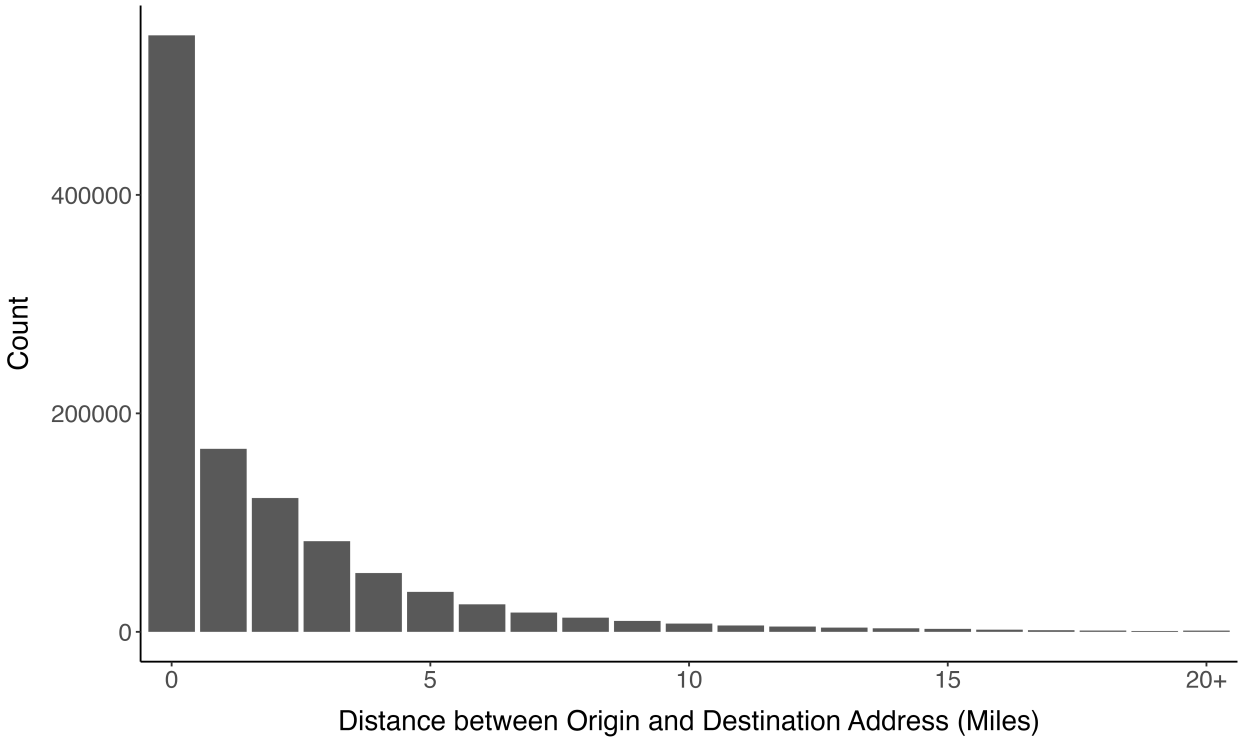
Notes: This figure plots the fraction of rental units in the city of Chicago by building size in tax year 2019. Each rental building is identified by its association with a multifamily land parcel in the Cook County Tax Assessor parcel database.

Figure A4: Ratio of total rental units from CCAO database to total rental units from ACS 5-year estimates

Sample Period	Assessor Units	ACS/Census Units	Ratio
2005-2009	591,116	607,533	0.9729
2010-2014	607,953	625,223	0.9724
2015-2019	643,126	632,627	1.0166

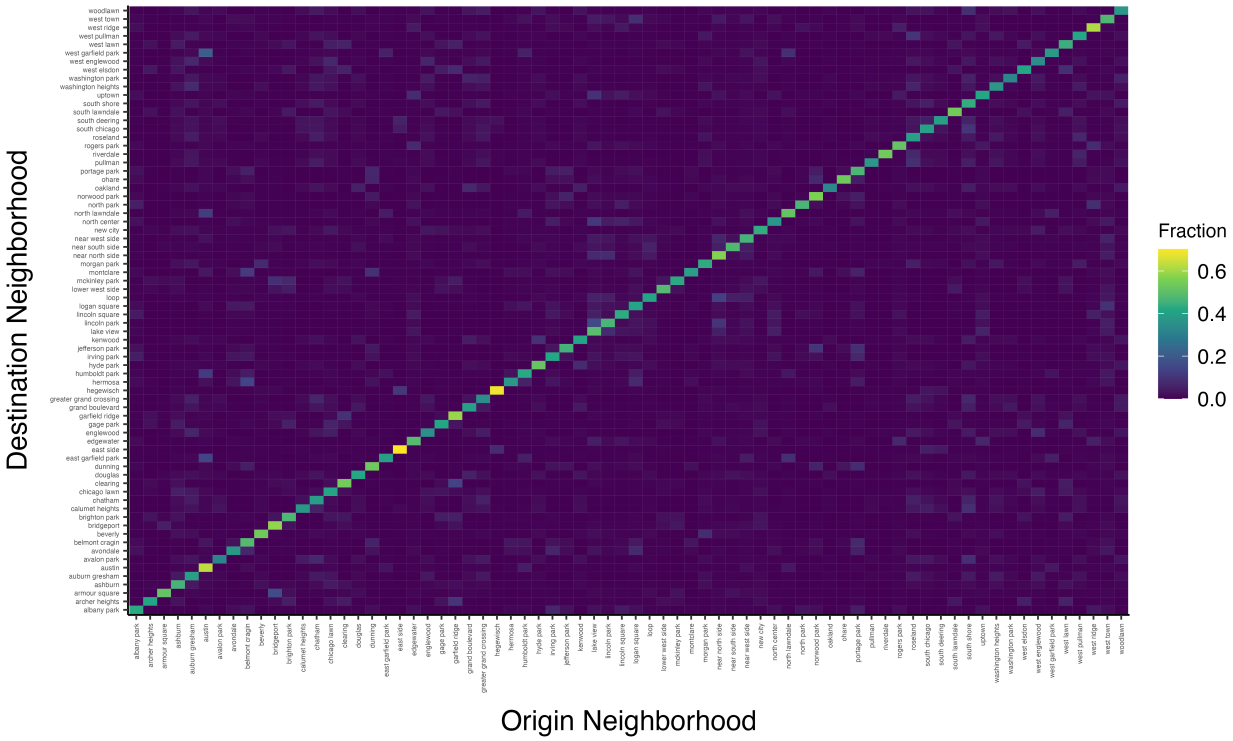
Notes: "Units Reported in CCAO" refers to the number of rental units calculated from the CCAO database. "Units Reported in Census" refers to the number of units reported in non-overlapping ACS 5-year estimates. "Ratio" divides the value in the second column by the value in the third column.

Figure A5: Approximately one-half of all moves in Chicago occur within 1 mile of origin address



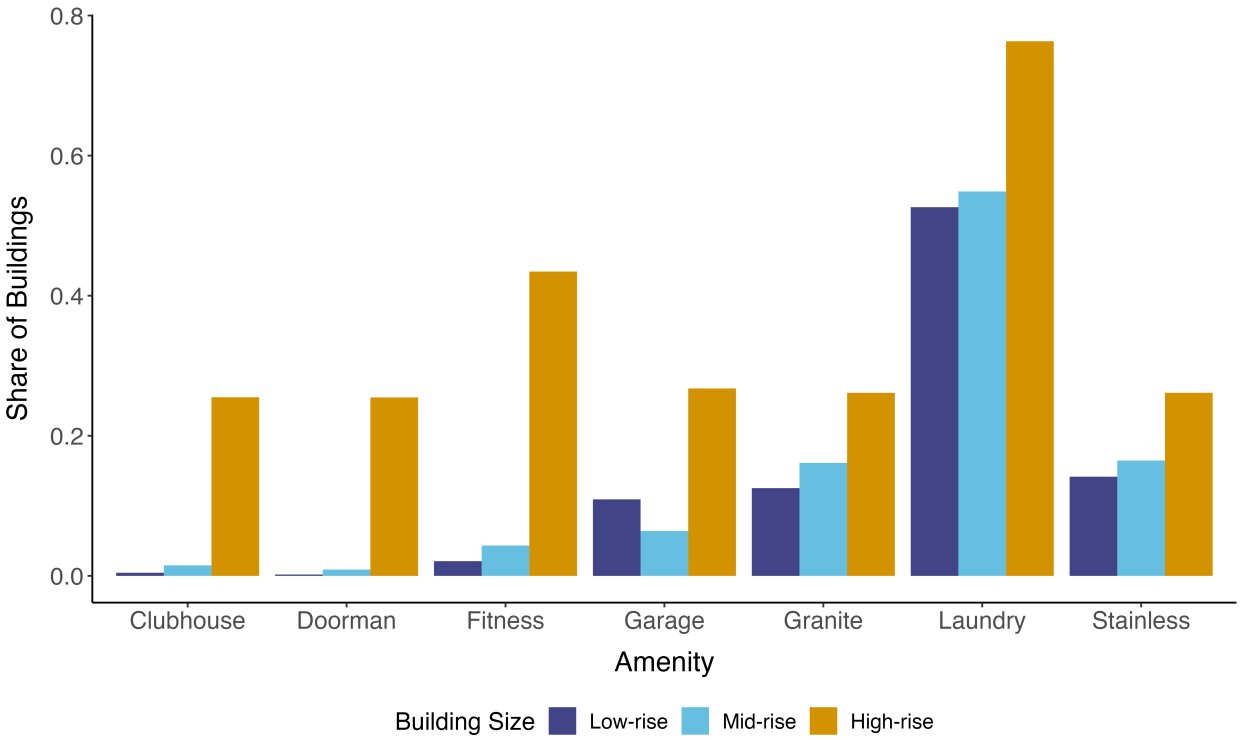
Notes: This figure plots the total number of renter moves that are between 0-20+ miles of the movers' original address. The data source is the Infutor Consumer Address History database. It contains over 1 million within-Chicago moves, meaning the origin and destination address are both within the city limits.

Figure A6: Fraction of total moves from each origin neighborhood to destination neighborhood



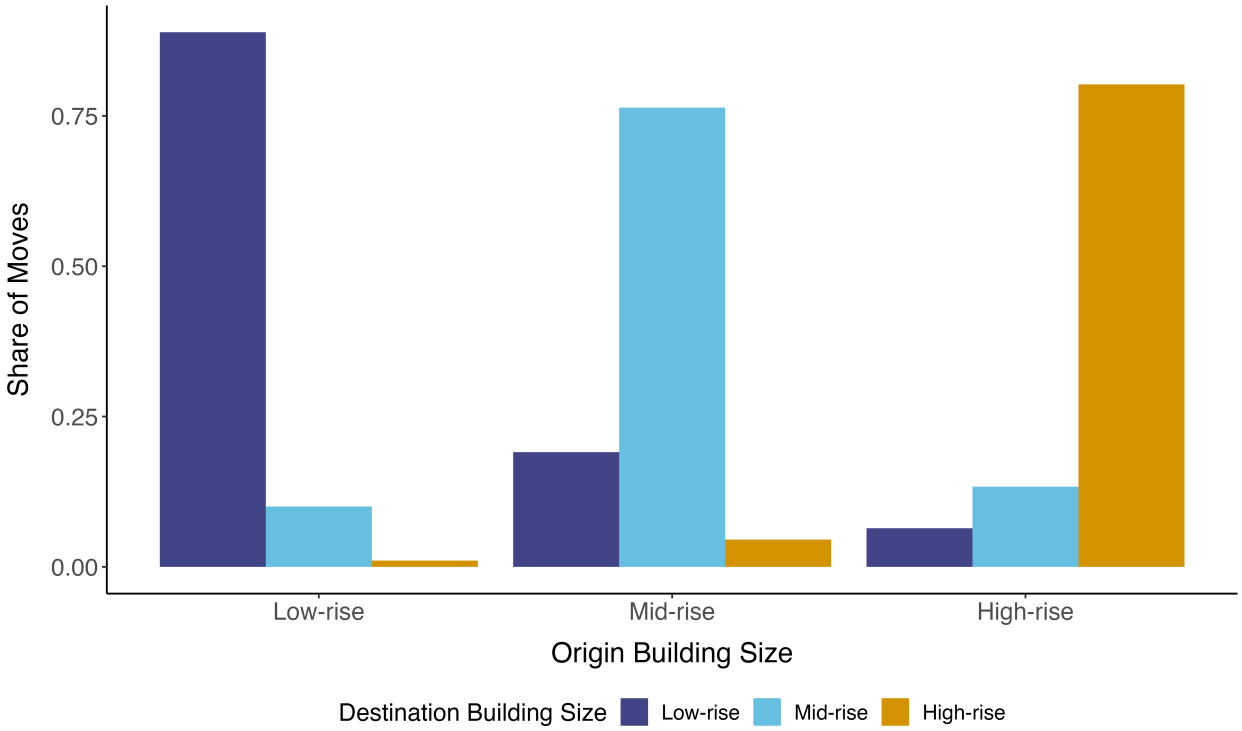
Notes: This figure plots the fraction of total renter moves from each origin neighborhoods to each destination neighborhood, excluding five neighborhoods with fewer than 1,000 rental units. The diagonal tiles represent shares of within-neighborhood moves. The data source is the Infutor Consumer Address History database. It contains over 1 million within-Chicago moves, meaning the origin and destination address are both within the city limits.

Figure A7: Fraction of multifamily buildings containing amenities by size



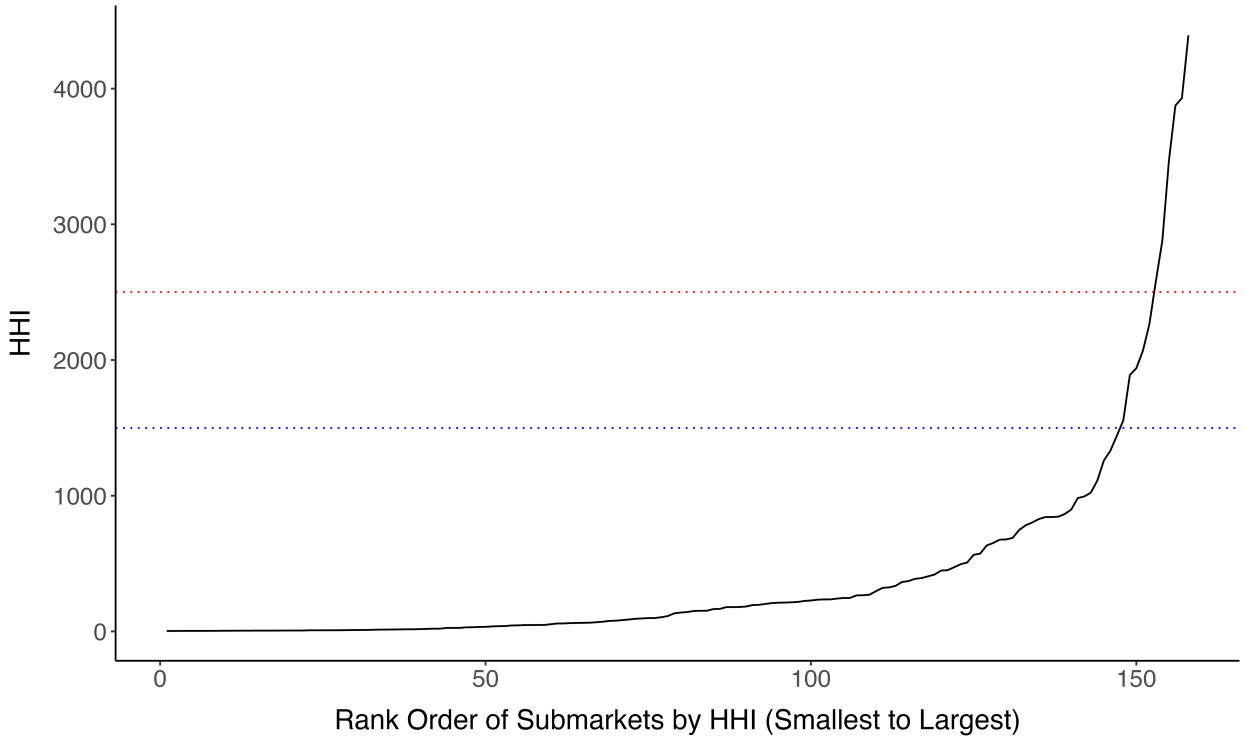
Notes: This figure plots the fraction of multifamily buildings containing each type of amenity by size. I link the rental listings data and parcel database by building-year, and collapse the data to calculate the fraction of buildings of each size group that ever contain each amenity.

Figure A8: Fraction of total moves from each origin building size to destination buildig size



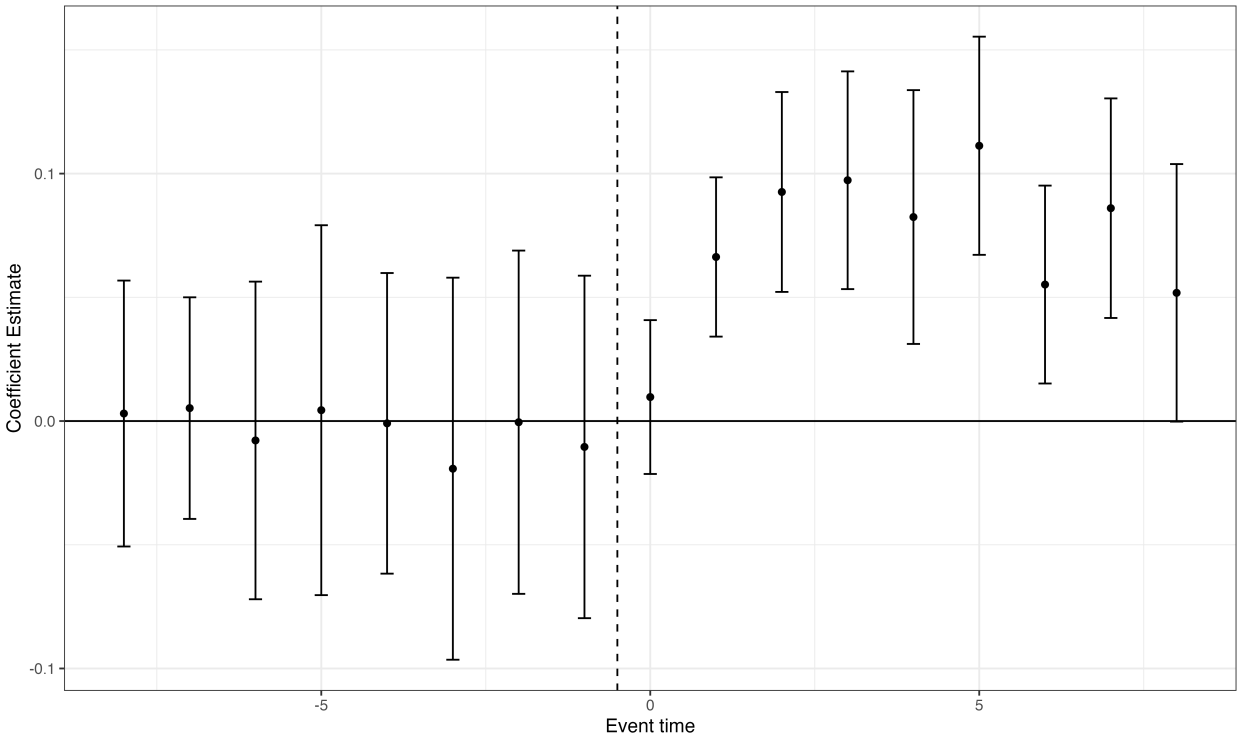
Notes: This figure plots the fraction of total renter moves between buildings of each size. The data source is the Infutor Consumer Address History database. It contains over 1 million within-Chicago moves, meaning the origin and destination address are both within the city limits.

Figure A9: Concentration in some submarkets exceeds DOJ thresholds



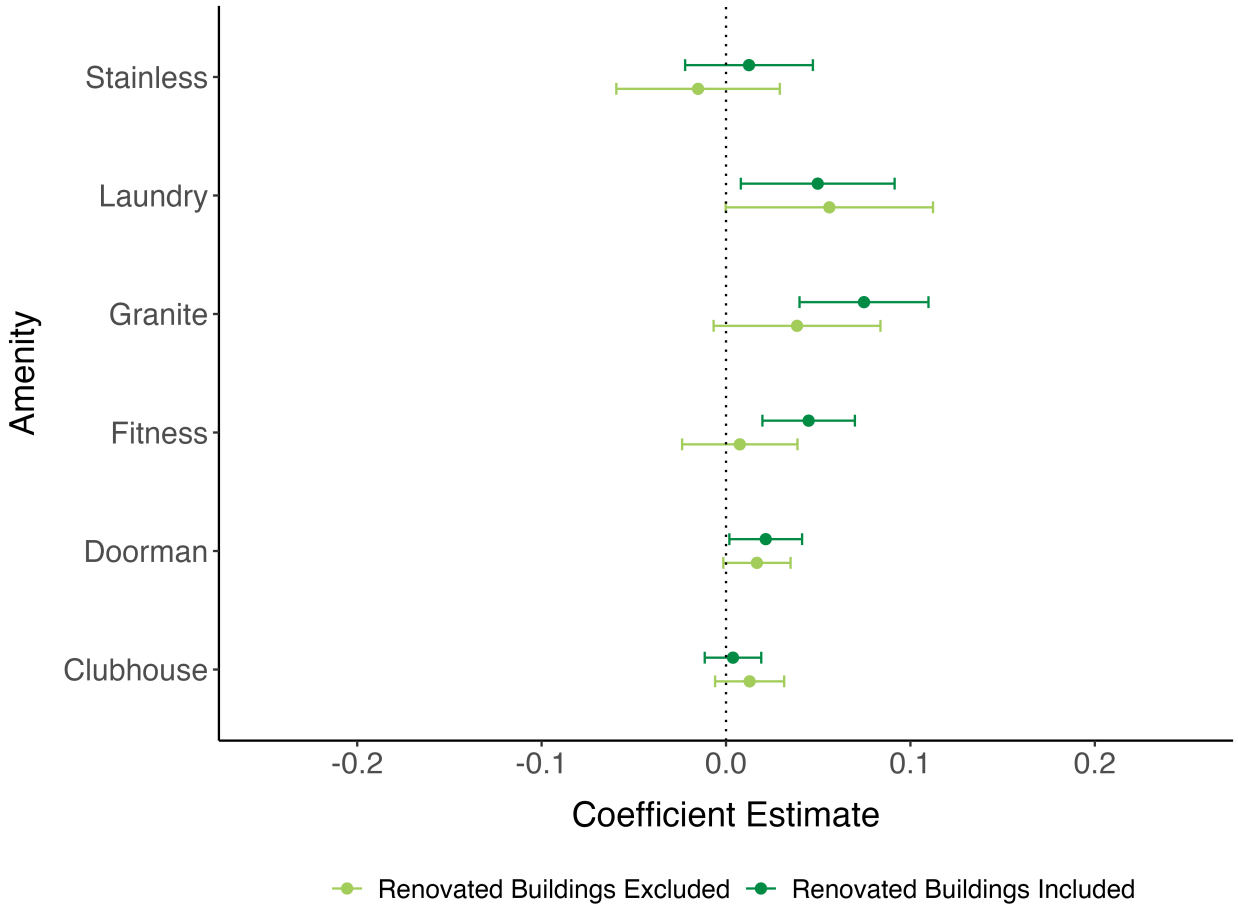
Notes: This figure plots the Herfindahl-Hirschman Index (HHI) for each rental submarket in the city of Chicago. Submarkets are defined by *neighborhood* × *building size*, for buildings that are 2-4 units, 5-49 units, or 50+ units. I include all submarkets with over 500 rental units in at least five distinct multifamily buildings; there are 160 submarkets included in the resulting plot. The blue dotted line indicates the DOJ threshold for moderately concentrated markets, HHI = 1500. The red dotted line indicates the DOJ threshold for highly concentrated markets, HHI = 2500.

Figure A8: Price estimates from staggered difference-in-differences using Borusyak et al. (2024) imputation procedure



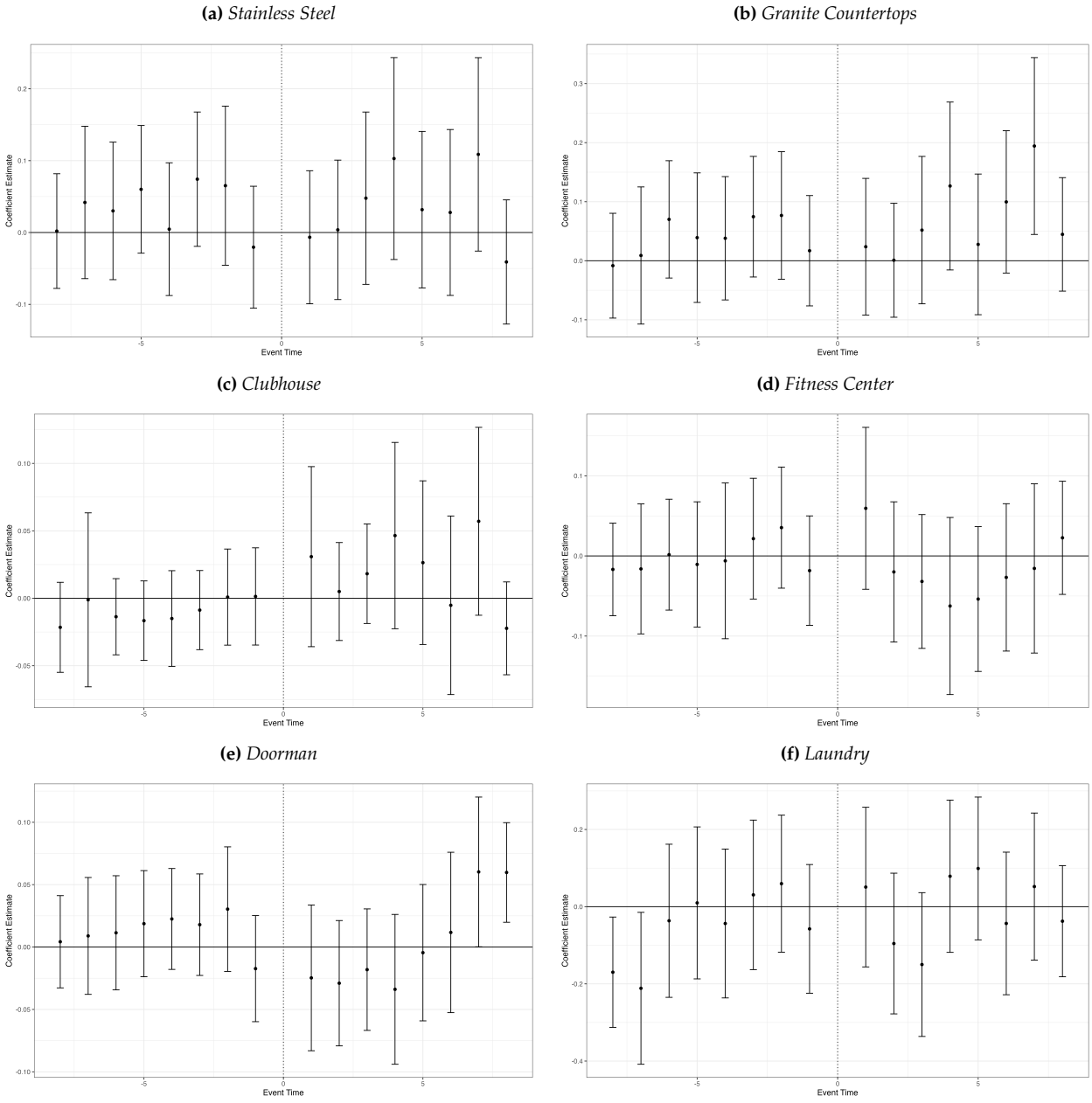
Notes: This figure plots estimates of β_τ obtained from the Borusyak et al. (2024) imputation procedure. All observations from $\tau \leq -8$ and $\tau \geq 8$ are pooled together.

Figure A9: Amenity likelihood difference-in-differences estimates by renovation status



Notes: This figure plots estimates of β_{bt}, reflecting the likelihood of observing each amenity in a rental listing after a big or small $\widehat{\Delta \text{HHI}}$ building sale. The estimates from the sample where renovated buildings are included are in dark green, and the estimates from the sample where renovated buildings are excluded are in light green.

Figure A10: Amenity likelihood estimates from staggered difference-in-differences



Notes: This figure plots estimates of β_τ obtained from equation (4) against event time. β_τ is normalized to zero in $\tau = -1$, which is marked with a vertical dashed line. All observations from $\tau \leq -8$ and $\tau \geq 8$ are pooled together.

Table A11. Demand estimates, OLS and IV

	(1)	(2)	(3)
Variables	OLS	IV	IV
Log price	-0.4339***	-1.626**	-3.046**
	(0.0112)	(0.6735)	(1.252)
Mean beds	-0.4983***	0.3671**	0.6862**
	(0.0047)	(0.1513)	(0.2812)
Stainless steel appliances	-0.0763***	0.1188***	0.0972***
	(0.0193)	(0.0353)	(0.0334)
Granite countertops	0.1865***	0.0735***	0.0435**
	(0.0193)	(0.0235)	(0.0175)
Furnished	0.2808***	0.0572***	0.0509*
	(0.0339)	(0.0207)	(0.0278)
Additional Amenities	Yes	Yes	Yes
Building FE		Yes	Yes
Quarter FE			Yes
Observations	110,851	110,851	110,851

Notes: This table reports the recovered demand estimates, α and β. Column 3 corresponds exactly to equation (7). The unit of observation is a building-year. Standard errors are clustered at building-sale level. ***, **, * denote significance at 10%, 5%, and 1% levels.