Article

Upzoning Chicago: Impacts of a Zoning Reform on Property Values and Housing Construction

Yonah Freemark[1] (iD)

Abstract

What are the local-level impacts of zoning change? I study recent Chicago upzonings that increased allowed densities and reduced parking requirements in a manner exogenous of development plans and neighborhood characteristics. To evaluate outcomes, I use difference-in-differences tests on property transaction prices and housing-unit construction permits. I detect significant, robust increases in values for transactions on parcels that received a boost in allowed building size. I also identify value increases for residential condominiums, indicating that upzoning increased prices of existing housing units. I find no impacts of the reforms, however, on the number of newly permitted dwellings over five years. As such, I demonstrate that the short-term, local-level impacts of upzoning are higher property prices but no additional new housing construction.

Keywords

zoning, land use, regulations, construction, affordability

[1]Massachusetts Institute of Technology, Cambridge, MA, USA

Corresponding Author:
Yonah Freemark, Department of Urban Studies and Planning, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139, USA.
Email: freemark@mit.edu

Introduction

American cities define how property can be developed through land-use regulations. Municipal governments typically implement zoning codes that determine what types of projects can be built where, set limits on building size, and establish minimum parking provisions. For policy makers interested in encouraging additional development, one prominent tool in their arsenal is upzoning, a regulatory move that increases allowed construction levels. In this article, I evaluate the localized, short-term impacts of a series of illustrative upzonings in Chicago.

Scholars and decision makers who are considering an upzoning's likely effects face competing expectations. On the one hand, much of the literature, in comparing different metropolitan areas or municipalities, finds that regions with stricter zoning controls overall feature lower housing affordability and less new construction. While such studies do not address the effects of specific zoning *changes*, policy makers often treat them as a motivation to upzone, inferring from them that upzoning will improve affordability and accelerate construction. On the other hand, some voice an opposing assumption: that by increasing speculation, upzoning may encourage rising local prices, if not ultimately gentrification and displacement. Yet this assumption has yet to be adequately demonstrated empirically. Clarifying and measuring how changes in zoning affect property values and new construction, particularly for housing, is important to determine appropriate land-use policy.

To identify these effects, this article studies a natural experiment involving upzoning in Chicago. In both 2013 and 2015, the city upzoned a large cohort of parcels uniformly, allowing higher housing unit density, increased floor-area ratios (FAR), and reduced parking requirements. I examine parcel-level transaction values and construction permit levels. My conclusions are twofold. First, I find statistically significant, robust evidence that a byproduct of upzoning is growth in property values on affected parcels. I specifically find some evidence for an increase in transaction prices of already-existing individual residential units affected by the change, offering evidence for higher housing prices in the short term on the properties where zoning is executed. These impacts occurred within two years of the zoning changes, suggesting a relatively rapid capitalization by landowners and developers. Second, I find no evidence for short- or medium-term increases in housing-unit construction, potentially a product of the relatively slow financing and approvals processes for new projects, but indicating that upzoning does not produce a supply response within five years after policy implementation.

I identify this causal relationship thanks to the application of treatment in a manner that was exogenous of potential confounders such as previously

proposed plans and community economic characteristics, and that allowed for the identification of a reasonable control group. I undertake a series of difference-in-differences tests, combined with a hedonic model that controls for property- and neighborhood-level characteristics. The study's primary contribution is thus offering new insight into what happens in communities soon after rezoning.

Impacts of Zoning in the United States

First introduced in New York City in 1916 and validated by the U.S. Supreme Court in 1926's *Euclid v. Ambler*, local zoning has extended to virtually every American municipality. Zoning has had a major impact on the built environment (Shertzer, Twinam, and Walsh 2016). It is used as a key tool for local governments to govern land use so as to reflect the demands of constituents, maintain property values, build tax bases, support economic development, and, in some cases, counter the perceived nuisances of multi-family homes, industrial land uses, or low-income families (Fischel 2001, 2015; Freemark 2018; Hirt 2014; Molotch 1976; Peterson 1981; Rothwell and Massey 2009; Schleicher 2013).

Zoning changes over time. In response to constituent pressure or development proposals, political officials alter zoning policies. Many American cities steadily reduced allowed construction levels throughout the twentieth century, though since the 1980s, that trend has reversed to some degree (Been, Madar, and McDonnell 2014; Gabbe 2017; Morrow 2013). In Chicago, as is often true elsewhere, zoning frequently takes on an individualized character; councilors (known as aldermen) take advantage of spot zoning (changes on single parcels) rather than follow a comprehensive plan (Schwieterman and Caspall 2006). In some cases, councilors reduce allowed density in advance of developer proposals to maximize their leverage (Nadig 2017).

Existing examinations of zoning policy have largely focused on the relationships between the average allowed built density at the municipal or metropolitan scale and outcomes in terms of average single-family home prices and aggregate construction. These comparisons are mostly synchronic, meaning that they compare policies at the same point in time, rather than examining how changes in zoning affect outcomes over time. These studies suggest that, in general, places with regulations that limit building size or dwelling unit density feature less construction and higher housing costs, compared with places that are more generous in density allowances.

Indeed, Chakraborty et al. (2010) find that stricter zoning regulations limit housing construction below that desired in the market, and Mayer and Somerville (2000) show that metropolitan areas with regulations mandating

lower density levels feature lower rates of new construction. Glaeser and Gyourko (2002) suggest that strict land-use regulations block new construction, restricting supply and increasing costs. Each study relies only on single-family home data, not considering rental, multifamily apartment buildings that are more common in larger cities, nor examining nonresidential uses. The latter two studies' metrics of zoning restrictions are also limited to data from the Wharton Residential Land Use Regulatory Index (Gyourko, Saiz, and Summers 2008), a measure that asks local practitioners to offer insight into typical permitting and approval times for projects and that does not directly address the question of *specific* zoning regulations (which differ greatly within and between municipalities) that limit—or encourage—certain uses and building scales.[1] Zoning restrictions have also been associated with higher rates of regional income segregation (Lens and Monkkonen 2016), exclusion of Black and Hispanic residents (Pendall 2000), and reduced economic growth (Glaeser 2012).

Prior research identifies a link between regulations that limit housing density and increased housing costs (Ihlanfeldt 2007), as well as higher land costs (Kok, Monkkonen, and Quigley 2014). Quigley and Raphael (2005) and Pollakowski and Wachter (1990) suggest that housing costs are higher in places with these stricter regulations. That said, as Quigley and Rosenthal (2005) emphasize, there is some ambiguity in these results. In comparing municipal regulations, for example, Glaeser and Ward (2009) show that stricter land-use controls are not correlated with differences in property prices when controlled for demographics and density, since there are sufficiently close substitutes available nearby. Moreover, since market demand is the "primary determinant of housing prices," it is worth emphasizing that restrictions on construction—whether in the form of zoning or growth controls—are only influential on prices to a limited extent (Nelson et al. 2002, p. vi). We should expect different outcomes from changes in those restrictions depending on *where* they are implemented, meaning impacts from a similar policy are likely to vary between blocks, neighborhoods, cities, or metropolitan areas.

Despite some uncertainty with regard to these findings, governments and think tanks argue for altering zoning laws and for allowing increased building through upzoning (City of Los Angeles 2015; City of New York 2014; McKinsey Global Institute 2014; White House 2016). The presumption is that developers would build more if they were simply allowed to do so (Gabbe 2017). The former chair of the U.S. Council of Economic Advisers, for example, recently argued that "relaxing zoning constraints could bring house prices more in line with construction costs and reduce the economic rents accruing to landowners," thus improving affordability (Furman 2015, p. 4).

Yet an expectation that competes with the previous perspective is that by increasing the potential for development, upzoning may increase values in affected areas. In theory, when it becomes legal to build more on a parcel, its value grows due to additional potential development. High levels of allowed construction produced property speculation on land in cities like Los Angeles in the early twentieth century (Weiss 1987). As Malpezzi and Wachter (2005, p. 160) argue, property value increases occur because of "lagged supply response"—a signaling of interest from developers buying property but who wait for the optimal moment to invest in new construction, which takes years to move forward. Angotti (2016) suggests that upzoning in New York was associated with higher property values, pricing out existing residents.

This finding, however, requires additional confirmation. Because much of the quantitative, causal scholarship focuses on synchronic, cross-regional comparative analyses, it does not examine the effects of specific zoning changes on the parcels where they are applied. We know more about the differences in development and cost between metropolitan areas than we do about what happens within neighborhoods when regulations about allowed density are altered. But changes in zoning occur on specific lots in specific cities; they are not generalized across regions.

Schill noted in 2005 that there has been insufficient study of the impacts of land-use reforms on housing supply and values, and that remains true today. Indeed, the impact of zoning changes has been underexplored in the literature, with two major exceptions: Thorson (1997) finds that a suburban downzoning reduced the long-term volume of housing permits, and Atkinson-Palombo (2010) finds that overlay zoning (linked to the creation of a new rail line) produced a value premium for existing residential condominiums in neighborhoods where the promise of new nearby amenities increased demand. One explanation for this insufficient research is endogeneity (Quigley and Rosenthal 2005), an inability to "sort out whether the supply effect or the amenity effect predominates" (Schill 2005, p. 11). We do not know the causal directionality of zoning's impacts. Say that restrictive zoning is correlated with higher values: Are these values due to a low housing supply in the context of high demand, or inversely are wealthier people who can afford to live in such places using their political power to enforce such restrictions? After all, high-income areas may regulate zoning more strictly to preserve the environment they desire (Fischel 2001). Besides endogeneity, we do not adequately understand how quickly zoning changes affect property markets, nor whether such changes affect just developable land or also existing housing and other building types.

An additional reason for this insufficient attention to studying change is that large-scale zoning reform is rare; there are few opportunities to examine

its impact (Freeman and Schuetz 2017). Of the changes that occur, many happen in response to a city's effort to, for example, promote economic development (Wolf-Powers 2005) or preserve historic characteristics (Fein 1985) in a single neighborhood, rather than citywide. Municipal zoning policy often targets lots or neighborhoods already primed for redevelopment—These are the communities Angotti studies. As such, the upzonings he reviews may be validating development trends or alterations in housing demand already underway, rather than inducing them.

This study takes advantage of a Chicago-wide upzoning applied uniformly to affected parcels, affecting neighborhoods with diverging economic conditions without specifically targeting areas planned for redevelopment. This rare, large-scale regulatory move allows me to disentangle the impacts of regulatory change from those of preexisting market interest, and to quantify the impact of zoning change on affected neighborhoods.

Evaluating Zoning Reform Through an Analysis of Chicago's 2013 and 2015 Upzonings

In mid-2013, Chicago Mayor Rahm Emanuel proposed a zoning change designed to encourage transit-oriented development (TOD) around the city's long-established rail-system stations (City of Chicago 2013).[2] The city council passed the ordinance in September. In part due to the perceived success of the legislation in encouraging construction (Podmolik 2014), the mayor pursued additional zoning changes (Emanuel 2015; Spula 2016). The council passed a new version of the law in 2015 that expanded the upzoned area and somewhat increased incentives (including for the properties affected in 2013), for properties with the same underlying zoning classes. Key to this study is a comparison of the areas initially affected by the 2013 reform with those additional areas rezoned in 2015, which allows me to estimate reaction to the zoning change; I also make comparisons with areas just outside of the 2015 area, as I describe in the following. Although these laws pertained to TOD areas, this study's conclusions should be interpreted more broadly. The question at hand is not the impact of being close to transit—this study does not examine the location sorting Atkinson-Palombo (2010) describes, for example, in connection with a new light rail line—but rather how upzoning affects development.

The ordinances, summarized in Table 1 (see Online Appendix A for additional details), operated as overlay districts on top of existing zoning, providing as-of-right benefits to potential developers. The 2013 reform applied to areas within 600 to 1,200 feet of stations (the latter along Pedestrian Streets[3]), and the 2015 reform expanded the area of applicability to between

Table 1. Summary of Provisions of 2013 and 2015 Chicago TOD Ordinances.

Zoning Change	Affected Parcels	Distance from Rail Station Entrances	Density Benefits	Parking Benefits
Reduced parking	Parcels zoned for FAR levels less or greater than 3 in Business (B), Commercial (C), Downtown (D), or Industrial (M) zones.	*(Applies to both changes)* 2013: Parcels located within 600 feet of rail station entrances, or 1,200 feet if situated along city-designated pedestrian street. 2015: Parcels located within ¼ mile of rail station entrances, or ½ mile if situated along pedestrian street.	n/a	*(Applies to both changes)* 2013: • No required parking for commercial uses. • 50% reduction in required parking for residential uses. 2015: • No required parking for any uses
Density boost (includes reduced parking)	Parcels zoned for FAR of 3 in B, C, or D zones		2013: • Increase in allowed FAR up to 3.5 (17% increase). • 33% to 50% increase in allowed dwelling units (e.g., MLA for a regular housing unit reduced from 400 to 300 sq.ft.). • Up to 17% increase in allowed building heights. 2015: • Increase in allowed FAR up to 4 (33% increase), with on-site affordable housing units. • 33% to 50% increase in allowed dwelling units. • Up to 25% increase in allowed building heights.	

Source. City of Chicago (2013, 2015).
Note. 2015 ordinance replaced 2013 ordinance, thus its provisions supplanted those in the former ordinance. MLA is the lot area required for each dwelling unit. A 6,000 sq. ft. lot with an MLA of 400 could be developed into 15 housing units, versus 20 units with an MLA of 300. TOD = transit-oriented development; FAR = floor area ratio; MLA = minimum lot area.

a quarter- and half-mile of stations. These changes enabled developers to avoid the often-lengthy rezoning process. Projects in zones receiving increased construction allowances (which I refer to as *density classes*) were allowed, but not required, to have a higher density of housing units, include taller buildings, incorporate more built area (through a higher FAR), and have reduced parking requirements, compared with preexisting rules. Developments in zones receiving just reduced parking requirements (which I refer to as *parking classes*) could provide fewer parking spaces no matter the scale of new construction. Although parking requirement reductions

could simply allow a smaller footprint (developers no longer having to build a garage or leave space for surface spaces), in some cases, they indirectly also increased allowances for inhabitable space, though to a lesser degree than received by the density classes.[4] The reforms, thus, allowed bigger buildings of many potential uses with more square footage and units.

The ordinances applied to parcels located around almost all Chicago rail stations, including those in neighborhoods downtown, and on the North, South, and West Sides. Some neighborhoods were in high demand while others suffered from high vacancy, and they varied in terms of income and ethnicity. Communities affected, thus, embodied a cross-section of the city; the upzonings did not specifically focus on strong-market neighborhoods likely to attract construction (though it is worth noting, of course, that the study does not examine areas of the city far from rail stations).

The cutoff for receipt of benefits, both in 2013 and 2015, was an arbitrary administrative decision unrelated to underlying neighborhood patterns or preexisting plans, allowing this natural experiment. Aldermen had no localized impact on the boundaries of the upzoning, as the cutoff was the same throughout the city. The lots affected by the two ordinances collectively accounted for only about 6% of the city's land area, since only those close to stations and with specific underlying existing zoning were affected.

Hypotheses

To analyze the impacts of the zoning reforms, and given what the scholarship has addressed thus far, I develop a series of hypotheses related to property values (H1), building permits (H2), and both (H3). I will return to these hypotheses throughout the analysis of findings.

> **Hypothesis 1a (H1a):** The upzonings were rapidly capitalized into property values. Transaction prices for parcels affected by the 2013 and 2015 reforms increased soon after passage. This corresponds to the expectation that allowing more building on a parcel increases its value.
> **Hypothesis 1b (H1b):** The upzonings affected property types differently. Readily developable sites (e.g., vacant land) increased in value more than those with existing uses. Existing residential units did not increase in value, given the difficulty required to redevelop them and the expectation that housing costs decline in the context of relaxed regulation (Ihlanfeldt 2007).
> **Hypothesis 1c (H1c):** The boost in allowed construction (density classes) produced a larger increase in value than the reduction in required parking (parking classes), reflecting the greater expansion in development capacity provided by the former change.

Hypothesis 2 (H2): The upzonings produced an increase in building permit activity. Because of the lagged supply response (Malpezzi and Wachter 2005), this took a longer time to occur than the increase in property values.

Hypothesis 3 (H3): The upzonings affected neighborhoods disparately, reflecting the underlying influence of the real-estate market (Nelson et al. 2002). Properties in higher-demand areas increased in value and attracted more permits than those in low-demand areas.

Method

Data Collection and Key Variables

The study integrates several data sources collected by public agencies using geographic information system software. The data used include the full (recorded) population of zoning classifications, transactions, and permits.

- *Zoning classifications*. I used City of Chicago zoning classifications from November 2012[5] to determine which parcels were affected by the 2013 and 2015 zoning changes, and whether they were upzoned for increased construction allowances and parking minimum reductions (density classes) or just received reduced parking requirements (parking classes).

- *Property transactions*. I collected all property transactions in Chicago between 2010 and mid-2018 from the Illinois Department of Revenue. Data include location, transaction values, and property sales type for each transaction, incorporating properties such as land, apartment buildings, and residential condominiums. Reliable, more detailed information, such as unit size or building square footage, was unavailable. I associated data with parcels and station areas. I used transaction values as a measure of property values.[6]

- *Building permits*. I dated and geocoded City of Chicago new-construction permits from 2010 to mid-2018. I eliminated duplicate projects and extracted the number of new residential units per project, excluding renovations and additions, from open-ended field notes. I associated permits with parcels and station areas and used them as a measure of housing unit construction.[7] Because of a lack of information about the scale of nonresidential construction (no square footage data are available, and estimated construction costs included in permits are notoriously unreliable), I did not use this dataset to analyze the zoning change's impact on other types of construction.

The study primarily analyzes these values in the period ranging from 1,000 days before the 2013 zoning change (December 16, 2010, at the bottom of the Great Recession) to 744 days after (September 24, 2015, when the city council passed the 2015 zoning revision). This period is designed to assess the short-term impact of the 2013 reform. However, I also consider longer-term impacts—up to mid-2018, about 1,000 days after the 2015 ordinance passed—in several instances so as to also consider the impacts of the 2015 upzoning.

The parcels I examine fit one of six conditions: the density classes affected by (A) the 2013 reform and (B) later by the 2015 reform; the parking classes affected by the (C) 2013 and (D) 2015 reforms; and outside comparison areas that, if the reforms had been expanded further to encompass all relevant parcels within a half-mile of stations (not just on Pedestrian Streets), would have received (E) density boosts or (F) parking reductions. The areas later affected by the 2015 reform make for a strong comparison with those affected in 2013 because they share the same underlying zoning classes and were only slightly further from station entrances, allowing me to identify the short-term effects of the 2013 law. The outside comparison areas were not affected by either reform and make for a somewhat less compelling control, as I note in the following. To account for the potential effects of the fact that parcels affected in 2013 are mostly closer to stations than those affected in 2015, which are, in turn, closer than those in the outside comparison areas, I control for distance from stations (though this control produced no statistically significant effect on outcomes). In many models, I also include controls for differences between neighborhoods through measures of demographics and built density to limit possible omitted variable bias.

I illustrate the distribution of these parcels in a prototypical Chicago neighborhood in Figure 1. I document the distribution of analyzed parcels around the city at the planning district level (a sort of larger neighborhood[8]) in Table 2. The land area of parcels affected by the 2013 and 2015 reforms (in terms of density and parking classes) is quite similar both citywide and within neighborhoods. The area of parcels analyzed in the outside comparison area group is larger, but the distribution through the city is similar. I do not analyze lots with underlying zoning incompatible with the zoning laws—such as lots zoned *only* for residential uses—as their characteristics (and potential for future development) make them poor comparisons with the rezoned lots. As Figure 1 illustrates, these nonanalyzed parcels account for the majority of land within a half-mile of most stations.

To conduct the property value analysis, I collected data on each property's distance to the nearest train station; its land square footage; its county-assessor-defined property type (e.g., apartment building or retail store); its

Figure 1. Prototypical rail-station-adjacent Chicago neighborhood, indicating illustrative distribution of analyzed parcels.
Source. The author.

underlying zonal density and type; the share of neighborhood land occupied by buildings (representing the area's built density); and several characteristics collected at the Census Tract level, including population density, ethnic composition, transit use, education level, household income, and house values. A summary of these covariates (Online Appendix B) demonstrates the strong similarities in composition of the properties affected by the 2013 and 2015 reforms, excluding transaction values and whether they were affected by the zoning change. As such, the areas affected by the 2015 reform are an effective control group to consider the short-term effects of the 2013 reform, the question I focus on in this article. It would be inappropriate to compare the parcels affected by the two reforms after the 2015 law was passed, since at that point, they became undifferentiated from a legal perspective. The outside comparison area, also in Online Appendix B, has characteristics similar to those of the other two, though it is less inhabited by renters. I take advantage of this outside area in the analysis that follows as a control group to consider the effects of the *2015* reform.

Table 2. Distribution of Studied Parcel Square Miles by Planning District.

Planning District	Density Classes			Parking Classes			Total
	Impacted by 2013 Law	Impacted by 2015 Law	Outside Comparison Area	Impacted by 2013 Law	Impacted by 2015 Law	Outside Comparison Area	
Citywide	0.53 sq. mi.	0.53 sq. mi.	0.61 sq. mi.	4.51 sq. mi	4.75 sq. mi.	8.20 sq. mi.	177.57 sq. mi.
Bronzeville–South Lakefront	0.11	0.10	0.10	0.20	0.36	0.85	8.55
Calumet	0.00	0.00	0.01	0.20	0.37	1.03	26.18
Central Area	0.04	0.04	0.04	1.55	0.58	0.47	6.99
Far Southwest Side	0.00	0.00	0.00	0.08	0.08	0.09	6.32
Lincoln Park–Lakeview	0.05	0.06	0.04	0.15	0.21	0.19	6.60
Midway	0.01	0.00	0.01	0.18	0.23	0.55	15.99
Milwaukee Avenue	0.04	0.02	0.03	0.20	0.31	0.44	6.59
Near West Side	0.05	0.15	0.18	0.13	0.14	0.24	3.99
North Central	0.01	0.01	0.01	0.18	0.19	0.26	12.45
North Lakefront	0.14	0.06	0.01	0.11	0.19	0.17	4.39
Northwest Side	0.01	0.01	0.01	0.30	0.34	0.59	28.39
Pilsen–Little Village	0.01	0.00	0.04	0.10	0.19	0.25	5.46
Stockyards	0.00	0.00	0.00	0.05	0.13	0.38	8.19
Stony Island	0.04	0.01	0.04	0.47	0.54	0.68	12.81
South Side	0.00	0.02	0.00	0.28	0.30	0.82	12.80
West Side	0.03	0.04	0.08	0.30	0.59	1.13	11.87

Source. Author's calculations.
Note. Areas affected by 2013 law were also affected by 2015 law, but not included in the latter's area calculation.

Analytical Approach

I deploy a method similar to that created by Been et al. (2016) on the impacts of historic preservation in New York City; it uses a hedonic property model combined with a difference-in-differences specification to evaluate how the creation of historic districts affected building construction and property values. The difference-in-differences analysis relies on a parallel trends assumption, for which I offer supporting evidence in the "Findings" section. I assume property values and housing unit permits on analyzed parcels affected and unaffected by zoning reforms would have had similar trends throughout the analysis period *if no zoning change had occurred*, thus accounting for underlying changes such as increases in property values or construction over the period analyzed stemming from adjacency to rail stations or location in Chicago in general. Results presented are the differences on top of those changes. Intuitively, this model describes average differences between changes in the areas compared, thus providing insight into the net impact of the upzonings. I implement this model using two general tests seeking to explore the impact of the ordinances: (1) an analysis of outcomes on density classes and (2) a similar analysis of outcomes on parking classes.

To measure the impact of the zoning reform on property prices, I develop a hedonic regression model that incorporates the property and neighborhood characteristics described earlier to allow for a standardized, "fitted" property value across community and property types. This includes both residential and nonresidential uses and allows comparisons across many types of properties. The following equation is the generalized version of this model, though I alter it several times to examine different characteristics of the property transactions dataset, as described in the findings section.

$$Property\ transaction\ values = \ln\left(N_{aeit}\right) = \beta_0 + \beta_1 Z_e + \beta_2 B_t$$
$$+ \beta_3 Z_e B_t + \gamma X_a + \theta Q_t + \alpha_i + \varepsilon_{aeit}, \tag{1}$$

where $\ln(N_{aeit})$ measures the log of the sales price per property a in treatment area e (such as affected by 2013 or 2015 reforms), planning district i, and quarter t. Z_e is a dummy variable representing whether the treatment area was upzoned and B_t is a dummy variable representing whether the transaction occurred after the zoning change. β_3 is the key variable in this analysis; it represents the interaction of treatment and time and thus the difference-in-differences. X_a is a vector of property-level covariates; Q_t is a series of fixed-effect variables for the quarter of the transaction (as a measure of time during the year); and α_i is a fixed-effect variable for each district. In some models presented in the following, I include the neighborhood-level covariates noted

earlier and district-level linear time trends.[9] To evaluate the robustness of the regression models, I undertake sensitivity analyses to account for potential geographical variation based on distance to train stations; concerns that the impact of the zoning change may have reflected some other policy change at a different time; and the potential for information leakage about the zoning law in advance of the zoning change. These tests confirm my findings and are described in the following.

For the housing unit permits analysis, I estimate the following equation:

$$New\,construction\,counts = U_{eit} = \beta_0 + \beta_1 Z_e + \beta_2 B_t + \beta_3 Z_e B_t$$
$$+ \alpha_i + \theta Y_t + \varepsilon_{eit}, \tag{2}$$

where U_{eit} measures the sum of new residential dwelling unit permits in treatment type e, planning district i, and year t. Z_e, B_t, and $Z_e B_t$ are the same difference-in-differences variables as in the previous equation. α_i is a fixed-effect variable for each district, and Y_t is a fixed-effect variable for each year.

Findings

Property Transaction Values

To assess H1, I examine impacts of the upzonings on the price of transactions across various property classes. I find that both 2013 and 2015 reforms were associated with statistically significant increases in property values among parcels upzoned for increased construction. Those that received just parking requirement reductions—a less dramatic change—had heterogeneous impacts that varied by property class and neighborhood.

Table 3 summarizes the results of several hedonic regression models of the density classes over the period concluding with the passage of the 2015 law, evaluating properties affected by the 2013 versus 2015 rezonings, using the date of the 2013 law passage as the threshold for treatment application. The key variable is the difference-in-differences estimate; because these models log property costs, its values represent the percentage change in values attributable to the zoning change. Models 1 to 4 document the impact of the reform across all transaction types after adjustment using the hedonic model. Using varying combinations of covariates, district and time fixed effects, and district-level time trends, I find consistently significant positive impacts of the reform of between 15% and 23.3%. This is of a similar order of magnitude as the increase in allowed density provided by the ordinance. These results confirm H1a, indicating rapid capitalization of the 2013 upzoning into property values.

Table 3. Regressions of Logged Property Transaction Values Citywide: Density Classes Affected by 2013 Versus 2015 Laws (December 2010 to September 2015).

	All Transaction Types				Residential Condos		Nonresidential
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Z_e Treatment	−0.369**	−0.078	−0.129	−0.018	−0.194*	−0.262***	0.462
	(0.165)	(0.099)	(0.081)	(0.085)	(0.099)	(0.098)	(0.339)
B_t Time period	0.098	0.114**	−0.119	−0.878**	0.009	−0.303	−3.098***
	(0.064)	(0.050)	(0.190)	(0.345)	(0.140)	(0.359)	(0.916)
$Z_e B_t$ Difference-in-differences: Impact of 2013 ordinance	0.233**	0.158**	0.150**	0.163**	0.132*	0.122*	0.497
	(0.101)	(0.073)	(0.070)	(0.080)	(0.072)	(0.067)	(0.322)
Constant	13.030***	11.420***	12.089***	11.665***	10.428***	10.511***	13.259***
	(0.608)	(0.564)	(0.338)	(0.547)	(0.234)	(0.753)	(1.325)
Observations	1,878	1,878	1,878	1,878	1,110	1,110	400
District and time fixed effects	No	No	Yes	Yes	Yes	Yes	Yes
Covariates	No	Yes	No	Yes	No	Yes	Yes
District time trends	No	No	No	Yes	No	Yes	Yes
Property types	All	All	All	All	Residential condo	Residential condo	Nonresidential transactions
R^2	.371	.564	.560	.601	.565	.631	.684
Adjusted R^2	.353	.548	.540	.577	.553	.613	.580

Note. Robust standard errors clustered at Census tract in parentheses. "All transaction types" indicates all transactions, but all models are adjusted for each sale's property classification (i.e., they are controlled based on what type of property class they are, such as residential condo, vacant land, commercial building, etc.). When included, covariates are property distance from station, property zone density, property zone type, neighborhood building density, station type, and neighborhood Census data.

*$p < .10.$ **$p < .05.$ ***$p < .01.$

To what degree did property values vary depending on property type? An examination of residential condos (which account for more than half of total transactions) in models 5 to 6 (with and without covariates and district time trends) identifies a 12.2% to 13.2% increase in property transaction values attributable to the upzoning, as opposed to the lack of increase I hypothesized in H1b (though in line with what Atkinson-Palombo [2010] found).

This finding was at a 90% confidence level, in part likely a reflection of the limited sample size; as I note in the following, I found much more significant but similar-magnitude changes for the larger cohort of condos affected by just the parking requirement reduction. I do not find a statistically significant impact of the reform on the nonresidential transactions examined alone in model 7, but the power of that analysis was limited by the few density class transactions during this study period and a wide array of property types.

Figure 2, loess graphs of density class property values, offers graphical evidence for the results of the difference-in-difference tests presented in Table 3. (A) illustrates hedonically fitted logged transaction values for the properties affected by the 2013 reform versus those affected by the 2015 reform between December 2010 and December 2016. (B) aligns the two groups at their values on the day of the 2013 ordinance's passage; this chart shows that these had very similar trends in the 1,000 days leading up to the law passage. (C) aligns the two groups at their values on the day of the 2015 ordinance's passage, documenting that they experienced similar trends *after* the 2015 change, when the 2015 parcels were upzoned, making them legally equivalent to the 2013 parcels.

These graphs offer compelling evidence that this comparison fulfills the parallel trends assumption of a difference-in-differences analysis; it supports the argument that the 2013 and 2015 groups acted similarly in terms of property price trends *before* the zoning change and, therefore, are comparable.[10] Moreover, they offer a graphical demonstration that the period *between* the two zoning changes was associated with a large increase in the values of the 2013 upzoned parcels, as contrasted with the 2015 parcels. The increase among the 2013 parcels was delayed by about six months after ordinance passage, as shown in (Figure 2, B); nevertheless, landowners and developers incorporated the reform into sales prices within two years.

The impact of the 2013 zoning change on parcels that received *just* a reduction in parking requirements in the period leading to the passage of the 2015 law was heterogeneous. Table 4's models 1 to 2 (with and without covariates and district linear time trends) show no significant change in property values citywide between the parcels affected by the 2013 and 2015 reforms. When I examine reform among varying property types and geographies (a more feasible analysis here because of a far larger number of parking
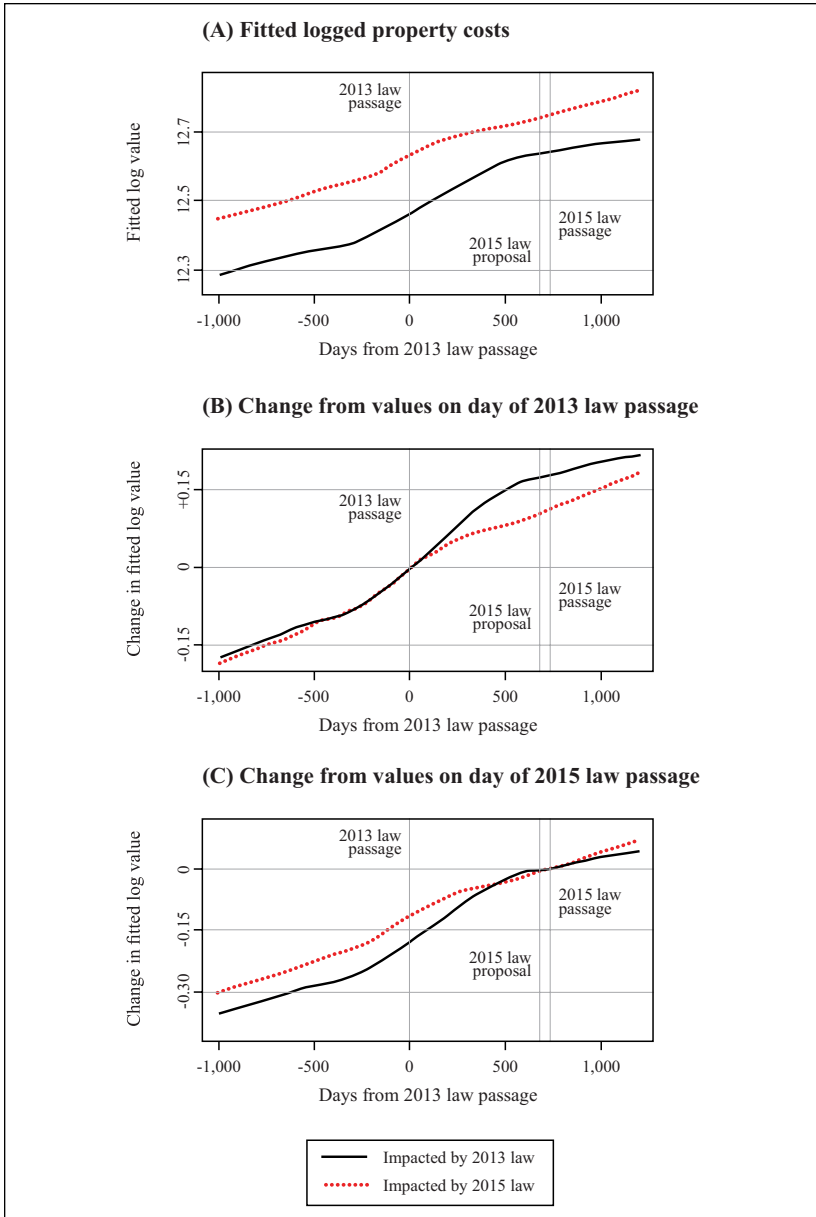
Figure 2. Property values between 2010 and 2016, by analysis area, density classes.
Source. The author.

Table 4. Regressions of Logged Property Transaction Values Citywide: Parking Classes Affected by 2013 Versus 2015 laws (December 2010 to September 2015).

	All Transaction Types					Residential Condos		Vacant Land
	Citywide		Downtown	High-Income Districts	Low-Income Districts	Citywide		Citywide
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Z_e Treatment	−0.108*	−0.067	−0.263	0.117*	−0.031	−0.183	−0.188	−1.133
	(0.057)	(0.081)	(0.165)	(0.062)	(0.139)	(0.122)	(0.121)	(0.884)
B_t Time period	0.358***	−1.290**	0.238*	−0.406	−1.295	0.255***	−2.913***	−0.994
	(0.096)	(0.536)	(0.133)	(0.788)	(0.533)	(0.081)	(0.434)	(2.977)
$Z_e B_t$ Difference-in-differences: Impact of 2013 ordinance	0.047	0.068	0.185***	−0.031	−0.042	0.095**	0.101***	1.833*
	(0.043)	(0.043)	(0.050)	(0.051)	(0.124)	(0.040)	(0.037)	(1.021)
Constant	11.852***	12.136***	12.746***	10.435***	12.224***	10.407***	13.254***	12.283**
	(0.390)	(0.566)	(0.755)	(0.666)	(0.776)	(0.290)	(0.591)	(5.058)
Observations	10,764	10,764	5,655	3,463	1,420	6,465	6,465	79
District and time fixed effects	Yes	Yes	Time only	Yes	Yes	Yes	Yes	Yes
Covariates	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District time trends	No	Yes	No	Yes	Yes	No	Yes	No
Property types	All	All	All	All	All	Residential condo	Residential condo	Vacant land
R^2	.499	.520	.585	.486	.527	.249	.253	.866
Adjusted R^2	.494	.514	.579	.470	.489	.244	.246	.625

Note. Robust standard errors clustered at Census tract in parentheses. All models include adjustment for property classification. When included, covariates are property distance from station, property zone density, property type, neighborhood building density, station type, and neighborhood Census data. High-income districts are Far Southwest Side, Lincoln Park–Lakeview, Near West Side, Milwaukee Avenue, North Central, and Northwest Side; their residents had median household incomes of more than $50,000 in 2015. Low-income districts are Bronzeville–South Lakefront, Calumet, Midway, North Lakefront, Pilsen–Little Village, South Side, Stockyards, Stony Island, and West Side; their residents had median household incomes of less than $50,000.
*$p < .10.$ **$p < .05.$ ***$p < .01.$

transactions than density ones), however, I discern differences. Table 4's models 6 to 7 (with and without district linear time trends) show a 9.5% to 10.1% increase in property values of residential condominiums attributable to the upzoning (at 95% or higher confidence levels). Again, this is opposed to what I expected in H1b, and raises questions for consideration. Perhaps the possibility of a reduction in parking in future developments increases the amenity value of existing residential units *with* parking, which become relatively rarer. Or the prospect of nearby new construction increases the amenity value of the neighborhoods around stations (Atkinson-Palombo 2010), though this is opposed to most scholarship on the desires of incumbent homeowners (Fischel 2001). On the other hand, parking requirement reductions could make redevelopment of existing residential buildings more feasible, thereby attracting investment—though the potential to do so is limited for condominiums.

Examining vacant land alone (model 8) shows a very large increase in transaction values for the parking classes that received the 2013 zoning change. The limited number of observations, and the 90% significance level, suggests that this figure should be assessed with caution, but it does confirm the intuition expressed in H1b that an upzoning is most likely to encourage investment on easily redeveloped land, and given the reductions in parking requirements, this upzoning may have made development feasible on land that was previously too small, or too oddly shaped, for new construction. An evaluation of the reform's impacts on several other property types for which I found little effect (though it is worth noting that the small sample size limited the power of these comparisons) is documented in Online Appendix C.

To examine H3, which hypothesized that neighborhoods would respond differently to the upzonings, I considered effects in different parts of the city. Models 3 to 5 suggest that the parking minimum reductions were associated with a large increase in values downtown (18.5%, at a 99% confidence level) but had no significant impact outside of downtown, including in high-income districts where I expected a demand-induced uptake. These findings could indicate that a reduction in parking mandates is most readily absorbed in neighborhoods able to easily accommodate people living without a car—the dense, mixed-use city center—but not in more auto-dependent neighborhoods. Or they might suggest that the amenity effect of parking associated with existing buildings is stronger downtown than elsewhere because of the limited number of spaces available.

One point worth emphasizing is that, in comparing the impact of the density upzoning (Table 3) and the impact of just parking minimum reductions (Table 4), the effect was stronger among the former groups, confirming H1c. This provides additional support for this article's causal claim, demonstrating that a more expansive upzoning produces larger property value increases.

The aforementioned analyses test the short-term impacts of the 2013 law by using the parcels affected by the 2015 law as a control. I could not consider the longer-term impacts on property values of the parcels affected by the 2013 law because the 2015 law essentially eliminated the control group. I thus now consider the impacts of the 2015 law by using parcels in the outside comparison areas as a control. Because these areas are, in general, further from station entrances, they may not be as easily comparable to the 2015 parcels as the 2013 versus 2015 examination was. Moreover, I do not find the same clarity of pre-treatment parallel trends between the outside comparison areas and the 2015 parcels as I was able to document in Figure 2 for the first analysis. Nevertheless, I examine them here as a sort of sensitivity analysis; were the effects of the 2013 reform a fluke, or do they appear to have been replicated after the 2015 reform passed?

Online Appendix D documents a series of difference-in-differences models with controls and linear time trends. Models 1 and 2 are similar to Table 3, model 4 and Table 4, model 2, respectively, in examining the upzoning's impact on density and parking classes (now using the date of the 2015 law passage as the treatment threshold). Model 1 reaffirms the previous finding, demonstrating a significant 16.8% increase in property values for parcels in density classes affected by the 2015 reform versus those in the outside comparison area. Model 2, unlike in the previous comparison, identifies a significant impact ($+13.3\%$) of parking reductions alone on property values. Model 4 shows no significant impact of the 2015 reform on single residences, in accord with H1b, but opposed to the earlier findings of the 2013 reform's impacts.

The 2015 zoning reform's impact depended on the neighborhood, as hypothesized in H3; though it produced significant increases in high-income districts (models 5–6), it had no significant effect in low-income areas (models 7–8). This reaffirms H3, suggesting that upzoning's impacts are limited to areas where market demand is present. For all models, the density upzoning produced a stronger effect than just the parking reductions, as hypothesized in H1c. Again, this analysis should be taken with a grain of salt; they are less robust in meeting the difference-in-differences specifications than the 2013 versus 2015 analysis. Nevertheless, they suggest that the 2013 reform's short-term impacts on property values were replicated for the 2015 reform, as hypothesized in H1a.

Building Permits

To evaluate whether the zoning changes affected short-term housing construction and assess H2, I examine changes in permitting for new residential units. As noted earlier, I was unable to examine permits for other types of uses, such as retail or offices, because of poor data quality. Figure 3 illustrates the cumulative housing units permitted on parcels affected by the 2013 and
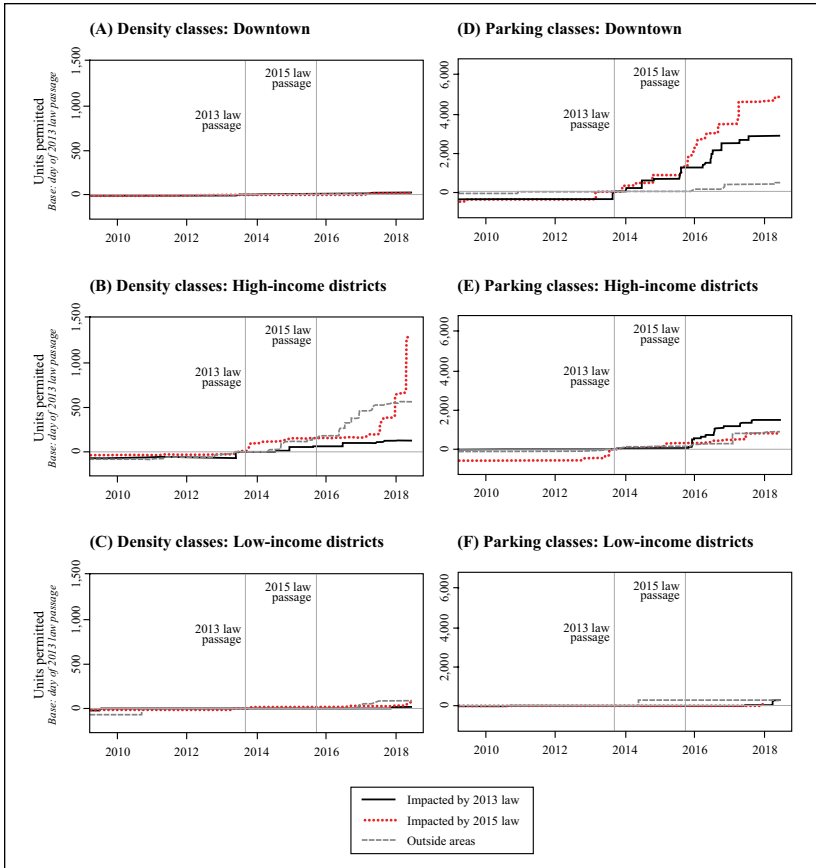
(A) Density classes: Downtown

(B) Density classes: High-income districts

(C) Density classes: Low-income districts

(D) Parking classes: Downtown

(E) Parking classes: High-income districts

(F) Parking classes: Low-income districts

Impacted by 2013 law
Impacted by 2015 law
Outside areas

Figure 3. Cumulative residential units permitted by analysis areas.
Source. The author.
Note. High-income districts are Far Southwest Side, Lincoln Park–Lakeview, Near West Side, Milwaukee Avenue, North Central, and Northwest Side; their residents had median household incomes of more than $50,000 in 2015. Low-income districts are Bronzeville–South Lakefront, Calumet, Midway, North Lakefront, Pilsen–Little Village, South Side, Stockyards, Stony Island, and West Side; their residents had median household incomes of less than $50,000. Y-axis scales of (A)(B)(C) are different from those of (D)(E)(F).

2015 laws, as well as in the outside comparison area, from 2010 to 2018 (this is not the *net* number of housing units, as reliable demolitions data were not available). All charts show change from the date of the 2013 law passage. Charts represent trends in different parts of the city to examine H3; (A) and (D) show conditions downtown; (B) and (E) in other high-income districts; and (C) and (F) in low-income districts.

Several features stand out. First, housing-unit permits were minimal in all of the analysis zones pre-2013. This is not much of a surprise given that the city was still recovering from the Great Recession until that point. Second, levels of housing-unit permitting varied considerably across the city; whereas there were major investments in new construction downtown and in high-income districts, close to zero residential units were permitted in the analysis areas in low-income districts (C) and (F) between 2010 and 2018. This was despite the fact that these areas encompassed a considerable portion of the upzoned area—64% of the density-class land and 42% of the parking-class land in 2013, according to Table 2. This is a rather clear illustration that the zoning changes did not induce movement toward investment in new housing construction in neighborhoods with preexisting low demand, confirming H3.

Third, there is minimal evidence that residential construction on parcels affected by the 2013 reform increased relative to other areas in the almost five years after the law was passed, and certainly not in the immediate term (in the two years before the 2015 law passage). Among density classes even in high-income districts (B), these parcels saw little uptick in permitting (there were few affected parcels in density classes downtown). Among parking classes, trends were similar as those in zones affected by the 2015 reform pre-2015 law passage in (D) and (E), indicating no relationship with the upzoning treatment. That said, construction in parking classes did appear to pick up in areas affected by the 2013 reform in high-income districts outside downtown more quickly than elsewhere beginning two years after law passage (E).

Fourth, it is true that permitting on parcels in density classes affected by the 2015 law accelerated quickly roughly three years after passage in high-income districts (B). Yet it is worth emphasizing that the city of Chicago expanded the area that qualified for increased density in May 2016, beyond the TOD ordinances (City of Chicago 2016). As such, the trends seen in this case may be a conflation of two separate policies. The 2015 areas also saw the highest rate of growth among parking classes downtown (D), particularly compared with the outside comparison areas. However, the latter finding, especially when combined with similar growth trends among the parcels affected by the 2013 reform, suggests that what might be represented here is simply the effect of new interest in construction in downtown, not the impact of the rezoning.

Table 5 illustrates the results of difference-in-differences tests that examine changes in housing unit permits at the planning district level. Models 1 and 2 explore the change in units permitted among density and parking classes combined, comparing the areas affected by the 2013 and 2015 reforms, with and without district linear time trends. Models 3 and 4, respectively, examine changes among density and parking classes independently.

Table 5. Regressions of New Housing Units Permitted Citywide, Using Data at the District Level.

| | Parcels Affected by 2013 vs. 2015 Laws December 2010–September 2015 Treatment Threshold: September 2013 | | | | Parcels Affected by 2015 Law vs. Outside Area December 2010–June 2018 Treatment Threshold: September 2015 | | | |
| | Density and Parking Classes | Density and Parking Classes | Density Classes | Parking Classes | Density and Parking Classes | Density and Parking Classes | Density Classes | Parking Classes |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Z_e Treatment	−3.301 (4.794)	−3.301 (3.377)	0.159 (0.400)	−3.460 (3.317)	7.945* (4.403)	8.875** (4.167)	−0.145 (0.625)	9.020*** (4.139)
B_t Time period	−5.821 (8.089)	−5.821 (8.912)	0.102 (1.610)	−5.923 (8.694)	5.115 (11.152)	6.058 (11.557)	−1.788 (2.447)	7.846 (11.339)
$Z_e B_t$ Difference-in-differences estimate	0.329 (7.146)	0.329 (6.803)	−0.923 (0.819)	1.252 (6.747)	27.719* (14.163)	24.894* (13.622)	6.460 (5.546)	18.434 (12.569)
Constant	−4.726 (10.786)	1.651 (2.053)	−0.079 (0.208)	1.730 (2.061)	−8.593 (7.317)	−4.437 (3.767)	0.072 (0.317)	−4.510 (3.802)
Observations	616	541	541	541	774	669	669	669
District and time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District linear time trends	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Analysis areas	Density and parking	Density and parking	Density only	Parking only	Density and parking	Density and parking	Density only	Parking only
R^2	.184	.294	.156	.292	.178	.279	.212	.274
Adjusted R^2	.153	.167	.003	.164	.152	.139	.059	.133

Note. Robust standard errors in parentheses.
*$p < .10$. **$p < .05$. ***$p < .01$.

This evaluation produces no statistically significant results for any of the difference-in-differences estimates, indicating no impact of the upzoning on new construction in the roughly two years following its passage. Similar analyses of the 2015 reform versus the outside comparison area show no significant impacts of the law on construction among the classes individually (models 7–8) and weak impacts ($p < 0.1$) among the classes together (models 5–6). This analysis does not evaluate changes in housing characteristics, such as floor area per unit or building heights (which may have increased due to the reform). Nor does the analysis provide any information about nonresidential construction or the possibility that the zoning changes reduced the number of parking spaces attached to new developments, one of the key other goals of the reforms. Nevertheless, these findings do not support H2; there is little reason to believe that either of the zoning reforms produced a significant increase in housing permits in the time period analyzed.

Additional Sensitivity Analyses

I conduct a series of sensitivity analyses to test the robustness of the property transaction results for the key question of the impacts of the 2013 reform. First, I examine only transactions occurring in two buffer zones constituted of parcels with centroids located either between 500 and 1,200 feet, or 300 and 1,350 feet, from station entrances. These tests encompass only the area at the edge between the areas affected by the 2013 versus 2015 laws, and account for about one-half and two-thirds, respectively, of the transactions used in the full-scale analysis above. This analysis eliminates properties either "too close" or "too far" from stations. In so doing, it addresses the potential bias represented by Pedestrian Street areas and doubles-down on the elimination of potential unmeasured, appreciative effects that may be caused by adjacency to transit.[11] Online Appendix E summarizes regressions on these buffer properties and demonstrates continued significance at similar levels for the density classes overall (compare with Table 3, models 1–2) and the residential condo parking classes (compare with Table 4, models 6–7).

I undertake a placebo time test to examine whether the 2013 zoning change impacts were a product of the upzoning, or whether they coincided with some other confounder. This test simulated results of the change "occurring" on every day between 1,000 days before the 2013 legislation passed and 744 days after, when the 2015 change passed. Online Appendix F (A) illustrates p values of difference-in-differences variables for density classes for placebo law change day; it shows an increase into insignificance for that value soon after the day of the actual zoning change, supporting the claim that the law was the source of the effect. Results of this test for residential condominiums

in parking classes are less robust (B), suggesting that we should be less confident in the reform's causal influence on changes in these property values.

Finally, I explore whether the 2013 zoning reform may have had different impacts depending on the period studied in Online Appendix G. Developers may have adjusted their strategy with regard to comparison properties when the 2015 law was proposed, not just when it was passed (models 1 and 4), or may have reacted to the change in law beginning when the 2013 reform was proposed (almost two months before it passed) (models 2 and 5), or may have reacted to both (models 3 and 6). The results are robust and, if anything, suggest that the findings presented in Tables 3 and 4 are conservative.[12]

Discussion

Many policy makers hope that increasing allowed built density will spur construction and expand housing affordability. But municipal- and metropolitan-scale, synchronic comparative evaluations, which account for the bulk of current research, do not assess the impacts of zoning changes. This study's key contribution is evaluating how the property market responds on the specific parcels where upzoning occurs. It takes advantage of two unique Chicago zoning changes that allow it to circumvent the potentially endogenous relationship between the decision to rezone and the changes in prices and construction that follow. It shows that one effect of upzoning is a short-term increase in property transaction prices. First, the upzone for increased construction (density classes) quickly increased transaction values. This is a sign that land prices adjusted to the expanded ability to build, providing a one-time boost to incumbent landholders and suggesting interest in future redevelopment at higher densities. Second, the finding that the reduction in parking requirements (parking classes) had a greater impact on the value of vacant land suggests that upzoning's largest impact will be on land ripe for building. These results indicate that by upping the future potential for building, upzoning increases land value. This occurs quickly, in advance of development.

Third, the study identifies growth in prices among already-existing residential condominiums in some of the models I undertake (likely because of the larger number of observations, the parking-class models produced higher levels of significance but similar coefficients as the density-class models). It is worth emphasizing that this study does not address the affordability of *rental* properties directly, but it seems reasonable to extrapolate that whatever forces changing the prices of owned units would also affect rented ones. An increase in housing unit-level values may suggest that affordability for potential new owners on affected parcels declined with upzoning, at least in the short term. On the *specific parcels where upzoning occurs*, costs appear to go

up for individual housing units. The reason why this change occurs is worthy of debate and further analysis. Does an increase in allowed construction make redevelopment more feasible and thus inflate sales prices? Does it increase the perceived amenity value of the neighborhood, since more shops and the like may come in? Does the reduction in required parking also make new construction to replace current building simpler, or does it make the parking spaces attached to existing units more valuable?

The real-estate development process is arduous, encompassing negotiation between developers, funders, communities, councilors, and city staff, and requiring site acquisition, design, financing, and public review—all before a permit is issued. This might explain this study's finding of no short-term impact on permit volume for new housing units. But I also find no medium-term effect—over five years—on construction permitting, a surprising result given commonly held expectations about how upzonings work. Developer reactions to an unexpected zoning change may be limited given the riskiness of adapting to new density allowances.

This article investigates the impacts of one city's rezoning during a rocky period in the real-estate market, thus its findings are not universally generalizable. But by offering causal findings, it adds to our knowledge of how upzoning affects the market, and adds granularity to our understanding of land-use regulations. Further research should examine long-term impacts of such reforms. More analysis is needed to sort out whether property values increased primarily due to increased construction capacity on site, or due to added amenity value derived from potential adjacent uses. Similarly, future qualitative evaluations must examine how developers perceive such zoning changes.[13]

If the product of upzoning is no change in construction levels but increases in property transaction values, including for some existing housing units, this policy may have some negative consequences in upzoned neighborhoods that rapidly become more expensive. For a scholarly community generally focused on improving affordability in the *regional* housing market through additional housing supply, this poses a challenge that requires further consideration of the varying, and potentially contradictory, impacts of upzoning. For municipal planners hoping to encourage new construction, these results suggest they will have to wait until the cranes arrive. For those hoping to address affordability, they may need to look for other solutions. Promising approaches being pursued by cities like New York include requiring affordable housing in market-rate buildings constructed in rezoned areas; setting aside municipal land and providing direct funding for fully affordable projects; and slimming the regulatory burden to reduce construction costs (City of New York 2014). Upzoning's potentially adverse local consequences necessitate a nuanced and varied approach to planning.

ORCID iD

Yonah Freemark 🔘 https://orcid.org/0000-0003-3622-6354

Supplemental Material

Supplemental material for this article is available online.

Notes

1. Examining these characteristics regionally may not account for heterogeneous local environments. For example, center cities of high-regulation regions may feature lax regulations.
2. Disclosure: As a staff member at the Chicago Metropolitan Planning Council, I advocated for the zoning change in 2013 and its successor in 2015. My advocacy included meetings with city council members and the mayor, analyzing the proposal, and attending public events where I testified in favor of the ordinance.
3. Pedestrian Streets are approved by city council. Most are located in higher-income areas, potentially biasing outcomes. However, I control for distance to stations in all models. I also conducted a sensitivity analysis excluding parcels far from stations; this showed no indication that pedestrian-street parcels experienced different outcomes.
4. For a hypothetical building on a small lot with a 60-foot height limit (roughly five stories), reducing the number of parking spaces from twenty to ten could enable a developer to install parking on just one level, not two, thereby making room for four, not three, apartment levels, increasing unit count and leasable square footage.
5. A small share of parcels in each of the analysis zones underwent zoning changes between 2012 and 2018, but I did not identify any noticeable trend suggesting

that these changes confounded study findings. This suggests little reason to be concerned about spot zoning affecting the analysis.

6. Property transaction prices are not directly a measure of housing affordability for renters, since they do not measure what they are paying. Nevertheless, they represent the cost of home purchasing, and higher property values ultimately get passed down to renters. I limited transactions to those worth $500 or more to eliminate zero- or extremely-low-value sales; I also considered other, higher cutoff levels but found similar difference-in-differences coefficients in regression models.

7. It should be noted that these data do not directly represent construction, as they are permits. However, this is the most comprehensive construction dataset available, permits require a significant fee, and I could identify no evidence that it is biased in any direction based on location or date of permit awarded.

8. Sixteen districts were defined by the city's Department of Planning and Development; they represent general neighborhood characteristics, such as income, property values, density, and general population demographics. Most districts contain several stations within, and were used instead of stations to increase the analysis' statistical power.

9. The hedonic model incorporated the following variables. For parcels, distance from rail station entrance; zone type (B, C, D, or M); built density of the surrounding neighborhood; square footage of the parcel; a dummy for whether the nearby station was a CTA "L" station or Metra commuter rail stop; and information about the current use of properties, as defined by the transactions data file (such as single residence, apartment building, land only, industrial building, office building, etc.). For the district encompassing the parcel, population density; share of residents by ethnicity; share of commuters using transit; share of adults with college degrees; median household incomes; share of residents who are renters; median housing unit value. I included fixed effects for the districts and the quarter in time. For models that analyzed differences in impact between 2013 and 2015 parcels, I included more detailed information about each property provided by the county assessor, which was more specific than the current use information noted earlier. This information was not readily available for the outside comparison area parcels and, thus, I did not include it in analyses including them. I also considered several other covariates, including the aldermanic ward and the type of transit station (elevated, subway, at grade, or along a highway). These evaluations offered no significantly different results from those presented.

10. This assumption was tested by conducting a difference-in-differences test with only transactions before the reform. An evaluation of the density upzoning over two periods (–1000 to –500 days vs. –500 to 0 days from the change) showed no significant impact between the two, suggesting parallel trends in the pre-treatment period. For residential condos alone in the density areas, this test also produced no significance and a very low coefficient.

11. The potential impact of station adjacency was also incorporated into the regression models presented throughout the article by controlling for distance of each property to station entrances.

12. I conducted several tests examining shorter periods before and after reform. Results showed lower coefficients for the difference-in-differences estimate and, in some case, weaker (or no) statistical significance. This further supports the contention that the reaction to the zoning change in terms of property prices took time (illustrated in Figure 2).
13. In my time working in Chicago, I frequently encountered developers who, years after the first zoning change, still were unaware of its potential to alter their mode of constructing buildings.

References

Angotti, Tom. 2016. "Land Use and Zoning Matter." In *Zoned Out!* edited by Tom Angotti and Sylvia Morse, 18–44. New York: Terreform.

Atkinson-Palombo, Carol. 2010. "Comparing the Capitalisation Benefits of Light-Rail Transit and Overlay Zoning for Single-Family Houses and Condos by Neighborhood Type in Metropolitan Phoenix, Arizona." *Urban Studies* 47 (11): 2409–26. doi:10.1177/0042098009357963.

Been, Vicki, Ingrid Gould Ellen, Michael Gedal, Edward Glaeser, and Brian McCabe. 2016. "Preserving History or Restricting Development? The Heterogeneous Effects of Historic Districts on Local Housing Markets in New York City." *Journal of Urban Economics* 92:16–30. doi:10.1016/j.jue.2015.12.002.

Been, Vicki, Josiah Madar, and Simon McDonnell. 2014. "Urban Land-Use Regulation: Are Homevoters Overtaking the Growth Machine?" *Journal of Empirical Legal Studies* 11 (2): 227–65. doi:10.1111/jels.12040.

Chakraborty, Arnab, Gerrit-Jan Knaap, Doan Nguyen, and Jung Ho Shin. 2010. "The Effects of High-Density Zoning on Multifamily Housing Construction in the Suburbs of Six US Metropolitan Areas." *Urban Studies* 47 (2): 437–51. doi:10.1177/0042098009348325.

City of Chicago. 2013. "2013 Transit-Served Location Ordinance, Pub. L. No. SO2013-5995."https://chicago.legistar.com/View.ashx?M=F&ID=2622760&GUID=28AF7E4A-C824-41BB-AD7E-79C50EBBDC8A

City of Chicago. 2015. "2015 Transit-Served Location Ordinance, Pub. L. No. SO2015-5334." https://chicago.legistar.com/View.ashx?M=F&ID=4047819&GUID=AAD79D61-FD90-418D-8182-BADEAF8B0DC5

City of Chicago. 2016. "Neighborhood Opportunity Bonus: Leveraging Downtown Zoning to Foster Neighborhood Development and Central Area Growth." Accessed December 31, 2018. https://www.cityofchicago.org/city/en/depts/dcd/supp_info/realigning-zoning-with-neighborhood-growth.html.

City of Los Angeles. 2015. "pLAn: Transforming Los Angeles." http://plan.lamayor.org/

City of New York. 2014. "Housing New York: A Five-Borough, Ten-Year Plan." http://www.nyc.gov/html/housing/assets/downloads/pdf/housing_plan.pdf

Emanuel, Rahm. 2015. *Emanuel Administration Second Term Priorities Committee: Recommendations for the Next Four Years*. Chicago: City of Chicago.

Fein, David. 1985. "Historic Districts: Preserving City Neighborhoods for the Privileged." *New York University Law Review* 60:64–103.

Fischel, William A. 2001. *The Homevoter Hypothesis: How Home Values Influence Local Government Taxation, School Finance, and Land-Use Policies*. Cambridge: Harvard Univ. Press.

Fischel, William A. 2015. *Zoning Rules! The Economics of Land Use Regulation*. Cambridge: Lincoln Institute of Land Policy.

Freeman, Lance, and Jenny Schuetz. 2017. "Producing Affordable Housing in Rising Markets: What Works?" *Cityscape: A Journal of Policy Development and Research* 19 (1): 217–36.

Freemark, Yonah. 2018. "Challenges in the Creation of Mixed-Use Affordable Housing: Measuring and Explaining Its Limited Prevalence." *Housing Policy Debate* 28 (6): 1004–21. doi:10.1080/10511482.2018.1506813.

Furman, Jason. 2015. "Barriers to Shared Growth: The Case of Land Use Regulation and Economic Rents." The Urban Institute, Washington, DC.

Gabbe, C. J. 2017. "How Do Developers Respond to Land Use Regulation? An Analysis of New Housing in Los Angeles." *Housing Policy Debate* 28 (3): 411–27. doi:10.1080/10511482.2017.1368031.

Glaeser, Edward. 2012. *Triumph of the City*. New York: Penguin Books.

Glaeser, Edward, and Joseph Gyourko. 2002. "The Impact of Zoning on Housing Affordability." Working Paper No. 8835, National Bureau of Economic Research, Cambridge. doi:10.3386/w8835.

Glaeser, Edward, and Bryce A. Ward. 2009. "The Causes and Consequences of Land Use Regulation: Evidence from Greater Boston." *Journal of Urban Economics* 65 (3): 265–78. doi:10.1016/j.jue.2008.06.003.

Gyourko, Joseph, Albert Saiz, and Anita A. Summers. 2008. "A New Measure of the Local Regulatory Environment for Housing Markets: The Wharton Residential Land Use Regulatory Index." *Urban Studies* 45 (3): 693–729. doi:10.1177/0042098007087341.

Hirt, Sonia A. 2014. *Zoned in the USA: The Origins and Implications of American Land-Use Regulation*. Ithaca: Cornell Univ. Press.

Ihlanfeldt, Keith R. 2007. "The Effect of Land Use Regulation on Housing and Land Prices." *Journal of Urban Economics* 61:420–35. doi:10.1016/j.jue.2006.09.003.

Kok, Nils, Paavo Monkkonen, and John M. Quigley. 2014. "Land Use Regulations and the Value of Land and Housing: An Intra-metropolitan Analysis." *Journal of Urban Economics* 81:136–48. doi:10.1016/j.jue.2014.03.004.

Lens, Michael C., and Paavo Monkkonen. 2016. "Do Strict Land Use Regulations Make Metropolitan Areas More Segregated by Income?" *Journal of the American Planning Association* 82 (1): 6–21. doi:10.1080/01944363.2015.1111163.

Malpezzi, Stephen, and Susan M. Wachter. 2005. "The Role of Speculation in Real Estate Cycles." *Journal of Real Estate Literature* 13 (2): 141–64.

Mayer, Christopher J., and C. Tsuriel Somerville. 2000. "Land Use Regulation and New Construction." *Regional and Urban Economics* 30 (6): 639–62. doi:10.1016/s0166-0462(00)00055-7.

McKinsey Global Institute. 2014. "A Blueprint for Addressing the Global Affordable Housing Shortage." New York.

Molotch, Harvey. 1976. "The City as a Growth Machine: Toward a Political Economy of Place." *American Journal of Sociology* 82 (2): 309–32. doi:10.1086/226311.

Morrow, Gregory. 2013. "The Homeowner Revolution: Democracy, Land Use and the Los Angeles Slow-Growth Movement, 1965-1992." Doctoral dissertation. Univ. of California, Los Angeles.

Nadig, Brian. 2017. "7-Story Affordable Housing Project Planned for Jeff Park at Milwaukee & Northwest Hwy." *Nadig Newspapers*, January 26. Accessed December 31, 2018. http://nadignewspapers.com/2017/01/26/7-story-affordable -housing-project-planned-for-jeff-park-at-milwaukee-northwest-hwy/.

Nelson, Arthur C., Rolf Pendall, Casey J. Dawkins, and Gerrit J. Knapp. 2002. "The Link Between Growth Management and Housing Affordability: The Academic Evidence." Discussion Paper for the Brookings Institution Center on Urban and Metropolitan Policy. Washington: Brookings.

Pendall, Rolf. 2000. "Local Land Use Regulation and the Chain of Exclusion." *Journal of the American Planning Association* 66 (2): 125–42. doi:10.1080 /01944360008976094.

Peterson, Paul E. 1981. *City Limits*. Chicago: The Univ. of Chicago Press. doi:10.7208/ chicago/9780226922645.001.0001.

Podmolik, Mary Ellen. 2014. "New Parking Policies Driving Transit-Oriented Development." *Chicago Tribune*, September 20. Accessed December 31, 2018. https://www.chicagotribune.com/classified/realestate/ct-mre-0921-podmolik -homefront-20140920-column.html.

Pollakowski, Henry O., and Susan M. Wachter. 1990. "The Effects of Land-Use Constraints on Housing Prices." *Land Economics* 66 (3): 315–24. doi:10 .2307/3146732.

Quigley, John M., and Steven Raphael S. 2005. "Regulation and the High Cost of Housing in California." *American Economic Review* 95 (2): 323–28. doi:10.1257/000282805774670293.

Quigley, John M., and Larry A. Rosenthal. 2005. "The Effects of Land Use Regulation on the Price of Housing: What Do We Know? What Can We Learn?" *Cityscape* 8 (1): 69–137.

Rothwell, Jonathan, and Douglas S. Massey. 2009. "The Effect of Density Zoning on Racial Segregation in U.S. Urban Areas." *Urban Affairs Review* 44 (6): 779–806. doi:10.1177/1078087409334163.

Schill, Michael H. 2005. "Regulations and Housing Development: What We Know." *Cityscape: A Journal of Policy Development and Research* 8 (1): 5–20.

Schleicher, David. 2013. "City Unplanning." *Yale Law Journal* 122 (7): 1670–1737.

Schwieterman, Joseph P., and Dana M. Caspall. 2006. *The Politics of Place: A History of Zoning in Chicago*. Edited by Jane Heron. Chicago: Lake Claremont Press.

Shertzer, Allison, Tate Twinam, and Randall Walsh. 2016. "Zoning and the Economic Geography of Cities." Working Paper No. 22658, National Bureau of Economic Research, Cambridge. doi:10.3386/w22658.

Spula, Ian. 2016. "Chicago's Proliferating Transit Oriented Developments Spark Controversy." *The Architect's Newspaper*, July 18. Accessed December 31, 2018. https://archpaper.com/2016/07/transit-oriented-development-in-chicago/.

Thorson, James A. 1997. "The Effect of Zoning on Housing Construction." *Journal of Housing Economics* 6 (1): 81–91. doi:10.1006/jhec.1997.0205.

Weiss, Marc Allan. 1987. *The Rise of the Community Builders*. New York: Columbia Univ. Press.

White House. 2016. *Housing Development Toolkit*. Washington, DC: White House.

Wolf-Powers, Laura. 2005. "Up-Zoning New York City's Mixed-Use Neighborhoods." *Journal of Planning Education and Research* 24 (4): 379–93. doi:10.1177/0739 456x04270125.

Author Biography

Yonah Freemark is a doctoral candidate in the Department of Urban Studies and Planning at the Massachusetts Institute of Technology.