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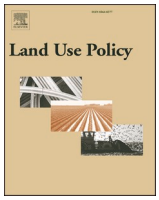

# How do upzonings impact neighborhood demographic change? Examining the link between land use policy and gentrification in New York City

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ABSTRACT

As cities across the country face mounting pressures to address the housing affordability crisis, planners and policymakers have increasingly eyed upzonings as an instrument to alleviate rising housing costs. Yet, upzonings have emerged as a site of deep conflict, driving a wedge between groups advocating for supply-side solutions and those calling for added tenant protections and affordable housing preservation. Upzoning advocates–many affiliated with the yes-in-my-backyard (YIMBY) movement–have argued that in allowing for denser development, upzonings will help to lift artificial restrictions on supply and lower housing prices in the long run. Opponents, often representing tenant interests, have countered that upzonings will accelerate gentrification and displacement pressures. Despite these cleavages about the effects of upzonings on gentrification and displacement, minimal empirical research to date has examined the link between upzonings and neighborhood demographic change. To help fill this gap in the literature, this paper examines how upzoning activity is associated with subsequent change in the non-Hispanic white population in New York City between 2000 and 2010. Using New York as a case study, this paper finds that upzoning activity is positively and significantly associated with the odds of a census tract becoming whiter, suggesting that neighborhood upzonings might accelerate, rather than temper, gentrification pressures in the short term.

## 1. Introduction

In recent years, planners and policymakers have championed proposals to upzone neighborhoods to address the nation's housing affordability crisis. Upzonings increase allowable residential densities often by relaxing the zoning code's height and bulk requirements or increasing floor area ratios (FARs) dictating the total size of a development. The core logic behind upzoning is that in allowing municipalities to build denser housing, upzonings will help to increase the housing supply and thus alleviate housing costs in high-demand real estate markets. Upzonings also strive to reduce residential segregation, as land use regulations that constrain multifamily housing development have been associated with elevated levels of segregation (Rothwell, 2011).

Yet, upzonings have emerged as a flashpoint in cities across the country, driving a wedge between those fighting for supply-side solutions (e.g. YIMBYs) and tenant rights groups. For example, California's embattled Senate Bill 50, which would have upzoned all parcels of land near transit stops for mid-rise apartments and condominiums throughout the state, serves as an illustrative example of current tensions that have pitted the two coalitions against one another. For pro-housing groups such as California YIMBY, SB 50 would stimulate housing production, lower housing costs, and mitigate gentrification and displacement pressures (Dougherty, 2020). Tenant advocates have countered that the bill would further fuel gentrification pressures and real estate speculation, as landlords of upzoned buildings would be incentivized to sell their properties at inflated prices reflecting their added development potential (Matthew, 2019). For example, Moms 4 Housing, a group of homeless and marginally housed mothers who called attention to rampant real estate speculation in the Bay Area by occupying a vacant Oakland home, opposed upzonings on the grounds that it would entice developers to build luxury developments in transit-rich areas and further fuel real estate speculation and gentrification (Holder and Mock, 2020). Phillips (2020, p. 6) has succinctly summarized this division between the two coalitions, writing: "If the core question of YIMBYs is 'Who benefits?,' for tenant advocates, it's 'Who is harmed?'".

Although neighborhood upzonings have emerged as a site of deep conflict, minimal research has examined how upzonings in fact impact neighborhood change (Budds, 2020; Capps, 2020; Whittemore, 2020). This gap in the literature is surprising, given both the increased usage of

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upzonings to address the housing affordability crisis in major metropolitan areas in the United States and the ongoing debate about how upzonings impact the hot-button issue of gentrification. Aiming to fill this gap in the literature, this paper examines upzoning activity in New York City as a case study into how upzonings interact with neighborhood change, using the non-Hispanic white population as a proxy for gentrification. Although private landowners can initiate rezonings through variances, this analysis focuses instead on "proactive upzonings," or upzonings that municipal entities, such as the city's planning or economic development departments, spearheaded (Denoon-Stevens and Nel, 2020). In so doing, this paper answers calls elsewhere in the literature to better understand how different forms of public investment shape gentrification pressures and illuminate the potentially unintended consequences of cities' land use actions (Zuk et al., 2018).

The paper is organized as follows: Section 2 reviews the literature on upzonings, land prices, and housing affordability. Section 3 provides a brief background on upzoning activity in New York City in the early 2000. Section 4 describes the data sources and methods used in the analysis. Section 5 presents the results of the regression analysis. Section 6 provides a discussion and outlines avenues for future research. Section 7 is the conclusion.

## 2. Literature review

An extensive body of research has examined how land use regulations affect housing production and land values in various metropolitan areas across the United States (Glaeser and Ward, 2009; Kok et al., 2014; Quigley and Rosenthal, 2005). According to this body of scholarship, a host of restrictions and land use regulations, such as excessive permitting fees, independent reviews to obtain building permits, and protracted environmental reviews, all play a hand in placing artificial restrictions on supply and raising housing prices. For example, Glaeser and Ward (2009) examine land use controls in cities in Greater Boston and find that cities with minimum lot size requirements and other land use controls are associated with higher land values, although the effects disappear after including a number of controls. Kok et al. (2014) examine the determinants of urban land prices in the San Francisco Bay Area and likewise find that the restrictiveness of a municipality's regulatory environment (measured through the number of independent reviews to secure building permits or zoning changes) is positively correlated with higher land prices. In a comprehensive survey of the literature, Glaeser and Gyourko (2003) examine the relationship between land use regulations and housing affordability and conclude that "in the places where housing is quite expensive, building restrictions appear to have created these high prices" (p. 23). Taken together, the literature has offered a solid body of evidence that land use regulations tend to raise land values and impede housing production, particularly in cities with restrictive land use regulatory practices, such as San Francisco or New York.

This scholarship has thus renewed calls to relax municipal zoning restrictions that hamper housing production and raise housing prices. In this context, planners and policymakers across the country have started to turn towards upzonings, or zoning changes that allow for increases in residential development capacity (often through floor area ratio, height, and bulk increases or reductions in minimum parking requirements), as a way to unlock added housing density and alleviate housing affordability challenges (Gabbe, 2018). Indeed, this increased uptake of upzoning makes sense; upzoning is one of the few tools that built-out cities, such as New York and San Francisco, can leverage to increase their housing supplies. Although several major metropolitan areas including Arlington County (VA), Boston (MA), Chicago (IL), New York City (NY), and Seattle (WA) have enacted upzoning policies, the majority of these policies started in the mid- to-late 2000 s, and thus the literature on upzonings is relatively nascent (Hickey, 2014). Scholarship that has touched on upzonings tends to focus on three primary themes including 1) investigating the determinants of upzonings, including city officials' calculus for deciding which areas of the city to upzone; 2) examining the impact of upzonings on subsequent housing production and land values; and 3) examining upzonings as a tool for value capture.

Weighing in on the first theme, Gabbe (2018) examines how a series of neighborhood- and parcel-level characteristics influenced the probability that lots in Los Angeles were upzoned between 2002 and 2014. Gabbe (2018) conducts a logistic regression model that identifies the determinants of upzonings as a function of a series of parcel, regulatory, and neighborhood characteristics. The author finds evidence that lots zoned for low-intensity, nonresidential uses in areas with lower political resistance were associated with a higher probability of being upzoned. In comparison, lots located in neighborhoods with a high concentration of homeowners and high-performing schools had lower probabilities of being upzoned, consistent with the "homevoter" hypothesis that homeowners tend to be in favor of land use regulations that minimize development projects that could adversely affect their property values (Fischel, 2004).

In a related study, Gabbe (2019) examines the prevalence of rezoning activity in three Silicon Valley cities–San Jose, Sunnyvale, and Santa Clara–and identifies factors that influenced the likelihood that specific areas were upzoned or downzoned. He finds that rezoning activity was not widespread overall, and that most rezonings tended to be initiated by property owners rather than through municipal action. After constructing a multinomial logistic regression model comparing the relative risk of a parcel being upzoned or downzoned compared with no zoning change, Gabbe also finds that parcels located in transit-rich areas near desirable amenities experienced a higher risk of being upzoned, suggesting that areas with prime development potential were more likely to experience increases in allowable residential densities.

Examining a series of upzoning activity in New York City in the early-to-mid 2000 s, Been et al. (2014) test whether "growth machine" politics (in which city officials defer to elite coalitions, e.g. landlords and developers) or the "homevoter theory" (in which city officials cow to homeowners' preferences) figured more prominently into land use decision making under the Bloomberg administration. In order to test this relationship, the authors leverage a dataset of all tax lots that the New York City Planning Commission rezoned between 2002 and 2009 and construct multinomial logit regressions examining how several tax lot and neighborhood-level variables influence rezoning activity. The authors hypothesize that "if zoning officials are motivated by homevoter preferences, relatively high levels of neighborhood construction activity, population growth, and price appreciation will increase the probability that a lot will be downzoned," as homeowners tend to oppose development that could adversely impact property values (Been et al., 2014, p. 256). Indeed, Been et al. find that tax lots had a higher probability of being downzoned if they were located in neighborhoods with high population growth and construction activity. The authors interpret these findings as evidence that the homevoter theory of urban growth plays a more direct role in rezoning decision-making in New York City.

Addressing the second theme, other upzoning scholarship has instead focused on examining the impact of upzonings on subsequent housing production and land values. Freemark (2019) investigates how a series of upzonings in Chicago between 2013 and 2015 impacted changes in residential transaction values and short-term housing production levels. In his paper, Freemark constructs a hedonic regression model to examine how increasing residential density impacts both of these outcome variables and controls for various parcel- and neighborhood-level characteristics. Freemark finds that transaction values are significantly higher among properties located on upzoned land, providing evidence that upzoning is positively associated with property value increases. If it is true that short-term increases in housing prices are a precursor to gentrification, Freemark's study provides some evidence that upzonings could accelerate gentrification pressures. The author, however, does not find statistically significant evidence that upzoned parcels are associated with higher housing unit construction activity within five years of the zoning change, casting doubt on

upzoning advocates' claims that these zoning changes will improve housing affordability through increased supply in the short term.

Rodriguez-Pose and Storper (2020) call into question the idea that density-increasing zoning changes will reduce housing affordability pressures. In their paper, the authors review a dominant argument in housing policy circles: that cities should relax their zoning codes because they tend to place artificial constraints on supply, raise housing costs, limit the inter-regional migration of lower-income households to more prosperous cities, and therefore exacerbate regional spatial inequalities. The authors debunk this theory, arguing that job availability plays a much greater role in a low-income household's calculus to migrate to a city than housing costs do. The authors conclude that "blanket upzoning policies are unlikely to increase domestic migration or to improve affordability for lower-income households in prosperous areas" (p. 223).

A final strand of upzoning research examines how city officials leverage upzonings as a tool to capture public benefits. According to this scholarship, upzonings are one of the most powerful tools that municipalities have at their disposal to derive public benefits when landowners or developers enjoy financial windfalls from land use changes initiated by the public sector. For example, Kim (2020) investigates how city officials leveraged their land use regulation powers to extract public benefits in the twenty largest development projects of five major metropolitan areas in the U.S. including Boston, Chicago, New York, San Francisco, and Seattle. Kim finds that all of the cities used one or more land use regulation measures (e.g. inclusionary zoning or impact fees) to obtain public benefits for all projects involving upzonings. Despite these benefits, Kim argues that cities lacked "analytical frameworks for evaluating the proportionality of the value created by upzonings and what is being asked for in return," suggesting that cities that rely on discretionary review for public benefit agreements might be leaving some benefits left on the table (p. 9). Elmendorf and Shanske (2020) likewise point to some of the limitations of leveraging upzonings as a value capture tool. Taking up the case of California's Senate Bill 827 (later, Senate Bill 50), Elmendorf and Shanske argue that the bill does not adequately account for non-compliance with state-mandates; although the state could impose penalties on growth-adverse localities, this gesture would be politically unpalatable given that localities tend to prize local control of land use. Instead, the authors argue that "states should confer on local governments the right to auction development rights created by upzoning pursuant to state policy."

Despite these valuable contributions to the literature, minimal research has examined the link between residential upzonings and neighborhood demographic change. Whittemore (2017) explores the racial and income characteristics of neighborhoods that local officials upzoned in Durham, North Carolina between 1945 and 2014, finding evidence that upzonings were more likely to occur in neighborhoods with a lower white population, but that these neighborhoods were not lower income compared to the citywide average. Since Whittemore is interested in exploring the role of race in local officials' decisions to rezone minority neighborhoods for industrial uses, he operationalizes upzoning as "changes from less intensive uses to more intensive heavy commercial and industrial uses" (p. 235). Thus, his analysis does not explore the kind of residential upzonings that constitute the focus of this analysis–that is, upzonings involving a change of use from a less intense residential category to a more intense residential category.

The few qualitative studies that do examine upzonings of this nature, however, provide rich insights into how neighborhoods change following city-initiated upzonings. For example, Angotti and Morse (2016) performed an in-depth case study of three New York City neighborhoods that were upzoned (Williamsburg, Chinatown, and Harlem) and found that the upzonings ushered in a wave of upscale residences and retailers. The authors argue that all three upzoned neighborhoods experienced an influx of high-end residential development and white households, lending support to the theory that upzonings induce white population growth and gentrification pressures. In a case study of two industrial neighborhoods in New York City (Greenpoint-Williamsburg in Brooklyn and Long Island City in Queens) that were upzoned to accommodate high-density residential and commercial development, Wolf-Powers (2005) finds that the upzonings "contributed to property speculation and the displacement of firms in what had been healthy light industrial districts, contributing to a shift in the city's economy away from industrial employment and toward an even more marked dominance of white-collar and service functions" (p. 380). While Wolf-Powers does not focus explicitly on shifting neighborhood racial demographics, her finding that the two neighborhoods became increasingly upscale suggests that some level of gentrification pressures might have ensued. With these case studies providing some qualitative evidence that upzonings accelerate gentrification pressures, this paper will test this relationship in a case study of upzoning activity in New York City.

## 3. Upzoning New York City

This paper examines a series of city-initiated upzonings in New York City between 2002 and 2009 under Mayor Michael Bloomberg's administration. The early- to mid-2000 s was a particularly active period of rezoning activity in New York City, in which city officials rezoned approximately one-third of the city's land area (Stein, 2018). While other cities have experienced minimal upzoning activity (Gabbe, 2019), New York City's rezoning activity is remarkable in that a considerable percentage of the city's land area was upzoned, allowing for greater residential development capacity and serving as a rich site for inquiry into neighborhood demographic change.

Although upzonings occurred in all five boroughs, individual upzonings came in several shapes and sizes. Some upzonings applied to a few blocks, while others covered tens of blocks, dramatically remaking the height profile of certain neighborhoods (Furman Center for Real Estate and Urban Policy, 2010). In some instances, upzonings involved changes from one residential land use to another residential land use allowing greater development intensity, while others involved changes from a non-residential to a residential land use (e.g. manufacturing to residential). Although New York City's zoning code regulates density through several mechanisms (e.g. height limits, lot coverage requirements, setbacks, side-yard requirements, and minimum parking requirements), I follow previous analyses by considering tax lots to be upzoned if they experienced at least a 10% increase in their maximum residential development capacity (*maximum floor area ratio * lot size*) between 2002 and 2009, given that FARs are the "most significant single constraint on building bulk in New York's zoning code" (Been et al., 2014, p. 248).

## 4. Data and methods

In order to examine the relationship between upzoning and neighborhood demographic change, I employ a beta regression model. The dependent variable in a beta regression assumes values in the standard unit interval (0, 1). Ferrari and Cribari-Neto (2004) recommend using the beta regression for modeling continuous variates, such as rates and proportions, since proportional data tend to exhibit abnormal skewness and heteroskedasticity at the extremes of the distribution (i.e. near 0 and 1), violating one of the core assumptions of linear regression that the error term is normal and has constant variance (Davis and Lopez-Carr, 2014). The main advantage of using a beta distribution is that the beta density can take on a number of different shapes such as left- or right-skewed, uniform, bell-shaped, or bimodal distributions, making it ideal to use for heteroskedastic proportion data. Similar to generalized linear models, the beta regression uses a link function (e.g. logit, complementary log-log, or log-log link) to "convert between the linear predictor model and the conditional mean on the scale of observations" (Douma and Weedon, 2019, p. 1416).

While it is a common technique to use transformation-based solutions (e.g. taking the natural log) when working with proportion data to

meet linear regression assumptions, this technique can lead to biased estimates and difficulties with interpretation (Douma and Weedon, 2019). Given the unique strengths of the beta regression for handling proportion data, I employ a beta regression using the logit link to model the dependent variable in this analysis–the proportion of white residents per census tract in 2010. I model the proportion of white residents in 2010 per neighborhood as a function of the proportion of a given census tract's total tax lot area that was upzoned between 2002 and 2009 in addition to various controls. Consistent with other studies of gentrification, I define a "neighborhood" as a census tract and measure all variables at this geographic level (Freeman, 2005). Last, I use the Longitudinal Tract Database to account for census tract boundary changes between 2000 and 2010 (Logan et al., 2014).

### 4.1. Dependent variable

The dependent variable is the proportion of non-Hispanic whites in 2010 per census tract. I examine this metric since previous studies have identified that in-migrants to gentrifying neighborhoods tend to be young, college-educated white households (Freeman and Braconi, 2004; Freeman, 2005; McKinnish et al., 2010; Wyly and Hammel, 2004).

### 4.2. Independent variables

#### 4.2.1. Upzoning activity

The independent variable of primary interest is the proportion of the total tax lot area in a census tract that was upzoned between 2002 and 2009.[a] As other scholars have noted, upzonings implemented under the Bloomberg administration tended to usher in a wave of luxury real estate development, raising surrounding rents and stimulating an influx of white residents to upzoned neighborhoods (Angotti and Morse, 2016). I hypothesize that neighborhoods with a higher proportion of upzoned tax lot area will be positively associated with a higher proportion of white residents.

In order to measure upzoning activity per neighborhood, I first examined zoning applications between 2002 and 2009 from the NYC Department of City Planning and identified rezonings where the lead applicant on the rezoning application was either the New York City Department of City Planning or the New York City Economic Development Corporation; this method helped to identify rezonings that were initiated through municipal, rather than private, action. Next, using the NYC Department of City Planning's Primary Land Use Tax Lot Output database, I identified upzoned tax lots as those that experienced at least a 10% increase in their maximum residential development capacity between 2002 and 2009[b]. The maximum residential development capacity is calculated by multiplying the tax lot's maximum residential FAR by the lot's size to obtain its maximum buildable area in 2002 (Furman Center 2010). The same calculation is then performed among lots in 2009 to obtain the maximum buildable area in 2009. Lots that experienced 1) at least a 10% increase in residential development capacity during these two time periods, 2) were located within city-initiated rezoning boundaries, and 3) underwent a land use code change were considered upzoned. Following Been, Madar and McDonnell's methodology, I use the ten percent threshold in order to differentiate between upzonings and "form- and contextual-based zoning changes that incidentally alter a lot's residential development capacity," but whose main objective is not to increase allowable residential density (2014, p. 248). Although this definition of upzoning does not account for other zoning constraints (e.g. height limits or side yard requirements) that in practice could limit how much could realistically be built on some tax lots, examining change in maximum buildable capacity is a widely accepted measure of upzoning in the literature (Been et al., 2014). Last, since different neighborhoods were upzoned at different time periods between 2002 and 2009, the model also includes a variable capturing the average number of years that the upzoning had been in effect per neighborhood. One might expect that the effects of upzoning, including on gentrification, would be more advanced in neighborhoods that had experienced upzonings for longer periods of time.

#### 4.2.2. Neighborhood amenities

The model includes several independent variables to control for other factors that might induce an influx in the white population apart from upzoning activity. The first set of independent variables addresses neighborhood amenities. Previous studies in the literature have found that gentrifying neighborhoods tend to offer urban amenities such as convenient public transit access, close proximity to job centers, and are home to an older housing stock "with character" (Helms, 2003). White residents, often the first in-migrants to gentrifying neighborhoods, thus might be more likely to move into neighborhoods where these amenities are present. In order to capture these amenities, the model includes a dummy variable indicating whether the census tract is within a 0.5-mile walking distance of a subway station (a proxy for public transit access) and the distance from the center of each census tract to midtown Manhattan in miles (a proxy for central city job accessibility). The model also includes a dummy variable indicating whether at least 75% of the land area of the tract is zoned for residential uses and its average building age is pre-war (i.e. pre-1940) (a proxy for a housing stock with "character") (Been et al., 2014). I hypothesize that neighborhoods that are within walking distance of a subway station, are closer to the central business district, and are located in a neighborhood with "character" will be positively associated with growth in the white population.

#### 4.2.3. Neighborhood demographics and life cycle factors

The model also includes a series of controls that capture the neighborhood's racial composition. Following Freeman and Cai (2015), the model includes variables capturing the proportion of Asian, Black, and Hispanic residents in 2000, as the "buffering" hypothesis predicts that white households are more likely to move into a majority Black neighborhood if other minorities are present. Additionally, since white households might be more likely to move to areas with a high concentration of other white residents, the model includes a variable examining distance to the closest majority-white neighborhood (Freeman and Cai, 2015). Majority-white neighborhoods might be more likely to offer the kinds of urban amenities attractive to white in-migrants and therefore be positively associated with growth in the white population.

Last, previous studies on residential mobility have found that life cycle factors, such as getting married or becoming a parent, figure prominently in a household's decision to move (Freeman, 2005). Following previous studies of residential mobility, the model includes the following controls as proxies for a neighborhood's life cycle: age, marital status, and presence of children.

#### 4.2.4. Neighborhood housing characteristics

The final set of independent variables captures various characteristics of the neighborhood's existing housing stock. First, using a dataset from the NYU Furman Center, the model includes a variable capturing the total number of residential units receiving housing subsidies per neighborhood. Previous studies of residential mobility have accounted

[a] The NYC Department of Finance's Primary Land Use Tax Lot Output (PLUTO) dataset starts in 2002, precluding an analysis of upzoning activity that started in 2000. Since the vast majority of upzoning activity occurred under the Bloomberg administration, which began in 2002, only a minority of pre-2002 upzoning activity is not captured in the model.

[b] In a small minority of tax lots located in high-density residential and commercial areas, the Primary Land Use Tax Lot Output database reports the maximum allowable commercial FAR, rather than residential FAR. Including these tax lots in the analysis understates the capacity for new development. However, following Been et al. (2014), I also included these tax lots in the analysis since they represented only 4% of total lots.

**Table 1**
Descriptive Statistics for Regression Variables (N = 2143).

| Statistic | Mean | Std. Dev. |
|---|---|---|
| Non-Hispanic white proportion, 2010 | 0.33 | 0.31 |
| Tax lot area upzoned proportion, 2002–2010 | 0.06 | 0.15 |
| Average number of years since upzoning | 1.47 | 2.20 |
| Transit access dummy | 0.65 | 0.48 |
| Distance to CBD (miles) | 7.61 | 3.51 |
| Asian proportion, 2000 | 0.10 | 0.13 |
| Black proportion, 2000 | 0.27 | 0.32 |
| Hispanic proportion, 2000 | 0.25 | 0.22 |
| Distance to closest majority-white neighborhood (miles) | 0.62 | 0.70 |
| Married proportion, 2000 | 0.44 | 0.12 |
| Children proportion, 2000 | 0.24 | 0.08 |
| Gross rent, 2000 | 984 | 867 |

Source: NYC Department of City Planning, NYC Department of Finance, NYC Department of Transportation, U.S. Census Bureau.

for the housing subsidy status of a unit under the logic that a household in a gentrifying neighborhood might "think twice" about moving out of a subsidized unit given the scarcity of affordable housing options available in the private market (Freeman and Braconi, 2004, p. 45). Scaling this logic up to the neighborhood level, one might expect that neighborhoods with a higher concentration of subsidized housing, which tend to house lower-income, minority households, might be more willing to hold onto their units, resulting in lower rates of housing turnover and thus staunching an influx of white households into newly available units. Second, the model also includes the average gross rent per neighborhood under the logic that white households might be more attracted to neighborhoods with more upscale housing. Last, the model includes a variable capturing the proportion of renter-occupied housing units.

#### 4.2.5. Analysis and descriptive statistics

After defining these variables of interest, I first fit a global beta regression model using the logit link that includes all of the above-mentioned variables (results in Table A1 of Appendix A). Then, employing a stepwise backwards selection approach, I iteratively removed the least significant variables one after another, to identify the most parsimonious model (Table 2). At each step, I compared the Akaike Information Criterion (AIC) between the original model and each simpler model, which is used to compare models with a different number of predictors (lower AIC values are indicative of a better fit model) (Corbelle-Rico and Crecente-Maseda, 2014). I repeated this process until all variables included in the model were significant, arriving at a final model with a substantially improved AIC over the initial global model (Volante et al., 2016).

Table 1 presents descriptive statistics for the variables included in the final model. In the average neighborhood in 2010, about one-third of residents identified as non-Hispanic white. There was considerable variation in the data, however, suggesting that some neighborhoods contained a considerably higher proportion of non-Hispanic white residents than others. On average, roughly 6% of a census tract's total tax lot area was upzoned between 2002 and 2009, reflecting the marked period of rezoning activity during this time period. An upzoning had been in effect for approximately one and a half years in the average neighborhood. In terms of the neighborhood amenities variables included in the analysis, about 65% of neighborhoods were within a 0.5-mile distance of a subway stop. The average neighborhood was about 7.6 miles from the central business district.

Table 1 also presents summary statistics for the neighborhood demographic variables and life cycle factors included in the analysis. In the average neighborhood in 2000, about ten percent of neighborhood residents identified as Asian, while roughly a fourth of residents identified as Black or as Hispanic (27% and 25%, respectively). The proportion of Black and Hispanic residents per neighborhood exhibited higher variation, indicative of the fact that some neighborhoods in NYC are home to a high concentration of Black or Hispanic residents. The average neighborhood was located about 0.6 miles away from the closest majority-white neighborhood. Controls capturing life cycle factors in the neighborhood indicate that roughly 44% of the population aged 16 years or older is married and about one-fourth of households have children. Last, in terms of the housing characteristics variables included in the final model, the average gross rent was roughly $984, although this variable contained high dispersion.

**Table 2**
Regression Results.

| Statistic | Coefficient | Odds Ratio | Std. Error | Pr (>\|z\|) | |
|---|---|---|---|---|---|
| Intercept | 0.83 | 2.29 | 0.10 | 0.00 | *** |
| Tax lot area upzoned proportion, 2002–2009 | 0.25 | 1.28 | 0.10 | 0.02 | * |
| Average number of years since upzoning | 0.02 | 1.02 | 0.01 | 0.00 | ** |
| Transit access dummy | 0.19 | 1.21 | 0.03 | 0.00 | *** |
| Distance to CBD (miles) | −0.03 | 0.97 | 0.01 | 0.00 | *** |
| Asian proportion, 2000 | −4.81 | 0.01 | 0.14 | 0.00 | *** |
| Black proportion, 2000 | −3.90 | 0.02 | 0.10 | 0.00 | *** |
| Hispanic proportion, 2000 | −3.92 | 0.02 | 0.11 | 0.00 | *** |
| Distance to closest majority-white neighborhood (miles) | −0.58 | 0.56 | 0.04 | 0.00 | *** |
| Married proportion, 2000 | 1.58 | 4.83 | 0.18 | 0.00 | *** |
| Children proportion, 2000 | 0.73 | 2.07 | 0.27 | 0.01 | ** |
| Gross rent, 2000 | 0.00 | 1.00 | 0.00 | 0.00 | *** |

Number of Obs: 2143
Type of estimator: ML (maximum likelihood)
Log-likelihood: 2648 on 13 Df
AIC: −5269
* Signif. codes: $p < 0.05$;
** $p < 0.01$;
*** $p < 0.001$
Source: NYC Department of City Planning, NYC Department of Finance, NYC Department of Transportation, U.S. Census Bureau.

## 5. Results

Table 2 presents the results from the beta regression model, presenting coefficients as log odds ratios and odds ratios. When the logit link is employed in a beta regression, the odds ratios take on a similar interpretation as those found in logistic regression. Instead of the odds referring to a ratio of two probabilities, the odds refer in the present analysis to the ratio of non-Hispanic white residents to total residents, which can be understood as the relative likelihood of a census tract becoming whiter (Conigliani et al., 2018, p. 656). With a lower AIC value, the final model presented in Table 2 offers a substantially improved fit over the global model (Table A1 in Appendix A).

The core finding from the model is that upzoning activity is positively and significantly associated ($p < 0.05$) with the odds that the census tract becomes whiter. When other variables are held constant, a one unit increase in the proportion of total tax lot area that is upzoned is associated with a 28% increase in the odds of a census tract becoming whiter. This result aligns with findings from previous case studies, which have found that upzonings tend to raise land values, accelerating gentrification pressures and spurring growth in the white population in New York (Angotti and Morse, 2016). One potential explanation of this result is that as land values in upzoned areas rise, developers will be inclined to pass increased costs onto renters in the form of higher rents, which in turn serves as a financial barrier to lower-income households from moving into the neighborhood (Stein, 2019). Another explanation of this finding relates to the fact that upzonings under the Bloomberg administration did not trigger mandatory inclusionary housing, which in offering more subsidized units to lower-income, minority households, might have mitigated gentrification pressures. In addition, the model provides support for the hypothesis that a census tract will become

whiter in areas that have experienced upzonings for longer periods of time. All else equal, a one unit increase in the number of years since an upzoning occurred is associated with a 2% increase in the likelihood of a census tract becoming whiter. The magnitude of this relationship is relatively low, however, so future research would benefit from examining whether these effects become more pronounced over time.

Variables capturing neighborhood amenities proved to be strong predictors of the odds of a census tract becoming whiter, consistent with the research hypothesis. When other variables are held constant, the odds of a census tract within walking distance of a subway stop becoming whiter is 1.21 times as great as a census tract that is not within walking distance of a subway stop. This finding is consistent with previous research that gentrifying neighborhoods with high transit accessibility tend to experience an influx of white residents (Helms, 2003). The relationship between a given census tract's distance from the central business district (CBD) and the odds of the census tract becoming whiter also moved in the hypothesized direction. For each extra mile that a given census tract is from the CBD, the odds of a census tract becoming whiter are reduced by 3%, indicative of the premium for convenient access to public transit among white residents.

The next set of independent variables capturing neighborhood racial composition did not provide strong evidence for the "buffering hypothesis," or the theory that white households will be more likely to move into gentrifying neighborhoods if other minorities already live there (Freeman and Cai, 2015). For each one unit increase in the proportion of Asian, Black, or Hispanic residents, the relative likelihood of a census tract becoming whiter is reduced, suggesting that white residents are more inclined to move into neighborhoods with a high concentration of white people. Net of other factors, for each one unit increase in the number of miles from the closest majority-white census tract, the odds of the census tract becoming whiter are reduced by 44%.

The final set of variables capturing neighborhood lifecycle factors also proved to be strong predictors of a census tract becoming whiter. All else equal, the odds of a census tract becoming whiter are multiplied by 4.83 for each one unit increase in the proportion of married households and multiplied by 2.07 for each one unit increase in the proportion of households with children.

## 6. Discussion and future research

Using the non-Hispanic white population as one metric of gentrification, this case study found evidence that neighborhood upzonings are positively and significantly associated with the odds of a census tract becoming whiter. These findings are consistent with previous qualitative studies of upzoned neighborhoods in New York City, which have found that upzonings tend to raise property values, induce real estate speculation, usher in a wave of upscale residential development and retailers, and become less in reach of low-income and minority households (Angotti and Morse, 2016; Freemark, 2019; Stein, 2018; Wolf-Powers, 2005).

This study opens up several avenues for future research to better understand how neighborhood upzonings interact with gentrification. One of the main limitations of this study is that it only focuses on the short-term effects of upzonings on gentrification. Although previous research has found that the first whisper of an upzoning can spark a flurry of real estate speculation long before an upzoning officially goes into effect, future research should examine how upzonings impact long-term demographic change–a rich site for future inquiry given the often long lag time needed for new-build construction (Savitch-Lew, 2016). Indeed, this study found evidence of a positive association between the odds of a census tract becoming whiter and the number of years that an upzoning had been in effect. Although the magnitude of the relationship was marginal, future studies should investigate the extent to which this relationship becomes more pronounced over time. Additional scholarship might also examine how upzonings effect other variants of gentrification, such as commercial gentrification, since previous studies have found that upzoned areas are associated with an influx of high-end retailers (Angotti and Morse, 2016).

Second, scholars should examine how upzonings that incorporate mandatory inclusionary housing or that are more targeted to wealthier neighborhoods interact with subsequent gentrification and displacement pressures. In recent years, it has become more common for cities to condition upzonings on the basis that a certain percentage of units will be set aside for lower- to moderate-income households. Although the upzonings considered in this analysis did not automatically trigger mandatory inclusionary housing (MIH) at the time, it is possible that the inclusion of additional low-income units provided through MIH would mitigate gentrification as additional units are provided to low-income, minority households. In order to combat gentrification pressures, some scholars have proposed targeting upzoning in high-opportunity neighborhoods (Phillips 2020) or have even pushed for raising the minimum allowable density across an entire region or state as a way to divert development away from "gentrification hot spots" (Wegmann, 2020, p. 116). Future research should examine whether these kinds of proposals, which are designed to minimize adverse impacts on low-income communities, lead to more equitable outcomes.

Last, more research is needed to better understand how neighborhood upzonings impact residential displacement. In cities across the country, tenant advocates have criticized upzoning policies, arguing that upzonings will induce displacement pressures and evictions (Matthew, 2019). Those advocating for supply-side solutions should not dismiss this perspective, especially given that public land use interventions have a long history of accelerating racialized dispossession and class-based violence in Black communities (Rabin, 1989). However, additional research is needed to better ground truth these concerns, investigating the extent to which upzonings–particularly those that include mandatory inclusionary housing or robust anti-displacement protections–in fact induce household displacement. If it is the case that upzonings instigate minimal displacement pressures, this research could help to better build trust between tenant advocates and YIMBYs, who arguably share a common enemy–unaffordable housing–but that have remained deeply divided on the best policy approach to solve the nation's housing affordability crisis.

## 7. Conclusion

In recent years, cities across the United States have eyed upzonings as a tool to address a host of urban challenges, from improving housing affordability to reducing greenhouse gas emissions through more compact urban development. In response, some tenant advocates have argued that upzoning policies spur gentrification and displacement pressures, arguing that landlords often sell upzoned policies at inflated prices, reflecting their added development potential (Stein, 2018). While previous research has found that land use regulations constraining supply elevates segregation by limiting how much multifamily housing can be built, minimal empirical evidence to date has examined the relationship between upzoning and neighborhood demographic change (Rothwell, 2011).

Although this paper provides some evidence that upzonings are positively associated with gentrification (as measured through the odds of a census tract becoming whiter), upzoning policies are far from one shape and size. Future research is needed to better understand the extent to which upzoning policies that include stronger tenant protection mechanisms (such as mandatory inclusionary housing or anti-displacement protections) induce gentrification and displacement pressures. If implemented with an eye towards minimizing adverse impacts on housing-insecure communities, upzonings hold promise to increase the supply of much-needed housing in strong-market cities, encourage more inclusive forms of urban development, and push back on the long history of public land use interventions advancing racialized dispossession in low-income communities of color.

**Table A1**
Global Model Regression Results.

| Statistic | Coefficient | Odds Ratio | Std. Error | Pr (>\|z\|) | |
|---|---|---|---|---|---|
| Intercept | 0.94 | 2.55 | 0.21 | 0.00 | *** |
| Tax lot area upzoned proportion, 2002–2010 | 0.24 | 1.27 | 0.10 | 0.02 | * |
| Average number of years since upzoning | 0.02 | 1.02 | 0.01 | 0.00 | *** |
| Transit access dummy | 0.17 | 1.19 | 0.04 | 0.00 | *** |
| Distance to CBD (miles) | −0.03 | 0.97 | 0.01 | 0.00 | *** |
| Neighborhood character dummy | −0.04 | 0.96 | 0.03 | 0.21 | |
| Asian proportion, 2000 | −4.84 | 0.01 | 0.14 | 0.00 | *** |
| Black proportion, 2000 | −3.90 | 0.02 | 0.10 | 0.00 | *** |
| Hispanic proportion, 2000 | −3.95 | 0.02 | 0.11 | 0.00 | *** |
| Married proportion, 2000 | 1.64 | 5.16 | 0.19 | 0.00 | *** |
| Children proportion, 2000 | 0.53 | 1.69 | 0.34 | 0.12 | |
| Median age, 2000 | 0.00 | 1.00 | 0.00 | 0.32 | |
| Distance to closest majority-white neighborhood (miles) | −0.58 | 0.56 | 0.04 | 0.00 | *** |
| Renter proportion, 2000 | 0.11 | 1.12 | 0.10 | 0.28 | |
| Average rent, 2000 | 0.00 | 1.00 | 0.00 | 0.00 | *** |
| Number subsidized units | 0.00 | 1.00 | 0.00 | 0.36 | |

Number of Obs: 2,143
Type of estimator: ML (maximum likelihood)
Log-likelihood: 2,650 on 17 Df
AIC: −5,266
Signif. codes: *p < 0.05
**p < 0.01
***p < .001.
Source: NYC Department of City Planning, NYC Department of Finance, NYC Department of Transportation, U.S. Census Bureau.

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## Appendix A

Table A1.

## Appendix B. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.landusepol.2021.105347.

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