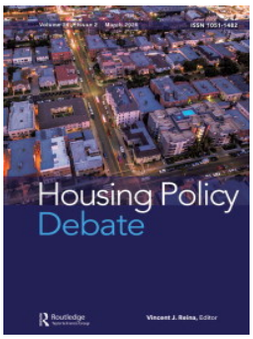

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How Does Upzoning Impact Residential Mobility Among Low-Income Households? Evidence from New York City

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ABSTRACT

As housing costs escalate, upzoning has emerged as a policy tool to expand the supply base and improve housing affordability. Although previous research has examined the relationship between upzoning and housing prices and supply, minimal research has examined how upzoning impacts residential mobility outcomes. We use household-level residential mobility data to examine the effect of upzoning on low-income renter households in New York City. Using propensity score matching and survival analysis, we find that upzoning slightly increased the risk of out-migration among low-income households. This risk grows as upzoning intensity increases, though the overall effect remains small. We further find that upzonings implemented later in the study period were associated with reduced out-migration, though further research is needed to ascertain the cause. Last, results provide suggestive evidence that some subsidized housing programs may help reduce displacement, though the magnitude of effects is modest and not consistent across programs.

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Upzoning; housing supply; residential mobility; big data; zoning reform; housing affordability

Introduction

As cities across the United States face rising housing costs, planners and policymakers are increasingly advocating for loosening regulatory constraints through upzoning to spur additional housing production and improve affordability. Upzoning refers to changing zoning laws to allow for greater development intensity—achieved through various adjustments such as allowing denser forms of development (i.e., accessory dwelling units), raising permitted floor area ratios, or relaxing height requirements (Gabbe, 2018). As upzonings gain traction, empirical studies have begun to examine the impacts of upzoning on land costs, housing production, and affordability (Freemark, 2020; Kuhlmann, 2021; Stacy et al., 2023). But it is also important to understand whether and how upzoning destabilizes communities; are residents able to stay in place after rezoning? Research on how upzoning affects households' residential

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mobility remains limited, constraining an understanding of how land use reforms may shape access to neighborhood opportunity structures.

Although classic economic theory would predict that upzonings will induce a supply response and improve housing affordability, some scholars and activists have raised concerns that upzoning could spur displacement among low-income renters, in particular in gentrifying neighborhoods (Angotti & Morse, 2023; Davis, 2021; Kim & Lee, 2025; Whittemore, 2021). Upzonings could induce displacement through several different pathways. For instance, upzoning could raise land values, resulting in real estate speculation and displacement. Alternatively, upzonings could spur positive amenity effects, raising prices and leading to displacement (Freemark, 2023). However, with some exceptions (Liao, 2023; Peng, 2023), minimal research to date has examined the relationship between upzoning and displacement. As upzonings are widely framed as a tool to desegregate neighborhoods in the policy arena (Sightline Institute, 2024), examining the link between upzoning and displacement is critical for assessing whether upzoning contributes to more equitable housing outcomes, including greater residential stability.

In this paper, we examine a series of upzonings implemented in New York City (NYC) in the 2000s to mid-2010s, during which dozens of neighborhoods across the city were upzoned. We focus on NYC because of the great heterogeneity in neighborhood conditions that were upzoned, including the socioeconomic and racial diversity of the impacted population and the fact that the city is emblematic of the "hot," supply-constrained markets where upzoning is likely to take place. Indeed, several prior studies have focused on NYC for these reasons, finding that upzoning is positively related to the neighborhood's likelihood of becoming whiter, in-migration of more high-skilled workers, and out-migration among residents (Davis, 2021; Liao, 2023; Peng, 2023). Additionally, we focus on NYC given the prevalence of subsidized housing, including that city's robust stock of public housing and rent-stabilized and rent-controlled buildings. Indeed, 1 in 17 households lives in public housing (New York City Housing Authority, n.d.), and about half of renters live in rent-regulated apartments (New York City Comptroller, 2024). Studying a city with a robust infrastructure for housing assistance thus allows us to examine how upzoning intersects with residential mobility in a context where protections against displacement are comparatively strong.

In this paper, we ask three research questions. First, how does upzoning impact the residential mobility of low-income renters? Second, how does the intensity of the upzoning impact the residential mobility of this same population? Third, to what extent do housing assistance programs, such as public housing, stem out-migration? To answer these research questions, we use household-level residential mobility data provided through Data Axle, which is increasingly used in residential mobility studies (Chapple & Song, 2025; Greenlee, 2019; Ramiller et al., 2024). This unique big data synthesizes public and private records to capture household information and granular residential addresses, enabling an analysis of year-to-year mobility outcomes rather than relying on long-interval measures. We then use propensity score matching and a Cox proportional hazards model to examine out-migration patterns among low-income renters in upzoned neighborhoods compared to similar, non-upzoned neighborhoods.

We find mixed evidence on the relationship between upzoning and residential mobility. We find slight increases in the overall probability of a move, with

displacement risks increasing as the intensity of the upzoning increases for renter households and to an even greater degree for low-income renters. However, this pattern does not hold uniformly across the study period. Upzonings implemented in the second half of the study period (2010–2013) were associated with lower observed out-migration risks within a six-year follow-up window, which may reflect differences in neighborhood characteristics, limited redevelopment capacity, or insufficient time for displacement effects to materialize. Further, we find a negative and statistically significant association between out-migration among low-income households and living in public housing or tract-level voucher prevalence, but a null effect among low-income households living in LIHTC buildings in our main model specifications. These results provide suggestive evidence that some subsidized housing policies could help stem displacement pressures, but that effects may vary by housing subsidy program type.

We contribute to the existing evidence base on how upzoning impacts residential mobility in three key ways. First, there are only two studies that have examined this relationship, and both use different datasets; Liao (2023) uses Infutor, and Peng (2023) uses the Longitudinal Employment-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) dataset. Ramiller et al. (2024) compare Data Axle and Infutor data in King County, WA, against the American Community Survey (ACS), finding that Data Axle is much better than Infutor at capturing closer estimates of total populations as well as the relative differences in residential mobility rates across different demographic characteristics. By using Data Axle in the present study, we can potentially provide more precise and demographically sensitive estimates of residential mobility, thus strengthening the validity and reliability of prior studies focusing on the same city. Second, our analysis examines how the intensity of the upzoning, or the increase in development capacity measured through Floor Area Ratios (FAR), interacts with residential mobility patterns. This approach allows for a greater understanding of how the relative intensity of an upzoning could shape subsequent outcomes, while accounting for diverse neighborhood characteristics. Third, we incorporate housing policy variables into our analysis, such as whether the householder lives in public housing or not, which enables us to examine the interaction between upzoning, residential mobility, and rental assistance programs that may help to mitigate the effects of displacement. In doing so, we seek to contribute to a better understanding of how upzoning impacts residential mobility and broader patterns of residential segregation in an era where upzoning is increasingly seen as a core policy to promote housing affordability.

This paper is structured as follows. First, we provide an overview of the literature on how upzoning impacts housing permits and supply, changes in rents and prices, and residential mobility. We then provide additional background about the upzonings under study and the data and methods we used. The next section shares the model results. We conclude with a discussion and policy implications.

Understanding the Relationship Between Upzoning and Mobility

The specific relationship between upzoning and residential mobility has received relatively little scholarly attention, despite the broad interest in the impacts of new housing supply on prices and gentrification. The dearth of studies is likely due to the

challenges in obtaining appropriate parcel-level data on zoning changes, any subsequent construction, and household moves, rather than just housing prices. But another issue is the lengthy (and slightly fuzzy) logic chain. Upzoning should lead to an increase in housing permits, which should increase housing supply. But depending on the market conditions, it might simply lead to land speculation, with or without construction. This activity will lead to changes in rents and prices. According to economic theory, prices should generally decrease if supply has increased, but there are conditions where we will see an increase instead due to amenity effects (Damiano & Frenier, 2026). Then, mobility will vary according to the income of residents. Price decreases will reduce incumbent low-income resident move-outs and increase move-ins, but increases are likely to spur move-outs as well as a decrease in move-ins by low-income newcomers. On the other hand, high-income residents will likely stay longer and move in more often with price increases (given the related transformation of the neighborhood).

In the following review of empirical studies, we break down this logic chain into its components: impacts on housing permits and supply, changes in rents and prices, and residential mobility and neighborhood change. We focus primarily on causal rather than descriptive studies. Given the unique market and context for this study—NYC's hot, expensive market with extensive housing regulations—we identify which studies focus on comparable areas.

Upzoning has mixed effects on residential permitting, depending on the local context. São Paulo, New Zealand, and California have all seen a surge in permits post-rezoning (Anagol et al., 2022; Bhatt, 2023; Greenaway-McGrevy, 2023). However, as a low-density, suburban, weak market context where multi-family development was mostly not allowed prior to the rezoning, the New Zealand case is not comparable to New York; likewise, most of California's surge in permitting was due to accessory dwelling units, which is not relevant to the New York corridor upzonings. Notably, studies in the slower markets of Chicago and Minneapolis have not found any significant impacts (Freemark, 2020; Selvamani, 2023).

Most, but not all, permits result in supply, but there are just two studies, on Auckland and Zurich, that have shown a substantial effect from rezoning on construction (Büchler & Lutz, 2021; Greenaway-McGrevy, 2023). In Portland, just 5% of upzoned parcels were developed (Dong, 2024), and an overview of upzoning across US cities found just a 0.8% supply increase after 3–9 years had passed (Stacy et al., 2023). Others have found no to minimal supply effects in Chicago (Freemark, 2020), Seattle (where there were affordability requirements as well) (Krimmel & Wang, 2023), and Charlottesville (Schragger & New, 2024). One possible interpretation of these limited supply effects is that zoning is not always the binding constraint on new development, or that sufficient time has not passed to witness the effects of these reforms. The impact of upzoning on prices and rents remains somewhat uncertain, due to a lack of evidence. Land values almost certainly increase (Freemark, 2020; Greenaway-McGrevy et al., 2021; Kuhlmann, 2021; Liao, 2023). São Paolo, Auckland, and Boston have seen lower prices and/or rents (Anagol et al., 2022; Greenaway-McGrevy, 2023; Kulka et al., 2023), but there was no significant rent change in Zurich (Büchler & Lutz, 2021).

However, numerous studies have examined the impact of new infill housing construction (regardless of upzoning) on affordability. Impacts on housing prices differ widely based on the type of infill development (Nygaard et al., 2024), so some find price increases (Brunes et al., 2020; Ding & Knaap, 2002), while others find no impacts or decreases (Ahvenniemi et al., 2018; Ding et al., 2000; Wiley, 2009). Studies of the impact of infill housing production (again regardless of upzoning) on rents have been more conclusive, indicating that adding new supply slightly decreases rents in the vicinity. Rents in buildings adjacent to new market-rate buildings in 11 cities across the US decreased by 5–7% (Asquith et al., 2023), and by 1% when new high-rises yielded a 10% increase in housing units in NYC (Li, 2022). New market-rate housing in San Francisco also reduced nearby rents (Pennington, 2021). However, one caveat is that older buildings may experience rent increases even as rent decreases in newer stock (Damiano & Frenier, 2026).

Yet some residents choose to stay and pay more for better amenities despite the increased rent burden, so rent and price changes may be a poor indicator of mobility. On the other hand, the new development and amenities could change the character of the neighborhood so that existing residents feel out of place and depart (Jacobus, 2016). Thus, to understand displacement, it is important to examine actual in- and out-migration patterns. Although not specifically about upzoning, recent research examines mobility patterns related to new residential construction. Multiple studies of vacancy chains have shown that market-rate housing construction may spur in-migration by lower-income households as higher-income households move from lower-rent housing to new market-rate housing (Asquith et al., 2023; Bratu et al., 2023; Mast, 2023; Pennington, 2021). In San Francisco and Los Angeles, new infill development slightly increases the probability of low-income households moving in across most types of neighborhoods but is also associated with slightly heightened out-migration rates (Chapple & Song, 2025).

Finally, the few previous studies that have linked upzoning to mobility patterns focus on the NYC case. Looking at impacts from upzonings from 2004 to 2013, Liao (2023) uses the Infutor dataset and finds that upzoning was associated with a higher likelihood of a move to a different neighborhood or metropolitan area, albeit not to lower-income areas. After the upzoning, neighborhood in-movers tend to come from slightly higher-income neighborhoods. A study of roughly the same period found in-migration by high-skilled newcomers but without impact on low-skilled residents (Peng, 2023). Although not a residential mobility study, Davis (2021) finds that upzoning activity is positively and significantly associated with the odds of a census tract becoming whiter in New York City. While these studies provide insights into how upzoning impacts displacement and neighborhood change overall, they do not distinguish between how different upzoning intensities could potentially have differential effects on neighborhood change. Meanwhile, a more recent study by Kim and Lee (2025) found that upzoning was positively associated with signs of gentrification in New York City, finding that these neighborhoods became whiter, more educated, and more affluent. This study further finds that more intense upzonings (defined as those with more than a 1.0 increase in Floor Area Ratio) were associated with higher rent growth and housing price appreciation, suggesting that upzoning could result in

differential gentrification effects depending on upzoning intensity. However, Kim and Lee (2025) do not directly examine the effect of upzoning on residential mobility.

Background about NYC Upzonings

The 2000s to mid-2010s represented a remarkably active period of rezoning activity in NYC. During Mayor Michael Bloomberg's tenure (2002–2013), the administration rezoned about a fifth of the city as part of the administration's broader goal to spur economic development, facilitate more contextual forms of development, and encourage transit-oriented development (Furman Center, 2010). The 120 rezonings across the city included upzonings, downzonings, and contextual rezonings (Savitch-Lew, 2017). Upzonings increased residential development capacity, while downzonings imposed stricter limits on development. Contextual rezonings made minor adjustments to other controls such as front or side yard requirements to encourage more "contextual" forms of redevelopment. Notably, the racial geography of these rezonings varied; upzoned parcels were more likely to be located in tracts with less than 20% white residents, whereas downzoned parcels had a higher probability of being located in tracts with more than 80% white residents (Been et al., 2014). Unlike rezonings implemented under subsequent mayoral administrations, Bloomberg-era rezonings did not trigger mandatory below-market-rate unit requirements.

Some scholars and activists have criticized Bloomberg-era upzonings for fueling gentrification and displacement, in particular in gentrifying neighborhoods that were upzoned. Prior qualitative research has found that upzoning implemented during this period spurred real estate speculation activity, as landlords were incentivized to strategically withhold properties from the market in anticipation of windfall gains following the upzoning (Angotti & Morse, 2023). Qualitative evidence further suggests that upzoning industrial and manufacturing neighborhoods during this period (e.g., Williamsburg, Greenpoint, and Long Island City) induced industrial business displacement (Checker, 2017; Curran, 2007; Wolf-Powers, 2005). However, minimal research has examined the link between upzoning and residential mobility, which the present study examines using data and methods that are described in further depth below.

Data and Methods

Data

This study relies on a unique proprietary big dataset produced by the private company Data Axle (formerly InfoUSA, Infogroup) to measure household-level demographic characteristics and residential mobility. Data Axle consumer data contains location information and imputed sociodemographic characteristics, which researchers are increasingly using to study residential mobility in various housing policy and neighborhood change contexts (Ramiller et al., 2024). Research suggests that Data Axle reports a similar number of households to the census estimates even at a granular geographic scale such as census tracts, but also contains bias in terms of representing different demographic groups and systematically undercounts residential mobility (Phillips, 2020; Ramiller et al., 2024). Meanwhile, although Data Axle systematically

underestimates mobility rates, it also captures relative differences in mobility rates across groups effectively (Ramiller et al., 2024), suggesting that the data can be useful for analyzing residential mobility if we move beyond the raw data and apply statistical models that can account for the discrepancies in the mobility rates in probabilistic terms.

We find similar results for our study area in our data validation during the 2006–2010 and 2015–2019 periods, where Data Axle estimates of the total number of households, share of renter households, and share of Black households in census tracts closely align with the American Community Survey (ACS) estimates at Pearson's correlation coefficient values near 0.95. Correlations are weaker at the block group level (coefficients ranging between 0.81 and 0.94), likely reflecting the larger margins of error in ACS estimates at that scale. This study uses covariate adjustment in a regression framework to address these issues, following similar studies (Song & Chapple, 2025).

One of the limitations of the Data Axle dataset is the inconsistency of the income variables within a household across different observation years. To address this issue, we follow prior studies and smooth household income by assigning each household to an income category based on the modal value for each location (Chapple et al., 2022; Song & Chapple, 2025).[1] We use the 5-year ACS data to obtain NYC's median household income, using values in the midpoint years to categorize households into five income groups, which are then used to compute the modal value—very low (below 50%), low (below 80%), moderate (below 120%), middle (below 150%), and high (150% and above).[2] Given our focus on the impacts of upzoning on low-income renters, we narrow our focus to households classified as very low- or low-income renters, but also set aside all renter households as a reference group to compare the modeling results. We also retain the income categories in the empirical models to account for residual differences between very-low and low-income renters, which helps prevent confounding between household income variation, exposure to upzoning, and the other covariates. Following the approaches of other studies (e.g., Thomas et al., 2024), we predict the householder's race (non-Hispanic white, Black, Asian, Hispanic) based on their full names using the rethnicity package in R, which is based on voter registration data (Xie, 2022).

Methods

Identifying Upzoned Block Groups

The first step in the analysis involved identifying upzoned parcels. To identify parcels that were upzoned, we used parcel-level data available from the NYC Department of City Planning's Primary Land Use Tax Lot Output (PLUTO) database. We identified upzoned parcels by examining parcels that experienced a positive increase in their maximum allowable Floor Area Ratio (FAR) between 2006 and 2015, were located within a city-initiated rezoning boundary, and underwent a zoning code change between these years (Furman Center 2010).[3] We examined city-initiated upzonings, or "proactive upzonings" (Denoon-Stevens & Nel, 2020), in order to focus on municipally initiated upzonings, as opposed to upzonings initiated by a private applicant. Although the Bloomberg administration initiated rezonings dating back to 2002, we

focused on examining upzonings between 2006 and 2015, as observations in the Data Axle dataset only begin in 2006. As our analysis accounts for pre-upzoning conditions by examining demographic changes dating back to 2000, it was necessary to exclude any upzonings that took place between 2000 and 2005 so as not to confound the effects of these prior upzonings on the analysis.[4] We repeated the above steps to identify upzonings that took place between 2000 and 2005 and removed them from consideration in the analysis.[5]

After identifying the upzoned parcels, we then aggregated the parcel-level data up to the census block group level, assigning each parcel to the block group with which it shared the greatest proportion of land area. To capture the intensity of the upzoning at the block group level, we calculated an area-weighted measure of FAR change. For each parcel, we multiplied the change in maximum FAR by the parcel's lot area, summed these values across all parcels in a block group, and then divided by the total lot area of parcels in the block group. This yielded a block group-level estimate of average change in allowable FAR, weighted by parcel size. We then used Jenk's Natural Breaks to classify upzonings into three upzoning intensity categories including "tiny" upzonings (< 0.27 average FAR increase), "moderate" upzonings (0.27–0.67 average FAR increase), and "big" upzonings (0.67–2.8 average FAR increase). The "big" upzoning category combines the top two break categories because data was sparser in that spectrum of the intensity distribution. Distinguishing between these upzoning types allows us to examine how upzoning intensity interacts with residential mobility patterns.

Propensity Score Matching

To examine the effect of upzoning on residential mobility among low-income households, we used propensity score matching (PSM) and a Cox proportional hazards model. PSM involves matching a treated unit (i.e., an upzoned block group) with a comparison unit (i.e., a non-upzoned block group) based on a propensity score (Hollander & Renski, 2017). The goal of propensity score matching is to reduce selection bias. The propensity scores are developed using a logistic regression model, in which a binary outcome variable (i.e., whether a block group was upzoned or not) is regressed against a series of baseline covariates measured before the intervention. The propensity score represents the predicted probability that a block group would be upzoned based on baseline covariates included in the model. A propensity score matching algorithm then identifies the best match between a treated and a comparison unit. We used R's MatchIt package, using nearest neighbor matching, as the propensity score algorithm. The matching process thus helps to reduce selection bias and ensure that comparison units are similar, on average, as their treated counterparts.

Baseline covariates included in the logistic regression model should represent covariates that impact both treatment selection and the outcome variable of interest (Austin, 2011; Dong, 2024). We ran two propensity score models. In the first model, we incorporated a series of baseline covariates representing parcel- and neighborhood-level characteristics measured prior to the upzonings. In the second model, we incorporated a variable to indicate neighborhood churn, or the percentage of households living in a different house between 1995 and 2000, available from the US Census. As block group boundaries change between the 2000 and 2010 decennial

censuses, we used geographic crosswalks available from the National Historic Geographic Information Systems (NHGIS) to handle data interpolation.[6]

We included several variables in the propensity score models. At the neighborhood level, we included variables representing total population, median household income, the percentage change in newly built units in the last ten years, median house value, racial demographics, the percentage of renter and owner-occupied units, and the vacancy and poverty rate. We also included several parcel-level variables that we aggregated up to the block group level. For instance, we included a variable capturing whether the block group was subway-accessible or had underbuilt development capacity (measured through the parcel's floor area ratio), as city officials might have been more likely to target transit-oriented areas that could accommodate added density for upzoning. We also included variables representing the median lot size, the most common land use, and the distance of the block group to the Central Business District (defined as Midtown Manhattan).

Prior to running the propensity score model, we first removed 306 block groups that included block groups with fewer than 200 people living in them (many of which overlapped with parkland). Since our study examines upzonings that took place between 2006 and 2015, we removed 518 block groups that were upzoned between 2000 and 2005. In total, about 14% of all block groups (standardized to 2010 geographies) were removed from the analysis. Appendix 1 presents the characteristics of block groups that we excluded from the PSM model against all block groups. As Appendix 1 shows, ineligible block groups reported higher median home values and household incomes, a lower share of households living in poverty, a greater share of white residents, and a lower share of Black residents compared to all NYC block groups. After running the PSM model, we tested whether there were significant differences between the treated and comparison groups, with the final PSM model not including the neighborhood churn variable.[7] Table 1 in the Results section provides balance statistics for the final model used in our analysis.

Survival Analysis

To explain how upzoning is associated with household residential mobility, we analyze Cox proportional hazards models with a set of covariates. These models estimate the hazard rate—the risk of a household relocating at a given time, conditional on the household remaining in place up to that point—which is expressed through the hazard ratio, calculated by exponentiating the model coefficient (Gailey et al., 2025). Prior studies on residential mobility have used Cox proportional hazards models across diverse contexts, such as to model the effect of environmental exposures on the expected time to a residential change (Brokamp et al., 2016) or to model the effect of moving frequency on health outcomes, such as diabetes and hypertension (Jacobson et al., 2020).

In the Cox model, a positive coefficient (or a hazard ratio greater than 1) means that a unit increase in the independent variable is associated with an increased hazard (or higher risk of moving out at a given moment); a negative coefficient (or a hazard ratio less than 1) indicates a lower risk. We analyze proportional hazards models because they allow us to capture the timing of events, accounting for censored

Table 1. Difference of means in prematching and postmatching variables in upzoned versus comparison block groups.

Variable	Treated mean	Control mean	*p*-value	Significantly different?
Population (2000)	1302	1290	0.58	No
Median household income (2000)	$35,745	$36,252	0.52	No
Percent units built from 1990 to 2000	3%	3%	0.26	No
Median home value (2000)	$183,385	$187,428	0.57	No
Percent white (2000)	29%	30%	0.41	No
Percent Black (2000)	33%	33%	0.81	No
Percent Hispanic (2000)	22%	22%	0.57	No
Percent Asian (2000)	11%	11%	0.66	No
Percent owner occupied (2000)	33%	33%	0.63	No
Percent renter occupied (2000)	67%	67%	0.63	No
Percent vacant units (2000)	6%	6%	0.61	No
Percent households in poverty (2000)	20%	19%	0.20	No
Median lot area	3483	3602	0.78	No
Median underbuilt capacity	0.56	0.84	0.00	Yes
Distance from CBD (miles)	7.4	7.2	0.13	No
Subway accessible (0/1)	0.2	0.2	0.07	No

observations (households that have not yet relocated) using continuous event time rather than fixed intervals.[8] The model distinguishes households that move earlier from those that move later during the observation period, but it assumes proportional covariate effects on the hazard. Accordingly, the Cox model estimates relative hazards conditional on timing, rather than time-varying covariate effects. In contrast, studies that simply compare changes in household location using regression models usually focus on a shorter time frame because they cannot account for the duration of time since the intervention (upzoning) and its effect on the likelihood of moving out (e.g., Song & Chapple, 2025). Hazard ratios summarize relative hazards, but they do not directly indicate the probability of relocation. For our final headline models, we also report the cumulative predicted risks for a baseline household profile in Appendix Table 2. By using Cox models, we can better understand not only whether out-migration occurs at a higher rate in upzoned neighborhoods, but also, conditional on timing and censoring.

We converted Data Axle's panel structure into one compatible with survival analysis. The data was "compressed" so that each household is assigned the first year when it was observed in a unique location, as well as the last year it was observed in that same location. For the main model specification, we track households from 2006, when our data is first available, to 2019, which captures locational trajectories several years after the last wave of upzonings while excluding the impacts of the COVID-19 pandemic. This structure allows us to examine transitions between locations over time, capturing the duration and timing of residential mobility. We create two such survival data frames: one for all renter households and another for low-income renter households. Using this data structure, we analyze two sets of models: (a) base models

that explain the association between upzoning and household out-migration, and (b) adjusted models that control for householder age, sex, race, marital status, and presence of children in the household from the Data Axle dataset.[9] Since these characteristics vary over time, but each household-location combination is summarized to a single observation, we use the mode values during the period in which the household was observed in its location of interest. We also merge the household data with NYC Housing Authority (NYCHA) public housing development data to account for whether the household lived in public housing. Additionally, we used HUD's "Picture of Subsidized Households" database to include a variable capturing the tract-level voucher rates (normalized by the number of renter-occupied units) in 2014. Finally, we used HUD's 2019 LIHTC Database to identify Low-Income Housing Tax Credit (LIHTC) buildings placed in service between 1987 and 2018 and identify whether a household lived in an LIHTC building or not in a given year.

Results

The first step in the analysis involved ensuring that the treatment and comparison block groups identified through the propensity score matching process achieved greater balance following the matching process. As Table 1 shows, the treated and comparison groups were more balanced post-matching, with only 1 of 16 variables statistically different from one another post-matching (at a 0.05 significance level). Specifically, the median underbuilt capacity was lower among treated units. Although perfect balance across all covariates is the ideal, the fact that the majority of variables were no longer significantly different suggests that propensity score matching successfully reduced observable selection bias. While the remaining imbalance should be considered a limitation of the present analysis, the improved balance indicates that the matched sample provides a stronger basis for estimating the treatment effect than the unmatched data. Nonetheless, the fact that there is imbalance in these characteristics may introduce bias into the estimated treatment effects, particularly in neighborhoods where these characteristics are most divergent between the treated and comparison groups. As described below, we conduct a sensitivity analysis to further validate our model results.

The Cox proportional hazards modeling results are presented in Table 2. First, the base model (Model 1) analyzes the relationship between upzoning and out-migration and a variable indicating whether the upzoning took place during the second half of the study period (between 2010 and 2013).[10] When examining the relationship between upzoning intensity and out-migration risks, we find that the coefficients for the upzoning categories were all positive and statistically significant for low-income renters. For example, the hazard ratio for big upzonings in the low-income renters model was 1.349 (exponentiated from the coefficient 0.300), which suggests that low-income households living in big upzoned block groups had a 34.9% higher rate of moving out of their location at any given time compared to their counterparts living in non-upzoned block groups. Impacts of upzoning on out-migration were also greater for low-income renters than for all renters across the board. However, upzoning intensity was not linearly related to the chances of out-migration in the base model. Moreover, upzonings introduced later in the study period were significantly associated

Table 2. Cox proportional hazards modeling results.

Model	Model 1		Model 2	
Sample	All renters	Low-income renters	All renters	Low-income renters
Upzoning				
Tiny upzoning	0.033	0.210***	0.006	0.094**
Moderate upzoning	0.128***	0.313***	0.140***	0.182***
Big upzoning	0.079	0.300***	0.199***	0.263***
Later upzoning flag (2010–2013)	−0.378***	−0.292***	−0.271***	−0.231***
Householder age				
25–34			−0.042***	0.004
35–44			−0.534***	−0.467***
45–54			−1.044***	−0.953***
55–64			−1.303***	−1.234***
65+			−1.482***	−1.422***
Householder sex				
Female			0.062***	0.171***
Unknown			−0.297***	−0.160***
Householder race				
Black			−0.326***	−0.410***
Asian			−0.291***	−0.374***
Hispanic			−0.498***	−0.611***
Income				
Low			0.240***	0.242***
Moderate			0.289***	
Upper			0.489***	
Married			0.087***	0.046*
Has children			−0.560***	−0.727***
Public housing			−0.244*	−0.297**
LIHTC			0.018	0.004
Voucher			−1.091***	−1.008***
Model summary				
R^2	0.003	0.004	0.052	0.044
Num. obs.	3,171,001	1,883,161	3,171,001	1,883,161

***$p < 0.001$.
**$p < 0.01$.
*$p < 0.05$.

with lower observed out-migration rates among both all renters and low-income renters, suggesting that upzonings implemented during different time periods may have differential effects on residential mobility, which we explore in greater depth below.

Once we control for household covariates (such as the householder's age and race) and the presence of subsidized housing in Model 2, we observe that a more systematic pattern emerges concerning the impacts of upzoning on residential mobility. The coefficients for upzoning categories are now ordered so that block groups with greater upzoning intensities are associated with a greater chance of out-migration across both models for all renters and low-income renters. In Model 2, the risk of out-migration among low-income renters continues to be higher than that of all renters. However, the risk of out-migration is generally reduced compared to Model 1. The effects of tiny upzonings were the smallest, with hazard ratios of 1.006 and 1.098 for all renters and low-income renters, respectively. However, the effect of tiny upzoning on all renters was not significant. Compared to the tiny upzoning category, the hazard ratios were greater for moderate (all renters: 1.150, low-income renters: 1.199), and big (all renters: 1.220, low-income renters: 1.300) upzonings. Across all upzoning intensities, low-income renters consistently faced an elevated risk of out-migration compared to

all renters. These effects are captured as different probabilities (or risks) of out-migration for a hypothetical low-income renter household in Appendix Table 2, where the probability of moving out by year 3 rises from 21.6% under no upzoning to 27.2% under big upzoning. Similar to Model 1, we again found that upzonings that were implemented later in time during the study period were associated with lower observed move-out rates. Thus, in Model 2, we found that upzoning intensity was positively and significantly correlated with a household's likelihood of moving out, that greater upzoning intensity increased the risk of out-migration, and that the risk of out-migration was slightly higher among low-income renters compared to all renters. We further found that upzonings implemented later in the study period were associated with lower observed out-migration risks.[11]

Model covariates showed effects consistent with prior research on residential mobility (e.g. Chapple & Song, 2025; Song & Chapple, 2024). Chances of out-migration were lower for householders that were older, were racial/ethnic minorities, or had children. Notably, residence in public housing was associated with lower chances of out-migration ($\beta = -0.297$, $p < 0.01$). While we were unable to control for whether specific households used a Housing Choice Voucher or not, the controls for tract-level voucher rates were negatively associated with out-migration, potentially suggesting that voucher utilization could dampen out-migration risk ($\beta = -1.008$, $p < 0.001$). However, we did not see significant associations between out-migration risks and LIHTC residency ($\beta = 0.004$, $p > 0.05$). These results allude to the possibility that some rental subsidy programs may help stem out-migration among low-income renters in upzoned areas, but also that effects could vary based on the specific housing subsidy program.[12]

Although propensity score matching substantially improved balance between the treatment and comparison groups, residual imbalance raises the possibility that households in treated block groups may differ in unobserved ways that correlate both with upzoning and out-migration risks, which could bias estimated treatment effects. To further validate model results, we conducted a sensitivity test (Appendix Table 3) comparing out-migration risks among households living in block groups without upzoning against households that lived on an upzoned *parcel* in an upzoned block group and households that lived on a non-upzoned *parcel* in an upzoned block group. In the final sensitivity test model (Model 2 in Appendix Table 3), we found that living on an upzoned parcel was positively and significantly associated with out-migration among low-income households. However, living on an upzoned parcel in an upzoned block group did not have a significant effect on out-migration among all renters. The sensitivity analysis therefore provides further support for the main model finding that upzoning is positively associated with out-migration risks among low-income renters. If the main model findings were an artifact of unmeasured differences between treated and comparison block groups, we would expect parcel-level distinctions to weaken or eliminate the estimated effects. That upzoning continues to be associated with heightened mobility among low-income renters in the sensitivity analysis provides further evidence that the association found in the main models is not likely a product of residual imbalance, but instead reflects the pressures generated by the upzoning itself.

Our results that upzonings implemented during the second half of the study period (2010–2013) were associated with lower observed displacement risks warrant additional

scrutiny. In follow-up models, we examined how the timing of the upzoning impacted subsequent out-migration risks, restricting follow-up to six years to allow a more comparable examination of households after upzoning occurs, rather than tracking households through 2019 (as performed in the main models). This analysis allows us to examine how displacement patterns may differ between upzonings implemented earlier in time (2006–2009) versus those implemented later in time (2010–2013) and examine displacement effects across a narrower time period. Among upzonings that were implemented earlier in time, living on an upzoned parcel was not significantly associated with increased out-migration risks among low-income households within the six-year follow-up window (Appendix Table 4). These results suggest that displacement effects may take longer than six years to materialize in our study context. Given that the redevelopment process (such as parcel assembly, financing, approval, and construction) can span several years, it is possible that the displacement effects of the early upzonings are not fully reflected within the shorter observation period but drive the displacement effects observed in the main model. The temporal context may also matter: New York City experienced intensified gentrification and reinvestment by the mid-2010s, which may have increased redevelopment demand and amplified displacement risks for low-income renters (Song & Chapple, 2024).

For upzonings implemented later in time (2010–2013), living on an upzoned parcel in an upzoned block group was associated with lower observed out-migration risks for all renters and low-income renters (Appendix Table 5). Although we cannot directly test the underlying causal mechanisms driving this relationship, we explored a few hypotheses as to why later upzonings were associated with lower observed displacement within the follow-up period. First, we examined whether the redevelopment potential differed between early and late upzonings by comparing median underbuilt capacity (a proxy for redevelopment potential) across block groups that were upzoned in the earlier versus later period. Parcels with higher underbuilt capacity offer greater physical and economic feasibility for redevelopment and therefore may be more likely to attract speculative investment or redevelopment pressures that could contribute to displacement; we reasoned that if parcels in block groups upzoned later in the study period reported lower underbuilt capacity, they might be less attractive to developers, thus reducing redevelopment pressures and lowering associated displacement risks. Consistent with this hypothesis, we found that parcels in later upzoned block groups reported significantly lower underbuilt capacity ($p < 0.05$).

Another possible explanation for the lower observed displacement risks associated with later upzonings is that the neighborhoods targeted for upzoning in the later period may have differed in important ways from those upzoned earlier. To assess this possibility, we compared the socioeconomic characteristics of early versus late upzoned block groups using 2009–2013 ACS data, finding that late upzoned block groups had significantly higher shares of white, college-educated people and reported higher median rents and home values. In these more socioeconomically advantaged—and often more residentially stable—neighborhoods, renters may be less vulnerable to displacement pressures generally, and upzoning may be less likely to trigger mobility or may even reduce moves. Thus, differences in neighborhood composition offer a plausible explanation for why later upzonings were associated with lower

observed out-migration. However, future research needs to further disentangle the causal mechanisms driving the relationship between upzoning and displacement, as will be discussed in further depth below.

Discussion and Conclusion

Overall, our findings suggest that displacement risks increase as the intensity of the upzoning increases for all renter households, including low-income households, but that the absolute differences in predicted risk for a typical household remain modest. One interpretation of these findings is that more intense upzonings may lead to more significant redevelopment, which could signal greater neighborhood transformation, attract higher-income residents or amenities, and increase displacement risks (Kim & Lee, 2025). In comparison, less intense upzonings might result in only modest increases in the housing supply, which could reduce competition for housing without triggering widespread redevelopment and displacement. In other words, the benefits of potential increases in the housing supply could outweigh potential gentrification and displacement effects. However, it is worth reiterating that the overall effects of out-migration across all upzoning intensities were marginal (as illustrated by the predicted risks in Appendix Table 2) and with less than 3 percentage-point differences in out-migration risks between baseline households in a big-upzoned block group compared to a non-upzoned block group.

Our results further indicate that upzonings implemented during different time periods are associated with different patterns of displacement risks. Upzonings implemented earlier in the study period were not associated with increased out-migration within a six-year follow-up window, but they did show significant associations when we tracked households through 2019. This pattern may suggest that displacement pressures unfold more gradually than a short follow-up period can capture, potentially due to long redevelopment timelines. These results point to the importance of using longer observation windows when evaluating residential outcomes associated with zoning changes.

A few different factors could help explain our finding that later upzonings were associated with lower observed displacement risks. One possibility is that insufficient time may have elapsed for displacement effects to fully materialize and be observable in the data. Second, differences in redevelopment potential—reflected in the lower buildable capacity of parcels in later-upzoned block groups—may have reduced pressures for redevelopment and associated displacement. Third, the neighborhoods targeted for late upzonings differed demographically from those upzoned earlier, which may make renters in these areas less vulnerable to displacement pressures on average.

Our models further suggest that some housing subsidy programs may play a role in mitigating displacement pressures; indeed, living in public housing or neighborhoods with higher shares of Housing Choice Voucher use was associated with lower out-migration among low-income households, whereas residence in LIHTC buildings did not show a significant association. Although these patterns warrant further investigation, particularly given the differences in program design and tenant populations, they indicate that some forms of subsidized housing may provide greater stability than others. Additional research would benefit from exploring why and if specific

housing subsidy programs better buffer households from upzoning-related displacement pressures.

Limitations of our analysis point to important avenues for future research. First, our study does not account for the amount of affordable housing produced through the Voluntary Inclusionary Housing (VIH) program implemented under Mayor Koch in 1987. While developers could voluntarily opt in to providing below-market-rate units under the VIH program, uptake was limited, as developers often did not consider a density bonus a sufficient incentive to develop below-market-rate units (Independent Budget Office, 2024).[13] As a result, our analysis cannot assess whether the inclusion of below-market-rate units in some upzoned areas may have moderated displacement pressures. However, the subsequent introduction of Mandatory Inclusionary Housing (MIH) under the de Blasio administration, which required affordable set-asides in newly upzoned areas, creates an opportunity for researchers to examine how affordability requirements could shape displacement risks.

Second, when upzoning occurs in neighborhoods with high churn, we observe smaller increases in mobility (i.e., displacement) relative to more stable areas. This suggests that the incremental effect of upzoning on residential turnover is lower in these contexts; however, a smaller increase in mobility does not necessarily imply a smaller negative effect on residents' well-being, as households leaving high-churn neighborhoods could relocate to lower-opportunity neighborhoods. Further research is needed to understand how baseline mobility patterns shape subsequent residential trajectories, such as the residential destinations of households moving out of upzoned areas.

Third, future research should explore the precise mechanisms through which upzoning impacts displacement. While we find that upzoning was significantly associated with increased mobility among low-income renters, our analysis does not illuminate which direct or indirect mechanisms drove this relationship. For instance, upzoning could trigger displacement through direct effects, such as new construction that physically replaces existing, affordable housing and ultimately results in tenant displacement. Upzoning could also induce displacement indirectly if it results in rising land values or shifts in higher-end amenities that make the neighborhood more desirable and expensive. Disentangling these causal pathways would allow researchers to decompose which factors most strongly drive mobility patterns and provide a clearer roadmap on how to design policy interventions that mitigate potential displacement risks.

Fourth, an important limitation of the analysis concerns the measurement of household income. While we frame our results in terms of low-income households, the underlying data are derived from a modeled consumer reference dataset, which may undercount or misclassify certain populations, particularly very low-income households (Ramiller et al., 2024). The household income measure thus may be subject to measurement error, and we encourage future work to explore displacement using additional sources of household-level income data where available to further validate estimates of low-income household mobility.

Finally, future research should more closely examine whether certain housing subsidy programs are more effective than others in buffering residents from displacement pressures. Our models offer preliminary evidence that public housing and tract-level

voucher prevalence may help mitigate out-migration among low-income households, while LIHTC shows no significant association. A deeper investigation into program-specific mechanisms would strengthen an understanding of how different housing subsidies interact with upzoning and help inform the design of a more effective anti-displacement framework.

Notes

1. Because Data Axle's household income variable is produced through a proprietary estimation process (Ramiller et al., 2024), we use smoothed ACS-derived income categories to improve consistency. Descriptive checks show that while household income and block group median household income are correlated, there is substantial variation within block groups, indicating that the household measure captures more than neighborhood context. Using neighborhood income would classify households by local socioeconomic conditions rather than by their own resources. As a robustness check, we stratified block groups into lower- and higher-income neighborhoods using ACS median household income; the resulting models yielded patterns consistent with our main estimates, indicating that our findings are not sensitive to whether income is defined at the household or neighborhood level.
2. There is no 5-year ACS data for 2006 to 2008, so we impute the city median income assuming a constant growth rate. Over 80% of households in the sample belonged to two or less distinct income categories throughout the study period.
3. We used the "NYC GIS Zoning Features" shapefile available from the NYC Department of City Planning to identify zoning map amendments where the lead applicant on the rezoning was the NYC Department of City Planning.
4. The earliest year for the PLUTO dataset is 2002. To account for upzonings that took place before that, we used the "NYC GIS Zoning Features" shapefile and project documents to identify upzonings where the lead applicant was the NYC Department of City Planning. Probable upzonings between 2000 and 2001 were removed from the analysis.
5. While we would ideally be able to include information on upzonings that took place prior to 2000, data limitations inhibit us from doing so, which is a limitation of the present analysis. However, the prior Giuliani administration did not pursue upzonings with the same vigor as the subsequent Bloomberg administration, and we therefore expect the number of upzonings in the 1990s to be comparatively less widespread.
6. These crosswalks include interpolation weights that enable the researcher to estimate how a variable measured in the base year (e.g., the number of households) can be allocated to a different geographic unit in a subsequent year based on boundary changes.
7. We tested a model with a neighborhood churn variable from the 2000 census, which measures the percent of populations that lived in a different house in 1995. However, introducing this variable led to an additional variable to be significantly different between the treatment and comparison block groups in the PSM model. Although we do not use neighborhood churn in block group matching, we explicitly control for churning in the sensitivity survival analysis.
8. In the paper, we use the term "risk of moving out" as shorthand for the hazard of moving in the Cox proportional hazards model, or the rate at which households relocate at a given point in time, conditional on having remained in place up to that point. This usage does not refer to the cumulative probability of moving over a fixed period.
9. As a sensitivity check, we add neighborhood churn measures (the rolling three-year average of in-migration and out-migration rates in the block group) during the three years preceding each household's exit year, following Chapple and Song (2025) and Song and Chapple (2024). Churn is computed from Data Axle and imputed for edge years (in-migration

2006 to 2008; out-migration 2006 to 2007 and 2019). For households that never move out, churn is assigned using the last observed year. Including the churn measures attenuates the upzoning coefficients while preserving sign and significance; housing subsidy variables lose statistical significance. This attenuation suggests that the effects of upzoning are stronger in more stable neighborhoods (or those with lower levels of existing churn), highlighting the role of baseline mobility patterns in shaping policy impacts. Since churn represents a potential pathway through which upzoning affects displacement and is a measure of displacement pressure, controlling for it introduces post-treatment bias by absorbing part of this mechanism. As a result, we treat these estimates as sensitivity estimates only. Across all models, the variance inflation factors (VIFs) for the independent variables are lower than 3, indicating that multicollinearity is not a concern.

10. Although our study period extends until 2015, no block groups that were upzoned in 2014 or 2015 were selected as matches in the ultimate propensity score matching model. For this reason, the second half of the study period is listed as only extending until 2013.
11. With churn controls, upzoning effects attenuate across all intensities but remain statistically significant, with larger effects at higher intensities. The reduced gap between all renters and low-income renters suggests churn-related channels matter more for low-income households.
12. We conducted an additional analysis examining the effect of upzoning on all homeowners and low-income homeowners. None of the upzoning categories had a significant effect on all homeowners' or low-income homeowners' risk of out-migration. However, upzonings implemented later in the study period continued to have a significant and negative effect on out-migration among all homeowners and low-income homeowners. Results from the homeowner analysis are available upon request.
13. The Association for Neighborhood and Housing Development (2013) found that only 13 percent of units (about 2700 units) developed in upzoned neighborhoods under the Bloomberg administration were affordable units. The present analysis does not control for whether upzonings included voluntary affordable units, which is a limitation of the analysis.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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