Bad Maintenance: How Gentrification Influences Landlord Behavior and Housing Quality

Sam Gass

Columbia University

QMSS Masters Thesis

Contents

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Abstract

When a neighborhood gentrifies local residents are often displaced by rising costs of housing and goods. In New York City regulations such as rent control and rent stabilization protect tenants from these forced migrations. When rents and real estate prices increase, the owners of buildings that contain these regulated units can lose untold sums of money due to these protections. This study seeks to quantify this dynamic through the use of 311 housing complaints and real estate data. It finds that, when a local area gentrifies, these complaints significantly increase. I contend that this relationship signifies the neglect and harrassment of local tenants by landlords attempting to rid themselves of regulated tenants in order to capitalize on favorable market conditions.

Chapter 1

Introduction

As city landscapes have continued to transform during the 21st Century, gentrification has once again moved to the forefront of the conversation surrounding urban transformation. Those who perceive the process as a negative force will often cite the displacement of local residents as its primary consequence. More formal studies have found it difficult to measure displacement related to gentrification, but most will cede to its existence on some level. The framework of this contention is sound; when the socioeconomic makeup of a neighborhood changes, prices of goods, services and real estate escalate beyond the economic means of current residents, ultimately forcing at least some to move.

Often neglected in this discussion is the role of the landlord or building owner in gentrification related displacement. Witnesses frequently provide firsthand accounts of landlords neglecting or harassing tenants when rents escalate. In New York City, rent control and stabilization are two of the primary defenses against the potential displacement of local tenants. When rents increase, these protections prevent landlords from renting out the units at higher rates or from selling their buildings for large profits. This dynamic can generate tension between a building owner and rent stabilized/controlled tenants who stand in the way of increased profits.

The complexities of this process is routinely discussed among tenants, advocates, and media outlets; but

rarely mentioned in academic journals. The lack of scholarly attention given to this issue in publications most likely originates from both inadequate data availability and the related difficulties in tracking patterns of local urban migration. This study endeavors to circumvent these roadblocks and quantify the previously mentioned phenomenon. It utilizes new sources of data to discern how fluctuations in local real estate markets modify the quality of housing and the behavior of landlords towards their tenants.

Chapter 2

Literature Review

A search for academic literature studying landlords and their contribution to gentrification related displacement returned few results. One study that relates very closely to this subject is a paper written by Richard Arnott and Elizaveta Shevyakhova in 2014 titled "Tenancy rent control and credible commitment in maintenance" (Arnott and Shevyakhova 2014). In this study, they examine the effect of rent stabilization laws on maintenance and housing quality for tenants with those protections. They posit that landlords have low incentive to maintain units with rent stabilization at the beginning of the lease. The study observes the relationship from an economic perspective, hypothesizing that the building owner will attempt to make up for the financial loss incurred by the regulation through a reduction of maintenance on the unit (Arnott and Shevyakhova 2014).

Despite the lack of studies in the focus area of this paper, the thorough literature on gentrification establishes a useful foundation for the study. It builds upon previous examinations of displacement by focusing on the role of landlords and building owners. Specifically, it observes how changes in local residential real estate markets, a proxy for gentrification, influence housing complaints.

Gentrification exists at the intersection of urban migration, economic inequality, urban renewal, poverty, sociology, and social economics. This locality it occupies in academia makes the process of reaching a consensus definition arduous. Some view the process as a necessary transitional force in decaying neighborhoods. This

conceptualization identifies gentrification as an organic development in the course of urban life cycles. The opposing argument decries gentrification as a destructive force whose collateral effects are borne primarily by the impoverished.

The ambiguity in the academic debate also bleeds into the political sphere. Lagendijk et. al. (2014) argue that the definition has shifted into an 'open concept'. Without an agreement of cause and effect, politicians have little leverage in enacting effective policies to mitigate displacement. Another perspective on this issue accepts gentrification as a problem, but suggests policies to counter it may do more harm than good (Sheppard 2012). With such doubt surrounding the definition and effects of gentrification, the progress towards consensus has lost momentum (Bondi 1999).

2.1 Gentrification in Academic Literature

The term gentrification was coined in 1964 in reference to the movement of middle class families in London (Sheppard 2014). Throughout the years many definitions for the phenomenon have emerged. Some focus on demographics; "a dramatic shift in their demographic composition toward better educated and more affluent residents" (Freeman and Braconi 2004). Others on the labor market: "Gentrification refers to a process of class succession and displacement in areas broadly characterized by working-class and unskilled households" (Atkinson 2000). Most approaches generally focus on changes in local urban populations.

In the mid 1970's the reverse migration of affluent individuals whom had fled the cities in the 40's, 50's, and 60's induced rapid changes in urban landscapes across the US (Henig 1981). This brought renewed interest to the study of gentrification and its potential effects on urban landscapes and the people who lived in them. The study of the phenomenon during this period mirrors the overarching narrative in its history; research struggling to identify the impact of the process as the public narrative focused on its perceived destructive effects.

Despite public opinion, much of the evidence gathered suggested that the displacement of poor residents was

overstated and that the urban migration was less significant than believed (Henig 1981). Newman and Owen (1982) estimated that displacement in US urban areas was only about 1%. They found that disadvantaged residents were more likely to be displaced, but were not necessarily worse off after displacement(Newman and Owen 1982). Lee and Hodge (1984) contended that the opinion that gentrification was the driving force behind urban displacement was misguided. They found that gentrification only accounted for some of the displacement in urban areas, and that other causes such as arson, industrial expansion, natural disasters, speculation, and government programs accounted for just as much if not more (Lee and Hodge 1984).

Studies that found some evidence of gentrification caused displacement even acknowledged that the effect was probably overstated in social discourse. Henig (1981) found that gentrification in the late 1970's increased the rate of displacement for elderly individuals but could not make 'firm and dramatic conclusions' due to the lack of evidence and complexity of tracking migration (Henig 1981). Marcuse (1986) acknowledges that tracking displacement from gentrification proves especially difficult because individuals who are displaced by the process generally migrate within the city. He found the overall effect of gentrification in New York City during the 1980's indeterminate, observing that a cost benefit analysis proves useless when one group is receiving the benefits and another the costs (Marcuse 1985)

Similar urban migration patterns in the 1990's caused a second wave of gentrification research. The global economic downturn during the 1970's and 1980's had reversed, or at least slowed, some of the previously seen patterns of gentrification and displacement (Lees and Bondi 1995). With the economic boom of the 1990's came another re invigoration of wealthy urban migration and gentrification in major US cities (Freeman and Braconi 2004). The subject of gentrification and its effects on urban population once again rose to the forefront of academic discussion, and continues today. Again, a pattern of ambiguity and uncertainty as to the true effects of gentrification on urban centers continues to dominate more current research, just as it had in the previous academic examinations.

In their analysis of New York City gentrification during the 1990's, Freeman and Braconi (2004) found that gentrification can actually reduce the displacement of poor households. They observe that when neighborhoods gentrify, they become more desirable, incentivizes the current residents to find ways to stay. The study cedes

that these findings do not dismiss the potential displacement that gentrification can cause, but instead bring to light the complexity and dual nature of the phenomenon.

In his study of gentrification in Boston, Vigdor (2002) found that less educated households were actually more likely to stay in their housing in a gentrifying neighborhood. He identifies a relationship between improving conditions and the rise in housing costs. Specifically, he contends that poor households in gentrifying neighborhoods weigh the benefits of improved conditions against the increasing costs of living. If they perceive the benefits as more valuable than the costs, they will find a way to stay. If the costs become to burdensome, however, they will move to other areas, disturbing the equilibrium in these other neighborhoods (Vigdor 2002). Ellen and O'Reagan (2011) find in their analysis that the overall effect of gentrification in New York during the 1990's was positive, although some residents were displaced. In general the process increased satisfaction in neighborhoods and did not displace as many people as originally assumed (Ellen and Oregan 2011).

Other studies of gentrification during this period identified adverse effects. Atkinson (2000) discovered significant displacement in London during this period, with the majority of those displaced working in unskilled labor markets. Freeman (2005) finds that households moving into gentrifying areas are more likely to be white and educated compared to households moving into non-gentrifying areas. Mckinnish et al (2010) contend that white college graduates are more likely to move into improving low income areas than non-improving low income areas.

An alternative approach, introduced by Sheppard (2012), conceptualizes the costs of displacement as communal. His research deconstructs the standard approach to gentrification and displacement, that the negative costs of the process are borne by displaced residents and the poor, and instead models the negative effects as community-based. The results of this approach indicate that the communities in which gentrification occurs are adversely effected by the local changes. He finds that large increases in housing turnover are associated with a 52-72% reduction in spending on community improvement expenditures (Sheppard 2012).

The academic literature surrounding gentrification is certain in one thing, its uncertainty. Scholars generally

agree on two core concepts in this area. First, that gentrification has historically caused some displacement in and harm to urban communities. Second, that most attempts to measure this effect find little evidence supporting the negative public perception and often find evidence of positive ramifications. The subject has proven immeasurably complex and obtuse to concrete analysis.

2.2 Rent Stabilization

Two policy initiatives relevant to this analysis are rent stabilization and, less importantly, rent control. These policies were introduced to New York City in the mid to late 20th century to combat New York's persistent housing shortage. Units designated as either rent stabilized or rent controlled are subject to strict regulations of the rental price and lease renewal.

Rent control refers to government-set rental prices. It was introduced in New York City during World War II as part of the US Emergency Price Act of 1942 to prevent abnormal price increases due to mass urban influx during the war. The policy was hindered by the Federal Housing Rent Act of 1947 which exempted new units from rent control (Gyourko and Linneman 1990). After this, rent control decreased in popularity across the country, but remained in New York. Today rent control in New York City is rare, only about 1% of units are rent controlled.

Rent stabilization, on the other hand, is widespread throughout New York City today. A 2011 survey estimated that 47% of units in New York City are rent stabilized compared to about 38,000 rent controlled units (Herrin, Yaget, and Mian 2016). Unlike rent controlled units, rent stabilized units are allowed yearly percentage increases in rent. The allowed increase is decided by the Rent Guidelines Board. This framework of this study relies on a lesser-known regulation of rent stabilized units; building owners are required to provide a rent-stabilized tenant with a lease renewal.

Chapter 3

Research Design and Methodology

This study hopes to introduce some clarity to the opaque relationship between gentrifying communities and local real estate holders. When an area gentrifies, people living in it risk losing both their home and community. In stark contrast,, building owners with properties in these neighborhoods have a unique opportunity to capitalize on favorable financial conditions. The high stakes nature of the situation for both sides produces tension in the relationship and can lead to confrontation.

Gentrification often creates high demand for rental units and seller friendly conditions in the real estate market. Standing in the way of property owners taking advantage of these conditions, however, are any tenants protected by rent regulations. In all likelihood, the Rent Guidelines Board's permitted rent increase will maintain stabilized rents far below their open market value. In addition, if an owner has tenants with these protections, they cannot sell their building to take advantage of the pro-seller environment.

This leads us to a critical assertion made in this study, that landlords and building owners in areas that are gentrifying will likely resent their rent stabilized tenants. This animosity will lead to both neglect and intentional harassment. At the very least, the building owners will try to make up for lost profits by reducing maintenance expenditures, resulting in the significant deterioration of their rental properties.

3.1 Research Questions

The preceding discussion leads us to the research questions used to conduct this study:

1.How do residential real estate prices affect the quality of housing and landlord performance in local urban areas?

2.Do changes in local residential real estate markets affect the quality of housing and landlord performance in local real estate markets? What is the temporal structure of this relationship?

3.When an area Gentrifies, do landlords and building owners intentionally (or unintentionally) neglect and/or harass their tenants in an attempt to forcibly move them? Is this relationship quantifiable utilizing new data sources?

3.2 Research Design

To approach this issue methodologically this study adopts a quantitative approach to measuring housing conditions and landlord behavior at the census tract level in New York City. At the highest level, it tracks changes in local real estate markets and measures the corresponding variation in housing complaints.

When a neighborhood gentrifies, the individuals or companies that own real estate in the area, as rational entities, will perceive the enormity of the economic opportunity at hand. For those with rent stabilized or controlled tenants, the ensuing realization that regulations prevent them from fully capitalizing on these conditions will undoubtedly dampen their excitement. It stands to reason that this realization may cause the building owner to resent those tenants who prevent them from maximizing their profits. They may feel less inclined to provide these tenants with legally required services and mandated property conditions. In accordance with the research of Arnott and Shevyakhova (2014), they may try to make up for financial loss by providing less maintenance. A more egregious scenario may involve building owners attempting to forcibly move these tenants by creating unlivable conditions.

The statistical models in this study are used to quantify this relationship. To measure the market perception of these real estate holders, i.e. their belief that their assets are increasing in value, I use real public real estate sales data. To inversely measure the effect of this perception, the retaliation and changes in housing quality, I employ 311 housing specific complaints. In addition to these primary variables, I also include measures of gentrification and rent stabilization density to account for the complexity in this relationship. The description of the data is outlined more in depth below.

3.3 The Data

This study employs data from several unique sources. It observes variables at the census tract level, specifically Year 2000 New York City Census Tracts. Due to missingness, it includes 1946 out of 2216 tracts in the final analysis. The majority of these are parks, industrial areas, and other tracts with little to no real estate activity. The remaining excluded tracts, such as those in midtown Manhattan, did not have enough residential real estate sales to be considered relevant. The study covers 13 years of annual data from 2004-2016 for a total of 25,298 observations.

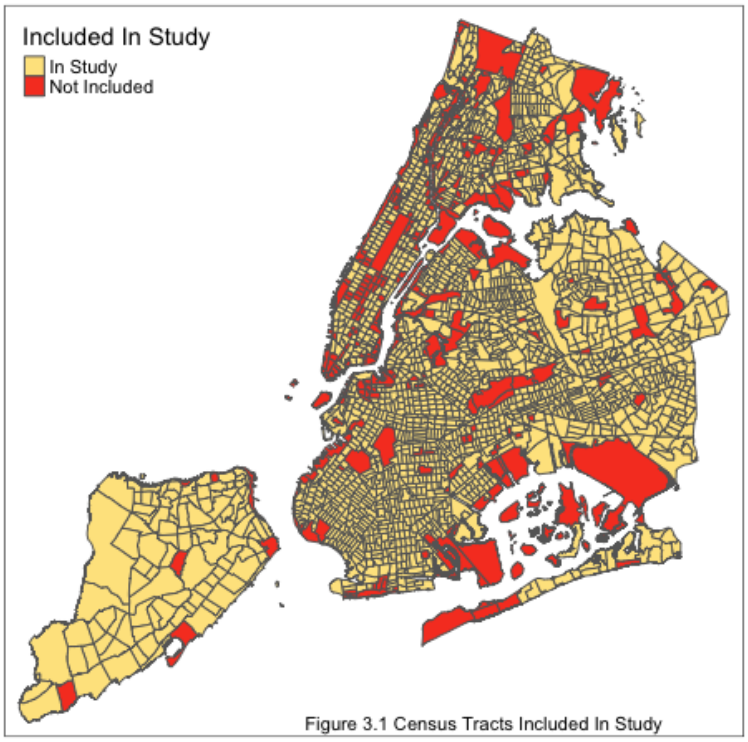

Figure 3.1 Census Tracts Included In Study

3.3.1 311 Call Records

The dependent variable in each of the models is the number of HPD-specific 311 complaints per residential unit per census tract over the course of the specified year. 311 call records are made publicly available on NYC Open Data dating back to 2003. The New York City Open Data portal is a government-run website that makes a large catalog of government data available for public consumption. The Open Data Portal is run by two government agencies, Mayor's Office of Data Analytics (MODA) and the Department of Information Technology and Telecommunications (DoITT).

The 311 telephone line is a NYC government-run service that receives complaints or questions about New York City. These complaints generally come from residents, but are not restricted to any individuals. The service accepts and documents complaints focusing on a wide-range of issues from noise complaints to rats. In each available year there are over 8 million individual records of complaints. This analysis focuses on complaints designated as under the purview of Housing Preservation and Development (HPD). These include

tenant complaints about their housing and building conditions which potentially violate the New York City Housing Maintenance Code (HMC) or the New York State Multiple Dwelling Law (MDL).

Each row of the originally scraped data represents a single 311 complaint filed by a NYC resident. They include an agency designation (filtered to only HPD complaints), complaint category (hot water, pests, construction etc.), time and date of call, resolution date, descriptor, address, Zip Code, and resolution description. In total there are 12 complaint types that are summed to create the total call variable:

1. Agency Issues: The caller is making a complaint about HPD service
2. Construction (General Construction): The caller is having issues with construction in or near the individual's building
3. Door/Window: The caller is having issues with insecure Doors and/or Windows in the unit
4. Electric: The caller is having issues with the Electricity in their unit
5. Elevator: There is a problem with the elevator in the building
6. Flooring/Stairs: The caller has a complaint about the conditions of the flooring and/or stairs in the building
7. Heat/Hot Water: The caller is having issues with the heat and/or hot water in the unit
8. Non-Construction: The caller is filing a complaint about issues with non-construction related structural problems in the building
9. Outside-Building: The complaint is about issues on the outside of the building
10. Paint/Plaster: The caller is having issues with the condition of paint and/or plaster in their unit
11. Plumbing: The caller is filing a complaint about the plumbing in the building
12. Safety: The complaint is about safety issues in and around the building

The total complaints per year varies moderately, and there is a general downward trend in the variable throughout the panel. In the first year, 2004, there were 599,389 total HPD complaints in the tracts included in the study. In the final year, 2016, there were 383,355 total complaints. This calculation only includes calls in census tracts included in the study.

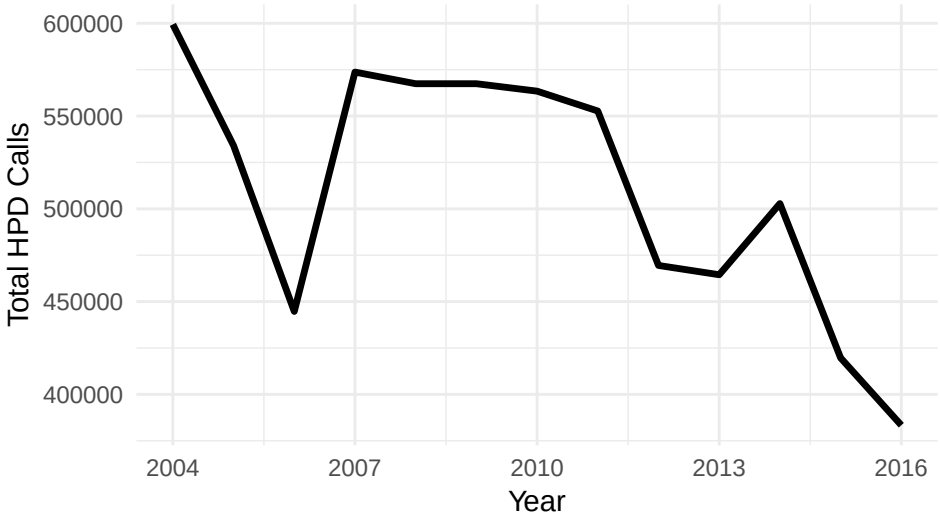

Fig 3.2 Total HPD Calls Per Year

The total number of HPD Complaints also varies widely by tract, with the average number of calls per tract per year at 232. There is significant variation in this number with a standard deviation of 339 calls.

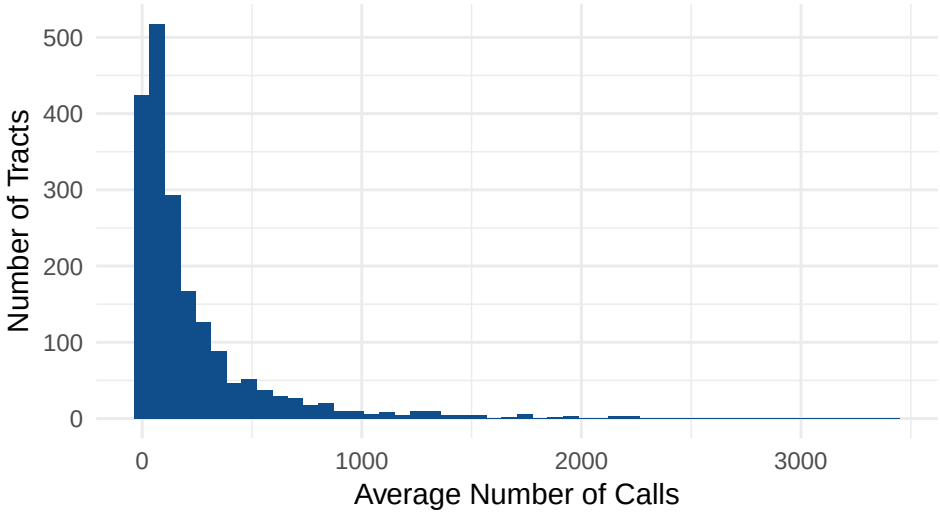

Fig 3.2 Average HPD Calls Per Tract

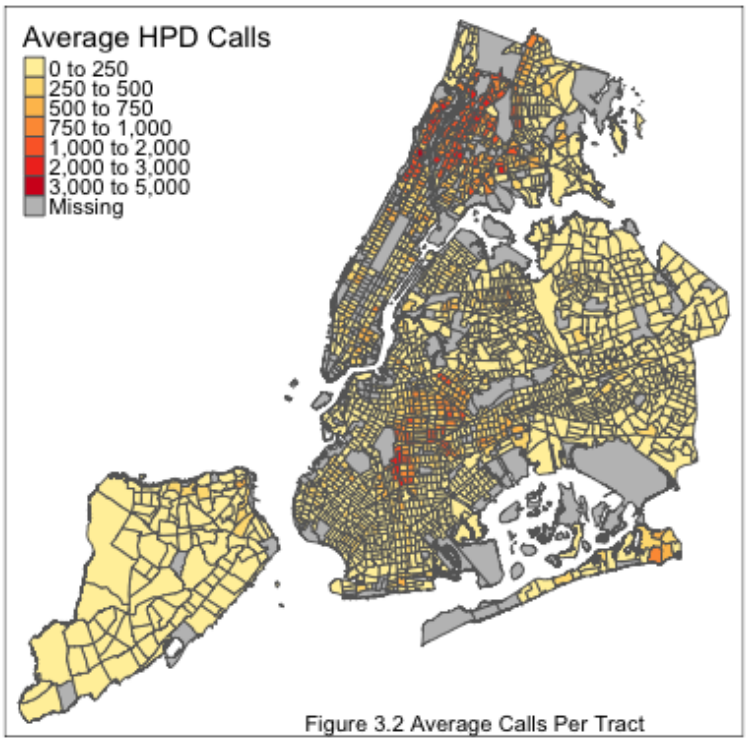

Figure 3.2 Average Calls Per Tract

3.3.2 Real Estate Sales Data

The primary independent variable in this study is the median price of one square foot of residential property in the designated geographic area in a designated year. To calculate this variable, I utilized the Rolling Sales Data available from the NYC Department of Finance (DOF). The Rolling Sales Data includes a summary of each individual property sale in New York City (filed with the government) from 2003-2016. Each year of the records is contained in its own individual data set.

Each individual row of the data represents a single property sale in New York City. The data includes the address of the property, the price of the sale, the tax designation of the property, the square footage, the zip code, and the zoning designation. To summarize by 2000 census tract, I merged with the Pluto record from the matching year.

Unsurprisingly, there is high variability in the data between census tracts. The average median sale price of one square foot of real estate is 298.87 dollars per census track in a given year with a standard deviation of 386.67 dollars.

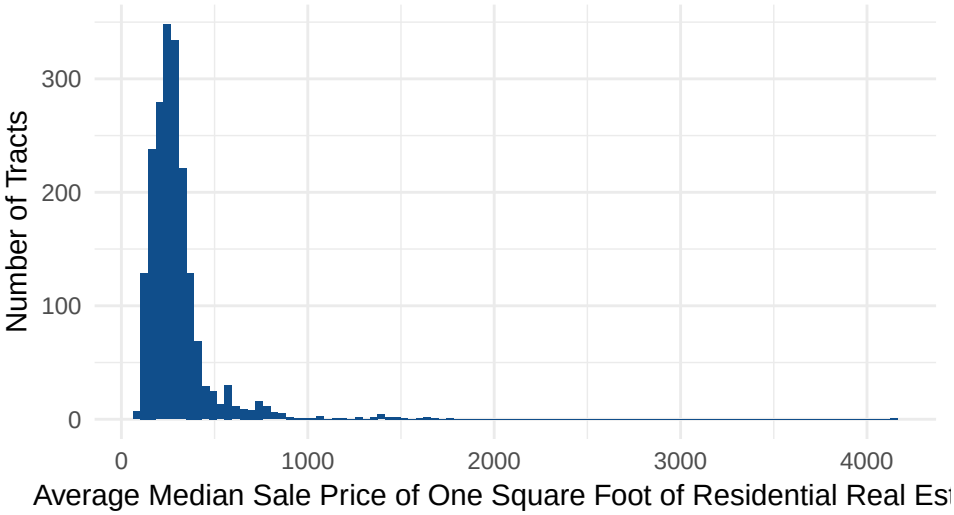

Fig 3.5 Average Median Real Estate Price

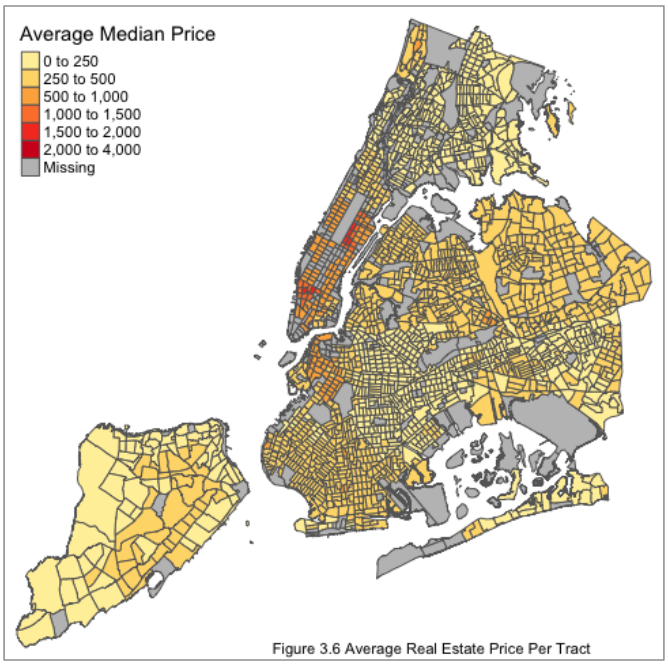

Figure 3.6 Average Real Estate Price Per Tract

3.3.3 Pluto Data

The Pluto Data Set, available from the New York City Department of Planning, is an extensive land use and geographic data set at the tax lot level. It contains a large swath of information about each tax lot including zoning designation, tax designation, and assessment values among many others. In this study, the data was used to match addresses to their census tracts and to calculate the number of residential units in each census tract.

3.3.4 Rent Control/Stabilization

It proved very difficult to find or aggregate any records about rent stabilized or controlled units in New York City. The agency in charge of overseeing the system, The New York State Department of Homes and Community Renewal (DHCR), does not make yearly lists of rent stabilized units in New York City available. In addition, yearly registration with the DHCR, which any building owner with rent stabilized or controlled units is supposed to do, is self-reported.

Luckily, I was able to find a data set scraped from the New York City tax records by John Krauss (Krauss, n.d.). This data set uses tax bills which are publicly available in pdf form online for every year 2007-2014. Tax bills for individual buildings list the number of stabilized units registered to that building each year. Krauss and his team used pdf scraping technology to extract data from the pdf records. The data contains the records for 44,911 buildings in New York City that were known to have a stabilized unit in them during that time span. For each building, there is a record for each of the years in that time span that include the number of stabilized units in the building that year.

There are multiple drawbacks in this data set. First, because there is no penalty to fail to register with the DHCR in a given year, there are numerous missing records in specific years in which a building simply forgot to register. To account for this, Krauss and his team employed estimation techniques to fill in the missing data:

If there is no stabilized unit count for a building that had one the previous year, the previous year's number is used in any of the following cases:

- The bill without a unit count had a SCRIE or DRIE abatement, indicating the continued presence of regulated units.
- The bill without a unit count maintained the same abatements as the previous year (for example 421a or J51) indicating that restrictions mandating affordability remained in effect.
- The building appeared on HCR's stabilized building list for the year without a unit count, indicating that it was in fact still stabilized. (Krauss 2014)

After reviewing the methodology behind the scraping, as well as the imputation techniques used to estimate missing data, I concluded that these data sets were sound enough to employ in this study. Future studies will need to check the records and estimations more thoroughly to verify the results.

The average number of rent stabilized units per year of this study in the included tracts is 576206.2. This number varies with a standard deviation of 19325.19. The average number of stabilized units per census tract per year is 296.097. This varies significantly from tract to tract with a standard deviation of 412.065.

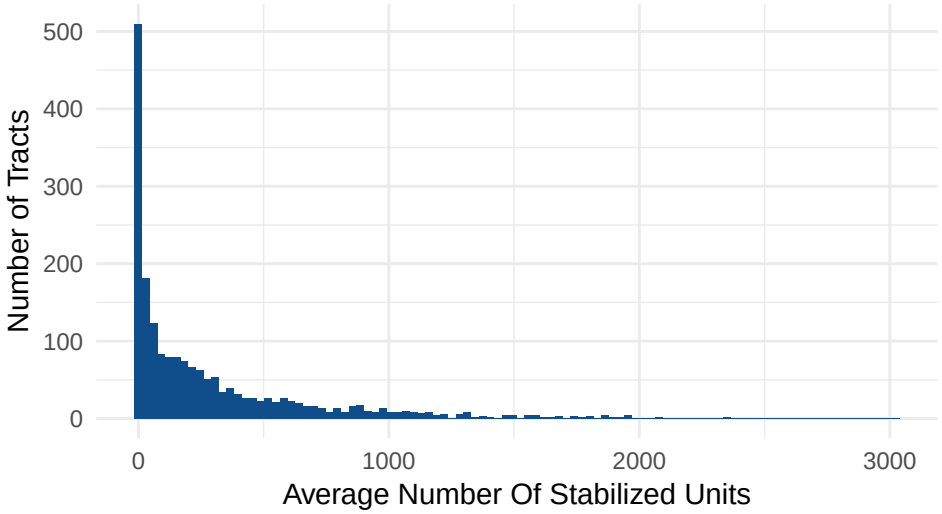

Fig 3.6 Distribution of Average Stabilized Units

3.4 Data Collection

The process of collecting and cleaning the data for this project was tedious to say the least. Both the 311 data and rolling sales data were scraped using the Python programming language. The rent stabilization data was downloaded from Github. Lastly, the Pluto Data Sets were downloaded directly from the New York City Department of Planning.

To collect the 311 call data, I used the Socrata API package in Python. For each year of the study, I downloaded a collection of every call designated under the purview of The Department of Housing Preservation and Development. Once the 6,642,684 calls were downloaded, they were grouped and summed by address. After this, I merged the addresses with the Pluto Data Sets to identify the census tract for each address. Due to messiness, this merge only identified around 80% of census tracts. To identify the remaining 20%, I used the CensusGeocode package in Python to send the missing addresses in batches of 1000 to the census matching service. Once the census tract for each building was identified, I grouped the buildings by census tract to find the total number of calls per census tract per year.

To gather the real estate sales data, I wrote a Python script to download the data set for each year from the Department of Finance website. Once the records were downloaded, they were merged with the Pluto Records by Borough Block and Lot to identify census tracts. I then eliminated records of non-residential sales data through filtering by tax code. I then removed condo sales with no square footage and sales of less than 1000 dollars. After this, the variable of interest, the price per square foot was calculated for the remaining sales by dividing the sale price by the square footage. The observations were then grouped by census tract in each year and the median price per square foot was identified.

To control for extreme values I calculated the median of sales in neighboring tracts in tracts with low counts of sales in specific years. To accomplish this, I first used the spdep package in R to identify the neighbors for each census tract using the census tract shape files provided by the Department of Planning. I then wrote a Python script to identify tracts with less than 5 sales in a specific year. The median price in these tracts in these years was replaced with the median sale price of all of the sales in that tract plus its neighbors in that

year.

Of all the aspects of this project, the data collection and cleaning process took the longest to complete. This process and the effort it took is what makes this project unique. The hours of collection and cleaning required to begin the analysis conducted in this paper act as a barrier of entry for most researchers. I plan to continue working with the data in the future and also hope to share it with other researchers.

3.5 Measures/Variables

To explore and expand upon the research questions presented in Section 3, I start by exploring the basic relationships between the high level variables and consequently build towards more complex models at each step. First, I explore the relationship of local real estate markets and HPD complaints excluding the temporal dimension and groupings. Next, the temporal effects are explored using fixed effects models. After this, rent stabilization is added to identify its role in these relationships. Next, tracts that gentrified in the given time period are identified and I explore the difference in the effect of real estate market changes in gentrified vs. non-gentrified localities. Lastly, I focus on the dynamic temporal elements of gentrification by identifying in which years during the gentrification process complaints increase the most.

3.5.1 Dependent Variable:

Total HPD Complaints per year per residential unit within each census tract x 1000 (rounded up). To calculate this variable I first calculated the total number of calls per tract in each year and divided them by the number of residential units in that tract. This transformation accounts for population differences between census tracts. I then scaled this variable by multiplying it by 1000, then rounded up to maintain a count structure for the Poisson models.

The designation HPD complaints refers to any 311-complaint received identified in their system as under the purview of the Department of Housing Preservation and Development. These are primarily tenant complaints

regarding their housing and building conditions. These complaints refer to conditions that potentially violate the New York City Housing Maintenance Code (HMC) or the New York State Multiple Dwelling Law (MDL).

3.5.2 Independent Variables:

3.5.2.1 Median Sale Price of Residential Square Foot

The primary independent variable is the median price of one square foot of residential real estate in the geography in the designated year.

This variable was calculated from the Rolling Sales Data Set. For each year I first filtered out non-residential sales (tax designation 1 or tax designation 2). This ensured only relevant residential real estate was included. This number was then divided by the total square footage of the building to account for size differences between building. Lastly, the sales were grouped by census tract and the median of each tract in each year was identified. Median was chosen as the measure, instead of mean, to control for high-value properties that could skew the results.

3.5.2.2 Percentage of Units that are Rent Stabilized

The percentage of residential units in the tract that were rent stabilized units in the year of the observation. This variable was calculated by simply dividing the number of rent stabilized units by the total number of residential units in the tract.

3.5.2.3 Gentrification Dummy

An additional independent variable in this model is a dummy variable indicating if the census tract gentrified between 2004 and 2016. The lack of academic consensus on the precise definition and measurement of gentrification allows for some flexibility in creating individual evaluations of the process. I adapted some

common measurement techniques, specifically those used by Ding, Hwang, and Divringi (Ding, Hwang, and Divringi 2016), to identify census tracts that gentrified between 2004-2016. In their study on gentrification in Philadelphia, Ding, Hwang, and Divringi define a census track that is gentrifiable as one that had a median income below the city-wide median at the beginning of the study. To be considered gentrified (or gentrifying) at the end of the time period, the census track must have an above city-wide median increase in median household income during the series.

I adapted this measurement to my variables by first identifying tracts whose average price of one square foot of residential real estate between 2004-2005 (to control for outlines) was below the city median. These tracts were considered gentrified if this price increased above the city wide median between this time period and 2015-2016. If a tract satisfied both of these qualifications, it was marked as gentrified (Gentrified dummy = 1).

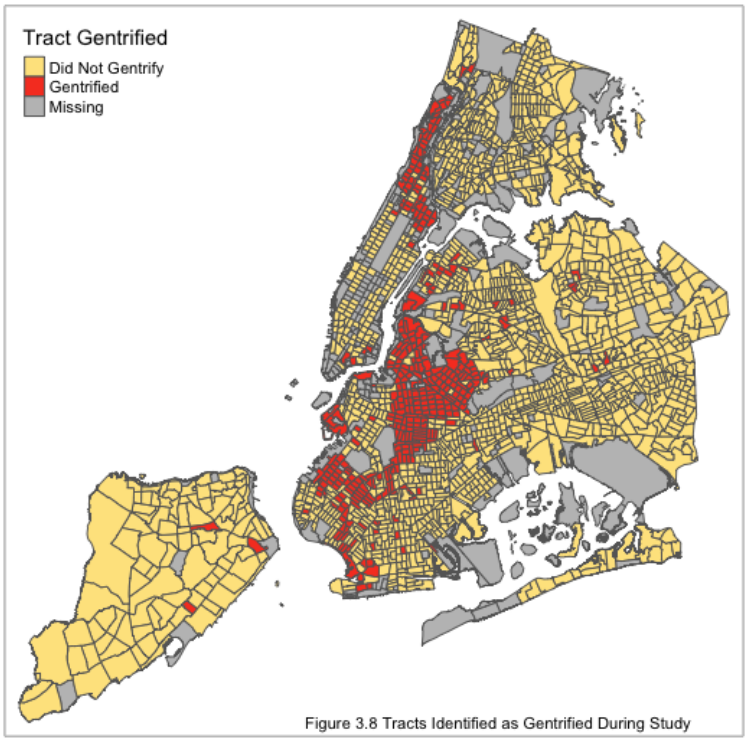

Figure 3.8 Tracts Identified as Gentrified During Study

3.5.2.4 Year of Gentrification

Tracts that were marked as gentrified received one additional variable, the year in which they gentrified. This variable was created by first identifying the residential real estate percentile among all tracts for each tract in each year. For example, if the price of one square foot of residential real estate was the highest in a particular tract in a particular year, this tract was marked as the 100th percentile in that year. After this the year-to-year percentile jump was calculated, ie if in one year the tract was in the 25th percentile and in the following year was in the 30th percentile the jump variable was marked as 5%.

Once these two variables were calculated, tracts marked as gentrified were separated out from the data set. The year in which they gentrified was identified as the year in which the percentile increase was greatest if the average percentile in the following years did not fall below the percentile in the identified year. For example, if the maximum percentile jump for a tract was 25 percentiles, the year in which this occurred was identified as the gentrifying year if the average percentile in the subsequent years did not fall below the percentile from that year. If they did, the second highest jump was used and so on.

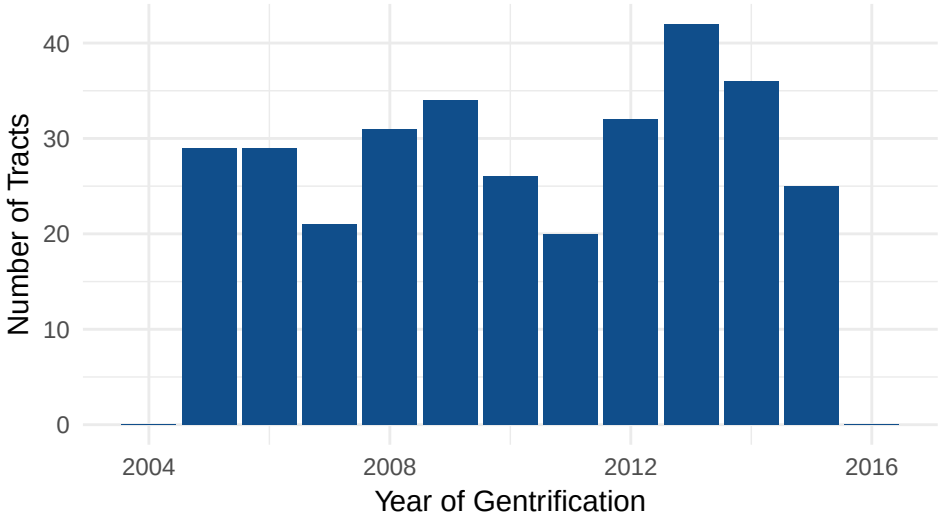

Fig 3.9 Number of Tracts Gentrified in Each Year

3.6 Statistical Modelling

To answer the questions presented in the research design, this study employs a spectrum of modelling techniques. The final data set is structured as a longitudinal panel; logically, a number of techniques designed for this structure are utilized. All statistical modelling was performed in R using the following packages: glm, pglm, plm, and lme4.

3.6.1 Generalized Linear Models (Poisson Distributions)

To outline the general relationship between my primary independent variables, the total number of calls per residential unit in each census tract and the median sale price of one square foot of residential real estate, Poisson regression was used. This technique is common when working with a dependent count variable that violates normal distribution assumptions. The model compensates for this by calculating the logarithm of the count data and taking the form:

$$log(\mu) = \alpha + \beta x$$

3.6.2 Fixed Effects

The fixed effects models are used due to the structure of the panel (small t large n). Fixed effects models measure deviations from the mean for each grouping. This structure controls for serial correlation within groups and reduces omitted variable bias. We are then left with within-group effects. The model takes the form:

$$(Y_{ij} - \bar{Y}) = \beta_1(X_{ij} - \bar{X}_i) + (\upsilon_{ij} + \bar{\upsilon}_i)$$

Where j is the individual and i is the time stamp.

3.6.3 Random Effects:

This study utilizes One Way Random Effects Models to compensate for possible serial correlation within individual census tracts in the sample. They are a form of the hierarchical models discussed later in this section. These models are variations of Feasible Generalized Least Square models and take into account the correlations in the data among st observations from the same group. These models are of the form:

$$Y_{ij} = (\beta_0 + u_{0j}) + \beta_1 X_{1ij} + \beta_2 X_{2ij} + e_{ij}$$

Where u are random intercepts for each group and e contains within group errors.

3.6.4 Autoregressive Dynamic Lag Models/Error Correction Models

To compensate for dynamic temporal relationships, this study utilizes Autoregressive Dynamic Lag Models (ADLs) and their generalized form Error Correction Models (ECMs). These models take into account the effects of lagged values of the independent and dependent variables on the dependent variable. ADL models are of the form:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \beta_0 X_t + \beta_1 X_{t-1} + \epsilon_t$$

Where p refers to the number of lags of Y_t, q the number of lags of X_t, and n the number of independent variables. (De Boef and Keele). The ECM is a generalization of this and uses the first-difference values of X and Y instead of the current values:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \beta_0 \Delta X_t + \beta_1 X_{t-1} + \epsilon_t$$

3.6.5 Hierarchical Modelling (Multi-Level Modelling)

The final model in this paper combines the previous techniques with multi-level modeling, also known as hierarchical modelling. To account for differences in subgroups, similarly to random effects, this statistical tool levels the observations into multiple groupings to compensate for unexplained variation among the groups. The models can take the form of single level regressions with correlations among the groupings:

$$y\ N(\gamma 01 + \gamma 1Gu + \beta x, \sigma^2 yI + \sigma^2 \alpha GG^T)$$

Where G is a matrix of grouping indicators (Gelman 2007).

Chapter 4

Results

Section 4.1 begins by exploring the general relationship between the primary predictor and dependent variable. The results of these basic models provide the foundation for some of the more complex statistical analyses later in the chapter. Each subsection builds upon the previous and adds an additional layer of complexity. The last two sections of this chapter present the results of the final models that are used answer the research questions.

4.1 Rental Prices and HPD Complaints

The first three statistical models explore the general relationships between real estate markets in census tracts and the number of HPD complaints. These results were used as a foundation for the more complex models in later sections.

Table 4.1: Model 1.1

	Coefficient (Exponentiated)	Standard Error	p
(Intercept)	584.2249330	0.0012450	0
Median_Sale100	0.6043496	0.0005317	0

4.1.1 Model 1.1

Model 1.1 is a generalized linear Poisson model that regresses the total calls per residential unit (x1000) per census tract against the median price of one square foot of residential real estate per census tract in all years with no controls. The results in table 4.1 indicate that for each hundred dollar increase in the median price of one square foot of residential real estate in a tract, the call rate of HPD complaints decreases by 40%, the coefficient is statistically significant ($p<.001$).

4.1.2 Model 1.2

The next model introduces a temporal element to the analysis by running fixed effects on the panel data with year-fixed effects included. The fixed effect also accounts for collinearity of variables within each census tract. When the effects of time and differences between tracts are accounted for in the analysis the relationship is dampened significantly but still statistically significant. The results in Table 4.2 indicate that for each one hundred dollar increase in the median price of one square foot of residential real estate, the expected call rate for HPD complaints decreases by 1.06% net of year fixed effects. The coefficient is statistically significant (p<.001).

4.1.3 Model 1.3

With the next model, I introduce a dynamic element to the fixed effects model. For each of the following models I replace the median price of one square foot of residential real estate with one and two year lags of the same variable. The results with the one year lag in Table 4.3 indicate the opposite effect for an increase in real estate prices in the year before. They reveal that a one hundred dollar increase in the median price of

Table 4.2: Model 1.2

	Coefficient (Exponentiated)	Standard Error	p
Median_Sale100	0.9894282	0.0006925	0
Year2005	0.8984185	0.0023473	0
Year2006	0.8517237	0.0024054	0
Year2007	0.9506221	0.0023508	0
Year2008	0.9484248	0.0023345	0
Year2009	0.9382482	0.0023134	0
Year2010	0.9406397	0.0023126	0
Year2011	0.9109813	0.0023308	0
Year2012	0.7801602	0.0024334	0
Year2013	0.7638356	0.0024672	0
Year2014	0.8140250	0.0024693	0
Year2015	0.7073149	0.0026588	0
Year2016	0.6407827	0.0027936	0

Table 4.3: Model 1.3

	Coefficient (Exponentiated)	Standard Error	p
Median Sale Lagged 1 Year	1.0014154	0.0007939	0.0748137
Year2006	0.9451075	0.0024477	0.0000000
Year2007	1.0534418	0.0024124	0.0000000
Year2008	1.0524138	0.0024268	0.0000000
Year2009	1.0451576	0.0024095	0.0000000
Year2010	1.0481544	0.0023764	0.0000000
Year2011	1.0153374	0.0023957	0.0000000
Year2012	0.8690483	0.0024923	0.0000000
Year2013	0.8485229	0.0025109	0.0000000
Year2014	0.9007252	0.0024932	0.0000000
Year2015	0.7783799	0.0026435	0.0000000
Year2016	0.7028023	0.0028284	0.0000000

one square foot of residential real estate in the year before increases the rate of HPD calls by .1%. These results are statistically significant at a lower level than the previous results ($p = .078$). The same model was run with two and three year lags, the results were not statistically significant.

4.2 Accounting for Rent Stabilized Units

The model in this section is also run as a fixed-effects Poisson regression. Due to missingness in the rent stabilization data, the panel length has been shortened to 2007-2014, this is true for all remaining models in the study.

Table 4.4: Model 2.1

	Coefficient (Exponentiated)	Standard Error	p
Median_Sale100	0.9887037	0.0017175	0.0000000
pct_stable	2.9537729	0.0237697	0.0000000
Median Sale Lagged 1 Year	0.9985028	0.0008029	0.0620239
Year2008	0.9988333	0.0023458	0.6187229
Year2009	1.0090421	0.0024268	0.0002080
Year2010	1.0110926	0.0024519	0.0000068
Year2011	0.9744479	0.0024569	0.0000000
Year2012	0.8297999	0.0025352	0.0000000
Year2013	0.8108089	0.0025116	0.0000000
Year2014	0.8676081	0.0024610	0.0000000
Percent Units Stabilized x Median Sale Lagged 1 Year	1.0243760	0.0049152	0.0000010
Median_Sale100 x Percent Units Stabilized	0.9941529	0.0037095	0.1139091

4.2.1 Model 2.1

To account for the harassment/neglect proposed in the research questions, I added a new variable; the percentage of units that are rent stabilized in each tract in each year. I interacted this variable with both the primary independent variable from the previous models as well as the lag of the primary independent variables. The results are displayed in table 4.4.

In this model, the interaction effect between the real estate price and the percent of stabilized units is positive and statistically significant ($p < .001$). This indicates that, as the two variables increase together, the positive effect on the number of complaints in the tract increases. In simple terms, tracts with both high real estate prices and a high percentage of rent stabilized units will have more complaints than those with either lower real estate prices or fewer stabilized units. The exponentiated β attached to the median sale price suggests that in tracts with no stabilized units, a hundred dollar increases in the median sale price of residential real estate decreases the rate of calls by 1% ($p < .001$).

4.3 Accounting For Gentrification

The statistical models in this section utilize hierarchical modelling techniques (Gelman 2007) to establish better fits within the groupings of the data. This technique includes random intercept and slope techniques in

Table 4.5: Model 3.1

	Coefficient (Exponentiated)	Standard Error	p
(Intercept)	60.8861338	0.1509395	0.0000000
Median_Sale100	0.9961531	0.0010385	0.0002060
Gentrification Dummy	1.0431309	0.0074466	0.0000000
Percent Units Stabilized	1.0117133	0.0002119	0.0000000
Year2008	1.0000366	0.0023458	0.9875663
Year2009	1.0118402	0.0024348	0.0000013
Year2010	1.0152871	0.0025071	0.0000000
Year2011	0.9792705	0.0025226	0.0000000
Year2012	0.8347068	0.0026219	0.0000000
Year2013	0.8164582	0.0026055	0.0000000
Year2014	0.8756400	0.0025527	0.0000000
Percent Units Stabilized x Gentrification Dummy	1.0002727	0.0001645	0.0973286

addition to to the previously used fixed effects models. To distinguish between gentrified and non gentrified tracts, the following models allow for random intercepts and random slopes for the real estate prices at each level of gentrification (1 or 0). In addition, they include random intercepts for each census tract.

4.3.1 Model 3.1

This analysis build upon the priors by differentiating between tracts defined as gentrified (or gentrifying) and not gentrified. The dummy variable indicating if the observation was of a tract that gentrified between 2004-2016 in a year before the gentrification occurred is included as an interaction with the percent of stabilized units:

The results of the model are displayed in table 4.5. The β attached to the percent of stabilized units indicates that, in observations that were not of gentrified tracts before the gentrification occurred, a 1% increase in the number of stabilized units increases the rate of calls by 4% excluding the effect of their real estate prices and all other variables in the model, the effect is statistically significant ($p < .001$). The interaction effect suggests that this effect is even greater in tracts that are in the process of gentrifying ($p < .01$). This effect can be seen in Figure 4.1, in both groups of observations, a higher percentage of stabilized units increases the amount of complaints. This effect is greater, however, in observations of gentrified census tracts in the years before their gentrification.

Table 4.6: Model 3.2

	Coefficient (Exponentiated)	Standard Error	p
(Intercept)	62.3670928	0.1282234	0.0000000
Median_Sale100	0.9892855	0.0017651	0.0000000
Year Before or of Gentrification Dummy	1.1807346	0.0138259	0.0000000
Percent Units Stabilized	1.0109594	0.0002357	0.0000000
Year2008	0.9978062	0.0023498	0.3499745
Year2009	1.0093130	0.0024420	0.0001470
Year2010	1.0122075	0.0025172	0.0000014
Year2011	0.9774965	0.0025285	0.0000000
Year2012	0.8333207	0.0026265	0.0000000
Year2013	0.8149800	0.0026090	0.0000000
Year2014	0.8737013	0.0025581	0.0000000
Median_Sale100 x Year Before or of Gentrification Dummy	0.9421857	0.0058139	0.0000000
Median_Sale100 x Percent Units Stabilized	1.0003816	0.0000522	0.0000000
Percent Units Stabilized x Gentrification Dummy	0.9994400	0.0003118	0.0724200
Pct Stabilized x Gent. Dummy x Median_Sale100	1.0004206	0.0001415	0.0029630

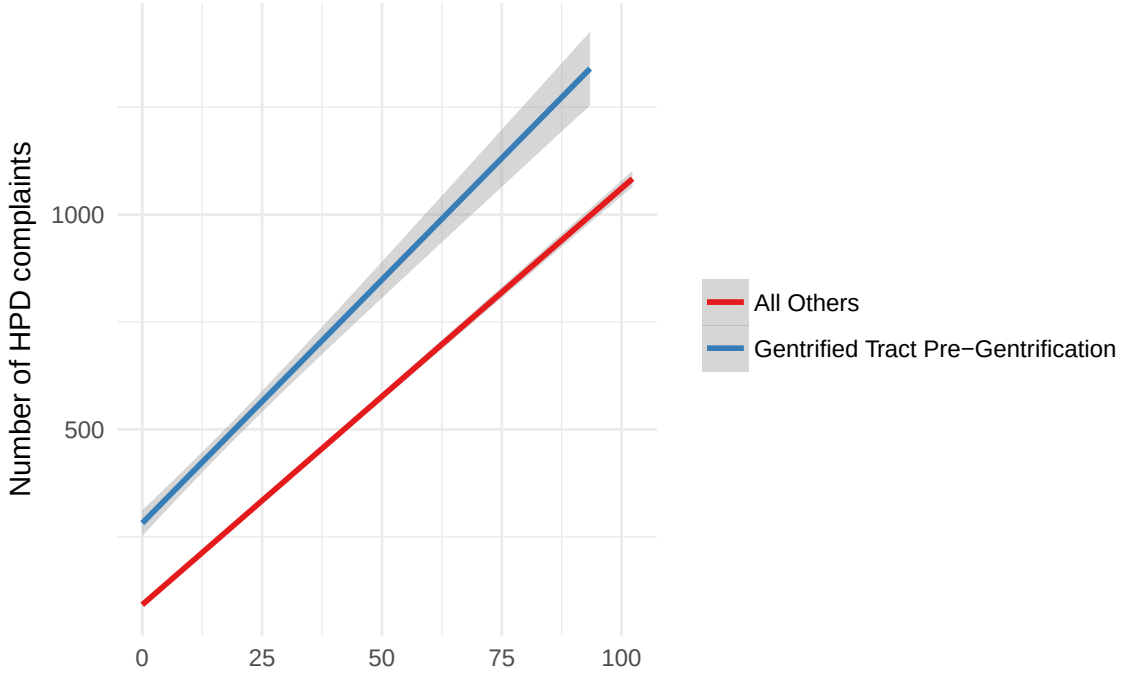

Fig 4.1 Marginal Effects for Model 3.1

4.3.2 Model 3.2

To also estimate the combined effect of stabilized unit percentage, gentrification, and real estate prices, Model 3.2 includes the real estate variable as a third term in the interaction effect:

The coefficient of significance in this model is the three way interaction term in Table 4.6. This indicates that, in gentrified tracts in the years before they gentrified, the increase of both the median real estate price and the percent of stabilized units together will significantly increase the number of complaints received ($p < .001$). The β attached to pre_gent is interpreted as meaning that, all other variables being held to 0, a tract that gentrified during the period of study in a year before it gentrified will have a complaint ratio 18% greater than a tract that did not gentrify or in the years after it gentrified. The coefficient attached to the Median Sale data indicates that a non gentrified (or gentrified in the years following gentrification) tract with no rent stabilized units will lower its call rate by 1.1% for each additional increase of 100 dollars in the median price of one square foot of residential real estate in the tract net of year fixed effects ($p < .001$).

4.4 Taking a Closer Look at Gentrified Tracts

The final two models in this study separate out the tracts identified as gentrified to expand on the temporal relationship between HPD complaints and gentrification. Only tracts that were identified as gentrified are included in these models. This narrows the sample to 381 tracts from years 2007-2014 (to include rent stabilized data). The same hierarchical modelling techniques were used in this section as in the previous with one change, the random intercepts only apply by tract instead of both by tract and level of gentrification.

4.4.1 Model 4.1

Model 4.1 is another example of a hierarchical model, with both fixed effects and random effects. Each individual tract is given a random intercept. The percentage of stabilized units variable is given a random slope for each census tract as well.

The results of this model are displayed in Table 4.7. The coefficient attached to the median sale price (divided by 100) is interpreted as meaning that in a gentrified tract with no stabilized units in a year when it did not gentrify, an increase of 100 dollars in the price of one square foot of residential real estate decreases the

Table 4.7: Model 4.1

	Coefficient (Exponentiated)	Standard Error	p
(Intercept)	4.095129e+39	0.9304021	0e+00
Median_Sale100	9.714159e-01	0.0014337	0e+00
Gentrified_Year	9.403349e-01	0.0067257	0e+00
Percent Units Stabilized	1.007347e+00	0.0014402	4e-07
Year	9.580515e-01	0.0004641	0e+00
Gentrified_Year x Percent Units Stabilized	1.001206e+00	0.0001598	0e+00

Table 4.8: Model 4.2

	Coefficient (Exponentiated)	Standard Error	p
(Intercept)	6.049640e+39	0.9829467	0.0000000
Median_Sale100	9.729628e-01	0.0014577	0.0000000
Year_Before	9.889988e-01	0.0062823	0.0782663
Percent Units Stabilized	1.007270e+00	0.0014446	0.0000005
Year	9.578624e-01	0.0004902	0.0000000
Year_Before x Percent Units Stabilized	1.001015e+00	0.0001513	0.0000000

number of HPD complaints BY 3% net of year fixed effects ($p < .001$). The pct_stable β indicates that in a gentrified tract *not* in the year that it gentrified, a 1% increase in the percentage of units that are rent stabilized increases the rate of complaints by .7% net of year fixed effects and the real estate price in that tract ($p < .001$). The interaction between the percent of stabilized units and gentrified year indicates that this effect is even greater in tracts in the year that they gentrified. This coefficient means that in the year of gentrification, a tract with 1% more stabilized units increases their number of complaints by .12% more than a tract not in the year of their gentrification net of all other variables in the model ($p < .001$).

4.4.2 Model 4.2

The final model in this study reruns Model 4.1 with the year before gentrification dummy indicator replacing the year of gentrification dummy. The results are as follows:

As you can see from the results in Table 4.8 the coefficients are very similar to the previous model. The β of interest, the interaction effect, states that in a gentrified tract in the year before they gentrify a 1% increases in the percentage of units that are stabilized increases the rate of complaints by .1% more than in all other years net of all variables in the model ($p < .001$).

Chapter 5

Discussion

This study utilized new, self-collected data, and therefore required a number of layered statistical analyses to establish baselines and support foundation assumptions. The models presented in the previous chapter build upon one another, and tell a story about the complex relationship between landlord behavior, rent stabilization, and rising property values. This chapter synthesizes the consequential results from the previous chapter with elements of my research design to draw relevant conclusions and demonstrate how the findings support my hypothesis that, as neighborhoods gentrify, landlords are more likely to neglect rent regulated units.

The statistical analyses from Section 4.1 and 4.2 of the results chapter establish baselines for the more complex models later in the chapter. Models 1.1, 1.2, and 1.3 provide a baseline for the study by describing the basic relationship between residential real estate prices and 311 complaint about housing conditions. The results indicate that, as expected, localities with more expensive real estate have significantly fewer complaints. Intuitively, this relationship makes sense. To compete in markets where consumers pay a premium for housing and there is greater demand for luxury housing, landlords must maintain their rental units at a higher standard than in less expensive markets. Additionally, landlords in more expensive rental markets may have more access to resources, and may be better able to afford superior building materials and routine property

maintenance.

Section 4.2 introduced the percentage of rent stabilized units per census tract to the model. The results of Model 2.1 revealed that tracts with higher percentages of rent stabilized units tended to have more complaints than tracts with comparatively lower percentages of stabilized units. This supports the hypothesis that landlords provide rent stabilized tenants with lower quality housing and maintenance. The interaction coefficient suggests that this effect is greater in tracts with higher real estate prices. This result suggests a narrative presented in the research design. In areas with higher residential real estate prices – and therefore higher rents – owners incur greater losses per regulated unit. Landlords then pass the burden of those losses onto their tenants in the form of property neglect and decreased responsiveness, or try to encourage rent stabilized tenants to move by refusing to Improve substandard conditions in their units.

The statistical analysis in Section 4.3 adds the gentrification dummy to Model 2.1 to observe the effects of gentrification on the relationship 311 complaints and real estate prices. The results of Model 3.1 confirm that a higher percentage of stabilized units in a tract increases that number of complaints at a statistically significant level. This effect is significant in non-gentrified tracts (or gentrified tracts post-gentrification), where a 1% increase in the percent of stabilized units increases complaints by 4%. In gentrified tracts, in the years before and of their gentrification, this effect is .027% greater. Qualitatively, these results indicate that the positive effect of an increase in the percent of rent stabilized units is greater in gentrified tracts in the years before and year of gentrification.

Models 2.1 and 3.1 support the hypothesis that, in areas that are gentrifying, building owners will provide a lower quality of service to rent regulated tenants. Based on the results of Models 1.1-1.3, rising real estate prices should reduce the number of complaints in gentrifying tracts. However, we can see from Model 3.1 that when a tract gentrifies, and therefore the real estate prices increase, the number of complaints increase in the years preceding, and year of, the gentrification.

Model 3.2 reveals that this effect is magnified in census tract where real estate prices are higher than the median. Specifically, the three way interaction coefficient between real estate prices, percentage of stabilized

units, and the pre-gentrification dummy indicates that the positive effect of increasing the percentage of stabilized units in gentrified tracts in the year of and years preceding gentrification is more pronounced in tracts with high real estate prices. This finding further reinforces the idea that stabilization regulations cause landlords to incur greater monetary losses in areas with high real estate prices, making them more inclined to harass and neglect rent stabilized tenants.

The final two statistical analyses in this paper examine the temporal patterns of the previously identified effect of changing real estate prices on housing-related 311 complaints in the gentrify tracts. Models 4.1 and 4.2 find that, in tracts that gentrified during the course of this study, higher percentages of rent stabilized units in the year of and year before the gentrification respectively lead to more housing complaints. This indicates that the perception of landlords and their behavior towards tenants is dynamic. The spike in real estate in the year of gentrification logically leads to harassment and neglect. The owners and landlords may, however, also perceive the changes to the neighborhood before the largest rent spike. This could mean that their behavior is not only in reaction to the financial loss they perceive in the present, but also to the perceived financial opportunity coming in the future.

The totality of these results paint a picture that is consistent with the relationship that was hypothesized before the statistical analysis was conducted. They suggest that, as predicted, the increase in rents and real estate prices brought on by gentrification lead to resentment of rent regulated tenants who prevent landlords from capitalizing on favorable trends in the market. This resentment, in turn, leads to neglect – and possibly even harassment – of rent regulated tenants, resulting in more housing-related 311 complaints in gentrifying tracts with the highest percentages of rent stabilized units.

5.1 Caveats and Future Studies

The primary drawback in this study is the lack of controls for individuals moving in and out of census tracts. This is a common roadblock for any study tracking gentrification; tracking local urban migration on a year-by-year basis is difficult in any scenario, especially when using public data. As the populations

and demographic makeup of census tracts change, so does the propensity for the new individuals living in the area to call 311 and make complaints. The analyses in this paper do not control for this change and any conclusions drawn from them must take this into account. That being said, this study utilizes dynamic year-by-year data, and accounts for these changes as much as possible by using year and tract fixed effects.

I hope to, in the future, expand the study by spending more time collecting data and controlling for changes in population. Any further studies can expand on this by introducing population change controls into the model.

Chapter 6

Conclusion

The relationship between tenants and landholders can be quarrelsome even during times of stability. Sudden changes in local real estate markets, which generate financial opportunities for the owners, can transform this relationship into a power struggle. In the midst of this struggle, property owners may neglect to provide these tenants with the legally required standards of housing. They may even attempt to circumvent regulations and force their tenants to leave by reducing the quality of their housing.

This study has found evidence supporting the existence of this relationship between landlord behavior, housing quality, and real estate prices. The results of the statistical analyses indicate that, as a census tract gentrifies, housing related complaints increase at a statistically significant level. This effect is magnified in areas which have a greater percentage of residential units that are rent stabilized. If we put these results in the context of the hypothesized relationship; as a neighborhood gentrifies, landlords become resentful of the financial losses they incur due to their regulated tenants and in turn reduce the quality of the housing they provide them.

The policy implications of this study are significant for urban areas facing gentrification. The benefits of urban renewal can vitalize previously stagnant areas. The communities, however, receive none of the benefits if they are forced to move. New York City provides some of the most thorough protections for its tenants. Despite these regulations families and individuals are still displaced regularly.

If cities want to efficiently allocate the benefits of economic renewal, they must enforce housing standards fairly across all socioeconomic tiers. The dynamics identified in this study suggest that more meticulous scrutiny is needed, especially in areas that are gentrifying, against landlords and building owners. In order for these regulations and protections for tenants to be fully effective, they must be executed in good faith and with the understanding that building owners and landlords are incentive to circumvent them.

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