

The Effects of Gentrification on Subsidized-Housing Programs in New York City

A Thesis Presented to the Faculty of Architecture, Planning and Preservation
Columbia University in the City of New York

In Partial Fulfillment of the Requirements
for the Degree Master of Science in Urban Planning

Sinae Lee

May 2016

Abstract

Over the several decades, rent-burdens for low-and moderate-income New Yorkers have continued to increase, leading to demands for more affordable housing. This trend has become only worse with citywide gentrification over time. Federal, state and city governments have implemented various subsidized housing programs to support more affordable housing units. One of the key determinants in stocks of affordable units is the opt-out rate, which is dependent on property owners' decision to leave the program after the contract term. Thus, information on what factors make owners stay in or leave subsidy programs can be useful in policy-makers' effort to preserve affordable housing units. This study examines factors associated with gentrification and their relationship with opt-out rate of subsidized rental housing programs. Through a statistical logistic regression model, this study investigated if factors associated with gentrification, such as median income, nearby property prices and other neighborhood conditions, have bigger impacts on owner' decisions to stay or leave subsidy programs than other factors that generally affect property prices or owner's decision to change property prices. The results suggested that gentrification predictors have substantial impacts on property's opting-out, comparable to other control factors. The findings of this study highlights the importance of using extensive neighborhood data to develop an effective affordable housing preservation strategy.

Table of Contents

1. Introduction	4
2. Background	
2.1. Affordable Housing Challenge in New York City	5
2.2. Subsidized Housing Programs	7
2.2.1 Overview of Subsidy Programs	7
2.2.2. Opt-Out of Subsidy Programs	9
2.2.3. <i>Factors Associated with Opt-out</i>	10
2.2.4. <i>Neighborhood Condition Factors</i>	11
2.3. <i>Gentrification in New York City</i>	12
3. Data and Method	
3.1. <i>Data Collection</i>	16
3.2. Methodology	16
3.2.1. Regression Model	18
3.2.2. Variables	18
3.3. Results	22
4. Conclusion	28
Reference	31

1. Introduction

Over the past decades, New York City has witnessed increasing rent-burdens for low-and moderate income renters, and a need for more affordable housing has grown accordingly.

Several federal and state subsidized housing programs, such as U.S. Department of Housing and Urban Development (HUD) financing and insurance programs, HUD project-based rental assistance, the New York City and New York State Mitchell-Lama Programs, or Low-Income Housing Tax Credits (LIHTC), have been implemented to create and preserve affordable rental units. Under these programs, private property owners keep rents affordable for the duration of the subsidy term, and upon the expiration of the contracts, they may leave the program. This indicates that the change in the stock of affordable housing units can be heavily dependent on owners' opt-out rates, not just on new development.

Thus, for policy-makers who strive to preserve affordable housing units, it is important to identify what factors make owners stay in or leave subsidy programs. These factors can vary from individual property's characteristics to neighborhood conditions where the subsidized housing units are located. However, despite the importance, there have not been sufficient studies conducted on these factors. In this sense, this study can shed some lights on this important subject, with a special focus on neighborhood conditions. The findings of this study can be useful in devising incentives for owners to stay in, or even newly opt in subsidized housing programs.

2. Background

2.1. Affordable Housing Challenge in New York City

For decades, low and moderate income New Yorkers have struggled to find affordable housing in the City’s expensive housing market, and this challenge has only worsened over time.

As Table 1 indicates, adjusted to 2010 dollars, while the city’s median household income showed a modest increase from \$49,693 to \$50,886 between 1970 and 2010, the median rent has almost doubled from \$555 to \$1,004. In other words, the city’s median household income has remained stagnant, whereas the median rent has been rising considerably faster between 1970 and 2010.

	1970	1980	1990	2000	2010
Total Occupied Housing Units	2,836,872	2,788,530	2,819,401	3,021,588	3,109,784
Renter Occupied Units	76.4%	76.6%	71.4%	69.8%	69.0%
Median Household Income (2010\$)	\$49,693	\$40,645	\$51,865	\$50,539	\$50,886
Median Rent (2010\$)	\$555	\$628	\$779	\$853	\$1,004
Rent-burdened households	28.5%	38.6%	39.0%	40.7%	48.7%
Severely Rent Burdened households	-	20.1%	-	22.3%	26.3%

Table 1. Housing in New York City

Source: NYU Furman Center, original data retrieved from U.S. Census, American Community Survey, New York City Housing and Vacancy Survey.

As a consequence of these trends, a significant number of New Yorkers have been faced with increasing rent burdens. One of the commonly accepted definitions of a “rent-burdened” household is one that pays more than 30 percent of its income on rent. A “severely rent-burdened household” would be paying more than half of its income on rent (NYC Department of City

Planning & NYC Department of Housing Preservation & Development, 2015). By this definition, the number of rent-burdened households in New York City has risen sharply over decades, to almost 50 percent of all renter households, and the share of severely rent burdened households amounted to 26 percent, as illustrated in Table 1.

Although this rising rent burden is a general trend for all renter households, an analysis of rent burden by income band indicates that lower income households tend to face higher rent burdens. As Figure 1 shows, households at low income bracket or below¹ pay more than 30 percent of their incomes toward rents, experiencing serious rent-burdens, while moderate and middle income households pay less share of their incomes to rents.

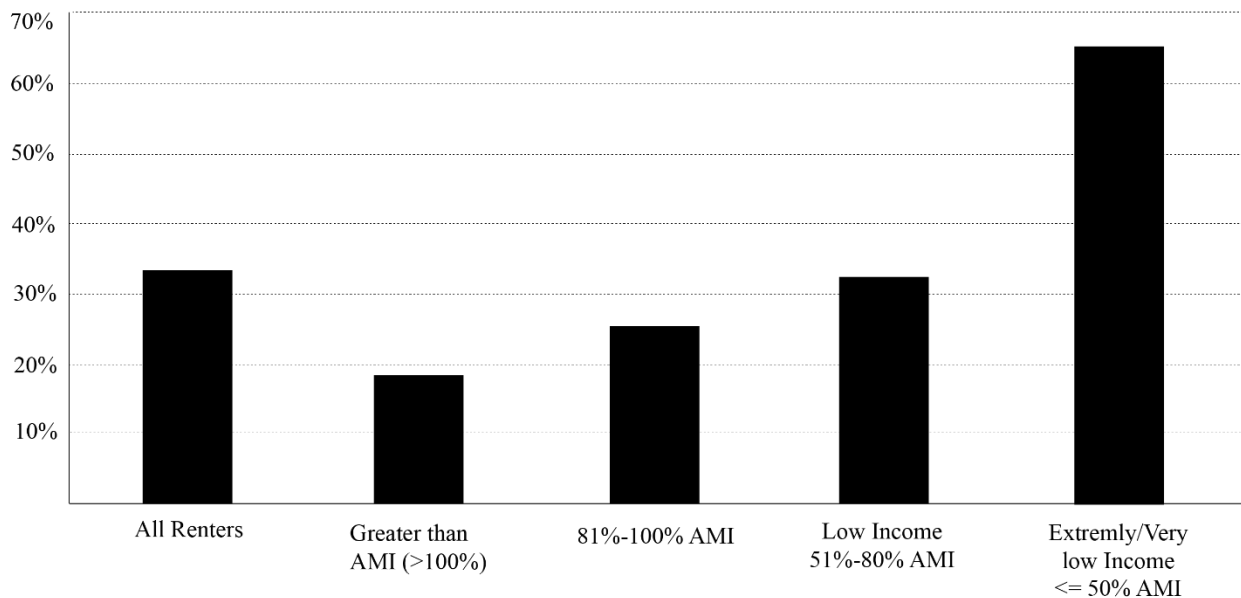


Figure 1. Median Gross Rent to Income Ratio by HUD Income Limits, New York City 2011

Source: 2011 NYC Housing and Vacancy Survey, Mandatory Inclusionary Housing, NYC Department of City Planning, NYC Department of Housing Preservation & Development. (2015).

¹ HUD defines income limits as follows. Based on Area Median Income (AMI) for a given geographic area, generally a Metropolitan Statistical Area, households who earn less than 30 percent of the AMI are considered to be extremely low-income, between 30 percent and 50 percent of AMI to be very low-income, between 50 percent and 80 percent of AMI to be low-income, and between 80 percent and 120 percent of AMI to be moderate-income.

2.2. Subsidized Housing Programs

2.2.1 Overview of Subsidy Programs

To reduce the burden on a number of rental households in New York City, the city, state and federal governments have come up with various affordable housing programs that preserve and provide affordable housing stocks. Besides public housing apartments that are owned and operated by the New York City Housing Authority (NYCHA), a large share of affordable housing units have been provided through subsidy programs. Under these initiatives, private developers build and keep housing stocks affordable to low and moderate income households in exchange for subsidies for a set time period. Major subsidy programs through which a large share of affordable housing units were provided include HUD financing and insurance programs, HUD project-based rental assistance, Low Income Housing Tax Credits (LIHTC), and Mitchell-Lama program.

	1960s	1970s	1980s	1990s	2000s
HUD financing and insurance	3,079	11,361	14,898	995	173
HUD financing and insurance/project-based rental assistance	467	7,494	22,797	5,326	2,915
Project-based rental assistance	891	4,889	11,803	2,164	1,390
Project-based rental assistance/Mitchell-Lama	0	22,996	248	0	0
Mitchell-Lama	14,772	19,199	0	0	0
Mitchell-Lama/HUD financing and insurance	0	1,788	0	0	0
HUD financing and insurance/project-based rental assistance/Mitchel-Lama	0	9,029	0	0	0
LIHTC	0	0	2,928	29,697	38,383
LIHTC/HUD financing and insurance	0	0	327	1,358	0
LIHTC/project-based rental assistance	0	0	0	103	0
LIHTC/HUD financing and insurance/project-based rental assistance	0	0	0	0	802

Table 2. Number of Units Developed by Decade and Program Subsidy Category

Source: Reina & Williams (2012).

HUD Financing and Insurance

The Federal Housing Administration (FHA) of the US Department of Housing and Urban Development (HUD) have financing and insurance programs that provide mortgage subsidies to private owners of multifamily housing to reduce development costs. In return, HUD required owners to agree to low income ‘use restrictions’ which restricted occupancy to households that meet the programs’ income limits and restricted contract renters. A total of 630 properties with 86,600 units of affordable housing were developed through these programs (NYU Furman Center, 2011).

HUD Project-based Rental Assistance

HUD has also provided a direct rental subsidy to owners through project-based rental assistance. Under these programs, tenants pay a certain percentage of the household’s income in monthly rent, no greater than 30 percent of his or her income, and HUD pays the difference between the tenant’s payment and the HUD-approved contract rent to the owner. The program facilitated the development of 697 properties with 104,000 units in New York City.

Low Income Housing Tax Credit Program

Low Income Housing Tax Credit Program (LIHTC) was created by the Tax Reform Act of 1986 to encourage private individuals and corporations to invest in affordable housing for lower income households. This program provides a tax credit over a 10-year period-a dollar-for dollar reduction in federal taxes owned on other income. By the end of 2010, 80,400 units had been financed in New York City through this program.

Mitchell-Lama

Mitchell-Lama was a moderate to middle-income housing development program operated by New York State from 1955 to 1978. In exchange for low interest mortgage loans and real property tax exemptions, developers agreed to regulation regarding rents charged and tenant selection. A total of 174 rental properties with 69,800 units were built under this program between 1955 and 1978.

2.2.2. Opt-Out of Subsidy Programs

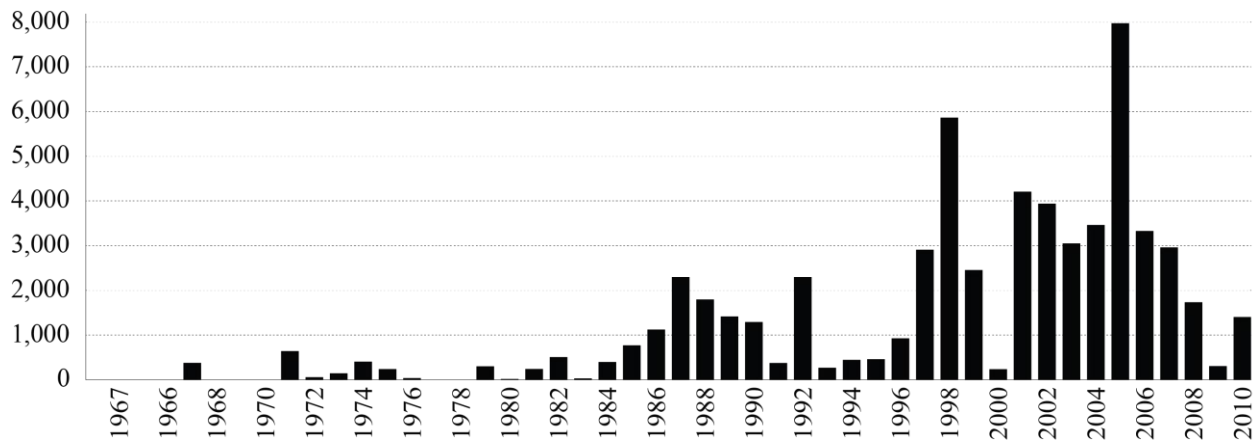


Figure 2. Subsidized Units No Longer Subject to Affordability Restrictions, by Exit Year
Source: State of New York City's Subsidized Housing: 2011. NYU Furman Center (2011)

Through one or multiple combination of these major programs, around 235,000 units of affordable rental housing were financed since the 1960s in New York City. Although these programs are managed by different government agencies and vary in contract periods, tenant eligibility, rent limit and other subsidy conditions, they are all privately owned, publicly subsidized program that are not permanently affordable with respective expiration dates. Upon the end of their subsidy term, a property owner can choose to stay in the programs, by renewing the contract and extending the affordability restrictions of the units. An owner also may leave the

program by opting out of all affordability restrictions and converting property to market-rate rental or condominium, and by selling his or her property to a new owner. Indeed, as Figure 2 shows, a number of properties have left subsidy programs after their expirations, leaving nearly one-quarter of the 235,000 units described above opted out as of 2010. This can be translated that a change in total affordable housing stocks can be dependent not only on new development but also on opt-out rates (NYU Furman Center, 2015).

Despite its importance in affordable housing policy, there have not been many studies done on these possible factors related to the opt-out decision, mainly due to lack of owner information. Several recent studies on this subject, however, indicate some common characteristics among properties that have left the subsidized housing programs.

2.2.3. Factors Associated with Opt-out

In ‘Multifamily Properties: Opting in opting out and remaining affordable’, prepared for the U.S. Department of Housing and Urban Development (Econometrica and Abt Associates, 2006), HUD-assisted project-based multifamily stocks were closely examined. The study compared properties that have left the assisted stock with that have remained in the HUD programs through quantitative descriptive analysis and qualitative descriptions of case studies. A multivariate logistic regression was conducted to explain the owners’ opt-out/opt-in decisions based on property, owner, program, and location variables. The study revealed that family-occupied properties in relatively well-off neighborhoods with market rents greater than the rents charged in the assisted properties have a higher likelihood of leaving the HUD-assisted stock.

A follow-up research, “Opting in, Opting out: a decade later” (HUD Multi-disciplinary Research Team, 2015), updated the 2006 analysis by replicating the quantitative analysis with additional

variables of regional and local housing market characteristics. In this research, the authors assessed the status of over 18,000 properties in HUD's multifamily portfolio from 2005 to 2014. Their analysis results echoed many of the findings in the original study, but property characteristics explain less of the variation in owners' decisions. Opt-outs continued to be more likely among properties that had low rent-to-Fair Market Rent ratios, were owned by for-profits, and were designated for family occupancy. The rent-to-FMR and ownership type variables were much less influential in this latest analysis than in the original report. Other factors associated with increased risk of opt-outs included partial rather than full coverage of units in the development by rental assistance contracts; lower physical inspection scores, implying that owners may opt out of Section 8 contracts when properties have extensive repair needs or are at risk of contract abatement by HUD; strong neighborhood rental housing markets; and strong regional home sales markets.

Reina and Begley (2014), focusing on Mitchell-Lama properties in New York City, conducted another quantitative research and yielded consistent results. In other words, properties located in neighbors with high property value growth, those with for-profit owners, and those past the affordability restrictions on all subsidies are more likely to opt out.

2.2.4. Neighborhood Condition Factors

As such, not only the individual characteristics of program, property, tenant and its owner, but also certain neighborhood conditions in which subsidized properties are located have an impact on opt-out decision. It is reasonable to assume that neighborhood conditions matter given that properties in subsidy programs are privately owned, and their owners are likely to view their

properties as investment and want to maximize their return. Consider a case where market-rate rentals in the neighborhood increased considerably since a property's opt-in of a subsidy program. If the owner of the property views the mandated rent level in exchange for subsidy is too low compared to the increased neighborhood rent level, he or she may leave the subsidy program upon the expiration and convert the property into market-rate rentals to realize higher potential profits (Reina and Begley, 2014). Forces that drive such neighborhood rent appreciation and a larger housing market change can be demographic changes in the neighborhood as well as the overall macroeconomic trend. One of the remarkable demographic changes that New York City and other U.S. cities have experienced during the past several decades is gentrification.

2.3. Gentrification in New York City

Gentrification is a complex process that has been widely debated in many literature. Freeman and Braconi (2004) described gentrification as a “dramatic shift in their demographic composition toward better education and more affluent residents”. Similarly, Vigdor et al. (2011) viewed that “gentrification brings renewed population growth, accompanied by an inflow of households with high education attainment, professional jobs, and few children. Corresponding outflows of socioeconomic status households are tempered to the extent that the neighborhood begins the process with high vacancy rates or the potential for more intensive development. Finally, gentrification often implies racial transition.” Whereas authors like Nelson (1988) imposes an additional necessary condition that initial residents must be displaced in the process, Kennedy and Leonard (2001) argued that gentrification must change “the essential character and flavor of the neighborhood”.

As the definition and nature of gentrification vary, so does its implication. One of the most frequently noted impacts of gentrification is displacement of lower-income households resulting from redevelopment projects or rising rents (Freeman and Braconi, 2004). LeGates and Hartman (1986) also argued that gentrification will force low-income minority groups out of desirable inner-city neighborhoods to less desirable areas, thus reducing their quality of life and diffusing and defusing their political power. Similarly, Newman (2006) pointed out the negative impacts of gentrification as not only the immediate displacement of residents in the process, but also as the impact of the restructuring of urban space on the ability of low-income residents to move into neighborhoods that once provided ample supplies of affordable living arrangements. As such, although previous studies on a link between gentrification and displacement have produced mixed results, it seems clear that gentrification is an important factor that affect rental and housing market trends in general.

In the meantime, it is well known that New York City has experienced drastic gentrification since the 1990s, as suggested by ample previous studies. Specifically, Freeman and Braconi (2004), in their analysis on gentrification and displacement, discussed that New York City's size and rapid regional economic growth during the 1990s produced several distinct areas of gentrification, as illustrated in Figure 3. Over time, this gentrification trend has only widened and intensified.

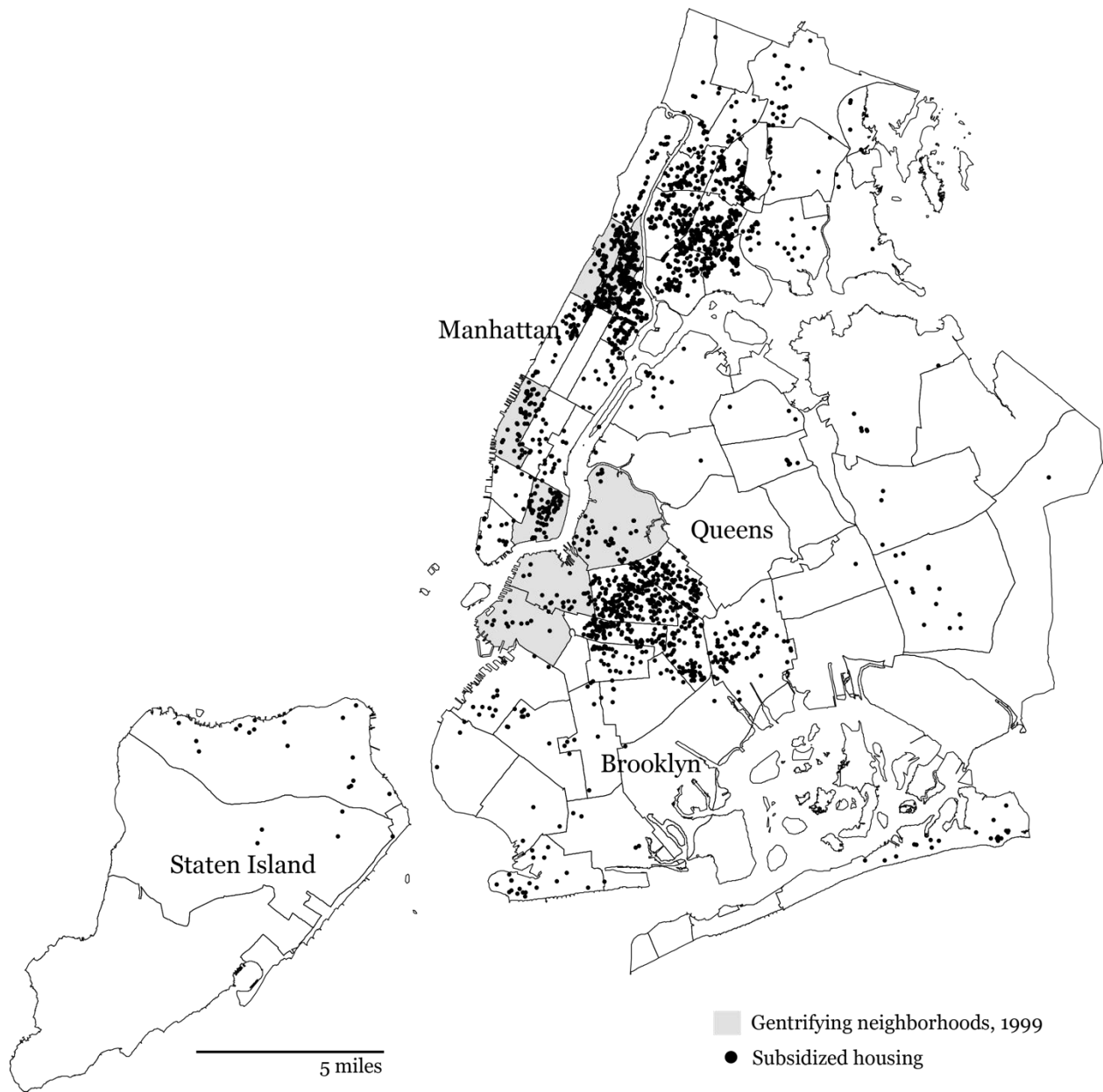


Figure 3. Location of Subsidized Property and Gentrification in New York City

Source: NYC Department of City Planning, NYU Furman Center

Note: Gentrifying neighborhoods identified by Freeman and Braconi (2004) include Chelsea, Harlem, the Lower East side, and Morningside Heights in Manhattan and Fort Green, Park Slope, and Williamsburg in Brooklyn.

A focus on gentrification in relation to opt-out is relevant considering the location of subsidized housing. As the Figure 3 shows, subsidized housing units are widely distributed in every borough, and substantial number of them were located in identified gentrifying areas. This suggests possible impacts of gentrification on subsidized properties. It is also worth noting that many neighborhoods where subsidized housing units are located are susceptible to gentrification. According to NYU Furman Center's report (2015), subsidized housing has generally been built in neighborhoods with low land costs, but in the intervening years, market rents and prices in some of these neighborhoods have risen considerably (NYU Furman Center, 2011), making opting out and converting to market-rate an attractive choice for a profit-seeking owner. Taken together, it would be useful and significant to investigate whether neighborhood conditions associated with gentrification influence owners' decision to opt out.

3. Data and methods

3.1. Data Collection

Data for this thesis is mainly drawn from NYU Furman Center's Subsidized Housing Information Project (SHIP) and US Census. SHIP contains physical and financial information on about 235,000 units of privately-owned subsidized affordable rental properties in New York City developed with financing and insurance from the U.S. Department of Housing and Urban Development (HUD), HUD project-based rental assistance, New York City or State Mitchell-Lama financing, or the Low-Income Housing Tax Credit (LIHTC). SHIP database also provides information on the status of each subsidized program which allows users to infer owners' opt-out decision. Information about neighborhood conditions where subsidized housing units were located is collected by census tract level. It is mainly retrieved from 1990 Census, 2012 American Community Survey (ACS) 5-year estimates. Other data sources include United States Department of Housing and Urban Development (HUD) and New York City Department of City Planning.

3.2. Methodology

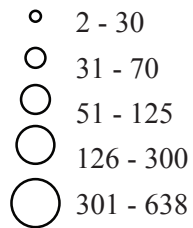
This research aims to examine whether there is a relationship between gentrification and owners' opt-out decision from subsidized rental housing programs. The hypothesis is that properties located in gentrifying areas are more likely to opt out subsidized housing programs than in those in not gentrifying areas. To prove this hypothesis, privately-owned rental units that started any of the major subsidized housing programs since 1990² are analyzed. To distinguish the effect of

² Despite data availability for Mitchell-Lama program in SHIP database, as this study only covers properties that started subsidized programs after 1990 and no development was financed through Mitchell-Lama since the late 1970, Mitchell-Lama properties are not included in the regression model.

Proportion of opted-out units to total subsidized units (%)



Number of Opted-opt units



▨ CD with no subsidized units

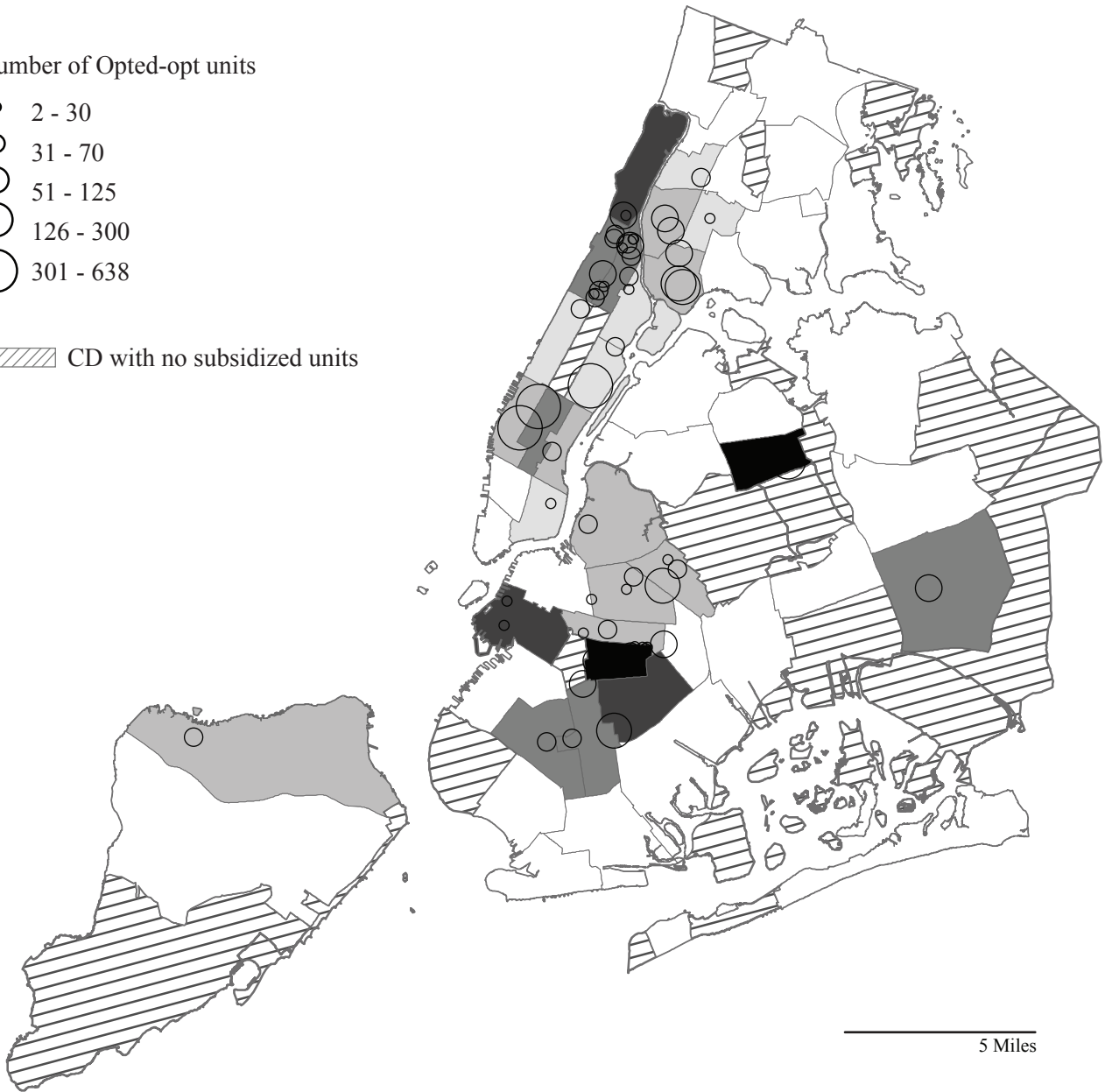


Figure 4. Subsidized Properties that Opted out as of 2012 (by Community District)

gentrification from other factors, the time period was set between 1990, when gentrification was widely observed and researched in New York City, and 2012, the year that the most up-to-date information is available for all subsidy property programs. The location of opted-out or stayed properties included in the analysis was mapped in Figure 4.

3.2.1. Regression Model

This study employs a multivariate logistic regression model to assess the impact of gentrification indicators on the likelihood an owner opted out a subsidy program in New York City, while controlling for other property and owner characteristics. The regression model is specified as:

$$\text{Ln} \left[\frac{P_{\text{Outout}}}{1 - P_{\text{Optout}}} \right] = \beta_0 + \beta_1 G_{\text{rent}} + \beta_2 G_{\text{income}} + \beta_3 G_{\text{bachelor}} \dots + \beta_7 O_o + \beta_8 P_{\text{unit}} + \beta_9 P_{\text{vlt}} + \beta_{10} P_{\text{year}}$$

where, P_{Outout} is the probability of an owner opts out a subsidy program, G represents a set of gentrification indicators fully described in the following variable section; O is coded for non- or for-profit ownership; and P measures three different property characteristics.

3.2.2. Variables

Dependent Variable

The dependent variable is a binary variable representing whether or not the owner opted out as of 2012. Properties that are classified as ‘Former’ in the SHIP dataset are the units whose owners opted out of the subsidized programs, and coded as ‘1’. Properties that stayed in any of the main four programs are coded as ‘0’.

Table 3. Variables for the Regression Model

Variable	Type	Explanation	Source
Opt-out			
Opt-out	binary	Properties that left or stayed in subsidized housing programs (0 = stay, 1=opt out)	SHIP, HUD
Gentrification Indicators (by Census Tract, 1990 - 2012)			
Δ Income ratio	continuous	Change in ratio of census tract's median household income to that of NYC	ACS 2012 1990 Census
Δ Rent Ratio	continuous	Change in ratio of census tract's median gross rent to that NYC	ACS 2012 1990 Census
$\% \Delta$ Bachelor's degree	continuous	Change in percentage of population with Bachelor's degree or more	ACS 2012, 1990 Census
$\% \Delta$ Owner-occupied housing units	continuous	Change in percentage of owner-occupied units	ACS 2012, 1990 Census
$\% \Delta$ Vacant units	continuous	Change in percentage of vacant housing units	ACS 2012, 1990 Census
$\% \Delta$ White population	continuous	Change in percentage of white population	ACS 2012, 1990 Census
Ownership Type			
Owner profile	binary	0=for-profit, 1= non-profit	SHIP, PLUTO, HUD
Property Characteristics			
Unit count	continuous	Total unit	SHIP
Violation count	continuous	Number of reported serious building violations	SHIP
Year built	continuous	Year properties were built	SHIP

Source: 1. ACS 2012, American Community Survey 2012 (5 year estimates), US Census Bureau
 2. 1990 Census, US Census Bureau 3. PLUTO, NYC Department of City Planning
 4. HUD: Multifamily Assistance and Section 8 Contracts Database
 5. SHIP: Subsidized Housing Information Project (SHIP), NYC Furman Center

Independent Variables

The independent variables of interest that are related to gentrification measure changes in demographic composition and socioeconomic status in the census tracts where subsidized housing units are located. Most of these measures were based on previous literature on gentrification. To be more specific, changes in percentage of white population, adults over 25 with Bachelor's degree or more, owner-occupied housing units, and vacant housing units between 1990 and 2012 were measured as each variable. In order to reflect the relative economic status of census tracts where subsidy properties are located, a ratio of median household income and median gross rent in the census tract to that of New York City³ in 1990 and 2012 were calculated, and changes in these ratios were included as variables.

If a census tract has been gentrifying or gentrified over time, the percentage of white population, adults with Bachelor's degree or more, owner-occupied housing units, income ratio and rent ratio are likely to increase while vacancy rate decreases. Thus, for the hypothesis to be proven, all or some of these gentrifying predictors except vacancy rate change variable would be positively related to opt-out, indicating higher probabilities of opt-out with higher values.

Control Variables

Several property conditions and owner's characteristics that may affect opt-out decisions are included as control variables. The owner profile variable specifies two different types of subsidy property owners. Properties owned by non-profit owners are coded as '1' and for-profit as '0'. I

³Adjusted to 2012 dollars, NYC's median household income was \$64,820 in 1990 and 63,982 in 2012. The median gross rent was \$854 in 1990 and \$1,084 in 2012.

expected that for-profit owners are more likely to opt out than non-profit owners, as several previous findings suggested (HUD multi-disciplinary research team, 2015 and Reina & Begley, 2014).

Table 4. Descriptive Characteristics of Properties that Stayed or Opted out of the Subsidy Programs as of 2012

Variable	Stayed (N=1,308)	Outed out (N=49)
Gentrification Indicators		
Income ratio (1990)	0.48	0.58
(2012)	0.61	0.71
Rent ratio (1990)	0.77	0.97
(2012)	1.32	1.28
Bachelor’s degree or more (1990)	11.38%	15.68%
(2012)	26.38%	33.89%
Owner-occupied housing units (1990)	12.21%	14.66%
(2012)	15.74%	16.77%
Vacant units (1990)	8.88%	9.43%
(2012)	11.62%	10.17%
White population (1990)	18.85%	25.34%
(2012)	25.27%	34.12%
Ownership Type		
Non-profit owner	20%	4%
Property Characteristics		
Unit count	48	79
Violation count	1.2	1.1
Year built	1938	1936

The property variables-building violation count, year built, and total units-measure the physical conditions of subsidy properties that may influence the opt-out. For example, properties in worse physical condition may be more likely to extend their affordability restrictions in exchange for a subsidy to fund improvements (NYU Furman Center, 2015). In contrast, owners of properties

with better physical conditions will be more likely to leave subsidy programs and convert their properties into higher market-rate rents to realize higher profits. Accordingly, this model may also show properties with low violation counts and that were built more recently are more likely to opt out. Detailed descriptions and sources for all variables used in the model are listed in Table 3 and corresponding descriptive statistics were illustrated in Table 4.

3.3. Results

Table 5 shows the results of the multivariate regression analysis. The first column contains estimated coefficients. Although it is rather difficult to interpret regression coefficients, they provide directional information about the link between explanatory variable and opt-out. For example, the white population variable has a positive coefficient, meaning that the higher the census tract's white population percentage change, the higher the logit for the property's opt-out in that census tract. The second column shows the relationship as odds ratio. The odds ratio for each independent variable implies how much the likelihood of opt-out would change for each one-unit change in that independent variable. An odds ratio greater than 1 indicates a positive relationship between the independent variable or control variable and the likelihood of opt-out while values less than 1 indicate a negative relationship. For example, for each increase of serious violation counts that has odds ratio of 1.0006, there is 0.1 percent increase in the odds of opt-out. The percent change in odds for unit increase in each explanatory variable is expressed in the third column.

Table 5. Logistic Regression Model for Property Opt-out

Variable	Coefficient	Odds ratio	%¹	
Gentrification Indicators				
Δ Income ratio	-1.93209	0.1448	-85.5	*
Δ Rent ratio	-0.43424	0.6478	-35.2	***
%Δ Bachelor's degree	0.03667	1.0374	3.7	**
%Δ Owner-occupied housing units	-0.01635	0.9838	-1.6	
%Δ Vacant units	-0.04819	0.953	-4.7	**
%Δ White population	0.00935	1.0094	0.9	
Ownership Type				
Property owner profile	-1.87739	0.153	-84.7	***
Property Characteristics				
Unit count	0.00525	1.0053	0.5	**
Violation count	0.00064	1.0006	0.1	
Year built	-0.00794	0.9921	-0.8	*
Pseudo R2 (McFadden's R2)	0.0955	-	-	
N	1357	-	-	

* $p < 0.10$, ** $p < 0.05$, *** $p < .01$

¹ % percent change in odds for unit increase in each explanatory variable

The regression model was adjusted to use robust standard errors.

Overall, a link between gentrification indicators and opt-out decisions it suggests is substantive, but not consistent. Among six predictors, four are statistically significant, and two of them were related in the expected direction. The percentage change of population with Bachelor's degree or more has the odds ratio of 1.0374, indicating that every 1% increase in this variable is associated with 3.7% increase in the odds of a property's opting out in that census tract. In contrast, the percentage change of vacant units was negatively related to the likelihood of opt out, as

expected. It has odds ratio of 0.953, meaning every 1 % increase in the percentage change of vacant units in a census tract between 1990 and 2012 is associated with about 4.7% decrease in the odds of a property’s opt-out.

Opposite of the expected results, the income ratio change and rent ratio change revealed a negative relationship with the odds of opting-out. The income ratio has the odds ratio of 0.1448, indicating that a unit increase in a census tract’s income ratio is associated with 85.5% decrease in the odds of a property’s opting out in that census tract. Similarly, the rent ratio change variable also shows that a unit increase in this variable decreases the odds of opt-out by 35.2%.

Some of control variables in the model perform according to expected predictions. Ownership type revealed strong impacts on the odds of opt-out with an odds ratio of 0.153. This indicates that a non-profit owner is 84.7% less likely to opt out than for-profit owner. Among property characteristics variables, the total unit variable suggested a modest statistically significant relation with the odds ratio of 1.0053. Another statistically significant predictor was year built, suggesting every 1 year increase in year built is associated with 0.8% decrease in the likelihood of opting out. This result is opposite to expected direction, which predicted the newer properties, the higher opt-out likelihood.

Table 6. Predicted Probabilities of Opting-out by Statistically Significant Gentrification Indicators

Predicted Probabilities		Predicted Probabilities	
%Δ Bachelor’s degree		%Δ Vacant units	
Low	0.0218241	Low	0.0568422
Medium	0.0320612	Medium	0.033993
High	0.0720798	High	0.0229513

Δ Rent ratio		Δ Income ratio	
Low	0.0610908	Low	0.0611202
Medium	0.0351384	Medium	0.0388062
High	0.0208138	High	0.0192767

To get a better sense of relationship between gentrifying indicators and opting-out, the predicted probabilities of opting-out when each statistically significant variable changes are presented in Table 6. I estimated the probabilities of opting-out when the value of each variable is low (at 5%), medium (50%), and high (95%). To control for the other covariates, they are fixed at their means. For example, in a census tract where the percentage change in population with Bachelor’s degree or more is high, about 36.37 or at 95%, subsidized properties have a probability of 0.07 of opting out. The predictions suggest that the incremental increase in the probability of opting-out as a result of an increase in the percentage change of Bachelor’s degree. In contrast, the estimated probabilities went down as the percentage change in vacant units, the change in rent ratio, and the change in income ratio increased.

As explanatory variables used in the regression were measured on different scale, it is hard to compare the odds ratio for one variable to that for another variable. In order to address this issue, I evaluated the effect of a 1-standard deviation change for continuous variables. In this model, only ownership profile variable is binary variable whose odds ratio and percentage can be directly interpreted, and the other variables for gentrification indicator and property characteristics are continuous variable. Table 7 presents the adjusted regression results to use 1-standard-deviation change as the basis for interpreting odds ratio and percentage. The first column labeled as StdX contains the odds ratio for 1-standard deviation change in the predictor, and the percentage change in this odds ratio is expressed in the % StdX column.

Table 7. Logistic Regression Model for Property Opt-out (by 1-standard-deviation change)

Variable	<i>StdX</i> ¹	% StdX ²	SDofX ³	
Gentrification Indicators				
Δ Income ratio	0.6535	-34.6	0.2201	*
Δ Rent ratio	0.7028	-29.7	0.8123	***
%Δ Bachelor's degree	1.5179	51.8	11.3793	**
%Δ Owner-occupied housing units	0.8832	-11.7	0.3983	
%Δ Vacant units	0.76	-24	5.6952	**
%Δ White population	1.1262	12.6	12.7055	
Ownership Type				
Property owner profile	0.4527	-84.7	0.3983	***
Property Characteristics				
Unit count	1.464	46.4	72.6228	**
Violation count	1.0074	0.7	11.5157	
Year built	0.7421	-25.8	37.5772	*
Pseudo R2 (McFadden's R2)	0.0955	-	-	
N	1357	-	-	

¹ *StdX* = change in odds for standard deviation increase in explanatory variable X

² %StdX = percent change in odds for standard deviation increase in X

³ SDofX = standard deviation of X

After the adjustment, the Bachelor's degree variable is found to be the most powerful predictor of all gentrification indicators, followed by income ratio change, rent ratio change, and vacant unit change.

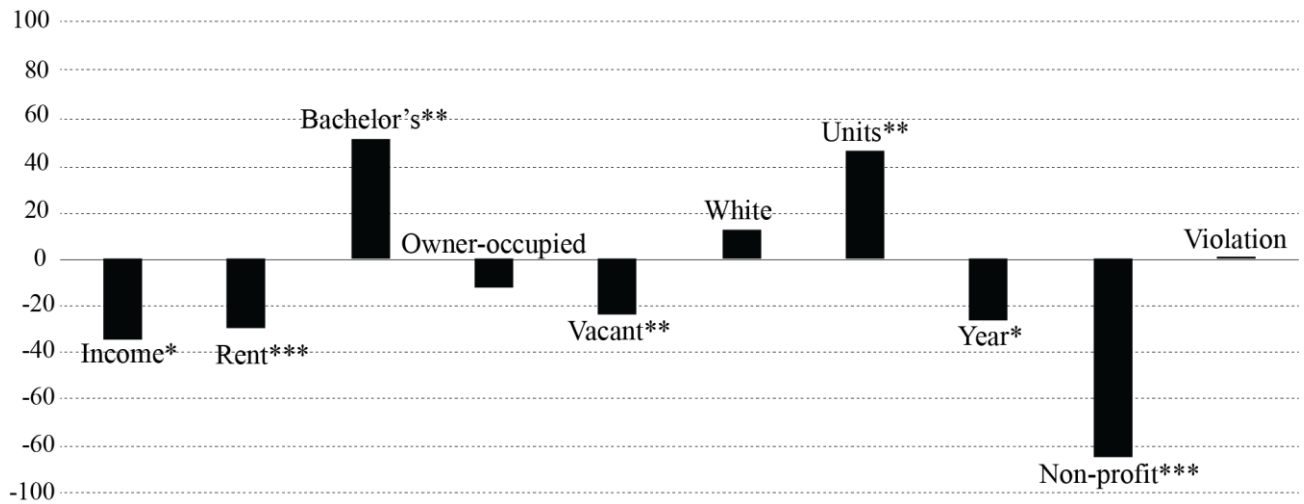


Figure 5. Percentage Change in Odds of Opt-out (by 1-standard-deviation change)

Other statistically significant control variables whose substantive size of relationship were relatively small in the regression result also showed large effects on opting out when 1-standard-deviation change was used as the basis of comparison. As the Table 7 shows, having a 1-standard-deviation more unit increases a property's odds of opt-out by 46.4%, and a property being a 1-standard-deviation newer reduces the odds of opting out by 25.8%. To compare the effects of each variable more easily, Figure 5 displays the percentage change in the odds ratio associated with each predictor in a bar graph form⁴. Except the ownership type that was binary and proven to be influential on opt-out in previous studies, the Bachelor's degree percentage change showed the most substantial increase in the odds of opt-out among all other continuous variables. The effects of other gentrification factors, income ratio change, rent ratio change, and vacant unit change, are also comparable to those of other control variables. Taken together, neighborhood conditions associated with gentrification are found to have substantial impacts on

⁴ For ownership type variable, percentage change in odd for a 1-unit change is used as it is a dichotomous variable (non-profit versus for profit).

property's opt-out, although the effects are not always considerably greater than that of other factors such as ownership profile.

Some limitations in this analysis leave a need for future study on this subject. First, as the dataset does not include the exact year of opting-out for each property, I assumed that the initial subsidy period ends within 22 years (1990-2012) for properties, and analyzed changes between this time period. Second, as the neighborhood conditions were analyzed by census tract level, census tracts where properties stayed and where properties opted out were overlapped in some cases, producing similarity among the data. Third, despite this model relied on previous literature to identify gentrification indicators, it is still difficult to measure the degree of gentrification and firmly define a neighborhood as gentrifying or gentrified. In addition, more extensive factors that might affect owner's opting out can be included as control variables to distinguish the effects of gentrification predictors. Further studies that address such issues would yield more solid and reliable results.

4. Conclusion

This thesis examined whether factors associated with gentrification would influence owner's decision to leave housing subsidy programs through a logistic regression model. Overall, the analysis yielded mixed results. Most of gentrification predictors are found to have impacts on opt-out, but the directions of the relationships are not consistent. The Bachelor's degree percentage change variable and the vacant unit change variable showed expected results. It was revealed that the higher the percentage change of Bachelor's degree or more in a census tract, the

higher odds of a property's opt-out. In contrast, the percentage change of vacant units was negatively related to the odds of opting-out. Opposite of the expected results, both the income ratio change and the rent ratio change were negatively related to a property's opting-out, indicating a greater increase in income and rent in a census tract decreases the odds of a property's opt-out. It is hard to point out the reason why property owners in census tracts where income and rent price increase are less likely to opt out. One possible explanation would be that the rate of rent growth in the neighborhood is not high enough to encourage owners to leave subsidy programs in which they are already guaranteed certain amount of rents from existing tenants. Further research that focuses on such economic factors and their impacts on opting-out might provide some insights.

As such, although not all of gentrification factors are related with opt-out in the expected direction, their statistical significance can suggest their influence on opting-out. At the same time, other factors that are known to affect property price and property's opting-out of subsidy programs were also found to influence opt-out decisions in this model. In particular, as suggested in several previous literature, for-profit owners were highly likely opt out compared to non-profit owners.

In sum, the findings indicated that properties located in neighborhoods with high Bachelor's degree holder growth, and less vacancy rate change, income growth and rent growth are more likely to opt out. Also, those with for-profit owners and more units and those built earlier showed higher likelihoods of leaving subsidy programs. This result suggests that New York City and other municipalities that strive to preserve subsidized housing stocks can use neighborhood conditions and other detailed data to better target their efforts. For example, as properties are

more likely to leave subsidy programs when the neighborhood shows some signs of gentrification, local governments should understand the impact of this change on the local property market and focus on incentives for property owners in these affected areas. At the same time, the findings of this study raise a need for discussion on the expiration, renewal and other overall terms of subsidy programs. As various factors including those discussed in this study do affect owners' decision to leave subsidy programs, some subsidy programs that make affordability restriction permanent can be a consideration. Finally, through this type of analysis, municipalities can better monitor the existing subsidized housing stocks and properly predict an owner's likelihood of opting out.

Reference

- Armstrong, A., Been, V., Bhalla, C. K., Ellen, I. G., Glashausser, A., McDonnell, S., ... & Wolf, C. (2011). State of New York City's housing & neighborhoods.
- Carpenter, J., & Lees, L. (1995). Gentrification in New York, London and Paris: An International Comparison*. *International Journal of Urban and Regional Research*, 19(2), 286-303.
- DeSalvo, J. S. (1975). Benefits and costs of New York City's middle-income housing program. *The Journal of Political Economy*, 791-805.
- Econometrica and Abt Associates. (2006). Multifamily Properties: opting In, opting out and remaining affordable.
- Ellen, I. G., & O'Regan, K. M. (2011). How low income neighborhoods change: Entry, exit, and enhancement. *Regional Science and Urban Economics*, 41(2), 89-97.
- Freeman, L. (2005). Displacement or succession? Residential mobility in gentrifying neighborhoods. *Urban Affairs Review*, 40(4), 463-491.
- Freeman, L., Cassola, A., & Cai, T. (2015). Displacement and gentrification in England and Wales: A quasi-experimental approach. *Urban Studies*, 0042098015598120.
- Freeman, L., & Braconi, F. (2004). Gentrification and displacement New York City in the 1990s. *Journal of the American Planning Association*, 70(1), 39-52.
- Hackworth, J. (2002). Postrecession gentrification in New York city. *Urban Affairs Review*, 37(6), 815-843.
- Helms, A. C. (2003). Understanding gentrification: an empirical analysis of the determinants of urban housing renovation. *Journal of urban economics*, 54(3), 474-498.
- Khadduri, J., Climaco, C., Burnett, K., Gould, L., & Elving, L. (2012). What Happens to Low-

- Sinae Lee, The Effects of Gentrification on Subsidized-Housing Programs in New York City Income Housing Tax Credit Properties at Year 15 and Beyond?. US Department of Housing and Urban Development, Office of Policy and Development Research.*
- Levy, D. K., Comey, J., & Padilla, S. (2006). *Keeping the Neighborhood Affordable: A Handbook of Housing Strategies for Gentrifying Areas*. Urban Institute.
- Marcuse, P. (1985). Gentrification, abandonment, and displacement: Connections, causes, and policy responses in New York City. *Wash. UJ Urb. & Contemp. L.*, 28, 195.
- Multi-Disciplinary Research Team. (2015). *Opting In, Opting Out a Decade Later*.
- Newman, K., & Wyly, E. K. (2006). The right to stay put, revisited: gentrification and resistance to displacement in New York City. *Urban Studies*, 43(1), 23-57.
- NYU Furman Center. (2011). *State of New York City's Subsidized Housing: 2011*.
- NYU Furman Center. (2015). *Housing, neighborhoods, and opportunity: the location of New York City's subsidized affordable housing*.
- Office of the Comptroller. (2014). *The growing gap" New York City's housing affordability Challenge*.
- Reina, V., & Begley, J. (2014). Will they stay or will they go: Predicting subsidized housing opt-outs. *Journal of Housing Economics*, 23, 1-16.
- Reina, V., & Williams, M. (2012). The importance of using layered data to analyze housing: The case of the subsidized housing information project. *Cityscape*, 215-222.
- Shimberg Center for Affordable Housing. "A risk assessment method for the preservation of assisted rental housing'." (2008)
- Vigdor, J. L., Massey, D. S., & Rivlin, A. M. (2002). Does gentrification harm the poor? *Brookings-Wharton papers on urban affairs*, 133-182.