Trajectories of Individual Behavior in the US Housing Market

Seungbee Choi

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Thomas W. Sanchez, Chair
Hyojung Lee
Andrew McCoy
Thomas Skuzinski

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ACADEMIC ABSTRACT

Three essays in this dissertation explore the behavior of individuals in response to the housing crisis and its consequences, and the impact of the pandemic on the short-term rental markets. The first essay examines the economic outcomes of young people who have returned to their parents' home, using data from 2003-2017 waves of the National Longitudinal Survey of Youth 1997 Cohort (NLSY 97). The economic outcomes of boomerang movers did not improve compared to the period of independent living, and the income gap with young people who remained independent widened. The residential movement of young people who make boomerang moves has an impact on their income, but this effect is short-lived. Going back to a parental house changes the region and urban form significantly, and movement of urban form from the central city to the suburban and from the suburban to out of the MSA has a negative impact on income. Findings from the study suggest implications. First, more affordable housing should be provided to reduce boomerang moves. Second, ways to increase job opportunities should be explored to reduce the short-term negative impact of boomerang move. Finally, education and vocational training opportunities must be increased to close the income gap among young people. The second essay seeks to answer the following questions through the experiences of individual households due to the foreclosure. First, did foreclosed households regain homeownership? Second, is there a relationship between socio-demographic characteristics of foreclosed household and regaining homeownership?

Third, where do homeowners who have lost their homes migrate? Finally, what characteristics of the neighborhood help foreclosed households recover? While previous studies have focused on the resilience of housing markets and regions, this study explores the link between regional characteristics and individual household recovery. The recovery of financially disadvantaged households is an important issue for communities and states. Identifying the mechanism that is responsible for household recovery has implications for implementing programs to aid household recovery. This study primarily relies on the 2005 -2019 Panel Study of Income Dynamics (PSID). Since 2009, PSID has added survey questions about foreclosure; Whether a foreclosure process has begun, the year and month of the start, the result of the process, and whether a foreclosed home is a primary residence. The findings of this study suggest that the government's recovery assistance program should aim to support relocation to areas with lower poverty rates and higher job and educational opportunities. The final essay explores changes in short-term rentals resulting from the COVID-19 pandemic. To identify the impact of the COVID-19 pandemic, this study uses New York City's Airbnb listing data from Inside Airbnb (IA), as well as supplemental data such as American Community Survey (ACS) data. Change in the number of STRs is divided into (1) the number of units left the platform and (2) the number of new units. The former relates to the survival of existing STR units and, the latter to the location choice of new units. The results show that the impact of several variables on survival and generation mechanisms changed since the COVID-19 pandemic. Since the survival mechanism and the generation mechanism of short-term rentals are different, they should be considered separately in regulating the STR to stabilize local housing markets.

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GENERAL AUDIENCE ABSTRACT

Although research has been conducted on the housing crisis and recovery of the housing market, there are still unanswered questions from two aspects. First, have the individuals affected by the crisis recovered? Were the individual decisions in response to the crisis effective? Second, how has the new crisis caused by the COVID-19 pandemic impacted the housing market? Are different characteristics observed from previous housing crises? While the evidence is reported that the relationship between the new crisis and housing demand has changed, the impact of the pandemic on contemporary housing crises such as gentrification and reduced housing stock is unknown. This dissertation explores the trajectories of individual behavior in the housing market, using various data sources and methodologies. Of the three essays in this dissertation, the first two essays explore the behavior of individuals in response to the housing crisis and its consequences, and the final essay explores the impact of the pandemic on the short-term rental markets.

The first essay investigates the economic outcomes of young people who return to their parental homes after periods of independent living using NLSY97 data. The second essay investigates the relationship between neighborhoods and the economic recovery of households using Panel Study of Income Dynamics. The third essay explores changes in the survival and generation mechanism of Airbnb units associated with the COVID-19 pandemic using New York City's Airbnb listing data. The results of each study commonly lead to the conclusion that housing affordability should be improved. It also

suggests that more affordable housing should be provided in areas of greater opportunities. This dissertation ultimately contributes to identifying individuals at risk from external shocks and suggesting goals and strategies for a healthy housing market.

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Chapter 1. INTRODUCTION

1.1 Research Background

There have been crises that negatively affected the US housing market. The Great Recession not only drastically reduced the US property value by nearly 30% but also drove many people out of the house (Belsky, 2013). More than four million homeowners lost homes because of foreclosure, and more homeowners were forced to sell at a poor price (Martin & Niedt, 2015; Rohe and Lindblad, 2013). Several studies examining the aftermath of the 2008 financial crisis report that the Great Recession displaced many households into less desirable neighborhoods or even homelessness (Kachura, 2012; Martin, 2012; Mykyta, 2013; Mykyta & Branch, 2015; Molloy & Shan, 2013; Niedt & Martin, 2013). After several years, the national housing market began to recover from the shock. However, rising housing costs and imbalances in supply and demand for housing have threatened housing affordability, especially for low-income households (Joint Center, 2017a, Joint Center, 2017b). According to the data drawn from 2019 American Community Survey, 20 million renters remained cost-burdened which accounts for 48.5% of renter households. Moreover, the unprecedented COVID-19 pandemic has triggered another housing crisis by causing a decline in economic activity, and it is still ongoing.

Scholars have paid attention not only to the negative impact of the crisis on the housing market but also to the disproportionate impact on certain groups and regions. Low-income, minority, and young people are reported to be more vulnerable to crises in the housing market. Low-income and minority were more likely to be foreclosed during the Great Recession, even after controlling for other factors (Allen, 2011; Gerardi & Willen, 2009; Laderman & Reid, 2008). They were more likely to move to lower-quality neighborhoods and experience a variety of physical and mental problems (Campbell & Cocco, 2015; Gerardi et al., 2018; Katz et al., 2013; Pollack et al., 2011; Williams et al., 2014). Young people responded to the crisis by giving

up their independence and living with their parents (Mather, 2011). The impact of crises varied by region. Regions with low auto dependency and high level of mixed land use were less affected by the Great Recession (Hartell, 2016; Immergluck, 2010). As the housing market recovers from the aftermath of the crisis, housing market resilience has emerged as an important issue. The recovery of the housing market differed by regional characteristics. Regional factors affecting housing market resilience are market type, urban form, location affordability, and racial composition (Dong, 2015; Dong & Hansz, 2016; Hwang, 2019; Pfieffer & Molina, 2013; Raymond et al., 2016; Wang, 2019a; Wang, 2019b; Wang & Immergluck, 2019a; Wang & Immergluck, 2019b). Uncovering the factors driving the recovery helps policymakers and planners prepare for future crises.

Although research has been conducted on the housing crisis and recovery of the housing market, there are still unanswered questions from two aspects. First, have the individuals affected by the crisis recovered? Were the individual decisions in response to the crisis effective? While individual household decisions in terms of residential mobility, tenure choice, and change in housing consumption, are well documented, less attention has been paid to the short- and long-term effects of those decisions on households. Housing market resilience studies have tracked changes since the housing crisis at the neighborhood and MSA levels, but a region with high resilience does not always indicate that all residents acquire an equal chance of recovery. If recovery mainly occurs among high-income households and whites, it implies that income and racial inequality in the region have deepened, widening the recovery gap. Examining individual household decisions and their consequences is valuable because it provides empirical implications, however, data limitations often make these impossible. For these studies, the same individual must be followed for a sufficient period using survey questionnaires that are consistent with the purpose of the studies. Panel surveys, such as the National Longitudinal Survey of Youth

(NLSY) and the Panel Study of Income Dynamics (PSID), which track individuals and households, make it possible to examine the consequences of individual decisions.

Second, how has the new crisis caused by the COVID-19 pandemic impacted the housing market? Are different characteristics observed from previous housing crises? Has it exacerbated existing housing problems? The COVID-19 pandemic has reduced housing demand in densely populated areas (Liu & Su, 2021). Since the dispersion of housing demand can alleviate existing housing problems, changes in housing demand triggered by a new crisis can rather be an opportunity in terms of housing affordability. The COVID-19 pandemic is negatively impacting all industries, not just tourism, by limiting people's mobility and causing massive unemployment. With the widespread work from home, people have moved from the city center to the suburbs. While evidence is reported that the relationship between the new crisis and housing demand has changed, the impact of the pandemic on contemporary housing crises such as gentrification and reduced housing stock is unknown.

1.2 Objectives and Contributions

Through this dissertation, I will explore the trajectories of individual behavior in the housing market, using various data sources and methodologies. Of the three essays in this dissertation, the first two essays explore the behavior of individuals in response to the housing crisis and its consequences, and the final essay explores the impact of the pandemic on the short-term rental and long-term rental markets.

The first essay of the dissertation, “Is back to the nest a good decision? The effect of returning to a parental home on the individual economic outcomes among young adults in the US”, aims to examine three economic outcomes (income, weeks of employment, and job security) of young people who have returned to their parents’ home. Young adults who achieved

independent living often go back to their parental homes because they cannot afford to maintain financial independence. While they can save living costs by returning to their parent's homes, they may have fewer job opportunities compared to living independently. This study seeks to answer the following questions: (1) Do economic outcomes of young adults who return to parental homes improve compared to when they were independent? (2) Do economic outcomes of young adults who return to parental homes improve compared to others who remain independent? (3) Do events that are likely to trigger a boomerang move or a change in residential location due to a boomerang move affect economic outcomes? While previous studies have focused on the causes of returning home, this study tracks young people who returned home. It contributes to identifying the effect of boomerang moves on their economic outcomes. The findings of this paper can provide direction for governments and planners to pursue by identifying the unexpected challenges young people may face when they give up their independence to relieve their financial burden. Especially in today's era of massive unemployment and increasing numbers of young people living with their parents due to COVID-19, it is important to come up with ways to improve the economic conditions of young people and enable them to choose financial independence.

The second essay, “Household recovery from foreclosure: examining foreclosed households’ trajectories in the US”, investigates the trajectory of foreclosed households. Although studies on the housing market resilience after the Great Recession show a relationship between regional characteristics and neighborhood recovery (Wang, 2019; Wang et al, 2019), little is known about the recovery of individual households which can be characterized as regaining homeownership or wealth lost in foreclosure. This study seeks to answer the following questions through the experiences of individual households who lost their homes: (1) Did foreclosed households regain homeownership? (2) Is there a relationship between socio-demographic characteristics of foreclosed household and regaining homeownership? (3) Where

do homeowners who have lost their homes migrate? (4) What characteristics of neighborhood help foreclosed household recover? While previous studies have focused on the resilience of housing markets and regions, this study explores the link between regional characteristics and individual household recovery. The findings from this study can provide valuable insights and information to planners, policy-makers developing public programs, and developers in the housing industry by characterizing the neighborhood that helps households recover. The recovery of financially disadvantaged households is an important issue for communities and states. Identifying the mechanism that is responsible for the household recovery has implications for implementing programs to aid household recovery. It helps determine which programs can give more benefits to recipients to achieve recovery: providing individuals with a monetary subsidy (e.g., covering relocation expenses) or encouraging and aiding them to move into a certain neighborhood.

The third essay, "Resilience of short-term rentals (STRs) during COVID-19 pandemic: Evidence from Airbnb listings in New York City", explores changes in STRs resulting from COVID-19 using New York City's Airbnb listing data. As the tourism industry has been hit hard by COVID-19, accommodations have looked for ways to survive. While hotels can use a variety of ways including adjusting prices and reducing employment to minimize financial losses, STR hosts can rent to long-term tenants or even sell their housing units to end their rental business (Gyódi ,2021). This transition could impact local housing markets, such as rent and housing affordability, through an increase in long-term rental housing stock. This study aims to answer the following four research questions: (1) What unit and neighborhood characteristics are associated with the survival of STRs during the pandemic? (2) Are there any differences in the association between the survival of STRs and their characteristics before and after the pandemic? (3) What are the determinants of new STR's location during the pandemic? (4) Are there any differences in the determinants of new STR's location before and after the pandemic?

The findings of this paper will ultimately provide insight into the impact of negative shock on the STRs and closely linked LTR housing markets. Prior to the COVID-19 pandemic, many cities enacted regulations such as owner-occupancy requirement, license requirement, and imposing multiple taxes to reduce the negative impact on housing affordability because the growth of STRs has reduced local housing stocks and raised rents in surrounding areas. Changes in survival and generation mechanisms during the pandemic period suggest a need for an approach that goes beyond existing regulations. It is possible to discuss the policy direction that the government and the local community should pursue, for housing stability and housing affordability in regions with high tourism demand.

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Chapter 2. IS BACK TO THE NEST A GOOD DECISION? THE EFFECT OF RETUNING TO PARENTAL HOME ON THE INDIVIDUAL ECONOMIC OUTCOMES AMONG YOUNG ADULTS IN THE US

2.1 Introduction

Young people who spent their adolescence in their parents' homes typically start independent living with events such as entering college, moving to the city for work, and marriage (Rosenfeld, 2007). Independent living has been regarded as one of the key markers of transition to adulthood because it is the first step in financial independence as well as it requires self-determination away from familial authority (Mykyta, 2012; Sironi and Furstenberg, 2012). However, young adults who achieved independent living often go back to their parental homes because they cannot afford to maintain financial independence. This phenomenon, called "boomeranging", has drawn public attention as the number of young people living with their parents has increased during the Great Recession (Qian, 2012). Along with young adults who have never moved out in the first place, the boomerang move is a key part of explaining this increase. According to recent studies, between 20% and 50% of young adults return home after leaving at some point in the US. (Parker, 2012; Sandberg-Thoma et al., 2015; South and Lei, 2015).

Why do young adults move back to their parents' homes after periods of independent living? Evidence suggests that it is primarily because of financial issues. While demographic factors such as marital status, race/ethnicity, educational attainment, and family issues affect returning to the parent's home at the individual level, economic factors such as poverty level, employment status, student debt, and college completion have been identified as key factors

(Houle and Warner, 2017; Mykyta and Macartney, 2012; Wiemers, 2014). In addition, the high unemployment rate during the Great Recession and the rising cost of living since then are factors driving young people to give up their independent life (Lee and Painter, 2013; Newman, 2012; Pilkauskas et al., 2014). Between 2007 and 2011, the number of young adults aged 25 to 34 living in their parents' homes increased from 4.7 million to 5.9 million (Mather, 2011). This number may be exaggerated as it includes the population who did not leave their parents' homes during this period, but recent evidence during the pandemic shows a more dramatic trend. Between February and July 2020, the number of young adults aged 18 to 29 living with parents increased by about 2.6 million which accounts for 5 percent of them, demonstrates the huge impact of the economic shock on the decision of living arrangements (Fry et al., 2020).

Is back to the nest a good decision? While much attention has been paid to the factors related to giving up independent living, the lives of young people after returning to parental homes are not well known. They want to get economic benefits, primarily to reduce living costs, by returning to their parents' homes. Living in a parental home helps young people reduce housing and living expenses. However, it may lead to negative consequences such as increased commuting costs and reduced income. Considering that most American families with children live in single-family houses located in suburban areas, boomerang kids are likely to have lower job accessibility than before. The commuting cost of those who have a job can increase, and those who do not have a job can have fewer job opportunities after moving to a weak labor market (Chan et al., 2019). In other words, the net income of boomerang kids can be reduced. However, changes in income and expenses after a boomerang move are unknown. I take my attention to young adults' lives after returning to the nest. This study examines the economic outcomes of young people who have returned to their parents' home using data from 2003-2017 waves of the National Longitudinal Survey of Youth 1997 Cohort (NLSY 97) which tracks nearly 9,000 individuals born between 1980 and 1984. Unlike household-based panel data that stops tracking

when an individual gains independence, NLSY 97 surveys on an individual basis, so it has the advantage of obtaining a complete set of data regardless of the living situation.

This study seeks to answer the following questions: (1) Do economic outcomes of young adults who return to parental homes improve compared to when they were independent? (2) Do economic outcomes of young adults who return to parental homes improve compared to others who remain independent? (3) Do events that are likely to trigger a boomerang move or a change in residential location due to a boomerang move affect economic outcomes?

Economic outcomes are measured by 3 variables – income, weeks of employment in a year, and full employment, which is employment for 52 weeks as a proxy for job security. Commuting cost and living cost are important cues to measure changes in the lifestyle, but it is not available in NLSY97. Therefore, this study examines the economic outcomes of youth through changes in income and employment status.

While previous studies have focused on the causes of returning home, this study tracks young people who returned home. It contributes to identifying the effect of boomerang move on their economic outcomes. The findings of this paper can provide direction for governments and planners to pursue by identifying the unexpected challenges young people may face when they give up their independence to relieve their financial burden. Especially in today's era of massive unemployment and increasing numbers of young people living with their parents due to COVID-19, it is important to come up with ways to improve the economic conditions of young people and enable them to choose financial independence. In fact, the federal government implemented the 2009 Recovery Act Summer Youth Employment Initiative for youth as part of American Recovery and Reinvestment Act (ARRA). States received $1.2 billion in employment and training funds to help disadvantaged youth hit hard by the recession, providing summer jobs to more than 314,000 youth. Regardless of the success of this policy, there was a lesson that simply investing large amounts of money to provide short-term jobs and educational opportunities not

linked to the labor market would not benefit young people (Bird et el., 2021). For a better policy, it is necessary to understand the situation of young people and consider the reality of the community.

2.2 Literature Review

2.2.1 The determinants of living arrangement

At the individual level, demographic and socioeconomic characteristics significantly affect the living arrangements of youth. Income and employment status are strong predictors of boomeranging. People who are unemployed or have unstable jobs are more likely to change their living arrangements. Young adults with a poverty-level income and young adults who are unemployed are more likely to live with their parents (Mykyta and Macartney, 2012). Income growth of youth increases their chances of living independently (Kaplan, 2012; Matsudaira, 2016; Wiemers, 2014). Student debt and consumer debt were expected to induce boomeranging, but results are mixed. Student debt is positively associated with boomeranging and shows that this association is greater for subprime borrowers (Dettling and Hsu, 2018). However, Houle and Warner (2017) show that when controlling covariates in the complete sample, student debt is no longer associated with boomeranging. But rising debt can cause new risks and can reproduce social inequality in the transition to adulthood.

Race/ethnicity and educational attainment, and the heterogeneity thereof affect the decision of living arrangement. Living in doubled-up households is common among African-American, Hispanic, and Asian-American households. Less than 20% of White adults over the age of 25 live in doubled-up households, while 36% of Hispanic adults, 32% of Asian adults, and 31% of Black adults live in doubled-up households (Wiemers, 2014). Considering the socio-economic advantage, White parents are more capable of providing financial support to their

grown children than black parents, so White children are more likely to achieve independence. (Rosenzweig and Wolpin 1993). Black and Hispanic young adults leave parental homes at an older age and are more likely to return to parental homes (South and Lei, 2015). Racial differences stem from socioeconomic achievements and group differences in marital status rather than cultural differences such as attitudes toward family and marriage (Britton, 2013). However, although most studies have found that racial heterogeneity exists, no single factor can clearly explain racial differences in the timing of leaving and returning to the parents' home (Lei and South, 2016).

The way young people respond to unemployment varies depending on their educational attainment. Individuals with less than a high school degree and with at least some college degree are more likely to give up their independent life (Kaplan, 2012; Wiemers, 2014). Highly educated people with high wages are less likely to return home but are more likely to boomerang in some labor markets where jobs are scarce (Newman, 2012). Young people who do not complete college education are at increased risk of boomeranging (Houle and Warner, 2017). In addition, family health issues, characteristics of the parental home (e.g., presence of coresident siblings, mother's educational attainment), family connectivity (e.g., emotional closeness to mother, instrumental help from family), and financial support from parents are an important role in choosing a boomerang move (South and Lei, 2015).

2.2.2 Life after returning parental home

Limited evidence suggests that young people can save living costs by returning to their parent's homes, but they may have fewer job opportunities compared to living independently. While much attention has been paid to the factors related to giving up independent living, studies on the lives of young people after returning to parental homes are scarce. Boomerang move helps reduce spending. Both the head of household and grown children of doubled-up households may accumulate assets (Clampet-Lundquist, 2003). However, parents' homes are likely to be located

in poorer labor markets with increased distance from current jobs or reduced employment opportunities. In particular, young people who lived independently are insensitive to the labor market in their parents' residence. Boomerang movers, on average, move to areas with a higher unemployment rate, and non-boomerang movers move to areas with a lower unemployment rate (Chan et al, 2019). Several studies suggest that the outcomes of boomerang kids may differ depending on the parent's neighborhood. Young adults living in neighborhoods close to their parents experience strong earnings recoveries after a job displacement, but the mechanism is unclear (Coate et al., 2017). Boomerang kids tend to stay longer if their parents' home is in a good labor market. In other words, the labor market is not considered much in boomerang decisions, but it shows that the labor market plays a role in life after the boomerang. The spending capacity of young adults is related to the period of co-residence with their parents. Young people with lower credit card limits are more likely to stay with their parents. (Dettling and Hsu, 2018).

2.3 Mechanism: Boomerang Move and after Boomerang Move

To reveal the relationship between the boomerang move and economic outcome, it is important to identify a valid mechanism and the direction of the causal relationship. Most studies on boomerang moves have analyzed cross-sectionally, so the interpretation of the causal relationship between variables is sometimes ambiguous. For example, the result that a minority ethnic group is more likely to return to their parent's home may be due to differences in education or income, or, regardless, cultural differences or structural inequality. This study identifies the mechanism by which a boomerang move occurs and the mechanism by which it affects income after the boomerang move occurs, respectively. Then, I set the direction of the causal relationship by integrating them.

According to the existing literature, income is a strong factor in predicting a boomerang move. Socio-demographics, household characteristics, residential location, individual personality, and family characteristics are also influential factors. However, these factors affect not only the boomerang move but also economic outcomes. The mechanism between variables that affect the previous year's income and boomerang move is expressed as follows.

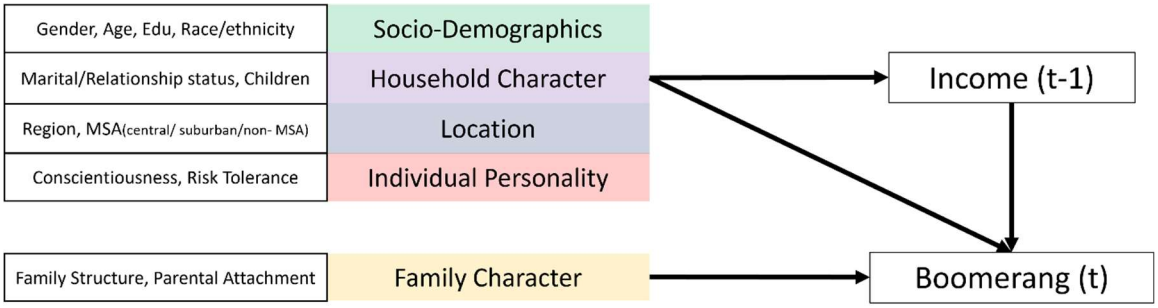

Figure 2.1. Theoretical mechanism that affects previous year's income and boomerang move

Changes in marital and relationship status such as getting married, divorced, or cohabiting are likely to occur simultaneously with the boomerang move. While the survey data may show that they change at the same time, a change in marital/relationship precedes a boomerang move. In other words, they are moving because their relationship has changed. Location changes are caused by boomerang moves. Moving to a parent's home means not only a residential move but also entry into a different labor market or a change in access from the existing labor market, which is expected to potentially affect income. The mechanism that can affect the income of young people after the boomerang move is as follows.

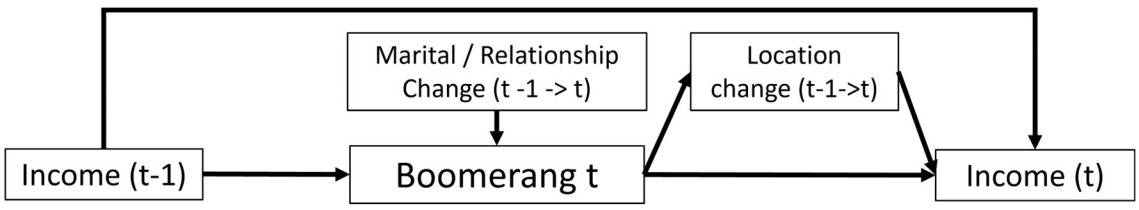

Figure 2.2 Theoretical mechanism that affects the income after the boomerang move

I set the direction of the boomerang move that occurs in year t and the causal relationship between variables in years t-1 and t through two mechanisms from Figure 2.1 and Figure 2.2. Variables that affect income in the previous year and boomerang move are considered exogenous.

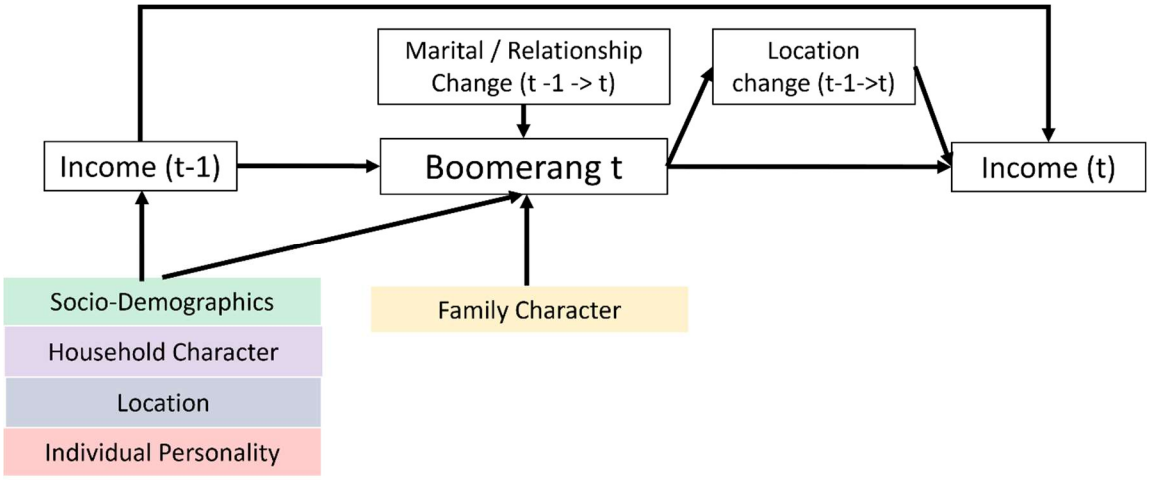

Figure 2.3 Integrated theoretical mechanism between variables and income before and after the boomerang move

2.4 Data and Methods

This study primarily relies on the data from 2003-2017 waves of the National Longitudinal Survey of Youth 1997 Cohort (NLSY 97) which tracks nearly 9,000 individuals born between 1980 and 1984. Survey respondents have been interviewed yearly since the original round of data collection in 1997 except for a two-year gap between the 2011 and 2017 waves. The NLSY 97 has several advantages over other data. First, it has the advantage of obtaining a complete set of data regardless of living arrangement. Most panel data are household-based surveys that stop tracking when an individual becomes independent of the household. Since NLSY 97 is an individual-based survey, it allows continuous observation of each respondent. Finally, it contains a variety of information about individuals, especially related to the respondent's personal traits. This information helps control the factors that can cause endogeneity problems in the analytical model. However, it does not include questions about personal spending

such as housing costs or commuting costs, so it is not possible to know the change in spending before and after the boomerang move.

However, the limitation of using this data is that it is impossible to directly estimate the difference in personal spending such as housing costs or commuting costs before and after the boomerang move. Questions on personal spending are not included, and residential area information is broadly provided in regions (Northeast, North Central, South, West) and urban forms (central city in CBSA, not in the central city, not in CBSA).

2.4.1 Measurement

Boomerang moves

Changes in independent living of individuals or households are expressed in terms such as doubled up, living arrangement, boomerang move, etc., depending on the survey data and the purpose of the study, and each measurement is slightly different. This study focuses on the boomerang move, returning to a parents' homes after independence. In previous studies, measuring boomerang moves using NLSY relied on an annual household roster. Boomerang moves are measured by changes in presence of parents in the household, but this can lead to ambiguous results. It is possible that respondents report differently between household rosters and actual cohabitors. Also, if independence and returning to a parental home occur in the same wave of survey, the household roster cannot capture the movement. In NLSY97, questions about independent life and boomerang move have been included since 2003.

Respondents are asked whether they have been independent for more than 3 months since the last interview and are asked whether they moved in with their parents or someone else's household. These two questions only provide information about independent living. When combined with household roster information, living status can be measured. If the household roster includes a mother, father, father-in-law, or mother-in-law in the year from independent to

dependent, it is measured as a boomerang move. Using this method, I can capture the five stages of living status related to a boomerang move. The living arrangement of 8,622 valid respondents of NLSY 97 is as follows.

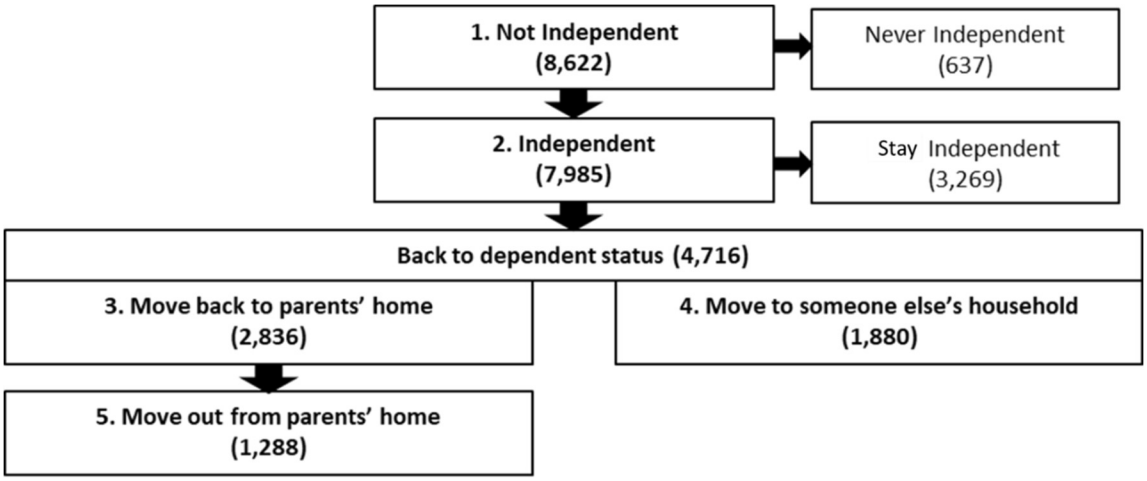

Figure 2.4 Living status experienced by respondents in NLSY 97

Since NLSY97 only asks about the first independence and first boomerang move, living status cannot be captured after steps 4 and 5. According to evidence from the household roster, there are three cases of people who respond "move to someone else's household" – (1) move to sibling or relatives' house, (2) married, and (3) cohabit. Because the NLSY defines independent living as being head of household or sharing that role equally with others, it can be interpreted that they are economically dependent on the householder. From an economic point of view, living in someone else's house and going back to parents' house can be considered the same concept as it reduces living expenses. However, boomerang movers have distinctive features. While living in a parent's house is psychologically more comfortable and doesn't necessarily require payment toward living expenses, it doesn't give young people the opportunity to choose a location. People who live in someone else's house have more choice of location. Therefore, the move to someone else's household is not defined as a boomerang move in this study.

Economic Outcomes

The economic outcomes used in this study are income, the number of employment weeks in a year, and full employment, which is 52 weeks of work. In the NLSY, respondents answer previous years' earnings and weekly employment status. Income is an intuitive indicator of the economic situation, weeks of employment can indicate unemployment and turnover, and full employment is used as a proxy for job security. Income and employment also allow us to infer changes in wages before and after a boomerang move.

Covariates

This study includes an array of time-invariant and time-varying covariates in analysis that may affect the link between boomerang move and economic outcomes. Time-invariant and time-variant controls include race (non-Hispanic White, non-Hispanic Black, Hispanic and other races), gender (female, male), age, marital/relationship status (never-married, married – living together, cohabiting with partner, and single but separated, divorced or widowed), having children, highest education (high school degree, some college, four-year college degree or higher), region of residence (Northeast, North Central, South, West), and urban form (a central city in CBSA, not a central city in CBSA, not in CBSA).

Family character and personal traits that make it possible to suppress causal relationships are also included. Family character includes the family structure in adolescence (two-parent biological, single parent, stepfamily, other family structure) and parental attachment. Parental attachment is measured using the method from Houle and Warner (2017). Respondents are asked the extent to which they agree with the following statements regarding their parents (measured on a 5-point Likert agree/disagree scale): (1) I think highly of him/her, (2) He/she is a person I want to be like, and (3) I really enjoy spending time with him/her. Houle and Warner take the average of a respondent's responses for each question and create a time-stable parental attachment scale by combining the measures into a single summed scale. Personal characteristics include financial risk tolerance and conscientiousness. Risk tolerance is measured using the method from

Letkiewicz & Heckman (2018). Risk tolerance questions were included in the NLSY97 in 2010. Financial risk tolerance was measured by asking respondents on a scale of 1 to 10 the extent to which they were willing to take financial risks, where 0 means “unwilling to take any risks” and 10 means “fully prepared to take risks.” The measurement of conscientiousness is from Letkiewicz & Heckman (2018).

2.4.2 Data restructure and missing value

To compare the economic outcomes before and after boomerang moves, the target population is selected, and the data are restructured. First, the data are converted to person-wave format, and each person-wave contains variables for 3 years. Respondents who are full-time students are excluded from the analysis. Since students do not usually have full-time jobs, it is not appropriate to compare the economic situation. Also, respondents whose living status was not independent (stage2) in the previous year were excluded. This exclusion is because this study ultimately wants to discern whether there are different economic outcomes among young people who remain independent and those who return to their parents' homes.

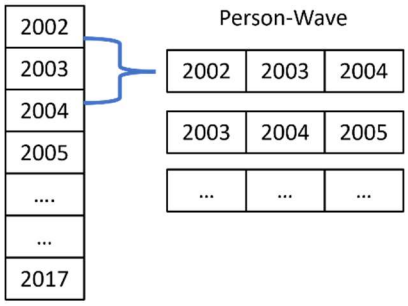

Figure 2.5 Restructuring data into person-wave format

Missing values are supplemented using Stata's multiple imputations (MI). MI method uses observed variables to estimate missing variables. This is known to be a less biased and more efficient method than the deletion technique (Lee & Carin, 2010). NLSY has been changed to survey once every two years since 2011, so there is no data for 2012, 2014, and 2016. The analysis is limited to the period from 2003 to 2010 when the observed variables for the sample were intact because the person-wave is a group of variables for three consecutive years. As variables related to employment status were measured completely without omission even in years

other than the survey year, economic outcomes are set from 2003 to 2015. All income-related variables have been converted to 2018 dollars.

2.4.3 Empirical strategy

First, this study compares the economic outcomes of boomerang movers and non-boomerang movers without control. Based on the time point t at which the boomerang move occurred, this study observes the three-year changes in the previous year, target year, and the following year. Then I estimate the regression with the income of the target year and the following year as the dependent variable. I employ the following linear probability model:

$$y_{i,t} = \beta y_{i,t-1} + \gamma \boldsymbol{B_{i,t}}(\times \boldsymbol{R_t}) + \delta \boldsymbol{L_{i,t}} + \theta \boldsymbol{X_{i,t}} + \sigma_t + \varepsilon_{i,t} \quad (1)$$

Here, $y_{i,t}$ indicates logarithm of income for person i in the target year. $\boldsymbol{B_{i,t}}$ is whether individual person i made a boomerang move in the target year. $\boldsymbol{R_t}$ indicates the recession period, which allows to estimate the coefficient of B move in the recession period and in the non-recession period, respectively. $\boldsymbol{L_{i,t}}$ is the residential location, indicating the region and urban form in which person i lives in the target year. In the basic model, only variables of the target year are included, but in the advanced model, the location of the previous year and changes in location are measured. $\boldsymbol{X_{i,t}}$ is an individual characteristic, including socio-demographic, individual personality, households and family characteristics. Finally, I added a time fixed effect σ_t to capture time-varying factors common to all.

As a final step, this study applies generalized structural equation modeling (GSEM) to elucidate the mechanism above. The most popular method for validating established causal relationships is path analysis using SEM, but in SEM, endogenous variables must be continuous variables. GSEM allows dependent variables and mediator variables to be categorical variables, but the limitation of GSEM is that it can only report the relative fit of the model and cannot compare the relative influence of variables through standardized coefficients.

2.5 Results

2.5.1 Changes in Economic Outcomes

The following reports the changes in three economic outcomes - income, weeks of employment, and full employment - in Table 2.1 for the full sample year and the recession period. The income of non-boomerang movers has steadily increased, showing a similar trend during the recession period. On the other hand, Boomerang(B) mover's income increased and then stagnated. During the Recession period, it stagnated in the target year and then decreases in the following year, lower than the previous year.

Table 2.1 Changes in income

Period		Observation	Growth (t-1->t)	Growth (t-1->t+1)
2003-2015	Full sample	21,455	5.93%	11.05%
	Boomerang move	670	6.06%	5.35%
	Not B Move	20,785	5.94%	10.83%
Recession 2007-2009	Full sample	5,516	5.11%	7.92%
	Boomerang move	203	0.27%	-2.09%
	Not B Move	5,313	5.26%	8.23%

While weeks of employment of non-B movers remain at a constant level, that of B movers decreased in the target year and then recovered to a higher level than the previous year in the following year. During the Recession period, the decline in weeks of employment is greater in the target year but returns to the previous level.

Table 2.2 Changes in Weeks of Employment

Period		Observation	Year (t-1)	Year (t)	Year (t+1)	Growth (t-1->t)	Growth (t-1-> t+1)
2003-2015	Full sample	21,455	44.83	45.59	45.62	1.70%	1.77%
	Boomerang move	670	41.43	41.13	43.38	-0.70%	4.73%
	Not B Move	20,785	44.58	45.31	45.23	1.65%	1.45%
Recession 2007-2009	Full sample	5,516	45.59	46.18	45.85	1.29%	0.58%
	Boomerang move	203	43.21	42.30	43.88	-2.12%	1.55%
	Not B Move	5,313	45.69	46.33	45.93	1.41%	0.53%

Full employment representing job security shows a similar pattern to that of the employment week. The full employment of non-B movers was maintained at a constant level, and that of B movers decreased in the target year and then recovered in the following year. A similar pattern was observed during the recession period, but overall, the B mover's job security level was lower than that of the full sample period.

Table 2.3 Changes in Full Employment

Period		Observation	Year (t-1)	Year (t)	Year (t+1)	Growth (t-1->t)	Growth (t-1-> t+1)
2003-2015	Full sample	21,455	64.0%	66.4%	64.3%	3.76%	0.37%
	B move	670	50.3%	43.6%	52.7%	-13.35%	4.75%
	Not B Move	20,785	64.5%	67.2%	64.6%	4.20%	0.26%
Recession 2007-2009	Full sample	5,516	65.2%	67.7%	67.1%	3.89%	2.92%
	B move	203	56.6%	48.3%	58.1%	-14.78%	2.61%
	Not B Move	5,313	65.5%	68.5%	67.4%	4.51%	2.93%

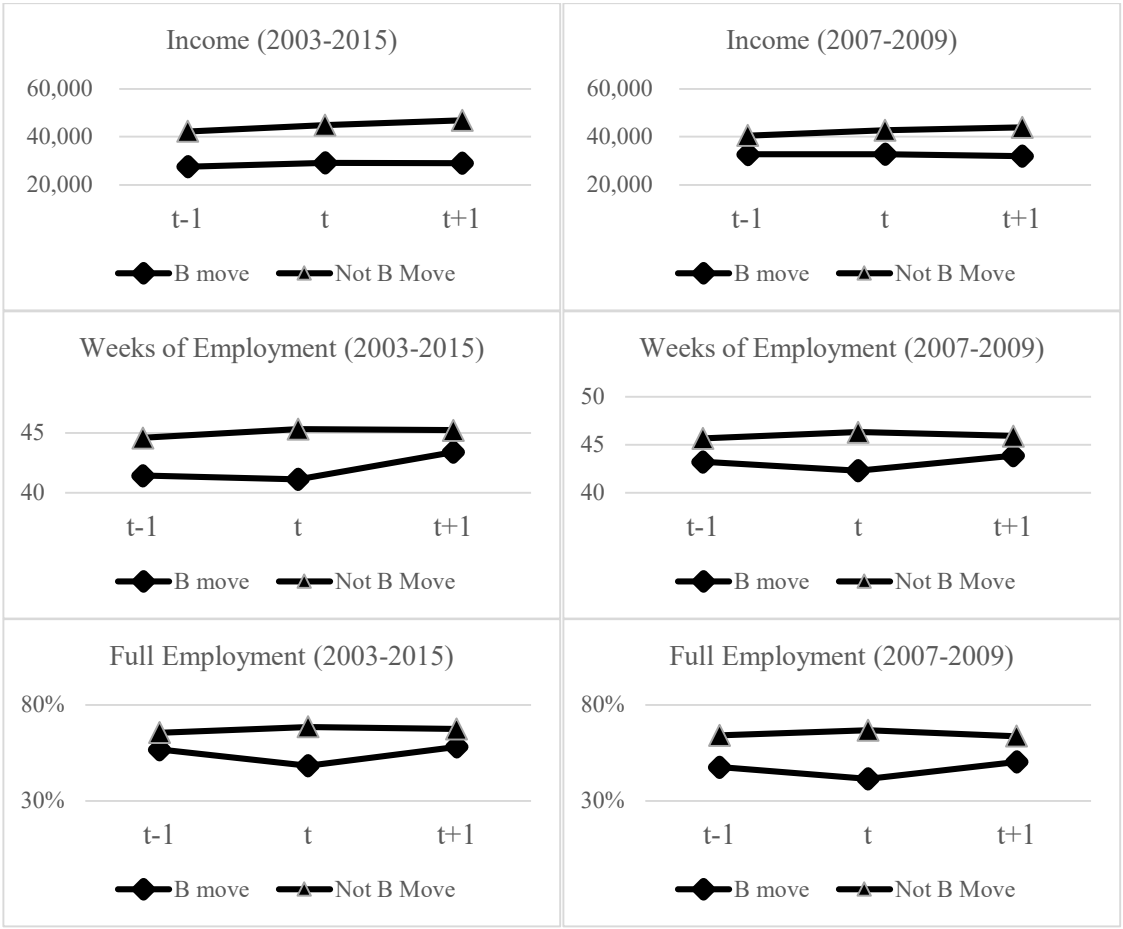

Figure 2.6 Changes in economic outcomes

Changes in the three economic outcomes reveal several findings. First, boomerang move is likely to occur along with job turnover or unemployment. On average, the number of employment weeks decreases in the year of the boomerang move. This appears to be a gap created by job turnover or due to job loss. Second, they are more likely to experience a lower quality of employment than before. In the year following the boomerang move, income did not increase even though the employment week had returned to its previous level. This means that they have lower-wage jobs than before, or the number of hours worked per week has decreased. In any case, the quality of employment has deteriorated. Third, while non-B movers showed a consistent pattern even during the recession period, B movers are negatively affected by the recession. Income growth, recovery in employment, and levels of job security are lower compared to non-recession periods. Finally, the gap between B movers and non-B movers already exists and has not been resolved. The income of B movers is 65% of that of non-B movers in the previous year of boomerang move. Other employment indicators are also shown to be low. What I pay attention to is the phenomenon that economic growth does not improve after b move despite the already poor economic status. The income gap, or income inequality, that exists between B movers and non-B movers appears to grow or persist.

Table 2.4 Economic outcomes in the previous year of B move

Average in year t-1	Boomerang Move	Not B Move	Ratio
Income (in 2018 dollars)	27,560	42,288	0.652
Weeks of Employment	41.43	44.58	0.929
Full Employment	50.3%	64.5%	0.780

2.5.2 Regression - the effect of returning to parental home on the income

This study performed regression with logged income of the target year and the following year as dependent variables, and the results are shown in Table 2.5 and 2.6. In Model 1, the target year's logged income is estimated using only the previous year's logged income and the target year's socio-demographics. Model 2 estimates the effect of returning to parental home by adding

a whether have a boomerang move. In this model, time-varying variables are converted into two variables: the state of the previous year and whether it has changed instead of the state of the target year. This can show the effect of time-varying variables more clearly. In Model 3, variables related to family characteristics and personal traits were added for control. In Model 4-6, the same operation was performed with the income of the following year as the dependent variable. In Model 4-6, the estimation was performed using the following year's logged income as a dependent variable.

The result from models 2 and 3 indicates that a boomerang move may harm income in the target year and the magnitude of the impact is greater during the Great Recession. In Models 5 and 6, a boomerang move during a recession harms income in the following year but has no significant effect outside the recession period. Across all models, the difference between non-Hispanic White and non-Hispanic Black is a significant factor that can cause an income gap. Also, education level is a significant factor that affects income. The change in residential location caused by the boomerang move is a factor that affects income significantly. As I expected, the movement of residential locations from the central city to the suburban and from the suburban to out of the MSA has a negative impact on income in the year of the boomerang move. However, the negative impact of changes in urban form is not lasting, given that the impact of these changes on income for the following year is not significant. Changing the region has no significant effect.

Marital and relationship changes that are likely to accompany boomerang moves affect income. The change from never married to living together or married has a positive effect on the target year and the following year. Conversely, returning to single status due to divorce or other reasons appears to have a negative impact on income. However, this cannot be interpreted as a causal relationship because the change in marital/relationship precedes boomerang move in terms of time. In other words, a causal relationship cannot be excluded that boomerang move occurs due to a change in marital/relationship, and that affects income.

Table 2.5 Regression models predicting income in the boomerang year

Dependent variable: Log Income in year t		***Model 1***		***Model 2***		***Model 3***	
Log Income in year t-1		0.4172	***	0.4167	***	0.4136	***
Boomerang Move							
B move in a Recession period				-0.1826	***	-0.1858	***
B move in another period				-0.0836	**	-0.0828	*
Sex (ref. female)							
Male		0.2569	***	0.2571	***	0.2608	***
Age		0.0309	***	0.0305	***	0.0312	***
Race/ethnicity (ref. NH White)							
NH Black		-0.0980	***	-0.0914	***	-0.0846	***
Hispanic		0.0079		0.0078		0.0076	
Other Races		0.0501		0.0495		0.0505	
Educational Attainment (ref. less than HS)							
HS Grad		0.2307	***	0.2321	***	0.2221	***
Some college		0.3088	***	0.3085	***	0.2930	***
BA plus		0.4830	***	0.4902	***	0.4640	***
Marital/Relationship in year t (ref. never married and independent)							
Cohabiting		0.0608	***				
Married		0.1285	***				
Divorced, separated, widowed (not-cohabiting)		-0.0416					
Marital/Relationship in year t-1 (ref. never married and independent)							
Cohabiting				0.0874	***	0.0851	***
Married				0.1151	***	0.1043	***
Divorced, separated, widowed (not-cohabiting)				0.0222		0.0122	
Marital/Relationship Change (ref. no change or similar status)							
Independent to married or cohabit				0.0602	*	0.0571	*
Back to independent				-0.0885	**	-0.0819	**
Having Children		-0.1057	***	-0.1090	***	-0.1076	***
Urban Form in year t (ref. central city in CBSA)							
CBSA, not in the central city		0.0377	**				
Not in CBSA		-0.0464					
Urban Form in year t-1 (ref. central city in CBSA)							
CBSA, not in the central city				0.0590	***	0.0564	***
Not in CBSA				0.0318		0.0306	
Urban Form Change (ref. no change)							
Move to central				-0.0073		-0.0070	
Move outside				-0.0654	**	-0.0633	**
Region in year t (ref. Northeast)							
North Central		-0.0852	***				
South		-0.0577	**				
West		-0.0348					
Region in year t-1 (ref. Northeast)							
North Central				-0.0709	**	-0.0758	***
South				-0.0443	*	-0.0473	*
West				0.0000		-0.0019	
Region Change (ref. no change)				-0.0008		-0.0014	
Family Structure (ref. two biological parents)							
Stepfamily						-0.0272	
Single-parent						-0.0633	***
Other family						-0.0350	
Parental Attachment						0.0020	
Conscientiousness						0.0351	***
Risk Tolerance						-0.0028	
Year (ref. 2003)							
	2004	0.0346		0.0454		0.0461	
	2005	-0.0126		-0.0098		-0.0091	
	2006	0.0427		0.0456		0.0446	
	2007	0.0451		0.0499		0.0497	
	2008	0.0186		0.0249		0.0257	
	2009	-0.0563		-0.0522		-0.0514	
	2010	-0.0364		-0.0338		-0.0343	
Constant		4.8687	***	4.8584	***	4.7191	***
N		12,071		12,071		12,071	
R2		0.2934		0.2939		0.2958	

Notes: *: p < 0.1, **: p < 0.05, ***: p < 0.01

Table 2.6 Regression models predicting income in the following year of boomerang move

Dependent variable: Log Income in year t+1		***Model 4***		***Model 5***		***Model 6***	
Log Income in year t-1		0.3449	***	0.3441	***	0.3412	***
Boomerang Move							
B move in the Recession period				-0.2302	***	-0.2319	***
B move in other period				-0.0739		-0.0709	
Sex (ref. female)							
Male		0.3094	***	0.3093	***	0.3116	***
Age		0.0271	***	0.0275	***	0.0278	***
Race/ethnicity (ref. NH White)							
NH Black		-0.1145	***	-0.1168	***	-0.1157	***
Hispanic		0.0174		0.0213		0.0188	
Other Races		0.1171	**	0.1184		0.1160	
Educational Attainment (ref. less than HS)							
HS Grad		0.2230	***	0.2277	***	0.2200	***
Some college		0.2953	***	0.3006	***	0.2865	***
BA plus		0.5229	***	0.5363	***	0.5110	***
Marital/Relationship in year t+1 (ref. never married and independent)							
Cohabiting		0.0615	***				
Married		0.1588	***				
Divorced, separated, widowed (not-cohabiting)		0.0177					
Marital/Relationship in year t-1 (ref. never married and independent)							
Cohabiting				0.1032	***	0.1027	***
Married				0.1345	***	0.1259	***
Divorced, separated, widowed (not-cohabiting)				-0.0328		-0.0412	
Marital/Relationship Change (ref. no change or similar status)							
Independent to married or cohabit				0.1217	***	0.1197	***
Back to independent				-0.0666	**	-0.0612	*
Having Children		-0.1137	***	-0.1082	***	-0.1061	***
Urban Form in year t+1 (ref. central city in CBSA)							
CBSA, not in the central city		0.0361	**				
Not in CBSA		-0.0424					
Urban Form in year t-1 (ref. central city in CBSA)							
CBSA, not in the central city				0.0621	***	0.0596	***
Not in CBSA				0.0048		0.0042	
Urban Form Change (ref. no change)							
Move to central				0.0217		0.0221	
Move outside				-0.0100		-0.0055	
Region in year t+1 (ref. Northeast)							
North Central		-0.0906	***				
South		-0.0436	*				
West		-0.0359					
Region in year t-1 (ref. Northeast)							
North Central				-0.0885	***	-0.0929	***
South				-0.0384		-0.0413	
West				-0.0348		-0.0367	
Region Change (ref. no change)				0.0140		0.0144	
Family Structure (ref. two biological parents)							
Stepfamily						-0.0329	
Single-parent						-0.0559	***
Other family						-0.0447	
Parental Attachment						-0.0097	
Conscientiousness						0.0395	***
Risk Tolerance						0.0019	
Year (ref. 2003)							
	2004	0.0171		0.0130		0.0145	
	2005	0.0072		-0.0016		-0.0002	
	2006	0.0087		0.0012		0.0015	
	2007	-0.0285		-0.0317		-0.0301	
	2008	-0.1054		-0.1076		-0.1048	
	2009	-0.0727		-0.0760		-0.0730	
	2010	0.0141		0.0062		0.0083	
Constant		5.7401	***	5.7184	***	5.5744	***
N		12,071		12,071		12,071	
R2		0.2432		0.2433		0.2454	

Notes: *: p < 0.1, **: p < 0.05, ***: p < 0.01

2.5.3 Valid Mechanism Using GSEM: Boomerang move and Income

I set the direction of causality and verified it through GSEM to compensate for the limitations of OLS regression, with which is difficult to build an event precedent. The main results of the GSEM are shown in Figure 2.7 and 2.8. Overall, the results of GSEM are similar to those of regression. Boomerang move has a significant effect on changes in urban form and region, two variables constituting residential location. Changes in urban form negatively affect income for the current year, but do not affect income for the following year. Changes in the region do not appear to affect income. Changes in marital/relationship affect boomerang move, and, like the consequences of regression, getting married or cohabitation has a positive effect and back to single harms income.

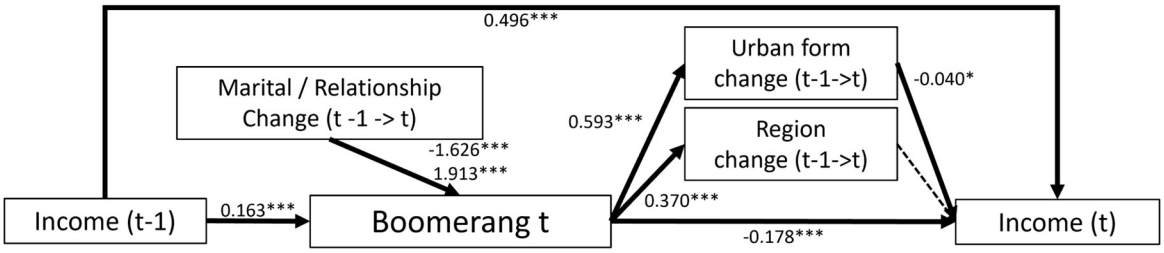

Figure 2.7 Part of GSEM results with dependent variable as income in the boomerang year

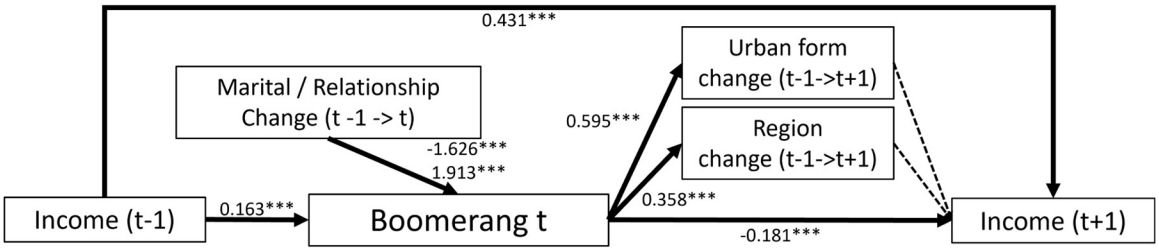

Figure 2.8 Part of GSEM results with dependent variable as income in the following year of boomerang move

2.6 Discussion

With a massive increase in the number of young people living with their parents during the COVID-19 period, concerns have been raised about the impact of the boomerang move on young people's lives. However, the consequences of returning to parental homes after periods of independent living were veiled. This study investigates the economic outcomes of young people who return to their parental homes after periods of independent living. Is back to the nest a good decision? While it is still unknown how much boomerang movers save living expenses, the negative economic consequences of the boomerang move are identified.

The economic outcomes of boomerang movers did not improve compared to the period of independent living, and the income gap with young people who remained independent widened. In particular, this gap widened even more during the Great Recession, meaning that a recession could cause income inequality problems among young people. However, it’s not a bad choice in the short term if the living expenses that boomerang movers save by staying at their parents' homes exceed the income gap. While saved living costs are relatively fixed, the income gap continues to widen, so it is not a desirable option in the long run. As Kaplan (2012) argues that living with parents can be a preparation period for better jobs in the future, if a boomerang move is considered as a leap forward, back to the nest can be a good decision.

The residential movement of young people who make boomerang moves has an impact on their income, but this effect is short-lived. Going back to a parental house changes the region and urban form significantly, and movement of urban form from the central city to the suburban and from the suburban to out of the MSA has a negative impact on income. This is consistent with the claim of Chan et al (2019) that boomerang moves take young people to a poorer labor market. However, this effect is not significant in the following year which means a short-term effect. This can be interpreted as taking some time to find a decent job.

Differences in race/ethnicity and educational attainment, directly and indirectly, affect boomerang move and income. GSEM results show that black individuals and households are more likely to make boomerang moves than white ones, and income differences resulting from racial differences increase the likelihood of boomerang moves. This is evidence of the existence of racial inequality, as this effect persists after the boomerang move. Similarly, less-educated people are more likely to make a boomerang move than people with more education, and income from differences in education increases the probability of boomerang move.

Findings from the study suggest implications. First, more affordable housing should be provided to reduce boomerang moves, which negatively impact economic outcomes, at least in the short term. Since the main reason young people return to their parents' homes is that they cannot maintain financial independence, affordable housing should be provided in areas with high accessibility to the labor market, to reduce the housing burden on young people. Second, ways to increase job opportunities should be explored to reduce the short-term negative impact of boomerang move. As the labor market changes, unemployed young people take time to find suitable jobs. As regions and urban forms change, it is difficult to find opportunities in the new labor market. Efforts at the government level are needed so that they can easily find and compare job opportunities in the new labor market. Finally, education and vocational training opportunities must be increased to close the income gap among young people in the long run. It is the minority and low-educated youth who are more likely to make a boomerang move, to be negatively affected by a boomerang move, and to be negatively affected by a recession. Having skilled jobs and higher education levels can lead to a higher income level, narrowing the income gap.

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Chapter 3. HOUSEHOLD RECOVERY FROM FORECLOSURE: EXAMING FORECLOSED HOUSEHOLDS' TRAJECTORIES IN THE US

3.1 Introduction

Despite policies and efforts to promote homeownership that have continued for decades (Herbert and Belsky, 2008), the homeownership rate dropped sharply to pre-1970 levels with the start of the sub-prime mortgage crisis in 2007. The National Delinquency Survey (2010) shows that the mortgage foreclosure rate increased to nearly five percent and nearly four million homeowners lost their homes between 2008 and 2011. Declining home prices by over 30% nationally and a rapid increase in the unemployment rate explain why many homeowners were foreclosed during the Great Recession (Belsky, 2013; Schwartz & Dewan, 2012). Fortunately, the national housing market returned to normal due to factors such as an increase in household purchasing power and low-interest rates (Joint Center for Housing Studies, 2017). The homeownership rate has rebounded since 2016 and has been on a steady rise (U.S. Census Bureau, 2020). Moreover, the decline in the homeowner vacancy rate and the soaring housing price show that the homeownership market has recovered from the aftermath of the recession and returned to its previous state.

But, did households who lost their home regain homeownership? Does the housing market recovery result from the recovery of foreclosed households? Although studies on the housing market resilience after the Great Recession show a relationship between regional characteristics and neighborhood recovery (Wang, 2019; Wang et al, 2019), little is known about the recovery of individual households which can be characterized as regaining homeownership or wealth lost in foreclosure. If the housing market recovery is driven by high-income groups or those who have not been damaged during the crisis, foreclosed households are likely to face challenges such as cost-burdened. Since foreclosed households are more likely to move to poor

neighborhoods and may have fewer opportunities for new jobs or may have to spend more time on commute than before, it is not easy to recover economically (Niedt & Martin, 2013; Pfeiffer & Lucio, 2015). In addition, they sometimes experience unexpected physical and mental problems after the foreclosure which negatively affects health, stability, and educational opportunities of family members (Katz et al., 2013; Pollack et al., 2011; Williams et al., 2014). They have many hurdles to overcome, but at least some of them become homeowners again. This study brings attention to the area where they lived during their recovery. In addition to individual efforts, and assistance from governments, I expect that there are some advantages or disadvantages brought by the characteristics of the residential area.

This study investigates the relationship between the characteristics of neighborhood and the economic recovery of households by tracking residential mobility of foreclosed households. It uses Panel Study of Income Dynamics (PSID) data of households experiencing foreclosure between 2006 and 2018. Figure 3.1 shows the potential mechanism by which neighborhood characteristics affect homeownership recovery. Neighborhood characteristics may affect homeownership recovery indirectly rather than directly. They affect income and wealth, which in turn affects regaining homeownership.

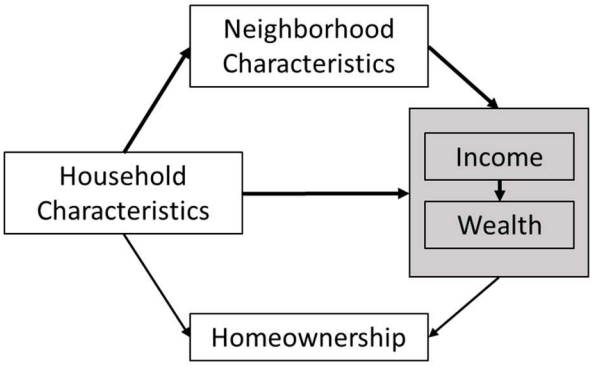

Figure 3.9 Potential mechanism of regaining homeownership

This study seeks to answer the following questions through the experiences of individual households who lost their homes. First, did foreclosed households regain homeownership? Second, is there a relationship between socio-demographic characteristics of foreclosed household and regaining homeownership? Several studies have dealt with the resilience of the housing market or neighborhood, but less attention has been paid to the recovery of individual households. Studies dealing with resilience and recovery of the housing market have reported that there is uneven recovery among races. This study examines if there is a structural gap among races. It also examines the difference in regaining homeownership by marital and parental status. These two variables have been regarded as strong motivators to buy a house in the tenure choice model.

Third, where do homeowners who have lost their homes migrate? While a number of studies have reported that they tend to move to poor neighborhoods, FRBNY/Equifax CCP data from 1999 to 2010 reported contrary results that foreclosed households did not move to less desirable neighborhoods (Molloy and Shan, 2013). The PSID sample can empirically demonstrate this relationship. In addition, examining their residential mobility identifies links between household characters and neighborhoods. It is expected that there are differences in where they migrated depending on the householder's race/ethnicity, and marital and parental status.

Finally, what characteristics of neighborhood help foreclosed household recover? In order to regain homeownership, stable income and sufficient savings are required. High job accessibility and low housing costs could help households recover. The unemployment rate, the share of rent-burden which is paying more than 30% of income on housing, auto-dependency, and rent are employed as a proxy for job accessibility and housing costs in the neighborhood, to verify the effect of neighborhood on income and wealth.

While previous studies have focused on the resilience of housing markets and regions, this study explores the link between regional characteristics and individual household recovery.

The findings from this study can provide valuable insights and information to planners, policymakers developing public programs, and developers in the housing industry by characterizing the neighborhood that helps households recover. The recovery of financially disadvantaged households is an important issue for communities and states. Identifying the mechanism that is responsible for the household recovery has implications for implementing programs to aid household recovery. It helps determine which programs can give more benefits to recipients to achieve recovery: providing individuals with a monetary subsidy (e.g., covering relocation expenses) or encouraging and aiding them to move into a certain neighborhood.

3.2 Literature Review

3.2.1 Effect of foreclosure on households

Early studies during the housing crisis focused on the characteristics of foreclosed households and the challenges they faced. Several studies have reported that minority is more likely to foreclosed (Allen, 2011; Gerardi & Willen, 2009; Laderman & Reid, 2008). Relatively low income explains the high proportion of foreclosure in Latino and African-American households, but even if income and credit scores, neighborhood characteristics, loan terms and lender characteristics are controlled, they are still more likely to foreclosed (Laderman & Reid, 2008).

After large-scale foreclosure, many households inevitably had to migrate. Foreclosed homeowners who lose their job are difficult to buy or rent a home not only because of their financial problem but also because of their foreclosure record and lower credit (Brevoort & Cooper, 2013; Ray & Guhathakurta, 2015). Between 2007 and 2012, about 10 million people were displaced due to foreclosure (Martin & Niedt, 2015). They were displaced into less desirable neighborhoods, lived with families and friends, or even became homelessness (Kachura, 2012; Martin, 2012; Mykyta, 2013; Mykyta & Branch, 2015; Molloy & Shan, 2013; Niedt & Martin,

2013). Between 2007 and 2012, about 23% of people who experienced displacement due to foreclosure are reported to live with others or become homeless (Martin & Niedt, 2015).

Just as the financial difficulty due to family member's illness increases the probability of foreclosure, the opposite causal relationship can be established. Foreclosure brings unexpected physical and mental problems to family members, including children. (Katz et al., 2013; Pollack et al., 2011; Williams et al., 2014). In general, financial stress is accompanied by high levels of anxiety and fear, leading to job loss, divorce and a variety of physical and mental illnesses (Campbell & Cocco, 2015; Gerardi et al., 2018; Himmelstein et al., 2005). Health problems such as high blood pressure, anxiety and depression have been reported in connection with foreclosure (Pollack & Lynch, 2009). Moreover, since foreclosed people are more likely to have the disease before foreclosure, the effect can be even more terrible (Kingsley et al., 2009). Over 8 million children are mentally stressed from foreclosure. Children are more likely to experience stress and lower academic performance from moving to a lower quality home, changing schools, losing friends, and adjusting to new places (Issacs, 2012). Students affected by foreclosure are chronically absent and are less likely to be promoted to the next grade level (Kachura, 2012).

Some post-foreclosure surveys provide a cross-sectional view of the problems created by the crisis. These ecological studies that analyze aggregate data explain the average characteristics of people who have experienced foreclosure, but do not tell us about the challenges that individuals have and how they overcome (Niedt & Martin, 2013). This is because it was difficult or impossible for researchers to track the movement of individuals after foreclosure (Kingsley et al., 2009; Makridis & Ohlrogge, 2019). Only one study using large-scale panel data sheds light on their progress, but there are results that contradict previous studies. Borrowers who moved from 1999 to 2010 due to foreclosure did not necessarily move to low quality housing (Molloy & Shan, 2013). It is true that foreclosure increases the probability of mortgage borrowers moving to multi-family houses, but they do not necessarily move to more crowded living conditions or less

desirable neighborhoods. They tend to move to areas with lower median income and shorter commuting time, but authors argue that there is no significant difference. They speculate that the reason housing consumption did not drop significantly was because foreclosed households cut other spending, but no clear explanation was given.

3.2.2 Effect of foreclosure on neighborhood

Neighborhoods with a sharp increase in vacant homes bring not only decrease in property value but also a variety of crimes and disorders that require local financial expenditures to solve. Since foreclosed properties are generally sold at a significant discount, they increase the local housing supply, thereby lowering the local home value (Lee, 2008). Several studies have found that abandoned properties lower the price of nearby properties, and the extent of the decline varies by region (Immergluck & Smith, 2006; Shlay & Whitman, 2006). Properties located around foreclosed properties decrease in value by approximately 1% per distressed property at its peak (Harding et al., 2009). As the distance increases from foreclosed homes, the discount sharply decreases. In neighborhoods where property values are declining, even small number of foreclosures tend to accelerate the pace of decline (Kingsley et al., 2009).

Empty neighborhoods threaten the safety and security of neighbors and cause disorder, increasing the risk of many types of crime. According to one study, neighborhoods with a high foreclosure rate in North Carolina have reported violent crimes that are about three times as high as in other regions (Bess, 2008). A 1 percentage point increase in the foreclosure rate of single-family homes in Chicago increased the number of violent crimes by about 2.33% (Immergluck & Smith, 2006). However, the relationship between property crime and foreclosure is not significant.

Local governments have to put their budget to solve problems that arise in empty neighborhoods such as crime, arson and fire, but as tax revenues decrease, local governments can face a serious fiscal crisis (Apgar et al., 2005; Kingsley et al., 2009). The cost of handling

foreclosed properties can range from as little as $27 to as much as $13,000. Furthermore, if the foreclosure process is not completed because the foreclosed property is not sold at auction, a municipal cost of approximately $19,000 per property is required (Apgar et al., 2005). Between 2008 and 2012, Newark estimated the foreclosure expenditure at $56 million (New Jersey Communities United, 2013).

3.2.3 Regional factors influencing the recession impact and housing market resilience

After diagnosing the various problems brought about by massive foreclosures and highlighting its negative impact, researchers focused on why impact of recession and housing market resilience vary by region. Under the assumption that certain characteristics that make up the metropolitan area or neighborhood reduce or worsen the recession, they focused on identifying the factors and revealing mechanisms of interaction among them. Regional characteristics affecting housing recession and resilience are housing market type and urban form at the metro level, and urban form, location affordability and racial composition at the neighborhood level (Dong, 2015; Dong & Hansz, 2016; Hwang, 2019; Pfieffer) & Molina, 2013; Raymond et al., 2016; Wang, 2019a; Wang, 2019b; Wang & Immergluck, 2019a; Wang & Immergluck, 2019b).

Dong & Hansz (2015) found that the three types of metropolitan areas categorized by growth pattern over the past decade have different depth and duration of recession. In fast-growing metros, housing recessions tend to be deeper and longer. Recent studies dealing with housing resilience classifies US metropolitan areas into 'boom-bust', 'strong', and 'weak' markets using two variables: change in housing prices and degrees of shock (Wang, 2019a; Wang. & Immergluck, 2019a; Wang & Immergluck, 2019b). In the boom-bust market, home prices grow rapidly during the boom period (2000-2006), drop sharply during the bust period (2006-2011), and rapidly return to the previous growth trajectory during the recovery period (2011-2014). The

strong market has not suffered a relatively large shock and shows a relatively steady growth compared to the US average growth trajectory. The weak market suffers a moderate or smaller shock and has a slower growth rate than the US average. Wang (2019a) found that the recovery patterns differ depending on the types of metro, showing that neighborhoods in strong markets recover faster than other regions and return to their previous state. Wang & Immergluck (2019a) found that the neighborhood factor influencing changes in long-term vacant varies by type of metro. In weak-growth metros, long-term vacancy tends to increase more in depressed neighborhoods, and in strong-growth metros it increases more in outlying county. Wang & Immergluck (2019b) stated that the factors that influence the resilience vary according to the type of metro. For example, location affordability contributes to recovery in suburbs in boom-bust metros, but not in strong and weak metros.

The urban form can affect neighborhood resilience because it can contribute to job accessibility, transportation accessibility, housing price and housing supply (Bartholomew & Ewing, 2011; Cervero & Kockelman, 1997; Ewing & Cervero, 2010; Levine, Inam, & Torng, 2005; Plaut & Boarnet, 2003; Song and Knaap, 2003). In the studies related to recession, the impact of urban form was investigated by dividing the hierarchy into metro level and neighborhood level. Although slightly different from study to study, urban form is primarily measured by size, density, mixed use at metro level, auto dependency, distance from center, housing stock age at neighborhood level. Due to the high foreclosure rates in suburban areas where sprawls exist and detached houses dominate (Mayer & Pence, 2008; Ong & Pfeiffer, 2008), urban form-central/high-density cities and suburban, low-density areas- is an important factor considered in resilience studies. Housing recession has a deeper and longer impact in larger metropolitan areas (Dong & Hansz, 2016). However, the results of studies examining the link between foreclosure and suburbs are mixed and vary from region to region (Lehnert & Grover, 2008; Mayer& Pence, 2008; Ong & Pfeiffer, 2008). The study results that the submarket structure

of the housing market has a greater influence on housing market dynamics than the urban form suggests that the importance of the urban form may vary depending on the housing market type (Ray & Guhathakurta, 2015). A study examining the effects of resilience in more than 300 metropolitan areas in the United States shows differences in resilience by urban form, types of metropolitan housing market and time (Wang & Immergluck, 2019b). Housing market conditions affect neighborhood recovery in the short term, while urban form affects in the long term (Wang, 2019a). In the strong housing market, a high level of mixed land use and a lower level of auto dependency showing characteristics of central/high density cities are strong predictors of housing price recovery (Wang, 2019b).

Location affordability is recognized as a factor influencing neighborhood resilience. Until the early 2000s, only housing affordability was used as a characteristic of the neighborhood, but researches using location affordability ((housing+ transportation cost) / household income) as a characteristic of the neighborhood are increasing, recognizing the importance of transportation cost in the residential choice. HUD defines location affordability as spending no more than 45% of household income on housing and transportation (HUD, 2017). In neighborhoods with high location affordability and dense urban form, recovery is quick after foreclosure (Wang & Immergluck, 2019b).

The racial composition is pointed out as a factor that varies the speed and degree of recovery. Black neighborhoods show slower recovery after the crisis and a steep decline in home prices, while white-dominant or middle- and high -income neighborhoods have higher home prices than before the crisis (Raymond et al., 2016). During the Great Recession, Blacks have relatively more barriers in the process of buying and selling foreclosed properties, causing residential stratification and exacerbating existing pattern of inequality and segregation (Pfeiffer & Molina, 2013; Hwang, 2019; William et al., 2013).

Taken together, foreclosure had several negative effects on households and neighborhoods. Foreclosed people have lower quality lives than before and have suffered physical mental illnesses. In neighborhoods with vacant homes, many types of crimes increased and local governments had to put their efforts and money to solve problems. After dark times, the economy and the housing market began to recover, and several studies have found meaningful results that certain neighborhood characteristics can lead to regional recovery. However, there are still some unclear questions about recovery. It is not known if households that experienced foreclosure during recession recovered. Studies on the resilience of neighborhoods imply recovery of region, not individual households, because the unit of analysis is neighborhood. If high-income households occupy vacant homes and local recovery has been achieved, inequality among income brackets could worsen. Foreclosed people may not have the ability to move to strongly resilient neighborhoods, which may have widened the recovery gap. The lack of research on the experiences of individual households is due to data limitations. Since individual households could not be tracked, it would have been difficult to understand their pathway. Therefore, this study aims to explore the recovery process of individual households by tracking the experiences after foreclosure of individual households.

3.3 Data and Methods

The purpose of this study was to identify the mechanism between neighborhood characteristics and regaining homeownership. Neighborhood characteristics and regaining homeownership do not have a direct relationship, but rather an indirect relationship in which neighborhood characteristics affect income and wealth, which in turn affects homeownership. Therefore, it tracks the residential mobility of foreclosed households and investigates the relationship between the characteristics of neighborhoods and the economic recovery of households. To do so, it examines (1) whether foreclosed households regain homeownership (2)

whether there is a difference in homeownership recovery by socio-demographic characteristics (3) whether there is a relationship between socio-demographic characteristics and residential mobility, and (4) what neighborhood characteristics affect the economic recovery.

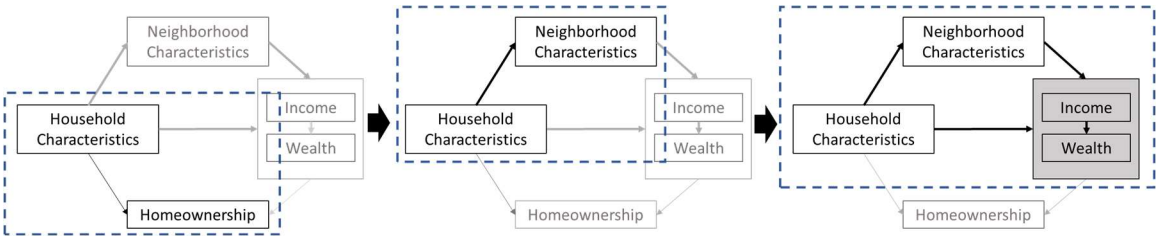

Figure 3.10 Analysis flow

This study conducts a descriptive analysis for the first three research questions and estimates a regression model for the last question. The key variable of interest would be the characteristics of the neighborhood where the households live after foreclosure. While existing migration studies mainly used share of below poverty to represent neighborhood quality, this study employs additional variables that are likely to be related to income and wealth, such as share of rent burden, share of commute by car, median gross rent, and unemployment rate. These variables are converted to quintiles, and this rank is measured by a relative comparison of zip code levels across the US for each year.

I estimate the regression with income and wealth as the dependent variables. I employ the following linear probability model:

$$y_{i,t} = \beta y_{i,t-1} + \gamma \boldsymbol{H_{i,t}} + \delta \boldsymbol{N_{i,t}} + \varepsilon_{i,t} \quad (1)$$

$$z_{i,t} = \beta z_{i,t-1} + \theta y_{i,t} + \gamma \boldsymbol{H_{i,t}} + \delta \boldsymbol{N_{i,t}} + \varepsilon_{i,t} \quad (2)$$

Here, $y_{i,t}$ indicates family income for household i in year t. $z_{i,t}$ indicates wealth without equity for household i in year t. $\boldsymbol{H_{i,t}}$ is household characteristics. $\boldsymbol{N_t}$ indicates neighborhood characteristics such as share of rent-burden, share of commute by car, median gross rent, and

unemployment rate. In the model, income and wealth in previous year are used as control variables to make the effect of the neighborhood clear.

There are two sets of data that allow individuals to be tracked over time even after foreclosure process. One is the FRBNY/Equifax Consumer Credit Panel and the other is the Panel Study of Income Dynamics (PSID). The first one has some advantages but fatal drawback that authorized people can access the data. The number of samples is so abundant that it is good to generalize the findings, and it is possible to identify if an individual has ever experienced the foreclosure process. Nevertheless, the results of the foreclosure process are unknown, the individual's location is not necessarily reported, and most importantly, only Federal Reserve researchers have access to the data. The second one contains information on the results of the foreclosure process and the approximate location of residence, but the sample size in each survey year is smaller than CCP dataset.

This study primarily relies on the 2005 -2019 waves of Panel Study of Income Dynamics (PSID). PSID tracks approximately 5,000 households across the country biannually, providing extensive information on foreclosure experience, familial relationships, homeownership status, locations where they live, life cycle events, socio-economic characteristics, and consumption patterns of the respondents. Since 2009, PSID has added survey questions about foreclosure; Whether a foreclosure process has begun, the year and month of the start, the result of the process, and whether a foreclosed home is a primary residence.

The geographic location of respondents came from the restricted-use file of the PSID. This study tracks the residential mobility of foreclosed households at the zip code level. Neighborhood characteristics are based on American Community Survey (ACS) 5-year estimates data and are matched to the geocode of the PSID. For example, 2012 PSID sample is combined with the 2010-2014 ACS 5-year estimates. The smallest unit of geographic unit provided by ACS

is the census tract, but zip code is used as the geographic analysis unit to ensure data reliability. All income-related variables have been converted to 2019 dollars.

Between 2006 and 2018, 321 households lost their homes in foreclosures. For measurement of residential mobility, I removed 80 samples who became homeowners within two years because it is unknown where they migrated as renters. 22 households that did not respond to the survey before and after foreclosure were excluded. The demographic characteristics of the excluded 22 samples were not statistically different from the analyzed samples. A total of 219 households are used for residential mobility-related analysis. In the regression model, two consecutive survey responses are combined into one dataset, and households should not have homeownership at the time of response. A total of 273 datasets are used for regression, with 159 datasets without missing values in the first and second survey years after foreclosure, and 114 datasets without missing values in the second survey and third survey years after a foreclosure.

3.4 Empirical Results

3.4.1 Descriptive analysis

Table 3.1 shows the recovery of homeownership by race/ethnicity. Regardless of race, 25% of the foreclosed households regained their homeownership within two years, and 42% of those regained within six years. Non-Hispanic Blacks have significantly lower rates of homeownership recovery than non-Hispanic White groups. This may be related to the findings of Raymond et al. (2016) that the recovery speed of the housing market in black-dense areas is slower than in white-dense areas. However, this result cannot be concluded that there is a systematic disparity among races because demographic and socioeconomic variables are not controlled.

Table 3.7 Recovery of homeownership by race/ethnicity

	Regaining homeownership							
Race/ethnicity	lost home (2006-2018)	within 2 years			lost home (2006-2014)	within 6 years		
Non-Hispanic White (Ref. group)	159	45	28%		138	69	50%	
Non-Hispanic Black	110	19	17%	**	98	28	29%	***
Hispanic	40	13	33%		38	19	50%	
Others	12	3	25%		10	4	40%	
Total	321	80	25%		284	120	42%	

Notes: *: p < 0.1, **: p < 0.05, ***: p < 0.01

Although there is no significant difference in the recovery of homeownership by parental status, the recovery rate of married households is higher than that of non-married households. This is most likely because marital status is a strong motivator for ownership recovery or because married couples have higher household income due to dual earners.

Table 3.8 Recovery of homeownership by marital and parental status

	Regaining homeownership				Regaining homeownership	
Marital Status	within 2 years	within 6 years		Parental status	within 2 years	within 6 years
Not married (Ref. group)	23%	32%		No child (Ref. group)	30%	48%
Married	26%	50%	***	Having children	23%	40%

Notes: *: p < 0.1, **: p < 0.05, ***: p < 0.01

Table 3.3 and 3.4 show the changes in neighborhood characteristics before and after foreclosure. Consistent with the assertion of Molloy and Shan (2013), there is no evidence that foreclosed households migrate to neighborhoods with higher poverty rates. More than half of the households showed no change in quintile across multiple variables, meaning that about half of the sample moved to a neighborhood similar to their previous residence. However, on average, they moved to neighborhoods with lower share of rent-burden, higher rents, higher household income, and lower unemployment rates. Considering the high correlation between rent, household income and unemployment, it suggests that job accessibility will be higher than before, but housing expenditure will also increase.

Table 3.9 Residential mobility of foreclosed households

	Average			Average Quintile		
	Before lost home	After lost home		Before lost home	After lost home	
% Below poverty	17.09	16.39		3.48	3.35	
% Rent-burden	54.05	51.88	***	3.74	3.57	***
% Commute by car	88.79	88.23		3.03	2.96	
Median gross rent ($)	947	985	***	3.61	3.70	
Household income ($)	54,397	56,759	**	2.94	3.08	*
% Unemployment	11.07	9.45	***	3.75	3.58	**
% Minority	38.13	35.69	*	4.16	4.15	

Notes: *: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$

Table 3.10 Changes in quintile before and after foreclosure

	Move to lower quintile	Move to same quintile	Move to upper quintile
% Below poverty	22%	50%	28%
% Rent-burden	31%	50%	20%
% Commute by car	28%	47%	25%
Median gross rent ($)	17%	60%	23%
Household income ($)	21%	50%	30%
% Unemployment	29%	54%	16%
% Minority	15%	71%	14%

Notes: *: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$

Table 3.5 reports the characteristics of the neighborhoods to which people moved after losing their homes by race/ethnicity. Compared to non-Hispanic whites, non-Hispanic blacks and Hispanic migrate to neighborhoods with higher share of below poverty, higher share of rent-burden, lower auto dependency, higher unemployment rate and higher share of minority. Non-Hispanic Black and Hispanic will have a harder time recovering from the aftermath of the foreclosure, as neighborhoods they migrated are likely to have fewer job opportunities and higher housing expenditure. In particular, the gap between non-Hispanic white and non-Hispanic Black is the largest compared to the gap between other races.

Table 3.11 Neighborhood characteristics after foreclosure by race/ethnicity

	NH White (Ref. group)	NH Black		Hispanic		Others	
# of households	103	85		23		8	
% Below poverty	13.17	22.03	***	18.19	***	11.85	
% Rent-burden	49.67	59.23	***	55.77	**	50.48	
% Commute by car	91.66	85.99	***	86.98	***	86.35	**
Median gross rent ($)	897	943		1,115	***	1,141	***
Household income ($)	58,783	46,954	***	58,113		66,329	
% Unemployment	8.47	14.62	***	10.67	***	7.94	
% Minority	18.54	59.41	***	49.85	***	30.74	*

Notes: *: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$

Married households migrate to neighborhoods with lower share of below poverty, higher median gross rent and household income, lower unemployment rate and lower share of minority. This result is most likely due to their higher household income.

Taken together, it is confirmed that there is a difference in the area to which foreclosed households migrate by race/ethnicity and marital status of householder. Although variables related to economic ability were not controlled for, considering that the samples underwent foreclosure in common, household characters are significantly associated with the location of migration.

Table 3.12 Neighborhood characteristics after foreclosure by marital and parental status

	Marital Status			Parental Status		
	Not married	Married		No child	Having children	
# of households	93	126		69	150	
% Below poverty	20.51	14.56	***	18.5	16.44	
% Rent-burden	55.71	52.83	*	54.1	54.03	
% Commute by car	87.44	89.77	*	86.35	89.9	**
Median gross rent ($)	899	982	**	931	955	
Household income ($)	47,756	59,298	***	51,051	55,936	*
% Unemployment	12.34	10.12	***	12.06	10.61	*
% Minority	46.11	32.26	***	39.02	37.73	

Notes: *: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$

3.4.2 Household and neighborhood effects on economic recovery after foreclosure

This study assumes that the characteristics of neighborhoods affect income and wealth accumulation, rather than directly affecting regaining homeownership, and economic recovery will lead to the recovery of homeownership. A linear probability model is performed to verify the effect of the characteristics of the migrant neighborhood on income and wealth. The regression results are shown in table 3.7 and 3.8.

The results indicate that neighborhood characteristics affect income but not wealth. Low unemployment rates, low auto dependency, and high median gross rent are positive associations with income. Households who move to a place with these characteristics are likely to increase their income quickly. Besides the neighborhood characteristics, income is positively associated with marital status and a bachelor's degree or higher. All else being equal, race/ethnicity is not a factor that affects income.

Variables of housing cost-to-income, rent, and auto dependency that are directly related to expenditure were expected to affect wealth, but neighborhood characteristics were not statistically associated with wealth. Also, except for a bachelor's degree or higher, the effect of household characteristics on wealth is not statistically significant. However, neighborhood characteristics related to income indirectly affect wealth because income is positively related to wealth.

Table 3.13 Regression results predicting family income

Dependent variable: Family income	Household		Neighborhood		Full Model	
	Std coefficient		Std coefficient		Std coefficient	
Family income in previous year	0.6298	***	0.6766	***	0.6141	***
Household Character.						
Age	-0.1538				-0.0648	
Married	0.1394	***			0.1378	***
Having children	0.0585				0.0124	
Race/ethnicity (ref. NH White)						
NH Black	-0.1957				-0.1097	
Hispanic	-0.0181				-0.0026	

Others	0.0201				0.0027	
Educational Attainment of householder (ref. less than HS)						
HS Grad	0.0562				-0.0220	
Some college	0.1154	**			0.0429	
BA plus	0.3244	***			0.3057	***
Neighborhood Character.						
% Unemployment			-0.1360	***	-0.1429	***
% Rent-burden			0.0091		0.0043	
% Commute by car			-0.0891	**	-0.1038	**
Ln(median gross rent)			0.1091	**	0.0772	*
N	273		273		273	
R2	0.6343		0.5482		0.6613	

Notes: *: p < 0.1, **: p < 0.05, ***: p < 0.01

Table 3.14 Regression results predicting wealth

Dependent variable: wealth	Household		Neighborhood		Full Model	
	Std coefficient		Std coefficient		Std coefficient	
Wealth in previous year	0.2784	***	0.3661	***	0.2767	***
Family income	0.1637	***	0.2856	***	0.1794	***
Household Character.						
Age	0.3969				0.0443	
Married	-0.2068				-0.0214	
Having children	0.0152				0.0270	
Race/ethnicity (ref. NH White)						
NH Black	-0.4198				-0.0597	
Hispanic	0.0199				0.0112	
Other Races	-0.0555				-0.0564	
Educational Attainment of householder (ref. less than HS)						
HS Grad	0.0319				0.0638	
Some college	0.0358				0.0625	
BA plus	0.3611	***			0.3612	***
Neighborhood Character.						
% Unemployment			0.0212		0.0371	
% Rent-burden			0.0473		0.0268	
% Commute by car			0.0016		-0.0068	
Ln(median gross rent)			-0.0347		-0.0321	
N	273		273		273	
R2	0.3715		0.2596		0.3748	

Notes: *: p < 0.1, **: p < 0.05, ***: p < 0.01

3.5 Discussion

This study investigates the recovery of households who lost their homes due to foreclosure between 2006 and 2018, focusing on the association between recovery and the characteristics of neighborhoods moved after foreclosure. 25% of foreclosed households regained homeownership within 2 years and 42% within 6 years. However, a disproportionate recovery is observed among races. Non-Hispanic blacks have a 29% rate of regaining homeownership within 3 years, which was 21% lower than that of non-Hispanic whites. The racial disparity is likely due to the migratory neighborhood. While the PSID sample shows that, on average, people do not move to lower quality neighborhoods than before, non-Hispanic blacks and Hispanic are more likely to migrate to areas of poor quality, higher rent-burden and fewer job opportunities compared to non-Hispanic whites.

Neighborhood characteristics are directly related to the increase in income of migrated households. Areas with low unemployment, low car dependence, and high median gross rents help raise households' incomes. Characteristics of an area with convenient transportation and many jobs, but high rents, are similar to those of downtown in the metropolitan area or New Urbanism community. Although regional characteristics do not have a direct relationship to wealth accumulation, neighborhoods do indirectly affect wealth accumulation as a significant portion of wealth is accounted for by income in the regression model. In other words, the characteristics of the relocated region directly or indirectly affect household economic recovery and indirectly affect regain homeownership.

The findings of this study suggest the following policy implications. In order to achieve household recovery, it is important to relocate families to places with affluent job opportunities. The government's recovery assistance program should aim to support relocation to a certain neighborhood, not simply to provide subsidies. In particular, in order to achieve racially equitable recovery, there will be a need for support programs that focus on the neighborhood of migration.

In the past, the US Department of Housing and Urban Development (HUD) launched a Moving to Opportunity (MTO) program that helps low-income families move into lower-poverty neighborhoods. After 10 to 15 years, recipients showed significant improvement in physical and mental health, but not economically (Sanbonmatsu et al. 2012). Turner et al. (2012) argue that incomes did not improve because low-income families participating in the MTO did not live in neighborhoods of high-opportunities. A neighborhood with high opportunities, as defined by the authors, is characterized by high incomes, high employment rates, high levels of education, predominantly whites, and high job densities. The only neighborhood characteristic the MTO focused on was the poverty rate. To improve their finances, programs must be designed to move them to areas with lower poverty rates and higher job and educational opportunities.

This study has some limitations. The number of samples extracted from PSID was not large enough, so it was not possible to test various variables and hypotheses. The influence of metro level variables as well as other neighborhood variables should be considered, but the sample size could not sufficiently cover it. Structural equation modeling can be considered to comprehensively verify the recovery mechanism used in the study, but it requires more samples. In addition, this study only analyzed people who lost their homes. From the perspective of overcoming financial difficulties, not only those who have gone through the foreclosure process, but also evicted renter households should be included in the household recovery study. Future studies will need to define the types of households in need of recovery and use rich data to illuminate diverse aspects of recovery.

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Chapter 4. RESILIENCE OF SHORT-TERM RENTALS DURING COVID-19 PANDEMIC: EVIDENCE FROM AIRBNB LISTINGS IN NEW YORK CITY

4.1 Introduction

Short-term rental (STR) platform, such as Airbnb, has grown over the past decade as it has brought benefits to hosts and guests by connecting them directly. Unlike the traditional accommodation industry, which is concentrated in a specific area, the new platform created a marketplace that allows heterogeneous product choices in terms of price and location (Einav et al, 2016). Once a very small fraction of accommodations, STRs have been widely accepted as a category of accommodation. As of 2019, STR has grown at a much faster rate than the US hotel industry, accounting for 9% of all accommodations in the 10 largest cities in the US (CBRE, 2020). As the number of STRs increased, negative externalities such as transportation, parking, maintenance, and safety issues appeared (Espinosa, 2016; Gallagher, 2017; Gurran & Phibbs, 2017). In particular, negative effects on the local housing market such as housing affordability become severe. There is ample evidence that an increase in STRs has a positive effect on rents and house prices in surrounding areas (Barron et al., 2021; Garcia-López et al., 2020; Sheppard and Udell, 2016; Todd et al., 2021). There are two mechanisms of how STRs increase rents and house prices. First, the opportunity of STR revenue raises house prices (Cocola-Gant & Gago, 2019; Yrigoy, 2018). The potential return on residential properties that can be used as STRs is reflected in the house price. Second, the supply of long-term rental housing decreases, leading to an increase in rent. Housing units used for short-term rentals are relocated from the long-term rental market (Barron et al., 2021; Simcock, 2021, Wachsmuth & Weisler, 2018). The reduced supply of long-term rental housing is reflected in rents in the local housing market. To reduce the negative impact on housing affordability, local governments enacted regulations such as owner-occupancy requirement, license requirement, and imposing multiple taxes. According to the

recent study, strict restrictions on short-term rentals had the effect of reducing the number of STRs, house prices, and rents (Koster et al., 2021).

With the unprecedented outbreak of the COVID-19 pandemic, there have been significant changes in people's lifestyles and mobility. Wearing masks and social distancing have become routine, and work from home (WFH) increased sharply (Bick et al., 2020). Along with government actions around the world such as travel restrictions and capping occupancy for venues, anxiety over the contagiousness of COVID-19 has reduced personal mobility. The ongoing COVID-19 pandemic has affected almost all economic sectors, and short-term rentals (STRs) are no exception. As of 2020, the total revenue of Airbnb decreased by 30% compared to the previous year (Airbnb, 2021). As demand for travel drastically declined, STRs were disappearing from peer-to-peer accommodation platforms. A decrease in the number of STRs can result from two factors. First, existing hosts running STR may have left the platform. A decline in STR revenue could force homeowners to give up, at least for a while, running their homes on STR. Second, the inflow into the STR market may have decreased. A decline in STR revenue may delay or discourage homeowners from entering the STR market. This study aims to answer the following research questions:

(1) What unit and neighborhood characteristics are associated with the survival of STRs during the pandemic?
(2) Are there any differences in the association between the survival of STRs and their characteristics before and after the pandemic?
(3) What are the determinants of new STR's location during the pandemic?
(4) Are there any differences in the determinants of new STR's location before and after the pandemic?

This study explores the impact of the COVID-19 pandemic on the STR market using the change in the number of STRs which is divided into (1) the number of units left the platform and (2) the number of new units. To identify the impact of the COVID-19 pandemic, this study uses New York City's Airbnb listing data from Inside Airbnb (IA), as well as supplemental data such as American Community Survey (ACS) data.

Existing STR studies use web-scraped data from Airbnb.com directly (e.g. Barron et al, 2021; Jiao and Bai, 2020) or rely on third-party scrapers such as InsideAirbnb (e.g. Garcia-López et al., 2020; Koster et al., 2021) or AirDNA (e.g. Todd et al., 2021; Wachsmuth & Weisler, 2018). Research using web-scraped data obtained from third-party sources has become popular as it helps to reduce the work time for data collection. Studies that checked the validity of data using two data sources (Amore et al., 2020; Koster et al., 2021) show that dataset from InsideAirbnb is not significantly different from other sources. However, the timing of data collection may cause slight differences.

This study is based on changes in Airbnb activity in New York City over two years - one year before and after the outbreak of COVID-19. The time when COVID-19 started to affect the STR market is set as March 2020 using three sources: the number of people infected with the coronavirus and the number of passengers at JFK Airport and LaGuardia. The number of COVID-19 infected people started to increase from mid-March 2020 in New York City. Although this figure has decreased since April because of government actions such as tourist closures, movement restrictions and social distancing, the impact of the pandemic on the community has continued. The decline in tourism demand is evident in monthly airport passengers. Monthly passengers of two airports in New York City - JFK and LaGuardia Airport - show a sharp decline since March 2020. Although the number of travelers decreased in February 2020 compared to the previous month, the 2019 data suggest that it is a seasonal fluctuation.

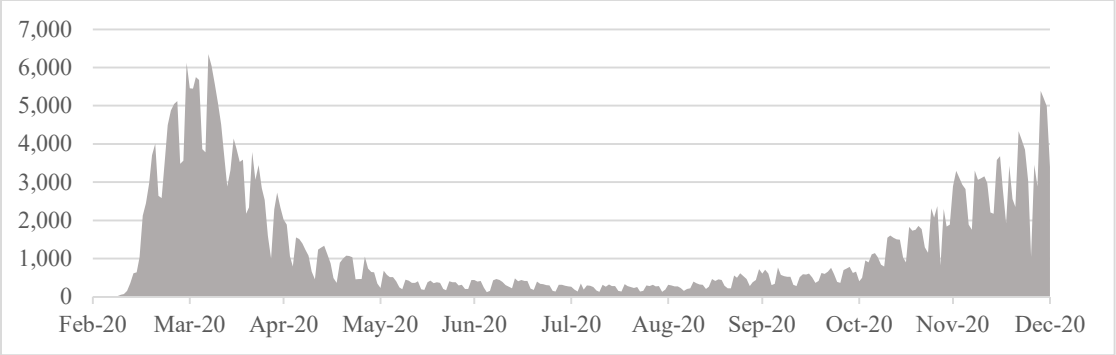
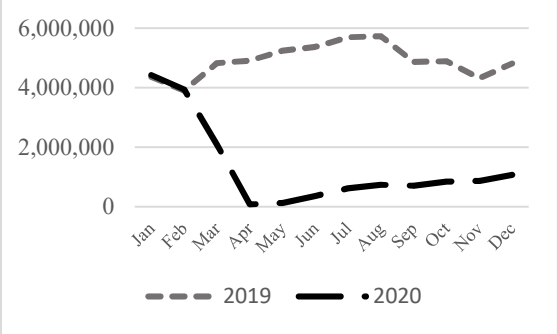


Figure 4.11 The number of new COVID cases in NYC

Source: New York City Department of Health and Mental Hygiene



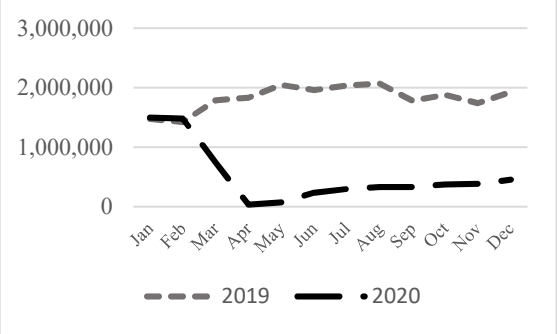


Figure 4.12 Monthly passenger of JFK Airport

Figure 4.13 Monthly passenger of LaGuardia Airport

Source: 2019 & 2020 Airport Traffic Report issued by *Port Authority of New York and New Jersey*

I focus on New York City for several reasons. First, New York City is the most developed STR market in the world. New York City is not only one of the leading tourist destinations but has an average of over 40,000 STRs registered with Airbnb as of 2020. Second, New York City is experiencing a housing affordability crisis. NYC is a job hub with a workforce of 4.6 million, but due to high housing prices and rent, many employees commute long distances or spend a large portion of their income on housing. Since NYC is a city where various industries such as finance, retail, and trade are concentrated as well as tourism, STR and LTR market are more closely related than in the resort cities where tourism is the main industry. Therefore, the findings of this study on the STR market can suggest implications in terms of housing

affordability and regulation. Third, high data accessibility of New York City-related data facilitates research. Due to the characteristics of NYC, which is a tourist city and a center of various industries, NYC has been a major target area for researchers. Various housing market information combined with geographic information can be obtained from various sources and findings from the study can be easily compared with existing studies.

Considering the large decline of the STR market for the first time and the flexible nature of STRs with free entry and exit from the market, it is expected that the survival mechanism of STRs has changed due to this pandemic. The findings of this paper will ultimately provide insight into the impact of the negative shock on the STRs and closely linked LTR housing markets. Changes in survival and generation mechanisms during the pandemic period suggest a need for an approach that goes beyond existing regulations. It is possible to discuss the policy direction that the government and the local community should pursue, for housing stability and housing affordability in regions with high tourism demand. In addition to policy implications, it advances existing knowledge about changes in peer-to-peer accommodations in response to the COVID-19 pandemic.

4.2 Airbnb and New York City

In New York City, where more than 1% of total housing units are listed on Airbnb, short-term rentals have been a center of debate for residents and city governments. It is known that an increase in STRs causes negative externalities and exacerbates housing affordability by driving up rents and house prices (Barron et al., 2021; Espinosa, 2016; Gallagher, 2017; Garcia-López et al., 2020; Gurran & Phibbs, 2017; Sheppard and Udell, 2016; Todd et al., 2021). STRs triggered gentrifying NYC neighborhoods, especially black-dense areas, by taking affordable rental units off from the long-term rental market (Wachsmuth & Weisler, 2018). The NYC government has

taken action and created new regulations to address these issues. According to the regulations set out on the Airbnb website, (1) hosts may be required to obtain a special license or permit in New York, (2) hosts should occupy their homes to rent out a Class A[1] multiple dwelling, (3) hosts can be restricted in how much they can charge for an Airbnb if they live in rent-stabilized and rent control properties and, (4) NYC imposes multiple taxes that may apply to transient occupancy or tourist use. In January 2021, a new regulation called data-sharing requirements has been added. This is a bill that allows accommodation information and transactions to be automatically reported to the city government for hosting of 30 days or less. New York City has imposed pressure on Airbnb for the past five years, recognizing that illegal short-term rentals still exist. Even though Airbnb resisted by suing NYC, they agreed to a new bill, which is in effect from January 2021. It is expected to promote stabilization of the housing market by correcting illegal operations and intentional omission of taxes.

Apart from the government's efforts, the number of short-term rental units has decreased during the pandemic period. Monthly changes in Airbnb listings in New York City are shown in Figure x. Listings with price outliers were excluded by applying the same method as in Jiao & Bai (2020). Compared to the pre-COVID period, Airbnb units decreased by about 25%. In 2019, listings peaked at the start and end of the year and maintained a similar level from March to October. In 2020, listings started to decrease from February and showed a continuous decline unlike in 2019, suggesting the impact of the COVID-19 pandemic. In December 2020, there was a decrease of about 7,000 listings, which seems to be the effect of the data sharing regulation. Figure x shows the monthly change in the number of existing listings and the number of new listings. Dividing Airbnb's survival and generation patterns helps identify the mechanisms by which the pandemic is affecting the STR market. The decrease in new Airbnb units explains more of the change in the total number of listings. While an average of 3,166 housing units were newly

[1] A “class A” multiple dwelling is a multiple dwelling that is occupied for permanent residence purposes.

activated every month on the Airbnb platform during the pre-COVID period, 1,872 units were activated during the post-COVID period, showing a 41% decline. The survival pattern after the pandemic did not show a significant difference. Existing listings decreased by an average of 3,098 during the pre-COVID period an average of 2,955 in the post-COVID period. The new regulation has been very effective in reducing existing listings. 9,500 listings have disappeared at a time in December 2020. Excluding December 2020, an average of 2,360 existing listings were removed each month, indicating that disappeared Airbnb listings during the post-COVID period are lower than during the pre-COVID period.

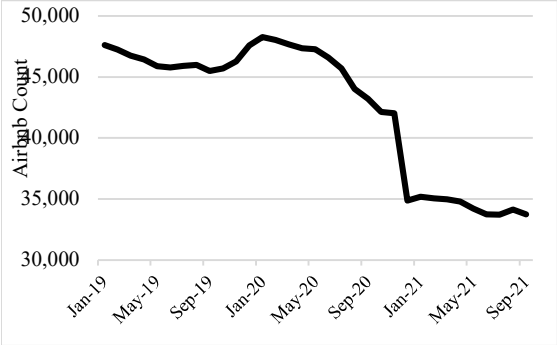


Figure 4.14 The number of Airbnb listings in NYC

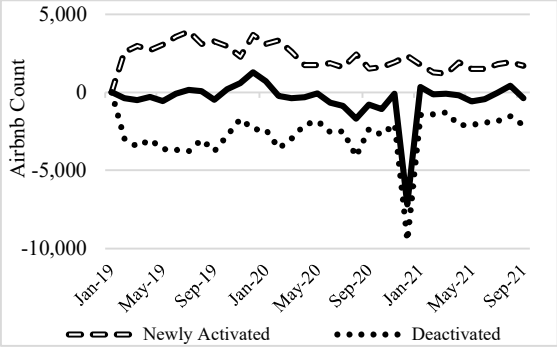


Figure 4.15 Monthly changes in Airbnb listings in NYC

Table 4.15. Monthly changes in Airbnb listings

	Pre COVID	Post COVID	Change (%)
Newly Activated	3,166	1,872	41%
Deactivated	-3,098	-2,955	5%
Monthly Change	68	-1,083	

Figures 4.6 and 4.7 show the concentration of Airbnb listings in the pre-COVID period and its change since the COVID-19 pandemic. The smallest geographic unit is the census tract, and the concentration is measured by the ratio of Airbnb listings to housing units. Since the pandemic, there has been a pattern of greater reduction in Airbnb listings in high concentration neighborhoods. Prior to the pandemic, the highest concentration of Airbnb was in Manhattan and the northern part of Brooklyn, and western Queens close to Manhattan. A further decline in

listings occurred in these regions after the pandemic. Figures 8-11 show the geographic patterns of deactivated and newly activated units, respectively. According to figures 4.6, 4.8, and 4.10, more existing units disappeared but more new units were created in neighborhoods with high Airbnb concentration before pandemic. Figures 4.9 and 4.11 suggest that the survival mechanism of existing listings and the creation mechanism of new units have changed after the pandemic. Figure 4.11 shows that the generation of new listings decreased in regions with high Airbnb concentrations in the post-pandemic period, whereas figure 4.9 suggests that there is no strong relationship between the disappearance of existing units and Airbnb concentration.

Taken together, STRs have threatened housing affordability in New York City, and the city government has implemented several regulations to protect residents. Airbnb listings have declined since the pandemic, due to two factors: the newly implemented data sharing requirement and the reduced tourism demand. In addition, the decrease in new listings contributed more to the change in total listing than the decrease in existing units, suggesting that the pandemic had different impacts on the creation and survival of Airbnb units. Therefore, in this study, the survival mechanism and the generation mechanism of Airbnb units before and after the pandemic by neighborhood are investigated to explore how the pandemic affected the STR market.

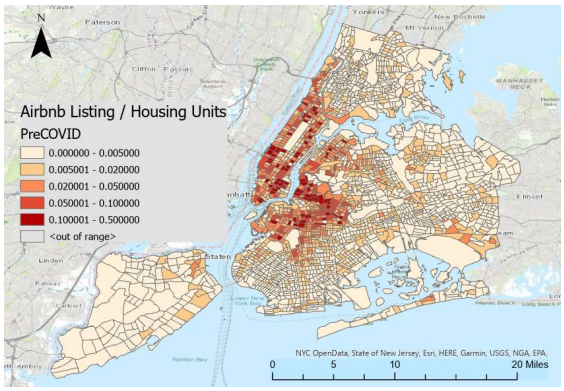


Figure 4.16 Airbnb concentration before pandemic

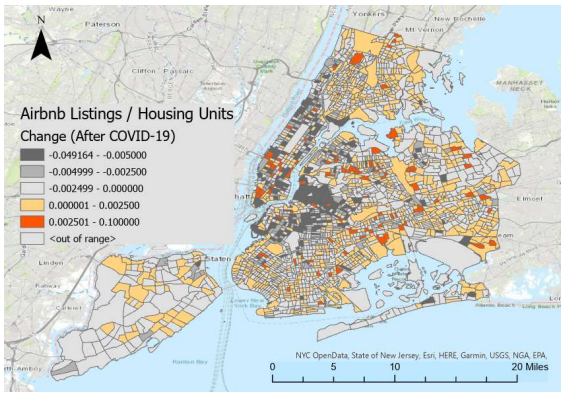


Figure 4.17 Change in Airbnb concentration since pandemic

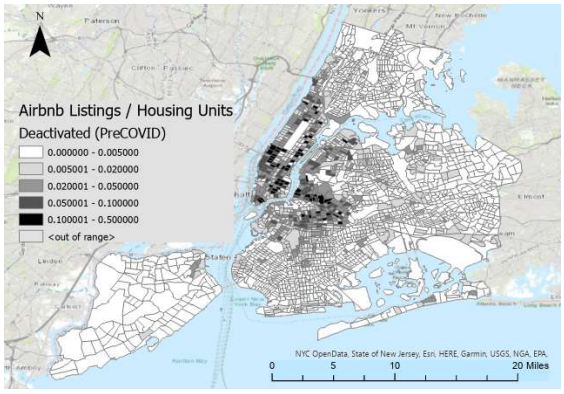


Figure 4.18 Disappearance distribution before pandemic

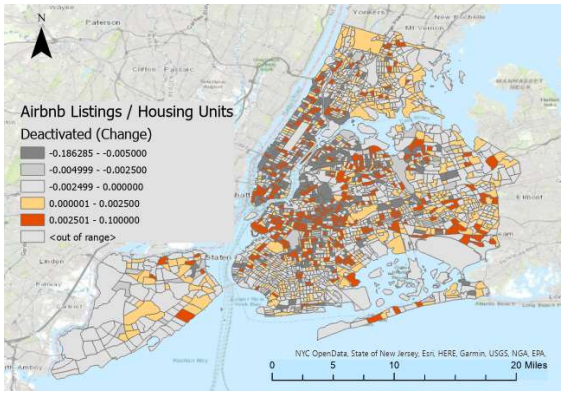


Figure 4.19 Change in disappearance distribution since pandemic

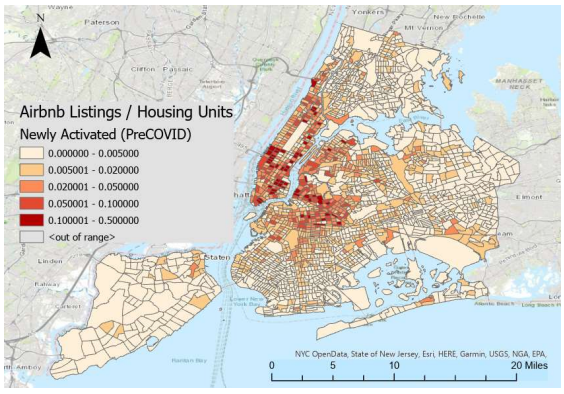


Figure 4.20 Generative distribution before pandemic

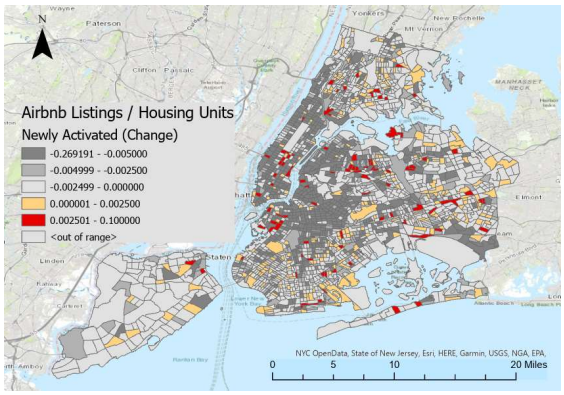


Figure 4.21 Change in generative distribution since pandemic

4.3 Related Literature

An increase in the number of STRs has been driving local property prices and rents to rise, not only in the United States but worldwide. Barron et al. (2021) reported that the number of STRs has a positive effect on residential house prices and rents, using the Airbnb listing data set across the United States and instrumental variable estimation strategies. Todd et al. (2021) asserted that the frequency of Airbnb listings is positively associated with house prices per square meter at the borough level in London by conducting a multivariable hierarchical regression analysis. Garcia-López et al. (2020) reported that an increase in listings on Airbnb drives up rents and house prices using panel fixed-effects models to control for neighborhood and time effects. For every 100 active listings in the Basic Statistical Area, rent increases by 1.9%, transaction

price by 4.6%, and posted price by 3.7% in Barcelona, Spain. Horn and Merante (2017) examined the changes in rents due to the increase in Airbnb using a hedonic model. The results showed that an increase in 1 standard deviation of Airbnb density increases local rents by 0.4% in Boston. Sheppard and Udell (2016) reported that a doubling of Airbnb listings in New York City increased house value by 6-11% using a hedonic model and increased by 31% using a difference-in-difference approach. Only Levendis and Dicle (2016) argued that there is no evidence of a correlation between rent and Airbnb in New Orleans, Louisiana using OLS regression. Most studies support that STRs increase local house prices and rents even after controlling for other variables.

The local housing market and STRs are closely related because STRs are converted from long-term market housing stocks (Barron et al., 2021; Simcock, 2021, Wachsmuth & Weisler, 2018). Wachsmuth & Weisler (2018) focused impact of the rent gap, which is the difference in earnings from LTR and STR, on the growth of STR market. They found a significant number of census tracts with more than 3% of long-term rental housing converted to Airbnb. Barron et al. (2021) argued that listings on Airbnb are likely to be allocated from the long-term rental market, based on fewer housing units occupied by long-term tenants and vacant rentals in areas with higher Airbnb listings. While rising rents can bring more income to property owners, they cause gentrification and displacement, and worsen housing affordability (Amore et al., 2020; Gant, 2016; Grisdale, 2021; Lee, 2016, Wachsmuth & Weisler, 2018; Yrigoy, 2018). Unlike typical gentrification that rents rise as owners realize their potential value through redevelopment or reconstruction, Airbnb-induced gentrification occurs without redevelopment (Wachsmuth & Weisler, 2018).

STRs not only show a different geographic distribution than traditional accommodations, but also highly susceptible to demand variation. This is because anyone with a housing unit can become an STR host and are free to leave the market at any time. For example, listings on the

STR platform increase during certain periods when there are local festivals. STRs are geographically concentrated in central urban areas, but they are more dispersed than hotels (Coles et al, 2017). STR market is known to be formed in an area with higher transportation accessibility and close to tourist attractions. Wegmann & Jiao (2017) found that Airbnb listings are more likely to be located in neighborhoods with good transportation, commercials, and young college-educated people. Jiao & Bai (2020) showed that Airbnb listings in major US cities are more likely to be located in neighborhoods with high transit access, short distances to the city center, and median housing value and household income.

While attention has been paid to the distribution of growing peer-to-peer accommodation platforms and their impact on the housing market, studies on the survival and resilience of STRs are scarce. Leoni (2020) used Ibiza's Airbnb data to identify factors influencing the survival of listings, and found four characteristics: listings' characteristics, location, degree of local competition and hosts' managerial skills. She found that in an area with low market concentration and high competition, instability and mortality were higher. Türk & Sap (2021) investigated survival of Airbnb listings in Istanbul between January and October 2020. They argued that the impact of spatial attributes on the survival of listings differs significantly before and after the COVID-19 pandemic. They found that users preferred locations close to natural amenities away from hospitals during the pandemic, and units located in isolated places have a higher chance of survival than units located in crowded and popular places. However, since they used the January-October 2020 dataset, they could not clearly distinguish changes in survival mechanism before and after the pandemic.

Research on the effects of a pandemic on STRs continues to grow. They primarily focused on the heterogeneous impact of the pandemic. Zhang et al. (2021) identified three types of hosts and imply that different host types have different response strategies against decreased demands. Xu et al. (2021) argued that hosts face four types of stress (economic stressors,

uncertainty, operation-related stressors and social stressors) due to the pandemic and use different strategies to cope with them in terms of mental health. Jang & Kim (2022) investigated spatially heterogeneous effects of clusters on the Airbnb performance in Florida. Leisure clusters negatively affected Airbnb revenue, rural counties with a high specialization of leisure and hospitality businesses were less affected by COVID-19 than urban areas.

Taken together, STRs influencing the local housing market continued to grow during the pre-COVID period but caused negative externalities. A significant number of listings have been removed from the platform with the COVID-19 outbreak, but the natures of the removed listings and their impact remain in question.

4.4 Data and Methods

This study examines the relationship between COVID-19 and the STR market by comparing the survival and generation mechanisms of New York City Airbnb listings before and after the COVID-19 pandemic. The primary data source is from Inside Airbnb (IA), which provides a large open dataset regarding Airbnb listings for major cities. Research using web-scraped data obtained from third-party sources such as Inside Airbnb or AirDNA has become popular. IA founder Murray Cox releases web-scraped data monthly. The data provided by IA includes location information as well as unit characteristics. I combined Airbnb data with neighborhood characteristics from various sources.

4.4.1 Variable List

A list of variables used in the study is presented in table 1. Variables are divided into two categories: unit and neighborhood characteristics. Unit room characteristics are attributes posted on the Airbnb platform including room type, price, rating, etc. In this study, a variable of whether the price was dropped during the analysis period was created and used as a proxy for the host's

efforts to survive. The unit location variables are calculated using the latitude and longitude information of individual units. Distances are measured by Euclidean distances in ArcGIS pro. The location of each unit is based on the distance from the nearest airport. In the context of COVID-19, I add a variable for hospital accessibility, measured as the distance to the nearest hospital. Most of neighborhood characteristics are from American Community Survey (ACS), an annual survey performed by the US Census Bureau. This study uses 2019 ACS 5-year estimates which is the most current data available at the census tract level. Subway accessibility is measured by the number of subway stations within 1000 feet of each tract. The density of listings referred to as intensity or concentration in previous studies is measured by the ratio of listings to housing units. The number of crimes was taken from the crime location information provided by the NYPD, and the number of crimes that occurred within a 1000 feet radius of each census tract was calculated considering that a significant portion of the crime occurred at local boundaries such as roads. Finally, location quotient (LQ) of leisure and hospitality are added as variables to investigate the effect of tourism-related industries. The former represents attractions-related industries including arts, entertainment and recreation, and the latter represents service-related industries including accommodation and food service (Lee et al., 2020). As LQ indicates the relative specialization or concentration of a particular industry in a region, it can explain changes in Airbnb users' regional preferences.

Samples are restricted to those located in tracts with housing units of 200 or more. The outlier price was removed using the same method as Jiao & Bai (2020). As of March 2019, there were 46,146 Airbnb listings in New York City.

Table 4.16 Variables used in the survival analysis

Unit of analysis			Airbnb Unit
Dependent Variable	Category		- Survival Time
Independent Variables	Unit	Room	- Room type (shared or private room = 0, entire house = 1) - # of Beds (0 / 1 / 2/ 3+) - Price per night - Whether the price was dropped (No = 0, Yes = 1) - Minimum night (over 30? =1) - Whether host is a superhost (No = 0, Yes = 1) - Rating (<=90 = 0, 91-95 = 1, 96-100=2)
		Location	- Distance to nearest airport - Distance to nearest hospital
	Neighborhood (census tract)		- # of subway station within 1000f - Ratio of Airbnb listings to housing units - Ratio of the number of crimes to population - Population density - Ln(median income) - Homeownership rate - Rental vacancy rate - Unemployment rate - % non-Hispanic Black - Location quotient (LQ) of leisure industries (NAICS 71: Arts, Entertainment, and Recreation) - Location quotient (LQ) of hospitality industries (NACIS 72: Accommodation and Food Services)

4.4.2 Empirical Strategy

This study performs a cox proportional analysis to reveal survival mechanisms. Survival analysis concerns analyzing the time to the occurrence of failure event. This model is widely used in the medical field as well as in the social sciences. The analysis focuses on examining the time it takes for a failure event (interruption) to occur and the relationship between these failures and unit, location and neighborhood characteristics. The dependent variable is the time to failure event and the independent variables include the unit characteristic and neighborhood characteristics. This study includes PUMA fixed effects to capture any factors that are common to all units in the PUMA area. I estimate the coefficients by configuring two time periods in one

analysis model and perform the significance test of the difference between the coefficients estimated in different time periods. I use the interaction term of the COVID period to facilitate comparing coefficients. After model estimation, a joint significance test is performed as a post-estimation to examine whether the survival mechanism has changed. March 2019 to February 2020 and March 2020 to February 2021 are set as pre-COVID and post-COVID periods, respectively, therefore, the analysis period is 2 years. In order to isolate the impact of the newly enacted regulation in NYC from the survival analysis, December 2020, when the failure ratio was irrationally high, was controlled in the analysis. The monthly change in the number of listings shown in Figure 4.5 suggests that the new regulation had a big impact at once.

Then, I run negative binomial regression to reveal generation mechanism. This is to verify the relationship between neighborhood characteristics and the creation of Airbnb units. Since events occurring in a specific region (such as traffic accident count) do not have a normal distribution, it assumes Poisson distribution or a negative binomial distribution. In this case, the negative binomial model was applied because the variance was larger than the mean. The unit of analysis is the census tract. And similarly, a joint significance test is performed to check changes in the mechanism.

Table 4.17 Analytic strategy

<table>
<tr><td rowspan="2">Methodology</td><td rowspan="2">Unit of Analysis</td><td>Pre-COVID19</td><td>Post-COVID19</td><td rowspan="2">Difference</td></tr>
<tr><td>Mar 2019-Feb 2020</td><td>Mar 2020-Feb 2021</td></tr>
<tr><td>Survival Analysis (Cox proportional Hazard Model)</td><td>Airbnb Units</td><td colspan="2">Unit Character. (× COVID period)
Neighborhood Character. (× COVID period)
PUMA Fixed effect (× COVID period)</td><td rowspan="2">Joint Significance Test
(Post estimation)</td></tr>
<tr><td>Negative Binomial Regression</td><td>Neighborhood (Census Tract)</td><td colspan="2">Neighborhood Character. (× COVID period)
PUMA Fixed effect (× COVID period)</td></tr>
</table>

4.5 Results

4.5.1 Descriptive Statistics

Table 4.4 reports the survival records for each analysis period. A failure event is defined as disappearing from the platform. There were 18,286 failure events with failure rate of 39.6% in the pre-COVID period. 27,860 units surviving after 1 year had a failure rate of 41.0% in the post-COVID period.

Table 4.18 Failure rate of each analysis period

	Number of Units in analysis	Failure event in 1 year	Failure Rate
Pre-COVID	46,146	18,286	39.6%
Post-COVID	27,860	11,424	41.0%

Table 4.5 shows the basic summary statistics for the variables used in the survival analysis. Since the analysis samples from the post-COVID period are units that survived the pre-COVID period, it sketches variations for 1 year. The proportion of units with discounted prices increased significantly to 37.6% in the post-COVID period, whereas 7.5% in the pre-COVID period. This suggests that hosts respond to reduced demand due to the pandemic through price discounts. Like the accommodation industry that responds to crises through price discounts and reduction of fixed costs, STR hosts use the option of price discounts in addition to suspending businesses.

Table 4.19 Descriptive statistics

	Pre-COVID19		Post-COVID19	
	Mar 2019-Feb 2020		Mar 2020-Feb 2021	
	Mean	SD	Mean	SD
Unit				
Room type (Entire house = 1)	0.501	0.500	0.510	0.500
Number of Beds	1.118	0.654	1.093	0.618
Price per night ($)	120	68	118	65
Price discount (Yes = 1)	0.075	0.263	0.376	0.484
Minimum Stay (30 days or more =1)	0.097	0.295	0.076	0.265
Superhost (Yes = 1)	0.170	0.376	0.184	0.387
Rating				
0-90 (%)	40		36	
91-95 (%)	18		18	
96-100 (%)	42		45	
Distance to nearest Airport (miles)	6.901	2.224	6.905	2.199
Distance to Hospital (miles)	0.795	0.522	0.800	0.523
Neighborhood				
Subway accessibility	2.106	2.086	2.042	1.965
Ratio of listings to housing units	0.022	0.015	0.021	0.015
Crimes per 1,000 persons	0.159	0.141	0.155	0.133
Pop density (per 1,000 square foot)	2.585	1.317	2.579	1.311
Median income ($)	84,741	39,836	84,626	39,392
Homeownership rate (%)	23.65	16.45	23.77	16.44
Rental vacancy rate (%)	4.15	3.61	4.06	3.54
Unemployment rate (%)	5.40	3.25	5.40	3.22
LQ of leisure	1.35	5.63	1.33	3.75
LQ of hospitality	2.70	3.70	2.76	3.74
Number of Listings	46,146		27,860	

4.5.2 Survival Analysis

This study conducts a survival analysis to investigate the association between survival and characteristics of Airbnb units in New York City. Survival analysis is estimated by dividing two periods of pre-COVID and post-COVID. Table 6 and 7 show the estimated coefficients, hazard rates, and the differences between the coefficients in the two periods.

Among unit characteristics, the impact of price per night, price discount, minimum stay, superhost, rating and distance to the nearest airport has changed since the pandemic. All being equal, Airbnb units with a higher price per night have a lower chance of surviving. This

relationship became stronger in the post-covid period. In other words, units with lower price were more likely to survive after the pandemic. Airbnb units that have discounted prices were more likely to survive. In the pre-COVID-19 period, discounted prices decreased failure event by 43% and in the post-COVID-19 period by 60%. This is consistent with Leoni (2020)'s argument that hosts who adjust their rates have a higher chance of surviving. The price discount effect was found to be greater in the post COVID19 period. Long-term stay units longer than 30 days showed a lower survival rate compared to short-stay units. After the pandemic, this relationship strengthened, making long-stay units more likely to leave the platform. Superhost and rating variables, which represent reputation and service level, have been dramatically changed. They were positively associated with survival rate in the pre-COVID period, but the direction of impact reversed in the post-COVID period. Since these variables are related to the host's expertise and the sensitivity to revenue, the changed mechanism indicates that operating a housing unit as an STR has become less attractive than other alternatives.

Among neighborhood characteristics, the effect of subway accessibility on survival is significantly different before and after the pandemic. Airbnb units located in neighborhoods with high subway access had statistically no effect on survival in the pre-COVID period, but it had a negative effect in the post-COVID period. Considering the claim that Airbnb units are more likely to be located in areas with good transportation access (Jiao & Bai, 2020; Wegmann & Jiao, 2017), hosts are likely to start an Airbnb business in an area with good transportation access, but they failed with a higher proportion than in other areas. The association between leisure and hospitality industries and survival, where the mechanism was expected to change due to the pandemic, did not change significantly. The results of the pre-COVID period show that the number of workers in accommodation and food service had a positive relationship with the survival rate, which is consistent with the expectation that units in areas with dense commercial facilities operate for a longer period of time.

Table 4.20 Results of survival analysis

	Unit Characteristics				Neighborhood Characteristics				Full Model			
	(1)		(2)		(1)		(2)		(1)		(2)	
	Pre-COVID19 Mar 2019-Feb 2020		Post-COVID19 Mar 2020-Feb 2021		Pre-COVID19 Mar 2019-Feb 2020		Post-COVID19 Mar 2020-Feb 2021		Pre-COVID19 Mar 2019-Feb 2020		Post-COVID19 Mar 2020-Feb 2021	
	Coef.	HR	Coef.	HR	Coef.	HR	Coef.	HR	Coef.	HR	Coef.	HR
Unit												
Room type (Entire house = 1)	-0.2767***	0.7583	-0.2525***	0.7769					-0.2722***	0.7617	-0.2511***	0.7780
Number of beds (Ref. 0-1)												
2	0.1008***	1.1061	0.2305***	1.2592					0.0970***	1.1019	0.2302***	1.2588
3+	0.2709***	1.3111	0.2772***	1.3195					0.2632***	1.3010	0.2744***	1.3158
Price per night ($)	0.0014***	1.0014	0.0027***	1.0027					0.0015***	1.0015	0.0028***	1.0028
Price discount (Yes = 1)	-0.5563***	0.5733	-0.9104***	0.4023					-0.5597***	0.5714	-0.9130***	0.4013
Minimum Stay (30 days or more =1)	0.4078***	1.5035	0.6324***	1.8821					0.4114***	1.5090	0.6372***	1.8912
Superhost (Yes = 1)	-0.0880***	0.9157	0.6241***	1.8666					-0.0884***	0.9154	0.6259***	1.8698
Rating (Ref. 0-90)												
91-95	-0.1148***	0.8915	0.4137***	1.5125					-0.1126***	0.8935	0.4186***	1.5198
96-100	-0.2501***	0.7787	0.0919**	1.0962					-0.2468***	0.7813	0.0943**	1.0989
Distance to nearest Airport (miles)	0.0242+	1.0245	-0.0067	0.9933					0.0283+	1.0287	-0.0202	0.9800
Distance to hospital (miles)	0.0091	1.0092	0.0584+	1.0602					0.0113	1.0114	0.0662*	1.0685
Neighborhood												
# of subway station within 1,000 feet					0.0128*	1.0129	0.0268***	1.0271	0.0074	1.0074	0.0336***	1.0341
Ratio of Airbnb listings to housing units					-0.0208	0.9794	-0.1948	0.8230	0.0149	1.0150	0.2090	1.2324
Crimes per 1,000 persons					0.0036	1.0036	0.0120	1.0120	0.0119	1.0119	-0.1505	0.8603
Pop density (per 1,000 square foot)					-0.0056	0.9944	0.0182	1.0184	0.0000	1.0000	0.0170	1.0171
Median income (in $ 1,000s)					-0.0013***	0.9987	0.0004	1.0004	-0.0014***	0.9986	-0.0007	0.9993
Homeownership rate (%)					-0.0017*	0.9983	0.0019+	1.0019	-0.0012+	0.9988	0.0007	1.0007
Rental vacancy rate (%)					0.0060**	1.0060	0.0057	1.0057	0.0049*	1.0049	0.0023	1.0023
Unemployment rate (%)					-0.0008	0.9992	-0.0003	0.9997	-0.0023	0.9977	0.0000	1.0000
LQ of leisure					-0.0025+	0.9975	-0.0020	0.9980	-0.0027*	0.9973	-0.0023	0.9977
LQ of hospitality					-0.0104***	0.9896	-0.0023	0.9977	-0.0110***	0.9891	-0.0060	0.9940
N	74,006				74,006				74,006			
LR chi2	4353.010				790.560				4461.770			
Wald $\chi 2$	Prob>chi2 = 0.0000				Prob>chi2 = 0.0000				Prob>chi2 = 0.0000			
Region Controls	Yes				Yes				Yes			
Event related sharing data controls	Yes				Yes				Yes			

Notes: +: p < 0.1, *: p < 0.05, **: p < 0.01, ***: p < 0.001

Table 4.21 Results of the cox proportional hazard model

	(1)		(2)		(3)	
	Pre-COVID19 Mar 2019-Feb 2020		Post-COVID19 Mar 2020-Feb 2021		Difference	
	Coef.	HR	Coef.	HR	Coef.	HR
Unit						
Room type (Entire house = 1)	-0.2722***	0.7617	-0.2511***	0.7780	0.0211	1.0213
Number of beds (Ref. 0-1)						
2	0.0970***	1.1019	0.2302***	1.2588	0.1331***	1.1424
3+	0.2632***	1.3010	0.2744***	1.3158	0.0113	1.0114
Price per night ($)	0.0015***	1.0015	0.0028***	1.0028	0.0013***	1.0013
Price discount (Yes = 1)	-0.5597***	0.5714	-0.9130***	0.4013	-0.3533***	0.7024
Minimum Stay (30 days or more =1)	0.4114***	1.5090	0.6372***	1.8912	0.2258***	1.2533
Superhost (Yes = 1)	-0.0884***	0.9154	0.6259***	1.8698	0.7142***	2.0426
Rating (Ref. 0-90)						
91-95	-0.1126***	0.8935	0.4186***	1.5198	0.5312***	1.7010
96-100	-0.2468***	0.7813	0.0943**	1.0989	0.3411***	1.4065
Distance to nearest Airport (miles)	0.0283+	1.0287	-0.0202	0.9800	-0.0485*	0.9526
Distance to hospital (miles)	0.0113	1.0114	0.0662*	1.0685	0.0549	1.0564
Neighborhood						
# of subway station within 1,000 feet	0.0074	1.0074	0.0336***	1.0341	0.0262**	1.0265
Ratio of Airbnb listings to housing units	0.0149	1.0150	0.2090	1.2324	0.1941	1.2142
Crimes per 1,000 persons	0.0119	1.0119	-0.1505	0.8603	-0.1623	0.8502
Pop density (per 1,000 square foot)	0.0000	1.0000	0.0170	1.0171	0.0170	1.0172
Median income (in $ 1,000s)	-0.0014***	0.9986	-0.0007	0.9993	0.0007	1.0007
Homeownership rate (%)	-0.0012+	0.9988	0.0007	1.0007	0.0020	1.0020
Rental vacancy rate (%)	0.0049*	1.0049	0.0023	1.0023	-0.0026	0.9974
Unemployment rate (%)	-0.0023	0.9977	0.0000	1.0000	0.0023	1.0023
LQ of leisure	-0.0027*	0.9973	-0.0023	0.9977	0.0004	1.0004
LQ of hospitality	-0.0110***	0.9891	-0.0060	0.9940	0.0050	1.0050
N	74,006					
LR chi2	4461.770					
Wald $\chi 2$	Prob>chi2 = 0.0000					
Region Controls	Yes					
Event related sharing data controls	Yes					

Notes: +: $p < 0.1$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

4.5.3 Negative Binomial Regression

The result of negative binomial regression shows that several neighborhood characteristics are related to the generation of new Airbnb units. Among these, the impact of Airbnb density and crime rates on Airbnb location has changed since the pandemic. STR units were more likely to occur in Airbnb clusters. However, there were fewer new Airbnb units in

Airbnb clusters in the post-covid period. STR businesses were less likely to be started in areas with higher crime rates, but this effect weakened in the post-COVID period. Crime data for 2019 was used in this study, and the regional distribution of crime may have changed due to the pandemic. This result means that the probability of Airbnb business in areas that were not preferred due to crime in 2019 has increased.

Table 4.22 Results of negative binomial regression

	(1)		(2)		(3)	
	Pre-COVID19 Mar 2019-Feb 2020		Post-COVID19 Mar 2020-Feb 2021		Difference	
	Coef.	IRR	Coef.	HR	Coef.	HR
Neighborhood						
Distance to Empire State Building (miles)	-0.1788***	0.8363	-0.2156***	0.8061	-0.0368	0.9639
Distance to nearest Airport (miles)	-0.1258***	0.8818	-0.1618***	0.8506	-0.0359	0.9647
# of subway station within 1,000 feet	0.0868***	1.0907	0.0787***	1.0818	-0.0081	0.9919
Ratio of Airbnb listings to housing units (%)	0.3876***	1.4735	0.3301***	1.3911	-0.0575*	0.9441
Crimes per 1,000 persons	-0.8125***	0.4437	-0.5509***	0.5764	0.2616*	1.2989
Pop density (per 1,000 square foot)	0.1169***	1.1240	0.1247***	1.1328	0.0078	1.0078
Median income (in $ 1,000s)	-0.0008	0.9992	-0.0006	0.9994	0.0002	1.0002
Homeownership rate (%)	-0.0067***	0.9934	-0.0087***	0.9913	-0.0021	0.9979
Rental vacancy rate (%)	0.0129**	1.0129	0.0107*	1.0108	-0.0021	0.9979
Unemployment rate (%)	-0.0210*	0.9792	-0.0208*	0.9794	0.0002	1.0002
LQ of leisure	0.0061+	1.0062	0.0033	1.0034	-0.0028	0.9972
LQ of hospitality	0.0030	1.0030	0.0056	1.0056	0.0026	1.0026
Constant	3.3952***		3.2372***			
/ln alpha			-0.8583			
alpha			0.4238			
Region Controls			Yes			

Notes: +: $p < 0.1$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$

4.6 Discussion

This study investigated changes in survival and generation mechanisms of Airbnb units associated with the COVID-19 pandemic using New York City's Airbnb listing data. The impact of several variables on survival and generation mechanisms changed since COVID-19 pandemic. First, Airbnb hosts used the option of price discount to survive, and its effect was greater in the post-COVID period. Second, superhost and rating variables that represent reputation and service level were positively associated with survival in the pre-COVID period, but the direction of impact reversed in the post-COVID period. Third, the effect of subway accessibility on survival is significantly different before and after the pandemic. Units located in neighborhoods with high subway accessibility are likely to disappear at a faster rate in the post-COVID period. Considering the flexible nature of STRs with free entry and exit from the market, it implies an increased LTR housing stock in a neighborhood with these characteristics. Since disappeared listings are more likely to return to the LTR, it means rental housing stock has increased in neighborhoods with high subway accessibility. Fourth, Airbnb units were less likely to be created in neighborhoods with high Airbnb density in the post-COVID period. Finally, Airbnb units were more likely to be created in neighborhoods with high crime rates in the post-COVID period. Airbnb listings decreased during the pandemic period, but this may be temporary. If tourism demand recovers, New York City's housing affordability could worsen. The results of this study argue that the survival mechanism and the generation mechanism are different. Methods for reducing LTR to STR conversion and methods for inducing STR to LTR conversion may be different. They should be considered separately in regulating the STR.

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Chapter 5. CONCLUSION

5.1 Key Findings

While the literature on the decisions of individual households in the housing market is abundant, literature on the short- and long-term effects of such decisions on households is scarce. In addition, although the relationship between the COVID-19 pandemic and changes in housing demand is often reported recently, the impact of this new crisis on the housing market has been little known. In this dissertation, I investigated the behavior of individuals in response to the housing crisis and its consequences, and the impact of the pandemic on the short-term rental market through 3 essays.

The first essay investigates the economic outcomes of young people who return to their parental homes after periods of independent living using NLSY97 data. While it is still unknown how much boomerang movers save living expenses, the negative economic consequences of the boomerang move are identified. The economic outcomes of boomerang movers did not improve compared to the period of independent living, and the income gap with young people who remained independent widened. In particular, this gap widened even more during the Great Recession, meaning that a recession could cause income inequality problems among young people. Going back to a parental house changes the region and urban form significantly, and movement of urban form from the central city to the suburban and from the suburban to out of the MSA has a negative impact on income. Differences in race/ethnicity and educational attainment, directly and indirectly, affect boomerang move and income.

The findings of first essay suggest implications as follows. First, more affordable housing should be provided in areas with high accessibility to the labor market to reduce boomerang moves, which negatively impact economic outcomes, at least in the short term. Second, ways to increase job opportunities should be explored to reduce the short-term negative impact of

boomerang move. Efforts at the government level are needed so that they can easily find and compare job opportunities in the new labor market. Finally, education and vocational training opportunities must be increased to close the income gap among young people in the long run. Having skilled jobs and higher education levels can lead to a higher income level, narrowing the income gap.

The second essay investigates the relationship between the characteristics of neighborhood and the economic recovery of households by tracking residential mobility of foreclosed households. 25% of foreclosed households regained homeownership within 2 years and 42% within 6 years. However, a disproportionate recovery is observed among races. The racial disparity is likely due to the migratory neighborhood. Neighborhood characteristics are directly related to the increase in income of migrated households. The characteristics of the relocated region directly or indirectly affect household economic recovery and indirectly affect regain homeownership.

The findings of second essay suggest the following policy implications. In order to achieve household recovery, it is important to relocate families to places with affluent job opportunities. The government's recovery assistance program should aim to support relocation to a certain neighborhood, not simply to provide subsidies. In particular, in order to achieve racially equitable recovery, there will be a need for support programs that focus on the neighborhood of migration. Public programs must be designed to move families to areas with lower poverty rates and higher job and educational opportunities.

The third essay explores changes in survival mechanisms and generation mechanism of Airbnb units associated with the COVID-19 pandemic using New York City’s Airbnb listing data. It also investigates the potential impact of changes in survival and generation mechanisms. Airbnb hosts used the option of price discount to survive, and its effect was greater in the post-COVID period. Superhost and rating variables that represent reputation and service level were

positively associated with survival in the pre-COVID period, but the direction of impact reversed in the post-COVID period. The effect of subway accessibility on survival is significantly different before and after the pandemic. Considering the flexible nature of STRs with free entry and exit from the market, it implies an increased LTR housing stock in a neighborhood with these characteristics. Airbnb units were less likely to be created in neighborhoods with high Airbnb density in the post-COVID period. Finally, Airbnb units were more likely to be created in neighborhoods with high crime rates in the post-COVID period.

The findings from this essay suggest that the survival mechanism and the generation mechanism are different. Methods for reducing LTR to STR conversion and methods for inducing STR to LTR conversion may be different. They should be considered separately in regulating the STR.

5.2 Limitation and Potential Future Research

This dissertation used panel data to track individual behavior, and the limitations of the study are mostly related to data. Since the NLSY97 data used in the first essay does not include personal expenditure, it was impossible to directly estimate the difference in personal spending such as housing costs or commuting costs before and after the boomerang move. Also, since detailed residential information was not given, the association between neighborhood characteristics and the financial status of boomerang movers was not known. In addition, this study explored only the short-term effect of boomerang moves, not the long-term effects of more than 5 years. In the future, I will examine the long-term effects of living with parents on income, wealth, and homeownership. NLSY97 collects information about wealth and homeownership every 5 years. The study aims to explore the long-term effects of economic independence for young people.

In the second essay, the number of samples extracted from PSID was not large enough, so it was not possible to test various variables and hypotheses. The influence of metro level variables as well as other neighborhood variables should be considered, but the sample size could not sufficiently cover it. Structural equation modeling can be considered to comprehensively verify the recovery mechanism used in the study, but it requires more samples. Future studies will test further hypotheses by including households notified of the foreclosure process and households at risk of foreclosure as target populations.

In the last essay, it cannot be argued that the results of the analysis apply to other regions as well, since the geographic scope is New York City, an urban area with a high proportion of international tourists. Therefore, future studies will perform a similar analysis for tourist cities with low housing affordability and high demand for domestic tourists during the pandemic.