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Essays on the Economics of Rental Housing and Crime

LaRhonda Renee Ealey
Syracuse University

ABSTRACT

Essays on the Economics of Rental Housing and Crime

My dissertation consists of three chapters in the area of applied microeconomics. The first chapter exploits the mass evacuation of thousands of New Orleans residents to numerous counties throughout the South in the aftermath of Hurricane Katrina to identify the impact of migration on rents and estimate supply elasticities in local rental housing markets. The second chapter follows with an investigation of the impact that the evacuations on crime in the destination counties. The analyses in the first two chapters are conducted using data from American Community Survey and the Federal Bureau of Investigation's Uniform Crime Reporting database. The third chapter focuses on the relationship between ownership concentration and rental housing market outcomes. This analysis employs panel data on individual senior housing properties from the National Investment Center for Seniors Housing and Care to measure ownership concentration and to examine its impact on senior housing rents and occupancy measures.

The Impact of Migration on Rents: Evidence from Hurricane Katrina
Hurricane Katrina struck the Gulf Coasts of Louisiana and Mississippi on August 29, 2005, leaving in its wake damage of catastrophic proportions. The mass evacuations before and after the hurricane led to the long-term displacement of more than half of the New Orleans residents to counties throughout the United States, but predominately in the South. This study uses a panel of Southern counties constructed from American Community Survey (ACS) data to estimate the impact of Katrina migration on local rents. Relying on the exogenous nature of this forced migration, this analysis finds that population changes due to Hurricane Katrina evacuations expanded the market demand for rental housing and consequently increased rents. Specifically, an increase in Katrina migration equal to 1 percent of the county population resulted in a 3 to 8 percent increase in the rents of natives. The study also suggests that the short-run rental housing supply is inelastic, with estimates ranging between 0 and 0.60.

The Impact of Hurricane Katrina Migration on Crime
The evacuations from Hurricane Katrina led to an influx of economically vulnerable people into numerous counties throughout the South This paper follows the empirical framework of the preceding chapter by exploiting the quasi-experimental nature of these evacuations to evaluate whether this mass migration had an impact on crime levels in the destination counties. The study uses a panel of Southern counties constructed of data extracted from American Community Survey (ACS) and the Federal Bureaus of Investigation's Uniform Crime Reporting database. The analysis finds that population changes due to Hurricane Katrina did not have a statistically significant impact on the total level of violent crimes or property crimes.

The Impact of Market Concentration in the Market for Senior Rental Housing
The senior housing rental market is one of the fastest growing housing segments, but relatively little is known about its market structure. This paper uses panel data on individual senior housing properties from the National Investment Center for Seniors Housing and Care (NIC) to examine the impact of ownership concentration in the market for senior rental housing. Market concentration is greatest in the independent living and assisted living senior housing markets. In

the assisted living market, in particular, increased concentration results in higher average monthly rents and lower occupancy, as would be predicted by standard microeconomic theory. In the independent living market increased concentration results in increased rent growth and lower occupancy. Nonprofit providers appear to attenuate the impact of market concentration, especially in the independent living market.

ESSAYS ON THE ECONOMICS OF RENTAL HOUSING AND CRIME

by

LaRhonda Renee Ealey

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"Never forget where we came from and always praise the bridges that carried you over."
Fannie Lou Hamer

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Chapter 1

The Impact of Migration on Rents: Evidence from Hurricane Katrina

1.1 Introduction

The price elasticity of housing supply is an important parameter in determining how demand factors, such as means-tested housing assistance programs and migration, impact rental market outcomes. In general, receipt of housing choice vouchers or migration can cause an increase in the local market demand for rental housing. If the rental market has a relatively inelastic supply, however, this change may result in a substantial increase in the rental rate and a proportionally smaller increase in the quantity of available housing. Unfortunately, the existing literature on housing supply is narrow, and there are few reliable estimates of short-run price elasticity of supply (DiPasquale, 1999; Green, Malpezzi, and Mayo, 2005). This paper exploits the mass evacuation of thousands of New Orleans residents to numerous counties throughout the South in the aftermath of Hurricane Katrina to identify the impact of migration on rents and estimate supply elasticities in local rental housing markets.

Hurricane Katrina struck the Alabama, Mississippi, and Louisiana Gulf Coasts on August 29, 2005, and it departed as one of the five deadliest and the costliest hurricane in U.S. history. Approximately 300,000 homes were destroyed or severely damaged, and levee breaches following the storm caused more than 80 percent of the city of New Orleans to be covered in 15 to 20 feet of water (U.S. Department of Homeland Security: White House Report, 2006). The severity of the storm and deplorable conditions of makeshift evacuation centers in New Orleans led to the evacuation of more than 400,000 people to various cities and towns throughout the United States, primarily in the South. In addition to the evacuees assisted by the government, those that voluntarily evacuated the Gulf Coast as a temporary measure prior to the storm soon

realized that they could not return home. This facilitated a long-term and, in some cases, a permanent move for nearly half of New Orleans' population (Plyer, 2015).

This analysis uses the quasi-experimental nature of these forced evacuations from New Orleans as a measure of migration in various counties throughout Louisiana and in bordering states. Data on household migration from New Orleans, and information on rents and additional covariates in evacuee destination counties are extracted from the American Community Survey (ACS) data set. The annual ACS asks respondents whether or not they are renters, the amounts of their monthly contract and gross rents, their migration status and city of residence one year before the survey date. Using the 2005-2007 cohorts, data are aggregated by household and then by county to develop a panel of 39 counties in Louisiana and the bordering states of Mississippi, Arkansas, and Texas. Fixed effects and weighted least squares regressions are employed to infer a causal relationship between migration and rents and rental housing supply elasticity estimates.

This analysis has three primary findings. Population inflows from New Orleans equal to 1% of the destination county's existing population are associated with a 4 to 8 percent increase in the contract rents of county natives and a 2 to 6 percent increase in their gross rents. Estimates of the stock of rental housing in the destination counties suggest that migration had no statistically significant impact on the supply of rental housing. The implied supply elasticity of rental housing ranges between 0 and 0.6, indicative of a relatively inelastic short-run housing supply.

The rental estimates from this analysis are in tandem with the previous findings of Saiz (2003), in that migration, at least in the short run, increases the rents of the native population, and this possibly decreases their real incomes by increasing the proportion of their household earnings that must be spent on housing. The short-run supply elasticity range from this study

complements the results from Saiz (2010). He found that areas with fewer geographical land constraints, which is true of the counties in this study, had a more elastic supply estimate. Saiz estimated long-run housing supply elasticities that ranged between 0.6 and 5.5 across 95 U.S. metropolitan areas. Particularly, in metropolitan areas such as Little Rock, AR, and Houston, Dallas, and San Antonio, TX, that are included in this study, his long run estimates ranged between 2.2 and 3. Linking the short-run elasticity estimates from this paper to his results, supports the notion that supply becomes more elastic over the long-run.

The remainder of the paper is organized as follows. Section 1.2 gives a brief overview of the literature on the impact of migration and immigration on local economic conditions. Section 1.3 includes a basic theoretical framework and background discussion on the Hurricane Katrina evacuation. Section 1.4 discusses the data and regression framework. Section 1.5 lays out the results, and Section 1.6 concludes with an overview and discussion of extensions on this analysis.

1.2 Literature Review

The early literature that examined the impact of immigration on economic conditions was primarily focused on local labor markets. Altonji and Card (1989) estimated that an increase in immigrants equal to 1 percent of the statistical metropolitan statistical area's (MSA) population decreased native wages by approximately 1.2 percent. A study by Card (1990) found that immigration in Miami, following the Mariel boatlift, increased the supply of low-skilled workers, but that there was not a significant impact on wages or the unemployment rates of native low-skilled workers. A latter study of labor supply accounting for differences in education and experience, however, estimated that immigration decreased native wages between 3 and 4 percent (Borjas, 2003).

Subsequent studies have examined the impact of migration and immigration on local economic conditions, such as housing prices. Saiz (2003) estimated the impact of the Mariel boatlift on rental rates and real income in Miami. He found that rents in Miami increased between 8 and 11 percent, compared to similar cities, and that this resulted in a short- run decrease of 1.4 percent in real income. A study of U.S. MSAs found that immigration inflows equal to 1 percent of a city's population were associated with a 1 percent increase in area median rents and housing prices (Saiz, 2007).

The existing literature on housing supply is narrow, and there are few examples of short-run price elasticity of housing supply (DiPasquale 1999; Green, Malpezzi, and Mayo 2005). Saiz (2010) concluded that geographical land constraints were a key determinant of the long-run elasticity of housing supply. He estimated that the average MSA had an elasticity of 1.75, and that areas with larger land constraints were more inelastic. In a study of the impact of housing choice vouchers on rental prices, Susin (2002) found that an increase in voucher receipts raised MSA rents by an average of 16 percent. He further asserted that his results were consistent with an inelastic supply of lower quality rental units. Eriksen and Ross (2013) studied the effect of increased housing vouchers on rents. They found that voucher recipients rented more expensive units, and that increases in individual rents were largest for these renters who were living in cities with a relatively inelastic housing supply.

This study uses a similar approach as Saiz (2003), by examining the impact of a migration shock on local rental rates. The nature of the forced evacuations and vast need for government housing assistance caused by hurricane Katrina would suggest that these movers were low-income and settled into low-quality housing.

1.4 Background

1.4.1 Basic Theoretical Framework

The standard supply and demand diagram illustrates the basic theoretical framework of the relationship between rents and migration. Population changes caused by in-migration expands the market demand for rental housing in destination markets. If the local market supply is perfectly elastic, as shown in Figure 1.1.1, the supply of housing will adjust to the change in demand and rental rates will remain unchanged. On the other hand, Figure 1.1.2 models a rental market where supply is relatively inelastic. The diagram illustrates that a shock to demand will cause rental rates to increase, and the increase in rents may be proportionally larger than the change in available units.

The migrants analyzed in this study are movers due to the unanticipated evacuations from New Orleans in the aftermath of Hurricane Katrina. As detailed below, the immediate circumstances and demographic profile of the majority of evacuees suggest that their move was exogenous, and that these movers became renters when they arrived to the new destinations.

1.4.2 Timeline of the Hurricane

Katrina made landfall on the South Florida Coast as a Category 1 hurricane on August 25, 2005, and it began to intensify as it headed toward the Gulf Coasts of Mississippi and Louisiana one day later. Federal emergencies were declared in the target areas on August 26, as those states began implementing disaster-response plans. The city of New Orleans was of particular concern, because its topography made it susceptible to destruction in the wake of a severe storm. Between August 27 and 28, the storm gained strength, becoming a Category 5 hurricane, as it continued heading towards the Gulf (U.S. Department of Commerce National Oceanic and Atmospheric Administration National Weather Service, 2006). In response,

officials in Mississippi and Louisiana ordered mandatory evacuations and began ramping up emergency-response plans (U.S. Department of Homeland Security Office of Inspector General, 2006). Aware that over 100,000 New Orleans' residents did not own vehicles, and that disadvantaged populations, like the elderly, would face evacuation challenges, the Superdome was designated as a shelter of last resort (Lipton, 2015).

Even though the State of Louisiana estimated that more than 1 million people evacuated before the storm made landfall, there were thousands who were not able to leave. By August 28, approximately 30,000 sought shelter in the Superdome and thousands more decided to shelter in place and "wait out" the storm (http://www.pbs.org/frontline). The morning of August 29, Hurricane Katrina made landfall as a Category 3 storm and decimated several Mississippi coastal communities in its path. Following the passage of Hurricane Katrina there was a breach in the 17th Street and Industrial Canal levees that caused approximately 80 percent of New Orleans to be covered in 15-20 feet of water (U.S. Department of Commerce National Oceanic and Atmospheric Administration National Weather Service, 2006).

Hurricane Katrina was one of the five deadliest and the costliest hurricane in U.S. history. The National Hurricane Center estimated that Hurricane Katrina left behind approximately $81.2 billion in damages, and the National Weather Service estimated the total economic loss to be more than $100 billion (U.S. Department of Commerce National Oceanic and Atmospheric Administration National Weather Service, 2006). More than 300,000 homes were severely damaged or decimated, and the infrastructure of the hardest-hit communities was completely destroyed (U.S. Department of Homeland Security Office of Inspector General, 2006).

1.4.4 Evacuations as an Exogenous Shift

The unanticipated and catastrophic flooding from levee breaches created an especially critical situation in New Orleans. As flooding continued to overtake the city, more residents began arriving at the Superdome and others to the New Orleans' Convention Center. These locations, however, were not equipped to accommodate the large number of evacuees. Sewage problems, overcrowding, and deficient supplies of food and water made the conditions at these centers deplorable. Yet, flood victims continued arriving for emergency assistance even days later. By August 30, Governor Blanco deemed the Superdome uninhabitable and ordered immediate and mandatory evacuations out of the stadium. Meanwhile, the Governor and FEMA reached out to a number of states and local municipalities to make shelter and temporary housing arrangements for arriving evacuees. Addressing the flood and the victims became a problem of epic proportion, and over four days between August 31 to September 3, FEMA, and the Departments of Defense and Transportation coordinated a plan which transported 23,000 people from Superdome to cities throughout the South with the majority arriving in Houston, TX. On September 3, 25,000 people began boarding evacuation buses from the Convention Center, and on September 4, it was reported that 2,000 medical evacuees were waiting to leave the airport. By September 6, Mayor Nagin asserted that there were still 5,000-10,000 more people in the city that needed to be rescued or evacuated, and he ordered a mandatory evacuation of the entire city (http://www.pbs.org/wgbh/pages/frontline/). While there are no official estimates, given the compilation of accounts, a conservative estimate of the government-assisted evacuations equals 55,000. A timeline of key Hurricane Katrina events compiled at The Brookings Institution estimated that 77,000 New Orleans residents were evacuated with government assistance (DeLozier and Kamp).

When evacuees boarded the buses and airplanes from New Orleans, they did so under strenuous circumstances without giving consideration to the economic conditions of the localities to which they would arrive. Their migration was forced and simply a matter of the desperate need for safety and shelter. Moreover, news reports indicated that evacuees boarded buses not knowing where they were going until they departed. An overview of the media coverage, government transcripts, and Congressional reports clearly demonstrated that the pre-Katrina evacuations were sudden and unanticipated in length. Likewise, post-Katrina evacuations were unplanned and haphazardly implemented with no thought-out plans to return the evacuees.

1.4.5 Evacuee Demographics and Destinations

The damage to the stock of housing made much of New Orleans uninhabitable. Consequently, this meant that persons who evacuated voluntarily and involuntarily were not able to return immediately. For many, such circumstances warranted a long-term and, in many cases, permanent move. In total, New Orleans lost more than half of its population in the aftermath of Katrina (Plyer, 2015). As of July 1, 2006, Frey, Singer, and Park (2007) estimated that the city's population had fallen by 229,000. New Orleans' Lower Ninth Ward, a part of the city's interior, was the area most affected by flooding. According to 2000 Census data compiled by The Data Center, pre-Katrina, the area was 98% Black, 60% were renters, 40% lived below the poverty level, 32% did not access to a vehicle, and 70% had a high school diploma or less (datacenterresearch.org). After the hurricane, it lost 85% of its pre-Katrina population (Jonassen, 2012).

Groen and Polivka (2008) estimated that of the evacuees who would return to Louisiana within a year of the hurricane, 97% had returned by December of 2005, and the average returning evacuee came back to their pre-storm address within 38 days. Evacuees who were

black, single and never married, had school-age children, and had lower educational attainment and family income were less likely to return to high-damage areas (Groen and Polivka, 2010; Frey et al., 2007). For obvious reasons, those that were bused out of New Orleans were also likely to share the same demographic profile as the non-returner group. Of the non-returners, more than 81% had relocated to counties in Louisiana, Mississippi, Alabama, Texas, Tennessee, Georgia, Florida, and Arkansas (Groen and Polivka 2008). Frey et al. (2007) also showed differences in migration patterns before and after the hurricane. For example, pre-Katrina migration patterns show that more than half of New Orleans's out-migrants moved to parishes (counties) in the New Orleans Metropolitan Statistical Area (MSA)[1]. After the hurricane, the destination for out-migrants became more widespread with more than 50% going to counties in Texas, Georgia, and Tennessee. Figure 1.2 illustrates the settlement pattern of New Orleans' out-migrants, who left the city in 2005, using the Internal Revenue Service's Statistics of Income data base. The map illustrates that out migrants from this time period were scattered throughout U.S. counties, however, the highest concentrations are located in counties in the southern most region.

1.4.6 Housing the Evacuees

Figure 1.3 illustrates the basic flow of the evacuation and housing process. Within the days and weeks following the storm, FEMA solicited various states to accept and provide housing for evacuees. States provided FEMA with the specific cities where victims could receive housing assistance and a corresponding maximum number of individuals to which services could be provided. FEMA then transported evacuees by the number and to the localities as designated

[1] Frey et al. (2007) construct migration patterns using ACS data.

by each state. The agency also asked that receiving states treat the Katrina evacuees as disaster victims from their own states (McCarthy, 2008).

FEMA provided housing assistance, similar to standard existing federal means-tested rental housing assistance, for Hurricane Katrina evacuees through provisions in Sections 403 and 408 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.[2] Section 403 provides federal assistance in order that states can provide for such immediate needs of disaster victims as emergency shelter. The "shelter" application of Section 403 assistance, however, was intended for state-implemented short-term mass evacuation centers. Unfortunately, the breadth of Katrina resulted in a need for Section 403 assistance to be used for up to 12 months, rather than for temporary shelter.

States were reimbursed under the Section 403 provision to pay for evacuee housing costs in one of three ways. States could either directly pay rental expenses, place evacuees in existing public housing units, or evacuees could transfer their existing Section 8 vouchers, if they had one. Some localities created housing assistance vouchers especially for Katrina evacuees. In large MSAs like Houston and Dallas, the majority of rental assistance was paid directly by the state due to limited public housing stocks and existing Section 8 waiting lists. Qualifications for Section 403 rental assistance only required that evacuees provide proof of having lived in the

[2] Public housing units are publically financed housing developments that are overseen by the Department of Housing and Urban Development (HUD) and managed by local housing authorities. Existing public housing rules were also applicable to Katrina evacuees in that they were required to pay no more than 30% of their income in rent (www.portal.hud.gov). Unfortunately, short supplies of public housing units are not uncommon, and this option was likely limited relative to the number of evacuees. Particularly, this was the case in Houston, TX (Joint Hurricane Housing Task Force Communications Team, 2006). The majority of evacuees received voucher assistance which operated much like HUD's Section 8 program with a few modifications. In general, housing voucher programs give tenants a transferrable subsidy that is applied to a private market unit with rents at or below the Fair Market Rent (FMR). FMR's are set at the 40th percentile of the county's or MSAs rents. Under Section 8 rules, the recipient pays at most one third of their income towards their rent, and the voucher is used to cover the balance (www.huduser.gov).

disaster area, and security deposits and background checks were waived. Rental units, however, had to meet the Section 8 program's Fair Market Rent (FMR) and inspection standards before voucher reimbursement was granted to states. By November, FEMA was compelled to relax the FMR restriction, and they allowed voucher recipients to pay differences for rents above the FMR out of pocket (Joint Hurricane Housing Task Force, 2006). The Congressional Research Service Report for Congress estimated that Section 403 assistance was applied to approximately 67,000 apartment leases in 32 states (McCarthy, 2008).

After the 12-month period of Section 403 assistance expired, FEMA transferred its housing assistance vouchers to provisions provided by Section 408, which had more eligibility restraints. Receipt of Section 408 assistance required that FEMA determine whether the evacuee was experiencing financial hardship, their former residence was unlivable and/or had other related difficulties post-Katrina (McCarthy, 2008). A key distinction of the Section 408 voucher assistance was that it was paid directly to the household. The maximum time allotment for the Section 408 voucher was 18 months (Joint Hurricane Housing Task Force, 2006).

1.5 Empirical Framework and Data

In the empirical analysis, each county is treated as a local rental market. Let *c* index the county, and *t* index the calendar year, then the econometric specification is

$$ln\,(R_{ct}) = \propto + \beta Katrina_{ct} + \boldsymbol{\delta X}_{ct} + u_{ct} \quad (1)$$

The dependent variable, $ln(R_{ct})$, is the log of mean rents for county natives in each year. *Katrina* is the main independent variable of interest, and it measures the migration rate as the inflow of Katrina evacuees over the destination county's population. The vector $\boldsymbol{X}$ contains county attributes that affect rents, $\boldsymbol{\delta}$ is the parameter vector associated with $\boldsymbol{X}$, α is the intercept, and *u* is the error term. The primary coefficient of interest is β, and it is interpreted as the percentage

change in rents of county natives for a 1 percentage point increase in the migration rate. Basic economic theory predicts $\beta>0$, if supply is not perfectly elastic, and there is an increase demand through in-migration.

The primary objective of this analysis is to obtain consistent estimates of β. There are, however, two possible identification issues. First, rents and migration may be jointly determined. The migration caused by Hurricane Katrina increases rents, but increased rents also may deter migration in spatial equilibrium (Moretti, 2011). Second, there may be time- and county-varying unobservables, such as economic growth expectations, that are correlated with local migration and rental rates.

The empirical framework addresses the identification issues in three ways. First, county and yearly fixed effects are added to the specification to remove the time-invariant unobservables and any general time effects that affect local market rents. Incorporating fixed effects, the error term is decomposed as follows

$$u_{ct} = \eta_c + \theta_t + v_{ct} \tag{2}$$

where η is the county fixed effect, θ is the year fixed effect, and v represents the idiosyncratic error. Second, following the literature that estimates the impact of immigration on rents, Saiz (2003, 2006), the specification includes controls for time- and county-varying market trends, represented by $\boldsymbol{X}_{ct}$ in the empirical specification. Lastly, the analysis relies on the exogenous nature of the Hurricane Katrina evacuations from New Orleans, discussed in Section 1.3, to identify consistent estimates of β.

To implement this, the analysis uses county-by-year panel data constructed from household observations in the 2005-2007 American Community Survey (ACS) (Ruggles et al., 2010). These years straddle the occurrence of Hurricane Katrina and subsequent evacuations, but this time frame is before the onset of the financial crisis and Great Recession. Unfortunately, the

2001-2004 ACS samples do not include county identifiers. Table 1.1 shows the counties that are available in the data. There are 39 counties in Louisiana and bordering states.

The empirical analysis employs two measures of the dependent variable, *R*, that are available in the data. Renters report two measures of rent, gross and contract, respectively. The ACS defines contract rents as the rent amount specified in the lease agreement between the household and landlord. Whether this amount includes utilities and heating costs is contingent upon the terms in the lease. Gross rents include contract rents, utilities, and heating costs for each household. The key explanatory variable, *Katrina*, is constructed from detailed questions about each household member's moving status one year prior to the survey date. Movers are also asked to indicate the foreign country, state, city or metropolitan statistical area of residence that they resided in before their move. This question facilitates the construction of a variable indicating whether the household moved from New Orleans. A specific reference date for migration from New Orleans, however, is not available in the public-use file. Since ACS data are non-overlapping and are collected monthly over the course of a year, this analysis follows the assumption used by Passel and Suro (2005). In particular, data are assumed to be collected at the midpoint of the year. As an example, for the respondent completing the survey at the midpoint of the 2006, July 1 would be the survey date. Respondents that answer "yes" to having lived in New Orleans one year prior would have left New Orleans after July 1 of 2005. The implication is that Katrina migrants will appear in both 2005 and 2006 ACS cohorts. *Katrina* is measured as follows,

$$Katrina_{ct} = \frac{\#\ NO\ Migrant\ Households_{t-1}}{\#\ Native\ Households_{t-2}} \times 100, \tag{3}$$

where *#NO Migrant Households* is the number of households that moved from New Orleans one year before the survey date in each year, and *#Native Households* is the number households that

have no migrants in the survey year. The *#Native Household* variable is essentially an estimate of the stock of households before migrants arrived to the destination counties.

Summary statistics in Table 1.2 demonstrate that the average inflow of New Orleans migrants increased by nearly 50% between 2005 and 2006, and it falls by nearly twice the level between 2006 and 2007. Sample average nominal rents and median nominal incomes are increasing, and the average unemployment rate for the sample is decreasing between 2005 and 2007.

1.6 Results

Table 1.3 presents panel estimates for the effect of Katrina migration on native contract rents. The basic theory that migration-induced increases in demand will increase rents in a housing market with a less than a perfectly elastic supply implies that β is greater than zero. In column 1, the fixed effects (FE) estimate of β, $\widehat{\beta}$, is equal to 0.084. This result indicates that a 1 percentage point increase in the population due to Katrina migration raises rents by 8.4 percent. To address heteroscedasticity in the error term, robust standard errors are shown in parentheses. With a robust standard error equal to 0.042 and at a 5% significance level, the null hypothesis that β is equal to zero is rejected, and the results suggest that housing supply is not perfectly elastic. Column 2 uses the same specification as column 1, but it includes controls for two county- and time-varying market trends, the unemployment rate and median income. Quantitatively, the estimate of β in column 2 and its interpretation are not substantially different from the result in column 1.[3]

[3] The sample is aggregated by household and then by county using the household sample weights provided by the ACS. One concern however is that the ACS weights do adequately adjust for Katrina evacuee households causing

Column 3 uses the same specification as in column 1, but it employs a different estimator, namely, weighted FE estimates of β. The weights are county-by-year cell sizes, in order to account for heteroscedasticity that is attributable to the varying numbers of household observations in each county. The result implies that a 1 percentage point increase in the population due to Katrina migration, raises rents by 3.8 percent. With a standard error of 0.018, the null hypothesis that the supply is perfectly elastic is also rejected. Colum 4 repeats the weighted FE estimates in column 3, but adds the two controls for market trends, and this estimate is not quantitatively different from the result in column 3.

Table 1.4 repeats the fixed effects and weighted FE specifications from Table 1.3, except the outcome variable is gross rents, a broader measure of *ln(R)*. Column 1 presents the FE estimate of β equal to 0.060 with a robust standard error of 0.034. This result also rejects the null that Katrina migration had no impact on rental rates. The estimate, however, implies that a 1 percentage point increase in Katrina migrants increased native gross rents by 6 percent, and that rental housing supply is not perfectly elastic. The estimate and interpretation of β, from the specification in column 2, is also not quantitatively different from that in column 1. Columns 3 and 4 show nearly identical weighted FE estimates of the impact of Katrina migration on gross rents, though the estimates are somewhat less precise.[4]

certain segments of this group to be underrepresented (Sastry and Gregory, 2012). This could affect how the Katrina migration variable is measured and bias results downwards.

[4]Additional dynamic panel data analyses were conducted to address a potential Nickell bias which is a consequence of data that has a relatively small number of time periods and a large sample size. Within the context of this study, Nickell (1981) asserted that the demeaning process which subtracts the county's mean rent and each explanatory variable from the respective variable creates a correlation between the regressor and the error. Coefficient estimates using Arellano and Bond (AB) approach, however yield results that are quantitatively similar to fixed effects and weighted fixed effects estimates reported in the study.

An increase in rents without a proportional increase in income would effectively decrease the native household's real income. Table 1.5 shows fixed effects and weighted FE estimates of the impact of Katrina migration on the median real income of all native renters. Column 1 employs FE estimation, and column 2 uses weighted FE. The results in both columns are small and show that Katrina migration had no impact, which was statistically different from zero, on the income of renter households.

Following Saiz (2003) an estimation is done to simulate how changes in the rent, due to migration, may increase the proportion of income paid for rent. The pre-Katrina rent-to-income ratio is the amount of gross rent expenses divided by the total household income in 2005. Assuming that there were no changes in other consumption goods and that income was unchanged, a simulated increase in the rent-to-income ratio is calculated by multiplying the gross rents by 5.3 percent from Table 1.4, column 2. This rent increase is then divided by household income and compared to the Pre-Katrina ratio. To account for certain household outliers, whose rent-to-income ratio is greater than one, the median county ratios are used for a more accurate account of central tendency. The pre-Katrina rent-to-income ratio is equal to 26.5 percent, and the post migration income ratio is 28 percent. This estimate suggests that Katrina migration decreased real income through rents by 1.5 percent. This estimate is also consistent with Saiz (2003) who found that rent increases, due to the Mariel boatlift, decreased the real wages of native Miami residents by 1.42%.

A potential concern is the means by which government officials determined the maximum number of evacuees that would be received in each area. If officials based this number on the stock of available rental housing, estimates of the Katrina migration impact on rental market outcomes would be inconsistent. Numerous media reports and press releases

however, suggest that the maximum number of evacuees was determined by the number beds available in emergency shelters and/or as a means of political posturing (Falkenberg 2006; Gelinas 2006; State of IL Press Release, 2005). The supposition that the local area's housing supply determined the number of evacuees received is further examined by measuring the correlation between rental housing vacancy rates and Katrina migration rates. Data on rental vacancy rates for the 75 largest MSA's are obtained from the U.S. Census Bureau's Housing Vacancy Survey, and ACS data are aggregated by MSA to calculate Katrina migration rates for each MSA. Table 1.6 presents reduced-form results that estimate the impact of vacancy rates on Katrina migration rates in each MSA while controlling for the distance from New Orleans. Column 1 shows that there is little correlation between the 2004 vacancy rate on the 2005 Katrina migration rate. Column 2 shows similar results using the migration rate from the 2006 cohort. Based on these results, it appears that the size of Katrina migration was exogenous with respect to the destination area's rental housing supply.

Table 1.7 shows estimates of the impact of Katrina migration on the supply of rental housing using the following model which is isomorphic to equation (2),

(4) $$ln\,(Q_{ct}) = \propto_c + \varphi Katrina_{ct} + \boldsymbol{\delta X}_{ct} + u_{ct}.$$

The independent variable, *ln* (*Q)*, is the log of the number of renter households and φ is the parameter estimate of the impact of Katrina migration on the housing supply. Earlier results reported in Tables 1.3 and 1.4 suggest that the rental market in not perfectly elastic but plausibly inelastic due to its durable nature. Therefore it is expected that φ will be relatively small, compared to β, and not statistically different from zero. Column 1 in Table 1.7 presents the FE estimate and robust standard error of φ. The fixed effects estimate is negative, but it is very small and not statistically different from 0, as expected. In column 2, the weighted FE estimate

is positive, but this result is not statistically different from zero either. In general, empirical estimates from equation (4) support the implication that the supply of rental units is relatively inelastic within the time frame that this data covers.

Multiplying the parameter estimates, $\hat{\varphi}$ and $\widehat{\beta}$, by the mean number of native renter households and mean rental rates, respectively, gives elasticity estimates of those variables with respect to Katrina migration. Hence, housing supply elasticity with respect to rent estimates are calculated as follows,

$$\frac{\left[\frac{\%\Delta Q}{\%\Delta Katrina}\right]}{\left[\frac{\%\Delta R}{\%\Delta Katrina}\right]} = \frac{\%\Delta \mathrm{Q}}{\%\Delta Rent}. \tag{5}$$

A range of supply elasticity estimates are calculated using values of $\widehat{\beta}$ and $\hat{\varphi}$. Where $\hat{\varphi}$ is equal to 0, the housing supply is perfectly inelastic. Employing $\widehat{\beta}$ equal to 0.08 and $\hat{\varphi}$ equal to 0.016, the supply elasticity is equal to 0.2.

Two stage least squares regressions are implemented to calculate standard errors that will test the significance of elasticity estimates. Table 1.8 shows two-stage least squares estimates of supply elasticity, based on the following specification,

$$ln\,(Q_{ct}) = \gamma\, ln\,(R)_{ct} + \boldsymbol{\delta X}_{ct} + u_{ct}, \tag{6}$$

where the parameter, γ, measures the elasticity of housing supply and the instrument is Katrina migration. The elasticity estimate in column 1 is small and the standard error indicates that this result is not statistically different from zero. Column 2 presents the weighted FE estimate of γ. That standard error also implies that the null hypothesis that γ is equal to zero, is not rejected. Table 1.9 repeats the specifications from Table 1.8, but second stage estimates use the predicted values of gross rents. The estimated supply elasticities are similar. In general, the interpretation of supply elasticity results suggest that, in the short-run, the market for rental housing is not perfectly elastic but supply-inelastic, with elasticity estimates that range between 0 and 0.65.

As previously indicated, the majority of non-returning Katrina evacuees were black households in which the highest level of education completed was a high school diploma. Therefore, it is plausible that native households with similar characteristics may have experienced quantitatively larger impacts from the Katrina migration when compared to their native counterparts. The specifications in Table 1.10 show weighted FE results that allow for heterogeneity using subsamples of renters based on gross rental rates compared to the Fair Market Rents (FMR), race, and education, respectively. Column 1 shows estimates for the sample split where native gross rents are equal to or less than the county's FMR, as determined by the Department of Housing and Urban Development (HUD), and column 2 shows estimates for the sample split where rents are greater than the FMR.[5] Column 1 shows a relatively small impact, less than 1 percent, of Katrina migration on the rents of natives paying less than the FMR, and column 2 suggests that migration increased rents above the FMR by 4.2 percent. A test of the null that these two estimates are equal, however, yields that the difference between the two results is not statistically significant. Column 3 reports estimates for native black households, and column 4 shows estimates for native non-black households. Results show a marginally larger impact of Katrina migration on black households, though robust standard errors indicate that this estimate is not statistically different from zero. A test also indicates that, by conventional criteria, the difference between these two estimates is not statistically different. Columns 5 and 6 show impacts based on two education levels. A high school diploma is the highest grade completed for one group, and having completed at least 1 year of college describes

[5] Fair Market Rents (FMRs) are primarily used to determine payment standard amounts for the Housing Choice Voucher program, and serve as a rent ceiling in other programs. FMRs are gross rent estimates that include rent and the cost of utilities. The FMR is set as the 40th percentile rent which is drawn from the distribution of rents of all units occupied by recent movers in a county (https://www.huduser.gov).

the second group. Column 5 suggests that a 1 percentage-point increase in Katrina migration increased the rents of households with a high school diploma or less by 6 percent. The change in rents for more educated households, in column 6, is 4.6 percent, but this estimate is not statistically different from zero, and a test reveals that there is also not a significant difference between the rent estimates of educated and less-educated households. Overall, the point estimates in Table 1.10 suggest some heterogeneity in impacts, but the estimates are not precise enough to draw any firm conclusions.

Even though Katrina migrants were spread in counties throughout the U.S., most households evacuated to southern states. Earlier estimates of the impact of Katrina migration on native rents restricted this analysis to counties in Louisiana and bordering states primarily because these counties are geographically closer to New Orleans and comparable along other economic and geographic dimensions. Additional analysis however is conducted to determine the impact of Katrina migration on native rents in counties in states that are contiguous to border states. Table 1.11 shows estimates of the impact of Katrina migration on native rents where the sample also includes counties in Oklahoma, Tennessee, and Alabama. Columns 1 and 2 show fixed effects results and columns 3 and 4 show weighted FE estimates of Katrina migration on contract rents respectively. The coefficients suggest that Katrina migration increased contract rents in local markets, but these results are somewhat smaller and less precise than the counterparts in Table 1.3, but not statistically different. Columns 5 and 6 show FE results and columns 7 and 8 show weighted FE results for gross rents. Similar to earlier results in Table 1.4, the impact of Katrina migration is positive. These estimates, however, are also quantitatively smaller and less precise than the panel estimates of gross rents that only include border counties.

1.7 Conclusion

This paper used the exogenous shock of an increase in rental demand caused by the evacuation of Hurricane Katrina victims throughout the South to estimate the impact of migration on rents. A panel of 39 counties was constructed using ACS data to determine market rents and Katrina migration rates in evacuee destination counties in Louisiana and its bordering states, Mississippi, Arkansas, and Texas. The analysis found that the migration of hurricane victims had a significant impact on the local economic conditions. Specifically, the analysis estimated that Katrina migration caused increases in rental rates of county natives between 3 and 8 percent.

The empirical results in this analysis are consistent with the existing literature. Saiz (2003) estimated that immigration caused differential rent increases between 8 percent and 11 percent in Miami, and that national immigration inflows caused a 1 percent increase in rents (2006). The supply elasticity was estimated between 0 and 0.60, suggesting that rental housing supply is inelastic in the short-run. These results are also in tandem with Saiz (2010) who estimated long-run supply elasticities between 2.2 and 3 in metropolitan areas that were in included in this panel.

There are three natural directions in which the analysis could be expanded. One dimension is spatial heterogeneity in impacts. In particular, rental housing markets, especially those for lower-income individuals are more geographically concentrated than at the county level. Data on Federal Emergency Management Agency (FEMA) claims are available at the zip code level, which could be used to examine more localized impacts. Next, the impact of migration on natives may have led to changes in household composition. Hence, an additional extension of this study is to determine if migration had an impact on native household crowding.

Lastly, there are other data available from the RAND Corporation, which collected more detailed information on individuals and households that were evacuated, both involuntarily and voluntarily after Hurricane Katrina, in their Displaced New Orleans Residents Survey (DNORS). This dataset would be useful in analyzing the long-term impacts of the evacuation, because the data have specific information on the tenure of evacuees in their destination counties.

Figure 1.1.1 – Perfectly Elastic Supply

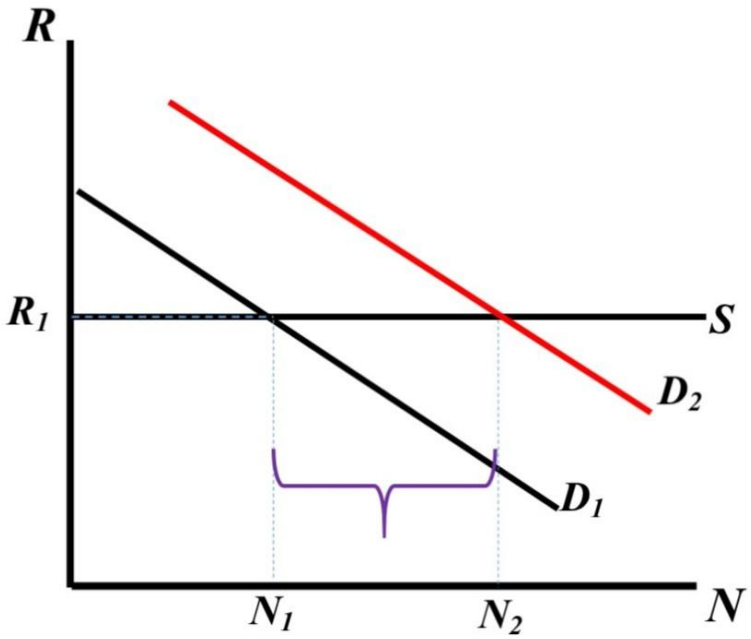

Figure 1.1.2 – Inelastic Supply

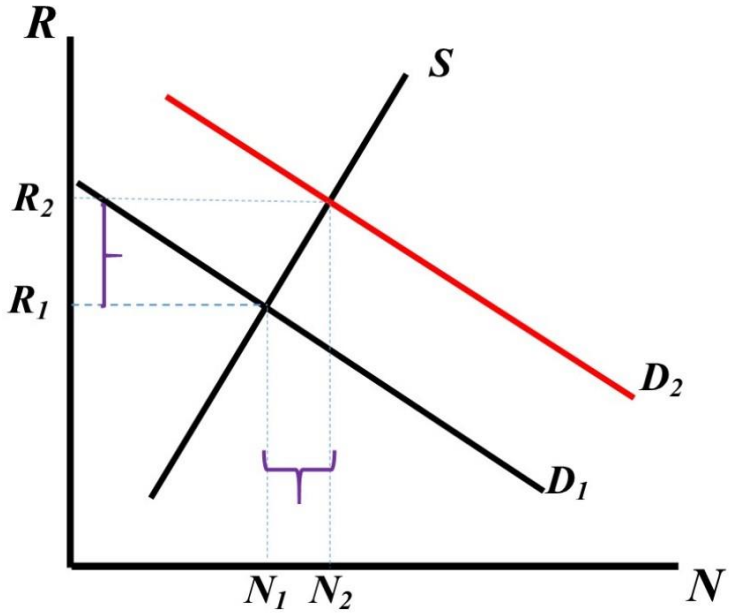

Figure 1.2

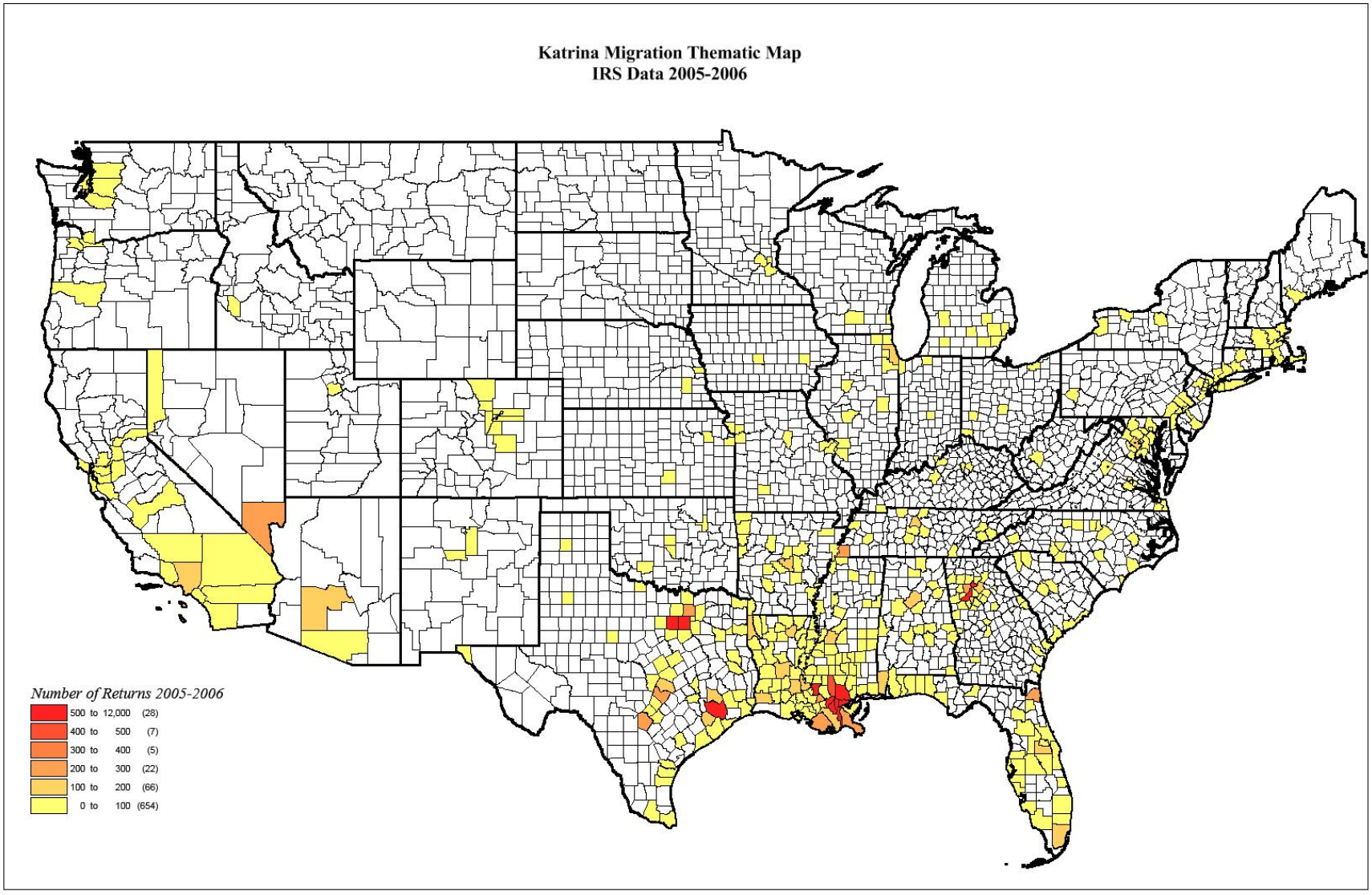
Katrina Migration Thematic Map
IRS Data 2005-2006
Number of Returns 2005-2006
500 to 12,000 (28)
400 to 500 (7)
300 to 400 (5)
200 to 300 (22)
100 to 200 (66)
0 to 100 (654)

Figure 1.3- Evacuee Flow Chart

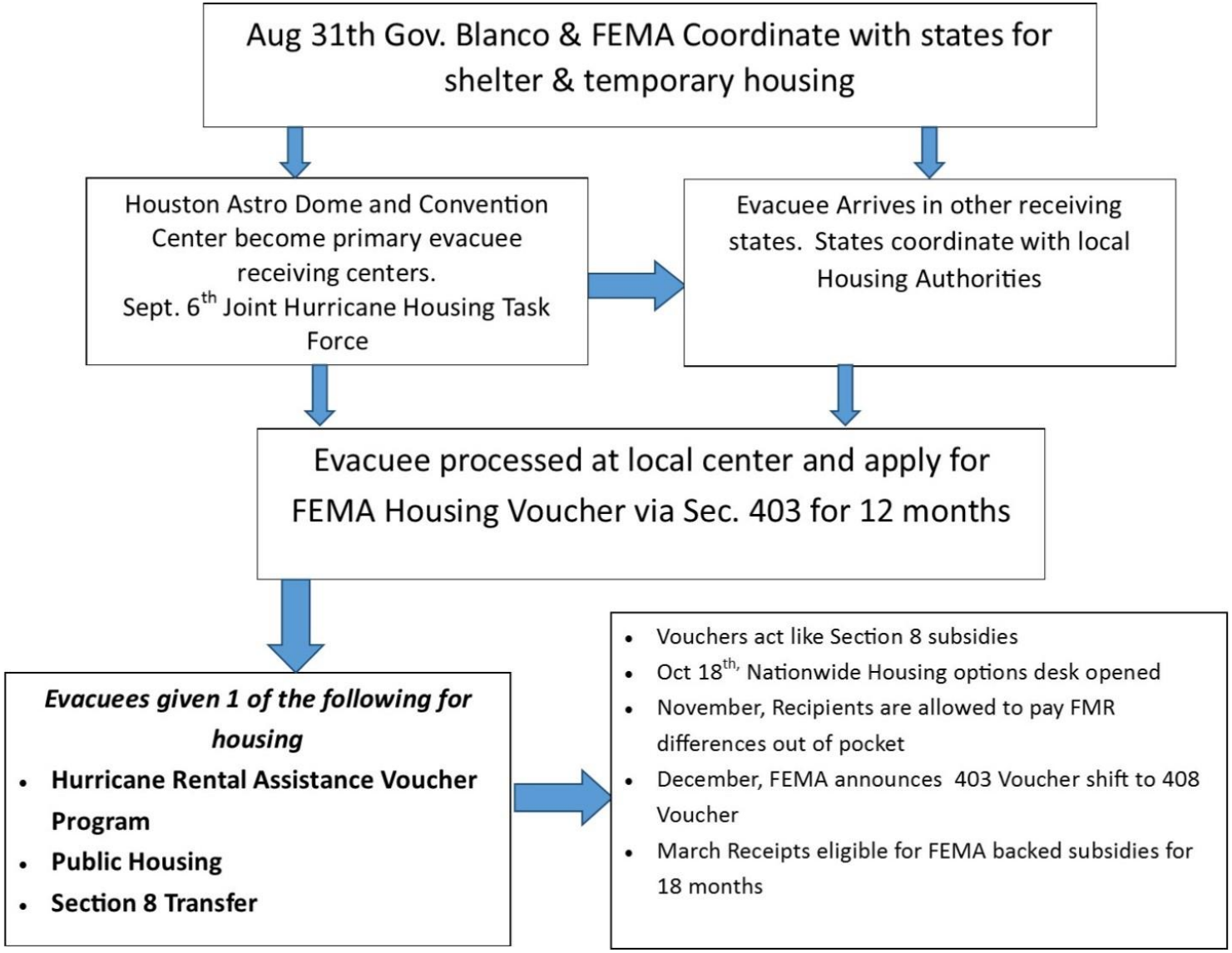

Table 1.1: Average New Orleans Household Migration Rates for 39 ACS Sample Counties

	New Orleans Migrants Per 100 Natives		
County	**2005**	**2006**	**2007**
Benton, AR	0.156	0	0
Pulaski, AR	0	0.742	0
Washington, AR	0	0	0
Caddo, LA	0.082	0.954	0.126
Calcasieu, LA	0	0.877	0.219
Ouachita, LA	0.646	0.488	0
Rapides, LA	2.874	1.191	0.196
Tangipahoa, LA	0.886	1.690	0.451
Terrebonne, LA	0	0.729	0
De Soto, MS	0	0	0
Harrison, MS	0	0	0
Jackson, MS	0.544	0	0
Rankin, MS	0	0	0
Bexar, TX	0.194	0.235	0
Brazoria, TX	0	0	0
Brazos, TX	0	0.170	0
Cameron, TX	0	0	0
Collin, TX	0.135	0.365	0
Dallas, TX	0.308	0.493	0.020
Denton, TX	0.322	0.139	0
Ector, TX	0	0	0
Ellis, TX	0	0.155	0
El Paso, TX	0	0	0
Fort Bend, TX	0	0.229	0
Galveston, TX	0	0.094	0.325
Harris, TX	0.697	1.446	0.127
Hidalgo, TX	0	0	0
Jefferson, TX	0.327	0.076	0.099
Johnson, TX	0	0	0
Lubbock, TX	0	0.374	0
Mclennan, TX	0	0	0
Midland, TX	0	0	0
Potter, TX	0	0	0
Randall, TX	0.157	0	0
Smith, TX	0.183	0.333	0.279

Note: Standard deviations are in parentheses.

Table 1 continued on next page

Table 1.1 continued: Average New Orleans Household Migration Rates for 39 ACS Sample Counties

	New Orleans Migrants Per 100 Natives		
County	**2005**	**2006**	**2007**
Taylor, TX	0	0	0
Webb, TX	0	0	0
Wichita, TX	0	0	0
Williamson, TX	0	0	0
Means	.193	.276	.047
(Standard Deviation)	(.493)	(.435)	(.106)

Note: Standard deviations are in parentheses.

Table 1.2: ACS Means and Standard Deviations for Rents and Time Varying County Trends

Variable	2005	2006	2007
	483	505	541
Contract Rent	(109)	(111)	(123)
	621	663	697
Gross Rent	(115)	(121)	(133)
	558	593	616
Gross Rent-Low Income	(118)	(121)	(129)
	722	775	823
Gross Rent-Moderate Income	(144)	(158)	(176)
	848	904	967
Gross Rent –High Income	(216)	(233)	(214)
	40,691	46,732	49,590
Median Household Income (t-1)	(10,802)	(11,503)	(12,120)
	7.37	6.51	5.45
Unemployment Rate	(2.36)	(1.82)	(1.51)
Number of Counties	39	39	39

Note: Standard deviations are in parentheses.

Table 1.3: Panel Estimates of Contract Rent for Natives using 2005-2007ACS Sample Data, Standard Errors in Parentheses

	Log Contract Rent			
Independent Variables	**(1) Fixed Effects**	**(2) Fixed Effects**	**(3) Weighted FE**	**(4) Weighted FE**
Katrina HH Migration per 100	.084	.075	.038	.037
	(.042)	(.038)	(.018)	(.018)
Log Median HH Income		-.184		-.133
		(.091)		(.123)
Unemployment Rate		-.008		-.011
		(.007)		(.006)
Year Control	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes
Number of Observations	117	117	117	117
Number of Counties	39	39	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Weighted FE specifications are weighted by the number of renter households in each county.

Table 1.4: Panel Estimates of Gross Rent for Natives using 2005-2007ACS Sample Data, Standard Errors in Parentheses

	Log Contract Rent			
Independent Variables	**(1) Fixed Effects**	**(2) Fixed Effects**	**(3) Weighted FE**	**(4) Weighted FE**
Katrina HH Migration per 100	.060	.053	.025	.024
	(.034)	(.031)	(.016)	(.016)
Log Median HH Income		-.139		-.125
		(.092)		(.112)
Unemployment Rate		-.005		-.010
		(.005)		(.006)
Year Control	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes
Number of Observations	117	117	117	117
Number of Counties	39	39	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Weighted FE specifications are weighted by the number of renter households in each county.

Table 1.5: Panel Estimates of Native Household Median Income using 2005-2007 ACS Sample Data, Standard Errors in Parentheses

	Log Median Household Income of Natives	
Independent Variables	**(1) Fixed Effects**	**(2) Weighted FE**
Katrina HH Migration per 100	-.014	-.009
	(.018)	(.017)
Year Control	Yes	Yes
County Control	Yes	Yes
Number of Observations	117	117
Number of Counties	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Weighted FE specifications are weighted by the number of renter households in each county.

Table 1.6: Ordinary Least Squares Estimates of the Relationship between Katrina Migration and MSA Vacancy Rates, Standard Errors in Parentheses

	Katrina Migration	
Independent Variables	**(1) 2005**	**(2) 2006**
Vacancy Rate 2004	-.00002	.0048
	(.0034)	(.0067)
Log Distance to New Orleans	-.0787	-.1247
	(.0228)	(.0068)
Number of Observations	60	60

Note: Standard errors are in parentheses

Table 1.7: Panel Estimates of Rental Housing Stock using 2005-2007ACS Sample Data, Standard Errors in Parentheses

	Log Renter Households	
Independent Variables	**(1) Fixed Effects**	**(2) Weighted FE**
Katrina HH Migration per 100	-.001	.016
	(.020)	(.017)
Year Control	Yes	Yes
County Control	Yes	Yes
Number of Observations	117	117
Number of Counties	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Weighted FE specifications are weighted by the number of renter households in each county.

Table 1.8: Panel Estimates of the Rental Housing Stock using Katrina Household Migration as an Instrument for Contract Rent, Standard Errors in Parentheses

	Log Number of Renter Households	
Independent Variables	**(1) Fixed Effects**	**(2) Weighted FE**
Log Contract Rent	-.008	.420
	(.301)	(.501)
Year Control	Yes	Yes
County Control	Yes	Yes
Number of Observations	117	117
Number of Counties	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Weighted FE specifications are weighted by the number of renter households in each county.

Table 1.9: Panel Estimates of the Rental Housing Stock using Katrina Household Migration as an Instrument for Gross Rent, Standard Errors in Parentheses

	Log Number of Renter Households	
Independent Variables	**(1) Fixed Effects**	**(2) Weighted FE**
Log Gross Rent	-.0007	.649
	(.020)	(.849)
Year Control	Yes	Yes
County Control	Yes	Yes
Number of Observations	117	117
Number of Counties	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Weighted FE specifications are weighted by the number of renter households in each county.

Table 1.10: Weighted Fixed Effects Estimates of Native Household Gross Rents by Household Demographic Characteristics, Standard Errors in Parentheses

	Log Gross Rents					
Independent Variables	**(1) Rent less than FMR**	**(2) Rent more than FMR**	**(3) Black**	**(4) Non-Black**	**(5) High School Diploma**	**(6) College**
Katrina HH Migration per 100	.007	.042	.068	.034	.060	.046
	(.014)	(.027)	(.064)	(.020)	(.029)	(.039)
Year Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	117	117	114	117	117	117
Number of Counties	39	39	39	39	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Weighted FE specifications are weighted by the number of renter households in each county.

Table 1.11: Panel Estimates of Native Household Rents using Counties Contiguous to Louisiana Border States, Standard Errors in Parentheses

	Contract Rent for Natives				*Gross Rent for Natives*			
Independent Variables	**(1) Fixed Effects**	**(2) Fixed Effects**	**(3) Weighted FE**	**(4) Weighted FE**	**(5) Fixed Effects**	**(6) Fixed Effects**	**(7) Weighted FE**	**(8) Weighted FE**
Katrina HH Migration per 100	.064 (.046)	.056 (.043)	.025 (.018)	.025 (.018)	.044 (.036)	.038 (.034)	.016 (.016)	.017 (.015)
Log Median HH Income		-.052 (.127)		-.063 (.122)		-.026 (.112)		-.055 (.109)
Unemployment Rate		-.001 (.007)		-.011 (.006)		-.008 (.006)		-.009 (.005)
Year Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	159	159	159	159	159	159	159	159
Number of Counties	53	53	53	53	53	53	53	53

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Weighted FE specifications are weighted by the number of renter households in each county.

Chapter 2

The Impact of Hurricane Katrina Migration on Crime

2.1 Introduction

Hurricane Katrina struck the Alabama, Mississippi, and Louisiana Gulf Coasts on August 29, 2005, and it is characterized as one of the five deadliest and the costliest hurricane in U.S. history. Levee breaches following the storm caused more than 80 percent of the city of New Orleans to be covered in up to 20 feet of water, and this led to the exodus of more than 400,000 New Orleans residents to various destinations throughout the United States. Furthermore, for some evacuees, the storm's destruction necessitated a long term resettlement in their destination towns and cities. Even though the evacuations were wide spread, the majority of those fleeing Hurricane Katrina landed in the South. The Houston Chronicle estimated, for example, that over 100,000 of the more than 250,000 Katrina evacuees that landed in Houston had made the city their home by October 2005 (Turner, 2015). Although Houston residents initially welcomed Katrina evacuees, their compassion soon turned into ridicule as they reportedly began to view the evacuees as the source of increased crime (Holeywell, 2015). For example, local and national headlines read as follows; "After welcoming evacuees, Houston handles spike in crime" (Moreno, 2006) and "New Orleans failures brought crime to Houston" (Cobb, 2006).

In general, spatial differences in location specific characteristics such as crime will be capitalized into housing prices. For example, Thaler (1978) documented an inverse relationship between property crimes and property values, and Lynch and Rasmussen (2001) reported substantial declines in house values in high crime areas. Linden and Rockoff (2008) estimated the impact of crime on housing prices and found that homes directly across adjacent to a

registered sex offender experienced a 12 percent decline in value. When there is a population influx of persons experiencing psychological and economic traumas combined with the fact that these non-returners were more likely to be economically vulnerable before the evacuations, it is not unreasonable to assume that there may be an increase in crime in areas that received Katrina evacuees. Furthermore, if there were increases in crime, the expectation is that this would be reflected in decreases in rents since the majority of Katrina evacuees received housing assistance in the form of rental vouchers.

The preceding chapter of this dissertation examined the impact that this Katrina-propelled migration had on rents in the destination counties. The study concluded that population inflows from New Orleans equal to 1% of the destination county's existing population were associated with a 4 to 8 percent increase in the contract rents of county natives and a 2 to 6 percent increase in their gross rents. Therefore, given that rents in these areas increased as a result of Katrina migration, it can be inferred that crime levels in these destinations remained unchanged or at least were not substantially increased by the evacuees. This paper follows the empirical framework of the preceding chapter by exploiting the quasi-experimental nature of these evacuations to evaluate whether this mass migration had an impact on crime levels in the destination counties.

Data on crime levels are extracted from the Federal Bureau of Investigation's Uniform Crime Reporting database and data on household migration from New Orleans and additional covariates in evacuee destination counties are extracted from the American Community Survey (ACS) data set. Negative binominal with fixed effects regressions are employed to infer a causal relationship between Katrina migration and crime. In general, this analysis finds that the

migration of Katrina evacuees into various counties throughout Louisiana and its border states of Mississippi, Texas, and Arkansas did not cause a substantial increase in crime levels.

The remainder of the paper is organized as follows. Section 2.2 gives a brief overview of the literature on the impact of natural disasters on crime. Section 2.3 entails a background discussion on the Hurricane Katrina evacuation. Section 2.4 discusses the data and regression framework. Section 2.5 lays out the results, and Section 2.6 concludes with an overview and discussion of the results.

2.2 Literature Review

This paper draws from the literature that examines the link between natural disasters and crime. There are two fundamental principles that explain how natural disasters impact crime. One proposition suggests that natural disasters provoke social and institutional altruism which can lead to decreases in crime. The second proposition maintains that the destruction and trauma caused by disasters lead to breakdowns in social cohesion and the mechanics that are used to maintain control, thereby causing increased crime (Zahran, Shelley, Peek, and Brody, 2009). Studies that empirically assess these competing propositions draw varying conclusions. For example, an analysis of the impact of Hurricane Hugo in Charlotte, North Carolina, in 1989 asserted that on the day that the storm arrived and the three days following, burglary reports increased (LeBeau, 2002). Lemieux (2014) studied changes in crime in Montreal, Quebec, following a 1998 ice storm that generated an extended blackout in the city. This study found that state sponsored relief programs via the issuance of disaster relief checks were linked to a decline in property crimes. He further rationalized that the decrease in property crimes may have been a consequence of the altruistic government response which was motivated by the disaster. A longitudinal research study on the impact of natural disasters on crime in Florida concluded that

natural disasters significantly decreased levels of property and violent crimes but significantly increased the expected count of reported domestic violence crimes (Zahran, Shelley, Peek, and Brody, 2009).

The literature that examines the impact of disaster on crime has primarily focused on the impact on crime in the disaster area. The catastrophic damage left in the wake of Hurricane Katrina on other hand facilitated the need to quickly evacuate thousands of New Orleans residents outside of the city for a sustained period of time. Crime impacts may have not been experienced in New Orleans alone, but also in evacuee destination communities. The existing literature on the impact of Katrina movers on crime however is narrow.

Houston, Texas, absorbed the largest number of evacuees outside of the state of Louisiana. In fact, Houston officials estimated that 250,000 people arrived there in the wake of the storm, and one year later approximately 150,000 New Orleans evacuees remained in the city (Bliss, 2015). Even though evacuees were initially welcomed to Houston, media reports cast a preponderance of blame on Katrina evacuees for a perceived spike in Houston's crime rate (Holeywell, 2015). Settles and Lindsay (2011) conducted a quantitative analysis of pre- and post-Katrina crimes, and a qualitative analysis of the exaggeration of media reports to test whether the in-migration of Katrina evacuees had in fact led to increased crime. The study found little empirical evidence that crimes rates had actually increased.

Varano, Schafer, Cancino, Decker, and Green (2010) studied the Katrina-related effects on crime over a 12-month period in 3 major metropolitan cities that received a relatively large number of evacuees, Houston, San Antonio, and Phoenix. The study extracted weekly crime data from the police departments in each location, which resulted in 87 pre-Katrina migration and 56 post-Katrina migration observations. The authors employed interrupted time series

analysis to draw inferences about the effects of Katrina on crime in the destination counties. This study found that there were modest effects on murder and robbery in Houston and Phoenix that were likely attributable to the rapid increase in the population post-Katrina migration. After controlling for existing trends in these destination cities, rises in certain other serious crimes like burglary, assault, rape, and auto theft could not be directly or independently attributed to Hurricane Katrina. Leitner and Helbich (2010) investigated the influence of Hurricane Katrina on the spatio-temporal distribution of crime clusters in Houston, and they found no significant impact.

2.3 Background

The disaster victims analyzed in this study are migrants due to the unanticipated evacuations from New Orleans in the aftermath of Hurricane Katrina. As detailed below, the immediate circumstances and demographic profile of the majority of evacuees suggest that their move was exogenous. The study relies on the exogenous nature of these moves to in part identify the impact that their long-term evacuation had on crime in the destination counties. The following sections provide background information that further explain why these moves are exploited as exogenous.

2.3.1 Timeline of the Hurricane

Katrina made landfall on the South Florida Coast as a Category 1 hurricane on August 25, 2005, and it began to intensify as it headed toward the Gulf Coasts of Mississippi and Louisiana one day later. Federal emergencies were declared in the target areas on August 26, as those states began implementing disaster-response plans. The city of New Orleans was of particular concern, because its topography made it susceptible to destruction in the wake of a

severe storm. Between August 27 and 28, the storm gained strength, becoming a Category 5 hurricane, as it continued heading towards the Gulf (U.S. Department of Commerce National Oceanic and Atmospheric Administration National Weather Service, 2006). In response, officials in Mississippi and Louisiana ordered mandatory evacuations and began ramping up emergency-response plans (U.S. Department of Homeland Security Office of Inspector General, 2006). Aware that over 100,000 New Orleans' residents did not own vehicles, and that disadvantaged populations, like the elderly, would face evacuation challenges, the Superdome was designated as a shelter of last resort (Lipton, 2015).

Even though the State of Louisiana estimated that more than 1 million people evacuated before the storm made landfall, there were thousands who were not able to leave. By August 28, approximately 30,000 sought shelter in the Superdome and thousands more decided to shelter in place and "wait out" the storm (http://www.pbs.org/frontline). The morning of August 29, Hurricane Katrina made landfall as a Category 3 storm and decimated several Mississippi coastal communities in its path. Following the passage of Hurricane Katrina there was a breach in the 17th Street and Industrial Canal levees that caused approximately 80 percent of New Orleans to be covered in 15-20 feet of water (U.S. Department of Commerce National Oceanic and Atmospheric Administration National Weather Service, 2006).

Hurricane Katrina was one of the five deadliest and the costliest hurricane in U.S. history. The National Hurricane Center estimated that Hurricane Katrina left behind approximately $81.2 billion in damages, and the National Weather Service estimated the total economic loss to be more than $100 billion (U.S. Department of Commerce National Oceanic and Atmospheric Administration National Weather Service, 2006). More than 300,000 homes were severely

damaged or decimated, and the infrastructure of the hardest-hit communities was completely destroyed (U.S. Department of Homeland Security Office of Inspector General, 2006).

2.3.2 Evacuations as an Exogenous Shift

The unanticipated and catastrophic flooding from levee breaches created an especially critical situation in New Orleans. As flooding continued to overtake the city, more residents began arriving at the Superdome and others to the New Orleans' Convention Center. These locations, however, were not equipped to accommodate the large number of evacuees. Sewage problems, overcrowding, and deficient supplies of food and water made the conditions at these centers deplorable. Yet, flood victims continued arriving for emergency assistance even days later. By August 30, Governor Blanco deemed the Superdome uninhabitable and ordered immediate and mandatory evacuations out of the stadium. Meanwhile, the Governor and FEMA reached out to a number of states and local municipalities to make shelter and temporary housing arrangements for arriving evacuees. Addressing the flood and the victims became a problem of epic proportion, and over four days between August 31 to September 3, FEMA, and the Departments of Defense and Transportation coordinated a plan which transported 23,000 people from Superdome to cities throughout the South with the majority arriving in Houston, TX. On September 3, 25,000 people began boarding evacuation buses from the Convention Center, and on September 4, it was reported that 2,000 medical evacuees were waiting to leave the airport. By September 6, Mayor Nagin asserted that there were still 5,000-10,000 more people in the city that needed to be rescued or evacuated, and he ordered a mandatory evacuation of the entire city (http://www.pbs.org/wgbh/pages/frontline/). While there are no official estimates, given the compilation of accounts, a conservative estimate of the government-assisted evacuations equals 55,000. A timeline of key Hurricane Katrina events compiled at The Brookings Institution

estimated that 77,000 New Orleans residents were evacuated with government assistance (DeLozier and Kamp).

When evacuees boarded the buses and airplanes from New Orleans, they did so under strenuous circumstances without giving consideration to the economic conditions of the localities to which they would arrive. Their migration was forced and simply a matter of the desperate need for safety and shelter. Moreover, news reports indicated that evacuees boarded buses not knowing where they were going until they departed. An overview of the media coverage, government transcripts, and Congressional reports clearly demonstrated that the pre-Katrina evacuations were sudden and unanticipated in length. Likewise post-Katrina evacuations were unplanned and haphazardly implemented with no thought-out plans to return the evacuees.

2.3.3 Evacuee Demographics and Destinations

The damage to the stock of housing made much of New Orleans uninhabitable. Consequently, this meant that persons who evacuated voluntarily and involuntarily were not able to return immediately. For many, such circumstances warranted a long-term and, in many cases, permanent move. In total, New Orleans lost more than half of its population in the aftermath of Katrina (Plyer, 2015). As of July 1, 2006, Frey et al. (2007) estimated that the city's population had fallen by 229,000. New Orleans' Lower Ninth Ward, a part of the city's interior, was the area most affected by flooding. According to 2000 Census data compiled by The Data Center, pre-Katrina, the area was 98% Black, 60% were renters, 40% lived below the poverty level, 32% did not access to a vehicle, and 70% had a high school diploma or less (datacenterresearch.org). After the hurricane, it lost 85% of its pre-Katrina population (Jonassen, 2012).

Groen and Polivka (2008) estimated that of the evacuees who would return to Louisiana within a year of the hurricane, 97% had returned by December of 2005, and the average

returning evacuee came back to their pre-storm address within 38 days. Evacuees who were black, single and never married, had school-age children, and had lower educational attainment and family income were less likely to return to high-damage areas (Groen and Polivka, 2010; Frey et al., 2007). For obvious reasons, those that were bused out of New Orleans were also likely to share the same demographic profile as the non-returner group. Of the non-returners, more than 81% had relocated to counties in Louisiana, Mississippi, Alabama, Texas, Tennessee, Georgia, Florida, and Arkansas (Groen and Polivka 2008). Frey et al. (2007) also showed differences in migration patterns before and after the hurricane. For example, pre-Katrina migration patterns show that more than half of New Orleans's out-migrants moved to parishes (counties) in the New Orleans Metropolitan Statistical Area (MSA). After the hurricane, the destination for out-migrants became more widespread with more than 50% going to counties in Texas, Georgia, and Tennessee. Figure 1.2 illustrates the settlement pattern of New Orleans' out-migrants, who left the city in 2005, using the Internal Revenue Service's Statistics of Income data base. The map illustrates that out migrants from this time period were scattered throughout U.S. counties, however, the highest concentrations are located in counties in the southern most region.

2.3.4 Housing the Evacuees

Figure 1.3 illustrates the basic flow of the evacuation and housing process. Within the days and weeks following the storm, FEMA solicited various states to accept and provide housing for evacuees. States provided FEMA with the specific cities where victims could receive housing assistance and a corresponding maximum number of individuals to which services could be provided. FEMA then transported evacuees by the number and to the localities as designated

by each state. The agency also asked that receiving states treat the Katrina evacuees as disaster victims from their own states (McCarthy, 2008).

FEMA provided housing assistance, similar to standard existing federal means-tested rental housing assistance, for Hurricane Katrina evacuees through provisions in Sections 403 and 408 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Section 403 provides federal assistance in order that states can provide for such immediate needs of disaster victims as emergency shelter. The "shelter" application of Section 403 assistance, however, was intended for state-implemented short-term mass evacuation centers. Unfortunately, the breadth of Katrina resulted in a need for Section 403 assistance to be used for up to 12 months, rather than for temporary shelter. Qualifications for Section 403 rental assistance only required that evacuees provide proof of having lived in the disaster area, and security deposits and background checks were waived. The Congressional Research Service Report for Congress estimated that Section 403 assistance was applied to approximately 67,000 apartment leases in 32 states (McCarthy, 2008).

2.4 Empirical Framework and Data

The empirical analysis tests whether the influx of Hurricane Katrina evacuees increased crime rates in the counties where they eventually resettled. Let *c* index the county, and *t* index the calendar year, then the econometric specification is

(7) $$Crime_{ct} = \propto + \beta Katrina_{ct} + \boldsymbol{\delta X}_{ct} + u_{ct}$$

The dependent variable, $Crime_{ct}$, is the total number of reported crimes for each county in each year. *Katrina* is the main independent variable of interest, and it measures the migration rate as the inflow of Katrina evacuees over the destination county's population. The vector $\boldsymbol{X}$ contains

county economic attributes that affect crime, $\boldsymbol{\delta}$ is the parameter vector associated with $\boldsymbol{X}$, α is the intercept, and u is the error term. The primary coefficient of interest is β, and it is interpreted as the change in the number of crimes for counties that experience a 1 percentage point increase in the migration rate as result of Hurricane Katrina evacuations. A rapid population increase resulting from the inflow of a proportionally large number of economically disadvantaged persons would predict $\beta>0$.

The primary objective of this analysis is to obtain consistent estimates of β. There are, however, two possible identification issues. First, crime and migration may be jointly determined. The migration caused by Hurricane Katrina may increase crime rates, but increased crime also may deter migration in spatial equilibrium (Moretti, 2011; Cullen and Levitt, 1999). Second, there may be time- and county-varying unobservables, such as economic growth expectations, and differences in policing practices across counties that are correlated with crime and local migration rates.

The empirical framework addresses the identification issues in three ways. First, county and yearly fixed effects are added to the specification to remove the time-invariant unobservables and any general time effects that affect local crime rates. Incorporating fixed effects, the error term is decomposed as follows

$$u_{ct} = \eta_c + \theta_t + v_{ct} \tag{8}$$

where η is the county fixed effect, θ is the year fixed effect, and v represents the idiosyncratic error. Second, following the literature that examines the relationship between crime and population changes and economic conditions, the specification includes controls for time- and county-varying market trends, represented by $\boldsymbol{X}_{ct}$ in the empirical specification (Cullen and Levitt, 1999; Raphael and Winter-Ebmer, 2001). Lastly, the analysis relies on the exogenous

nature of the in-migration due to the Hurricane Katrina evacuations from New Orleans, discussed in Section 2.3, to identify consistent estimates of β.

To implement this, the analysis merges data from the Federal Bureau of Investigation's (FBI) Uniform Crime Reporting (UCR) program collected between 2005 and 2007 (United States Department of Justice, 2012) and the 2005-2007 American Community Survey (ACS) (Ruggles et al., 2010). This time frame was chosen for three reasons. For one, these years straddle the occurrence of Hurricane Katrina and subsequent evacuations. Second, there is an empirical link between business cycles and crime (Cook and Zarkin, 1985)[6], and this time frame is before the onset of the financial crisis and Great Recession. Third, the 2001-2004 ACS samples do not include county identifiers.

The empirical analysis examines various measures of the dependent variable, *Crime*, that are available in the data. The FBI's UCR program's annual reports include a compilation of monthly crime statistics as reported to the FBI by local law enforcement agencies. The UCR indexes reported crime incidence into two categories, violent crimes and property crimes. Data on violent crimes include the numbers of murders and non-negligent homicides, forcible rapes, aggravated assaults, and robberies. Property crime statistics include the numbers of arsons, burglaries, larceny thefts, and motor vehicle thefts. Since the data are presented by each reporting law enforcement agency and not by municipality, county crime statistics are estimated by collapsing the data reported by each county's sheriff department and the police department of the city which serves as each county's seat.

The key explanatory variable, *Katrina,* is constructed from detailed questions in the ACS about each household member's moving status one year prior to the survey date. Movers are

[6] Cook and Zarkin (1985) reported that crime rates related to robbery and burglary increased during a recession.

also asked to indicate the foreign country, state, city or metropolitan statistical area of residence that they resided in before their move. This question facilitates the construction of a variable indicating whether the household moved from New Orleans. A specific reference date for migration from New Orleans, however, is not available in the public-use file. Since ACS data are non-overlapping and are collected monthly over the course of a year, this analysis follows the assumption used by Passel and Suro (2005). In particular, data are assumed to be collected at the midpoint of the year. As an example, for the respondent completing the survey at the midpoint of the 2006, July 1 would be the survey date. Respondents that answer "yes" to having lived in New Orleans one year prior would have left New Orleans after July 1 of 2005. The implication is that Katrina migrants will appear in both 2005 and 2006 ACS cohorts. *Katrina* is measured as follows,

$$Katrina_{ct} = \frac{\#\ NO\ Migrant\ Households_{t-1}}{\#\ Native\ Households_{t-2}} \times 100, \tag{9}$$

where *#NO Migrant Households* is the number of households that moved from New Orleans one year before the survey date in each year, and *#Native Households* is the number households that have no migrants in the survey year. The *#Native Household* variable is essentially an estimate of the stock of households before migrants arrived to the destination counties.

Household observations from the ACS were collapsed by county and merged with UCR county crime statistics to construct a county-by-year panel of 39 counties in Louisiana and bordering states. Table 1.1 shows the counties that are available in the data and the respective Katrina migration rate for each year included in the panel.

New Orleans household migration rates presented in Table 1.1 demonstrate that the average inflow of New Orleans migrants increased by nearly 50% between 2005 and 2006, and it fell by nearly twice the level between 2006 and 2007. Summary statistics in Table 2.1 show that

the average level of total violent crimes decreased each year between 2005 and 2007, and the average level of property crimes increased between 2005 and 2006 but fell between 2006 and 2007. This table also shows that median nominal incomes increased, and the average unemployment rate for the sample decreased within the panel's time frame.

2.5 Results

Table 2.2 presents panel estimates of the effect of Katrina migration on the total number of violent crimes that are reported each year. The basic theory suggests that β is greater than zero because an influx of economically disadvantaged persons will lead to increased crime in the local area. In column 1, the fixed effects (FE) estimate of β, $\widehat{\beta}$, is equal to 98.03. This result indicates that a 1 percentage point increase in the population due to Katrina migration raises the number of crimes reported by 98. To address heteroscedasticity in the error term, robust standard errors are shown in parentheses. With a robust standard error equal to 88 however, further interpretation of this result suggests that Katrina migration did not have a significant impact on violent crime incidences. Column 2 shows the results of the log-level fixed effects specification where $\widehat{\beta}$ is equal to -.012. The interpretation of this result suggests that 1 percentage point increase in the population from Katrina migration decreased violent crime occurrences by 12 percent. This result is also not statistically significant from zero.

Two issues arise from the level and log-level specifications. First, some counties may not have any reported crimes in certain categories such as murder, and in this instance the observations would be dropped. Second, for each crime variable reported in the summary statistics in Table 2.1, the respective standard deviation is substantially larger than each variable's mean which may be indicative of over-dispersion. Therefore, column 3 reports results

from the negative binominal fixed effects regression. The negative binominal regression framework is typically used to model count data when there is over dispersion in the outcome variable. In this particular specification, the β coefficients are estimated by maximum likelihood, hence column 3 also includes the incidence-rate ratio (IRR) which is e^{β} in brackets. The IRR is interpreted as the factor by which the crime level would differ in response to a 1 percentage point increase in the Katrina migration rate. The result in column 3 suggests a substantially smaller increase in the level of total violent crimes for a 1 percentage-point increase in the population due to Katrina migration. Furthermore, the standard error also indicates that this impact is not statistically different from zero. Columns 4, 5, and 6 repeat the specifications in columns 1, 2, and 3 respectively, but these include controls for two county- and time-varying trends, the unemployment rate and median income. Quantitatively, the estimates of β that include the added controls are not substantially different from the respective results in columns 1, 2, and 3. Tables 2.3 through 2.6 give the results for the specific classifications of violent crimes and are summarized as follows.

Table 2.3 repeats the fixed effects and negative binominal specifications from Table 2.2, except the outcome variable is the number of murders and non-negligent homicides reported for the each year. Column 1 presents the FE estimate of β equal to 3 with a robust standard error of 2.29. The log-level specification in column 2 suggests that a 1 percentage-point increase in Katrina migration increased murder incidence by 5%, and column 3 suggests that a 1 percentage-point increase in Katrina migration would have increased the level of murders by a factor of 1.08. The sizeable standard errors again indicate that these results are imprecise. The level fixed effects and negative binominal fixed effects regression results that include added controls in columns 4 and 5 are similar in magnitude and interpretation to the results without the added

controls. Interestingly, the log-level specification in column 2 suggests that Katrina migration had a negative impact on murders, but this result is also not statistically significant.

Table 2.4 reports the estimates of the impact of Katrina migration on rape. The results of the log-level fixed effects specifications with and without the added controls suggest that a 1 percentage point increase in Katrina migration increased the number of rapes by approximately 10 percent. Furthermore, the robust standard errors reject the null that Katrina migration had no impact on rape. Even though the results from the level fixed effects and the negative binominal regressions are also positive these β coefficients are not statically different from zero. Therefore, the analysis is careful not to draw any definitive conclusions from this result.

In general, the coefficients and standard errors in Table 2.5 indicate that Katrina migration had no impact on aggravated assault. Table 2.6 shows panel estimates of robbery, also categorized as a violent crime. The level fixed effects specifications in columns 1 and 4 suggest that migration had a positive impact on robbery while log-level and negative binominal estimates suggest that Katrina evacuees negatively impacted robbery incidences. Regardless, however, in all cases neither of these β are different from zero.

Burglary, larceny, and motor vehicle theft are categorized as property crimes which the FBI further describes as crimes to obtain money, property, or some other benefit. Given that the those likely to experience long term displacement in the aftermath of Hurricane Katrina were likely to be economically disadvantaged, this group may also be more predisposed to commit the aforementioned property crimes for economic gain.

Table 2.7 gives estimates of total property crimes. The log-level fixed effects regression results in columns 2 and 5 suggest that 1 percentage-point increase in the population resulting from Katrina migration would decrease the total number of property crimes between 3 and 4

percent. Whereas the negative binominal regression coefficients in columns 3 and 6 report that when the population increased by 1 percentage point due to Katrina migration the total number of property crimes decreased by a factor of .96. Though, the standard errors the of the β estimates across each specification determines that these results are imprecise. Tables 2.8 through 2.10 report estimates of three classifications of property crimes.

Analysis of the panel estimates of burglary in Table 2.8 indicate that Katrina migration did not cause an increase in burglary. In fact, the results suggest that Katrina migration decreased these occurrences, but these impacts are not statistically different from zero. Table 2.9 reports estimates of the impact of Katrina migration on larceny. The log-level fixed effect specification in column 5 which controls for unemployment and income, suggests that a 1 percentage-point increase in the Katrina migration rate caused a 4.5% decline in the larceny. Interestingly, this coefficient is statistically significant at the 10% level. One plausible explanation for the decreases in larceny and burglary attributable to Katrina migration could be a consequence of changes in policing after the arrival of evacuees to these destination cities. Table 2.10 reports panel estimates of the impact of Katrina migration on motor vehicle theft. The log-level fixed effect specifications in columns 2 and 5 suggest that Katrina migration decreased auto theft, but these coefficients are quantitatively small and not different from zero. The negative binominal specification in column 3 suggests that 1 percentage point increase in the Katrina migration increased auto theft incidences by a factor of 1.02, but the specification with added controls in column 6 suggests that Katrina migration decreased auto theft incidences. In either case the coefficients have relatively large standard errors; hence an impact of Katrina migration is indeterminate.

In general, with the exception of the analysis of rape, the results complement the finding of Varano et al (2010) and support the assertion that the migration of Katrina evacuees into various counties throughout Louisiana and its border states of Mississippi, Texas, and Arkansas did not cause a substantial increase in crime incidences.

2.6 Discussion

This chapter examined the impact of the mass migration of Hurricane Katrina victims on crime in counties throughout the South. A panel of 39 counties was constructed by extracting information on crime from the FBI's UCR database and using ACS data to determine Katrina migration rates in evacuee destination counties in Louisiana and its bordering states, Mississippi, Arkansas, and Texas. The analysis found that the migration of hurricane victims did not have a significant impact on the local violent crime or property crime levels. The empirical results in this analysis are consistent with existing studies that examine the impact of Hurricane Katrina on crime in the evacuee destination cities. Varno et al. (2010) and Leitner and Helbich (2010) investigated the impact of Katrina migration in large metropolitan areas that received a substantial number of Katrina evacuees, and they also did not find any significant impact.

In addition to estimating the impact of Katrina on the overall crime, this study also examined the impact of Katrina migration on specific types of crimes. Even though Katrina migration did not impact violent crimes such as murder, aggravated assault, and robberies, the empirical analysis suggested that Katrina migration did have a positive impact on reported rape. Though, this analysis is careful not to draw any firm conclusions because this result is not robust across specifications. This outcome however does warrant some further discussion and investigation.

A report from National Public Radio's Katrina & Beyond series conducted an investigative report on rapes and sexual assaults that occurred in make-shift evacuation centers including but not limited to the New Orleans Superdome and abandoned schools and apartment buildings in New Orleans before the mandated evacuations. Interviewees in the report asserted that post-Katrina chaos, which placed vulnerable and predatory persons in close proximity, coupled with distressed law enforcement mechanisms, created the perfect environment to commit a crime and not report a crime. After hearing numerous accounts of rapes and sexual assaults, several rape victims' advocacy groups launched extensive campaigns to encourage Katrina evacuees who were raped or sexually assaulted before evacuating the city to report those crimes to local law enforcement officials in their new locations (Burnett, 2005). This is one plausible explanation as to why Katrina migration appears to have a positive and significant impact on rapes in the destination counties.

There is also a dimension in which this study could be expanded and that is to examine heterogeneity impacts. In particular, it is plausible that Katrina evacuees may have been more geographically concentrated than at the county level. Hence, it would be interesting to estimate more localized impacts of Katrina migration on crime. If certain crime statistics are available by zip code, that data could be merged with data on Federal Emergency Management Agency (FEMA) claims from Hurricane Katrina, which are available at the zip code level, to examine more localized impacts.

Table 2.1: Means and Standard Deviations for Crime Variables and Time Varying County Trends

Variable	2005	2006	2007
	2,209	2,196	2,120
Total Violent Crime	(5,455)	(5,550)	(5,352)
	26	28	27
Murder	(70)	(77)	(74)
	127	125	118
Rape	(221)	(222)	(202)
	718	744	762
Robbery	(2,319)	(2,400)	(2,406)
	14,451	14,219	14,616
Total Property Crime	(30,624)	(30,656)	(31,904)
	3,314	3,311	3,517
Burglary	(7099)	(7,073)	(7,760)
	9,525	9,187	9,718
Larceny	(19,221)	(19,015)	(19,690)
	1,612	1,721	1,682
Car Theft	(4,586)	(4,795)	(4,689)
	40,691	46,732	49,590
Median Household Income (t-1)	(10,802)	(11,503)	(12,120)
	7.37	6.51	5.45
Unemployment Rate	(2.36)	(1.82)	(1.51)
Number of Counties	39	39	39

Note: Standard errors are in parentheses.

Table 2.2: Panel Estimates of Total Violent Crimes using 2005-2007ACS Sample and UCR Data, Standard Errors in Parentheses

	Total Violent Crimes					
	# Crimes	*Log Crime*	*# Crimes*	*# Crimes*	*Log Crime*	*# Crimes*
Independent Variables	**FE (1)**	**FE (2)**	**NB-IRR (3)**	**FE (4)**	**FE (5)**	**NB-IRR (6)**
Katrina HH Migration per 100	98.03 (88.29)	-.012 (.051)	.011 (.037) [1.01]	106.93 (89.19)	-.002 (.053)	.017 (.038) [1.02]
Log Median HH Income				127.06 (257.66)	-.249 (.257)	-.027 (.180) [.974]
Unemployment Rate				8.50 (12.55)	-.018 (.015)	.010 (.011) [1.01]
Year Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood			-426.35			-425.94
Number of Observations	117	117	117	117	117	117
Number of Counties	39	39	39	39	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Negative binominal specification results also report the incidence rate ratio, IRR in [].

Table 2.3: Panel Estimates of Murder using 2005-2007ACS Sample and UCR Data, Standard Errors in Parentheses

	Murder					
	# Crimes	*Log Crime*	*# Crimes*	*# Crimes*	*Log Crime*	*# Crimes*
Independent Variables	**FE (1)**	**FE (2)**	**NB-IRR (3)**	**FE (4)**	**FE (5)**	**NB-IRR (6)**
Katrina HH Migration per 100	3.00 (2.92)	.050 (.109)	.069 (.076) [1.07]	2.85 (3.11)	-.026 (.130)	.074 (.078) [1.08]
Log Median HH Income				-1.91 (5.45)	-.442 (.674)	.114 (.715) [1.12]
Unemployment Rate				-.146 (.446)	-.083 (.057)	-.023 (.029) [.978]
Year Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood			-174.64			-174.33
Number of Observations	117	109	117	117	109	117
Number of Counties	39	38	39	39	38	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Negative binominal specification results also report the incidence rate ratio, IRR in [].

Table 2.4: Panel Estimates of Rape using 2005-2007ACS Sample and UCR Data, Standard Errors in Parentheses

	Rape					
	# Crimes	*Log Crime*	*# Crimes*	*# Crimes*	*Log Crime*	*# Crimes*
Independent Variables	**FE (1)**	**FE (2)**	**NB-IRR (3)**	**FE (4)**	**FE (5)**	**NB-IRR (6)**
Katrina HH Migration per 100	17.3 (13.2)	.106 (.046)	.101 (.063) [1.11]	17.67 (13.69)	.091 (.052)	.093 (.065) [1.10]
Log Median HH Income				6.40 (22.96)	.100 (.482)	.098 (.347) [1.10]
Unemployment Rate				.309 (1.76)	-.021 (.023)	-.015 (.017) [.985]
Year Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood			-278.39			-278.00
Number of Observations	117	115	117	117	115	117
Number of Counties	39	39	39	39	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Negative binominal specification results also report the incidence rate ratio, IRR in [].

Table 2.5: Panel Estimates of Aggravated Assault using 2005-2007ACS Sample and UCR Data, Standard Errors in Parentheses

	Aggravated Assault					
	# Crimes	*Log Crime*	*# Crimes*	*# Crimes*	*Log Crime*	*# Crimes*
Independent Variables	**FE (1)**	**FE (2)**	**NB-IRR (3)**	**FE (4)**	**FE (5)**	**NB-IRR (6)**
Katrina HH Migration per 100	72.21 (73.09)	-.001 (.059)	.018 (.047) [1.02]	84.00 (75.34)	.021 (.064)	.033 (.048) [1.03]
Log Median HH Income				219.84 (268.32)	-.280 (.300)	-.018 (.220) [.982]
Unemployment Rate				10.22 (14.16)	.033 (.020)	.021 (.013) [1.02]
Year Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood			-413.30			-412.15
Number of Observations	117	117	117	117	117	117
Number of Counties	39	39	39	39	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Negative binominal specification results also report the incidence rate ratio, IRR in [].

Table 2.6: Panel Estimates of Robbery using 2005-2007ACS Sample and UCR Data, Standard Errors in Parentheses

	Robbery					
	# Crimes	*Log Crime*	*# Crimes*	*# Crimes*	*Log Crime*	*# Crimes*
Independent Variables	**FE (1)**	**FE (2)**	**NB-IRR (3)**	**FE (4)**	**FE (5)**	**NB-IRR (6)**
Katrina HH Migration per 100	5.49 (17.45)	-.050 (.043)	-.018 (.046) [.982]	2.41 (18.52)	-.061 (.057)	-.037 (.048) [.964]
Log Median HH Income				-97.28 (62.07)	.313 (.344)	-.080 (.251) [.923]
Unemployment Rate				-1.88 (4.17)	-.021 (.025)	-.019 (.014) [.981]
Year Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood			-316.33			-315.33
Number of Observations	117	115	117	117	115	117
Number of Counties	39	39	39	39	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Negative binominal specification results also report the incidence rate ratio, IRR in [].

Table 2.7: Panel Estimates of Total Property Crimes using 2005-2007ACS Sample and UCR Data, Standard Errors in Parentheses

	Total Property Crimes					
	# Crimes	*Log Crime*	*# Crimes*	*# Crimes*	*Log Crime*	*# Crimes*
Independent Variables	**FE (1)**	**FE (2)**	**NB-IRR (3)**	**FE (4)**	**FE (5)**	**NB-IRR (6)**
Katrina HH Migration per 100	-619.92 (565.92)	-.031 (.028)	-.034 (.026) [.966]	-659.09 (579.53)	-.038 (.028)	-.043 (.025) [.958]
Log Median HH Income				-1,974.9 (1,071.55)	-.225 (.117)	-.245 (.091) [.783]
Unemployment Rate				-53.75 (67.00)	-.004 (.007)	-.004 (.007) [.996]
Year Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood			-555.30			-553.00
Number of Observations	117	117	117	117	117	117
Number of Counties	39	39	39	39	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Negative binominal specification results also report the incidence rate ratio, IRR in [].

Table 2.8: Panel Estimates of Burglary using 2005-2007ACS Sample and UCR Data, Standard Errors in Parentheses

	Burglary					
	# Crimes	*Log Crime*	*# Crimes*	*# Crimes*	*Log Crime*	*# Crimes*
Independent Variables	**FE (1)**	**FE (2)**	**NB-IRR (3)**	**FE (4)**	**FE (5)**	**NB-IRR (6)**
Katrina HH Migration per 100	-337.33 (323.61)	-.027 (.037)	-.033 (.042) [.968]	-367.92 (328.17)	-.031 (.039)	-.042 (.039) [.960]
Log Median HH Income				-851.01 (408.27)	-.528 (.303)	-.513 (.172) [.600]
Unemployment Rate				-20.92 (30.38)	.006 (.014)	-.007 (.010) [1.01]
Year Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood			-484.15			-479.73
Number of Observations	117	117	117	117	117	117
Number of Counties	39	39	39	39	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Negative binominal specification results also report the incidence rate ratio, IRR in [].

Table 2.9: Panel Estimates of Larceny using 2005-2007ACS Sample and UCR Data, Standard Errors in Parentheses

.	Larceny					
	# Crimes	*Log Crime*	*# Crimes*	*# Crimes*	*Log Crime*	*# Crimes*
Independent Variables	**FE (1)**	**FE (2)**	**NB-IRR (3)**	**FE (4)**	**FE (5)**	**NB-IRR (6)**
Katrina HH Migration per 100	-384.34 (314.29)	-.038 (.026)	-.039 (.027) [.961]	-423.78 (328.71)	-.045 (.026)	-.047 (.027) [.954]
Log Median HH Income				-926.72 (710.21)	-.147 (.113)	-.192 (.120) [.826]
Unemployment Rate				-30.38 (42.18)	-.005 (.007)	-.005 (.007) [.995]
Year Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood			-525.71			-524.20
Number of Observations	117	117	117	117	117	117
Number of Counties	39	39	39	39	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Negative binominal specification results also report the incidence rate ratio, IRR in [].

Table 2.10: Panel Estimates of Auto theft using 2005-2007ACS Sample and UCR Data, Standard Errors in Parentheses

	Auto Theft					
	# Crimes	*Log Crime*	*# Crimes*	*# Crimes*	*Log Crime*	*# Crimes*
Independent Variables	**FE (1)**	**FE (2)**	**NB-IRR (3)**	**FE (4)**	**FE (5)**	**NB-IRR (6)**
Katrina HH Migration per 100	101.76 (70.76)	-.001 (.048)	.017 (.054) [1.02]	96.61 (74.53)	-.020 (.048)	-.0004 (.054) [1.00]
Log Median HH Income				-197.17 (203.57)	-.052 (.389)	-.140 (.274) [.869]
Unemployment Rate				-2.45 (13.04)	-.023 (.019)	-.021 (.014) [.980]
Year Control	Yes	Yes	Yes	Yes	Yes	Yes
County Control	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood			-525.71			-524.20
Number of Observations	117	117	117	117	117	117
Number of Counties	39	39	39	39	39	39

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the county level. Negative binominal specification results also report the incidence rate ratio, IRR in [].

Chapter 3

The Impact of Market Concentration in the Market for Senior Rental Housing

3.1 Introduction

One of the most rapidly growing sectors of the housing market is for senior housing. Senior housing is defined as residences that are developed for and occupied by persons over the age of 55 and encompasses a growing variety of housing options including aging-in-place alternatives like independent living and assisted living residences. These aging-in-place options are marketed as alternatives to co-residence or institutional residences such as nursing homes (Sabia, 2008).

Relatively little is known, however, about the market structure for senior housing. Private market senior housing data that was compiled by the American Seniors Housing Association indicated that of the 541,105 senior rental housing units owned and operated by the top fifty companies, the majority of those units, 64 percent, were owned by only the top ten companies (National Real Estate Investor Special Informational Section, 2013). This suggests there might be substantial market power in senior housing, which, by standard microeconomic theory, would be associated with higher than competitive market rents and lower occupancy.

The primary contribution of this paper is to empirically examine the relationship between ownership concentration and rents and occupancy in the senior rental housing market. The analysis uses unique panel data on individual senior housing properties from the National Investment Center for Seniors Housing and Care (NIC) to measure ownership concentration and to examine its impact on senior housing rents and occupancy measures. The data contain private market senior rental housing details on 13,057 properties in the 100 largest metropolitan areas for years 2006, 2008, 2010, and 2012. The data also contain average monthly rents, rent growth,

absorption rates, and occupancy level information from 100 of the largest U.S. metropolitan areas between 2006 and 2012. In this analysis the metropolitan statistical area (MSA) is treated as the local senior housing rental market and market concentration is estimated using a Herfindahl-Hirschman Index (HHI)

There are three primary findings. First, the degree of market concentration varies across both metro areas and property types. In addition to the total market for private senior rental housing, three property types are also measured: independent living, assisted living, and skilled nursing facilities. Independent living senior housing markets are more concentrated relative to the assisted living and nursing care markets. For example, the independent living housing market is concentrated in approximately 60% of the metropolitan areas whereas the assisted living and nursing care markets are only concentrated in approximately 13% and 8% of metropolitan areas respectively. Second, fixed-effect panel estimates indicate that higher ownership concentration is associated with higher rents and lower occupancy, which is in accordance with the contemporary price and concentration empirical literature (Reiss, 1989; Singh and Zhu 2006). Third, estimates for separate property types suggest heterogeneity in the impact of market concentration on rents and occupancy. For example, a ten percentage point increase in concentration was associated with a 2.3 percent increase in the rental growth rate in the independent living market. Increased ownership concentration was also associated with increased rents in the assisted living markets. Finally, not-for-profit ownership status appears to dampen the impact of market concentration on rents and occupancy.

The remainder of the paper is organized as follows. Section 3.2 includes a description of senior housing, a discussion of the basic theoretical framework, and an overview of the applicable literature. Sections 3.3 and 3.4 discuss the regression framework and data

respectively. Section 3.5 lays out the results and Section 3.6 concludes with an overview of the analysis and caveats.

3.2 Background

Historically, the most prevalent senior housing options included remaining in the care of family members and loved ones in the seniors' home, moving in with adult children or family members, restricted retirement communities, or nursing homes (Stevenson and Grabowski, 2010). As seniors are able to live longer, healthier, more independent lives, and have more income and wealth, however, housing trends for seniors include a growing marketplace for more aging-in-place alternatives as opposed to institutional residences such as nursing homes.

The National Investment Center for the Seniors Housing and Care Industry (NIC) describes senior housing as housing for people over the age of 55 that includes architectural and structural accommodations that older individuals require to live comfortably and moreover independently as they continue to age (NIC.org). There are four primary property classifications of senior housing; independent living facilities, assisted living facilities, nursing care facilities, and memory care facilities. Each differs according to the ancillary services provided within each structure. Independent living senior housing is generally described as an autonomous housing option where some properties may provide light services such as house-keeping and meals. In addition to housing, assisted care living facilities provide some level of health care or nursing to residents as well as meals, minor personal care and support, social activities, and supervision. Total care nursing homes provide housing, full service meals, transportation, and twenty-four hour skilled-nursing care to all of its residents. Memory care developments provide housing and extensive services to residents with dementia conditions like Alzheimer's. Some senior housing

facilities also offer continuing care retirement communities (CCRCs) options that provide a variety of services within one geographic space.

One characteristic of this type of housing is that it appears to have concentrated ownership. The American Seniors Housing Association compiled a list of the nation's 50 largest private seniors' housing owners of independent living, assisted living, memory care and skilled nursing facilities for adults over the age of 55 in June, 2013. The data indicated that of the 541,105 units owned by the top fifty companies, 64 percent of those units were owned by ten companies (National Real Estate Investor, 2013). These data did not include subsidized units or properties where more than thirty percent of the units were skilled nursing units, and this further suggests that there may be some level of ownership concentration in the market for independent living and assisted living units. Entry barriers such as high development costs, the inability of smaller firms to obtain capital financing, and scale economies that are present in the general rental housing market may be causes of ownership concentration in the senior rental market.

Economic theory maintains that in a space where competitive market conditions are present, the absence of entry barriers drives supply to an efficient level of output where the value of the good to the marginal buyer is the same as the cost of producing it. On the other hand, in settings where supply is highly or moderately concentrated, markets conceivably exhibit monopolistic properties where prices are higher, quantity is lower, and firms earn higher profits by virtue of their market power. The fundamental cause of market concentration could be substantial entry barriers, such as scale economies, capital requirements, product differentiation advantages or a combination of the three (Schmalensee, 1989).

Empirically, little has been written on the economics of senior housing. Numerous inter-industry studies have analyzed how market structure impacts market behaviors. The majority of

studies that have examined the relationship between concentration and profitability have found a positive relationship, though the effects tended to be small and not statistically robust (Schmalensee, 1989). Other studies have analyzed the impact of concentration on price rather than profit. This empirical literature has the general consensus that higher market concentration is associated with higher prices (Weiss, 1989).

More narrowly, Nyman (1994) examined the relationship between market concentration and the price of nursing home care in Wisconsin. In particular, in that state certificate of need laws limit the number of nursing care beds, which generates a barrier to entry. Nyman found that higher market concentration resulted in higher prices of private nursing care, and that for-profit nursing homes were more likely to have higher prices due to market concentration.

3.3 Empirical Framework

The literature that analyzes the relationship between ownership concentration and price typically begins with a variation of the following structural equation,

$$\ln(P_m) = \beta MktCon_m + \boldsymbol{\delta X}_m + u_m \,. \tag{1}$$

The dependent variable, *P*, is the observed price in market *m*, $MktCon_m$ is a measure of market concentration, the vector, $\boldsymbol{X}$ contains exogenous cost and demand conditions in each market that affect price, $\boldsymbol{\delta}$ is the parameter vector associated with $\boldsymbol{X}$, and *u* is the error term. The primary coefficient of interest is β which measures the impact of market concentration on price.

In this empirical analysis, the metropolitan statistical area (MSA) is treated as the local senior housing rental market, and the price measure is the rent in the senior housing market. Market concentration is estimated using a Herfindahl-Hirschman Index (HHI). The HHI is derived by first calculating the market share, *S* of each firm competing in a market as follows,

(2) $$S = \frac{\#units_i}{\#units_m},$$

where *#units* is the number of senior rental units owned by firm *i*, divided by the total number of units in firm *i's* metropolitan area, *m*. The market shares of firms are then squared and summed over all the firms in a market to compute the level of concentration in each market as follows,

(3) $$HHI = \sum_{i=1}^{N} S_i^2.$$

The HHI takes into account the relative size distribution of firms competing in each market. Hence, the HHI increases as the number of firms decreases and as the disparity in size that exists between those firms increases as well. Therefore, the econometric specification is

(4) $$\ln(R_{mt}) = \beta HHI_{mt} + \boldsymbol{\delta X_{mt}} + u_{mt}$$

where *R* is the average monthly rent in metropolitan statistical area, *m*, at time *t*. The parameters will be estimated by OLS. In addition, following Evans et al. (1993), Schmalensee (1989), Singh and Zhu (2006), and Weiss (1989), the error term is modelled as follows,

(5) $$u_{mt} = v_m + \tau_t + \varepsilon_{mt}$$

where v_m is an MSA fixed effect that accounts for time-invariant market-specific factors affecting rent and concentration, τ_t is the time effect, and ε_{mt} is the idiosyncratic error. Increased market concentration will increase rental rates in the local market interest, hence the predicted value of β is greater than zero. With fixed effects, the estimate of β is identified by within metro area changes in ownership concentration across time, which are taken to be exogenous.

Senior housing projects are built by three general categories of developers, private for profits, nonprofits, and the public sector. Data collected by the National Investment Center for Seniors Housing and Care between 2007 and 2013 illustrated that the majority of private market independent and assisted living senior living facilities, and memory care facilities were owned and operated by for-profit entities.

The increased presence of nonprofit senior housing developments may then lower rental rates in the market for senior units. By definition nonprofits are mission driven organizations that operate to maximize purpose as opposed to profit. There are numerous advantages of the non-profit management and provision of certain goods and human services. As noted by O'Regan and Quigley (2000) nonprofit housing groups often help the most vulnerable of populations who are neglected by the for-profit sector.

Therefore, in addition to the specification in (4), the parameters of a second model will be estimated,

(6) $\ln(R_{mt}) = \beta HHI_{mt} + \gamma_1 ForProfit_{mt} + \gamma_2 ForProfit_{mt} \times HHI_{mt} + \delta X_{mt} + u_{mt}$

where *ForProfit* measures the proportion for-profit units in metro area *m,* at time *t,* and *ForProfit* x *HHI* is an interaction term that captures whether a higher proportion of for-profit units in a metro area strengthens the impact of market concentration on rents.

3.4 Data Description

The analysis uses two data sources on senior rental from the National Investment Center for Seniors Housing and Care (NIC) from 100 of the largest U.S. metropolitan areas for even-numbered years between 2006 and 2012. NIC is a nonprofit organization whose mission is to "advance the quality and availability of seniors housing and care options for America's elders through research, education and increased transparency that facilitate informed investment decisions, quality outcomes and leadership development in seniors housing and care" (NIC.org). The first data source contains private market senior rental housing details on 13,057 properties, including the name of the property, owner, address, metropolitan area, profit status, property classification type, number of units, and number of units by type for each property. The second

data source contains average monthly rents, rent growth, absorption rates, and occupancy level information at the metropolitan level. NIC categorizes metro areas into two classes, primary and secondary markets. Primary senior housing markets entail the 31 largest metro areas whereas the remaining 69 are considered secondary markets. Table 3.1 lists the metropolitan areas used in this study.[7]

The four property classifications of senior housing in the NIC data are independent living communities (IL), assisted living residences (AL), skilled nursing care facilities (NC), and memory care facilities (MC) The distinguishing factor between the different types of senior housing is the level of services provided. For example, IL communities are multifamily rental housing developments, available to residents over the age of 55, which offer light services such as dining facilities, light housekeeping, and organized social and recreational activities. Assisted living residences offer the same services as IL communities, and in addition, these residences have skilled nursing staff to assist residents who require assistance with a range of activities for daily living. Additional AL services include tasks like helping residents bathe, dress, and administering medications. Some AL residences may also be regulated by state agencies depending on the level of services (Stevenson et al, 2010). Skilled nursing care facilities provide skilled nursing care to all of their residents on a 24 hour basis.[8] Memory care (MC) refers to those institutions that only specialize in the care of residents with Alzheimer's and various forms of dementia (NIC.org).

[7] Data are only available for the 31 largest metropolitan areas for the 2006 wave. These metropolitan areas are also identified in Table 3.1.

[8] Entry into the nursing care market is also regulated in 36 states by certificate of need (CON) laws. The goal of CON laws is to control health care costs by coordinating the level of supply. Approval of new NC developments and expansions require the demonstration of critical needs not being fulfilled by existing servicers (National Conference of State Legislatures)

The data are collapsed to construct a metropolitan area panel data set of market supply information. Data on the number of units and the number units by property type facilitate the calculation of metro level HHI's for all four senior structure types as well as metro level HHI's based on unit type. The Department of Justice Antitrust Division evaluates market concentration as follows,

- $HHI > 0.18$ Concentrated
- $0.1 \leq HHI \leq 0.18$ Moderate Concentration
- $0.01 \leq HHI < 0.1$ Unconcentrated
- $HHI < 0.01$ Competitive.

Table 3.2 summarizes ownership concentration in the 100 metropolitan areas and the respective average monthly rent (AMR) for each of the four levels of concentration. The data suggest that the markets for all senior housing types were relatively competitive across all four waves (2006, 2008, 2010, and 2012). The IL, AL, and NC markets however show more variability in ownership concentration and changes over time. Furthermore, the analysis in Table 3.2 indicates that more than half of the IL markets were moderately and very concentrated, whereas AL and NC markets were mostly unconcentrated and competitive across all four periods. In the AL markets, median rents are higher when there is more concentration, but median rents in the IL and NC markets were slightly lower in concentrated markets.

Table 3.3 gives the same information as Table 3.2 but for the 31 primary metropolitan areas. The market for senior housing is more competitive in larger cities across the four property classifications. Table 3.4 describes ownership structure and median rent growth across property classifications. The median rent growth in concentrated IL and NC markets tended to be higher when compared to unconcentrated IL and NC markets.

Concentration impacts were assessed using five different dependent variables, average monthly rents, average monthly rent growth, absorption, the change in mean annual absorption, and stabilized occupancy rates for each metro area. Absorption is the change in occupied units from the previous quarter, and the annual average changes were calculated for each metro area based on the provided quarterly reports. Stabilized occupancy rates measured the occupancy of properties that had been opened for at least two years, and the occupancy for properties open less than 2 years was only included as stable if those properties had reached occupancy of at least 95% since their opening. Table 3.5 gives the summary statistics for the aforementioned outcome variables, market concentration measured as a HHI, and the proportion of for-profits units in the markets for all senior housing. Tables 3.6, 3.7, and 3.8 give those summary statistics for the IL, AL, and NC markets respectively. The mean rent for all housing types increased between each period, and these increases were largest in the markets for IL units. Assisted living rents decreased between the 2006 and 2008 waves but increased between 2008 and 2010 and between 2010 and 2012. The largest rents were in the AL markets whereas the lowest rents were in the skilled nursing care segment. Even though NC's provide a wider and more complex range of services, it is reasonable to assume that these price differences are likely due to the high level of Medicare subsidization that such facilities receive.

Across each time period, mean rental growth rates were declining in the market for all senior housing, fluctuating in the IL market, but declining in the AL and NC markets. Absorption was greatest in the IL markets, and it was also increasing across each period with the exception of a decrease between the 2006 and 2008 waves. The larger share, about 75%, of for-profit senior housing installments were in the AL and NC markets. The mean proportion of for-profit IL markets was approximately 60%. There was also relatively little to no change in the

proportion of for-profit senior housing establishments across the four waves. Figures 3.1 through 3.4 show histograms, which illustrate that, across the 3 different senior housing types, rents, were more normally distributed in the unconcentrated markets.

3.5 Results

This section presents pooled ordinary least squares (OLS) and fixed effects (FE) regressions results of the model discussed in Section 3.3. Separate results are reported for the overall senior housing market, independent living (IL), assisted living (AL), and skilled nursing care markets (NC) in Tables 3.9, 3.10, 3.11, and 3.12 respectively. Concentration and profit status impacts in each market are measured using five different dependent variables: log mean monthly rents, annual rental growth rates, absorption, absorption growth and stabilized occupancy rates. Each table presents four sets of results for each dependent variable. Column 1 uses pooled ordinary least squares (OLS) and column 2 uses fixed effect (FE) to estimate the impact of ownership concentration on the dependent variables. Columns 3 and 4 repeat columns 1 and 2 respectively but also include the proportion of for-profit senior housing developments and an interaction variable of the HHI and proportion of for-profit units.

3.5.1 All Senior Housing

Table 3.9 presents panel estimates of the impact of ownership concentration in all senior housing markets. In column 1, the pooled OLS estimate of β, is equal to 1.892. This result suggests that a 100 percent increase in the HHI, would decrease market area rents by 189 percent. Column 2 shows the fixed effects estimate of the impact of ownership concentration on monthly rents. Even though the estimate is positive, as expected, the coefficient is not statistically different from zero. Columns 3 and 4 use the same specification as in columns 1 and

2, respectively, but it includes controls for the proportion of for-profit units in each market and the interaction term. These estimates suggest that there are negative correlations between ownership concentration and MSA rents and between the proportion of for-profits and rents. The point estimates from these specifications however are not statistically different from zero.

The following set of results in Table 3.9, report estimates the impact of ownership concentration on rent growth. Pooled ordinary least squares results suggest that a 100 percent increase in the HHI causes a 15 percent decrease in rental growth rates. The FE estimate in column 2 suggests that a 100 percent increase in the ownership concentration causes a 63 percent increase in rental growth rates. The estimates of rental growth in columns 3 and 4 vary substantially, and these results are not statistically different from zero. The specifications that estimate the impact of market concentration on absorption suggest that ownership concentration has a negative impact on absorption and the coefficients are statistically significant at the 5% level in models that only include the HHI independent variable. Ordinary least squares standardized coefficients show that an increase of 1 standard deviation (.0163) in the Herfindahl index, would decrease absorption by an average of 14 units over the course of a year, and FE results indicate a decrease of 48 units over the course of a year.

Absorption growth coefficients differ in size and in the direction of the impact, however, and these estimates are not different from zero across all four specifications. Fixed effects results of stabilized occupancy in column 2 suggest that a 100% increase in HHI, increases the stabilized occupancy rate by 92% and this result is significant at the 5% significance level. In addition, the FE specification with interactions in column 4 also suggests that an increased proportion of for-profits enhances the effect of ownership concentration on stabilized occupancy.

The results of the all senior housing market analysis vary in terms of the direction and magnitude of the estimated impacts of market concentration and profit status across the various specifications. Recognizing that the different types of senior housing vary according to payment mechanisms, regulatory measures, and the level of services provided, the following sections separately analyze the impact of the market concentration and profit status in the various types of senior housing.[9]

3.5.2 Independent Living

Table 3.10 repeats the specifications presented in Table 3.9 but for the independent living senior housing markets. The OLS result in column 1 suggests that a 100 percent increase in the HHI of independent living markets, decreases rents by 42 percent. The estimated value of β from the fixed effects specification in column 2 suggests that a 100 percent increase in the independent living HHI, decreases average monthly rents by 124 percent. The OLS and FE specifications, in columns 3 and 4 respectively, yield quantitatively similar results from the fixed effects result in column 2. Even though significance varies across specifications, the direction of the impact is consistently negative. The average monthly rent regressions show a positive relation between the proportion of for-profit units and rents.

In terms of rent growth, the HHI-IL follows the expected sign, and is statistically different from zero at the 5 percent level in the FE specification presented in column 2. A 100% increase in the HHI increases rental growth rates by 23 percent. The FE specification in column 4, which also controls for the proportion of for-profit units and the interaction of for-profit units and ownership concentration is quantitatively similar to the previous result though it is less

[9] Metropolitan level rent and absorption data are unavailable for memory care units, therefore those are not included in the analysis.

precise. Pooled OLS and FE results also indicate that an increase in the proportion of for-profit units increases the impact that the HHI has on rental growth rates.

The next set of results in Table 3.10 includes an analysis of the effect of ownership concentration on absorption. Increased market concentration decreases absorption in the market for IL senior units similar to the overall market. Ordinary least squares standardized coefficients, based on the result in column, show that an increase of 1 standard deviation (.0723) in the HHI-IL, would decrease absorption by an average of 11 units over the course of a year. The fixed effects result in column 2 indicates a decrease of 26 units over the course of a year. The absorption coefficients from the OLS and FE specifications that control for the proportion of for-profit units and the interaction term are also consistently negative though not statistically different from zero at an acceptable significance level.

The following section of Table 3.10 shows results from regressions that examine the impact of ownership concentration on absorption growth. The ordinary least squares result in column 1 suggests that increased concentration decreases absorption growth, and FE results in column 2 show the same direction of impact, but the results differ in magnitude. Interestingly, FE regressions with interactions reverse the direction of the impact, and an increase in the proportion of for-profits increases absorption growth. The interaction of HHI-IL with the for-profit variable is also significant at the 5% level, and it is negative. The estimates of absorption growth as measured by the specification in column 4 may imply that in the IL market concentration is prevalent amongst the non-profit segment and that more for-profit units weakens the impact that concentration has on absorption growth.

The last section of regression results reported in Table 3.10 provides estimates of the impact of ownership concentration on stabilized occupancy. Ordinary least squares results in

columns 1 and 3 suggest that increased ownership concentration decreases stabilized occupancy rates, whereas FE results in columns 2 and 4 suggest that increased ownership concentration increases stabilized occupancy. Also, the OLS regression in column 4, with interactions show that the increased presence of for-profit owners along with increased concentration decreases stabilized occupancy, and that increased for-profit developers strengthens the negative impact of increased concentration on stabilized occupancy. The FE estimates in column 4, however differ in terms of the direction on the impact, and the results are not statistically different from zero.

3.5.3 Assisted Living

Table 3.11 gives panel estimates of average monthly rents, rent growth, absorption, absorption growth and stabilized occupancy for assisted living senior housing across the metro markets included in the data. Fixed effects regression results in column 2 show that a 100 percent increase in the assisted living HHI increases average monthly rents by 57 percent. This result is statistically different from zero at a l% significance level.

Estimates of rent growth in AL markets however vary across the specifications. The OLS specification in column 1 suggests a negative correlation between concentration and rent growth, whereas the OLS specification with added controls in column 3 shows a positive correlation between concentration and rent growth. Furthermore, the interaction term is negative and statistically significant which implies that an increase the proportion of for-profit units weakens the impact of concentration on area rent growth.

Standardized coefficients from the ordinary least squares estimate of absorption in column 1 show that an increase of 1 standard deviation (.0538) in the HHI-AL decreases absorption by an average of 3 units over the course of a year. Fixed effects results in column 4 indicate a decrease of 93 units over the course of a year. Interestingly, the negative and

statistically significant interaction coefficient from the specification in column 4 suggests that more for-profit ownership strengthens the negative impact that increased concentration has on absorption. This could also imply that increased non-profits could attenuate the negative impact that concentration has on absorption.

The next set of results in Table 3.11 estimate ownership concentration impacts on absorption growth. These estimates are consistently positive across all four specifications. The point estimates, however differ substantially in magnitude. The results that estimate the impact of ownership concentration on stabilized occupancy suggest that an increase in the concentration decreases stabilized occupancy. The OLS and FE specifications with added controls in columns 3 and 4 respectively, however, suggest that increased concentration increases stabilized occupancy rates. In addition, the interaction terms in both specifications are also negative and statistically significant. This also implies that an increase in the proportion of for-profits weakens the impact of concentration, as measured by the HHI.

3.5.4 Nursing Care

Table 3.12 gives panel estimates of the MSA average monthly rent, rent growth, absorption, absorption growth, and stabilized occupancy for nursing care housing markets. The direction of impact across the OLS and FE specifications varies. The OLS parameter estimates in columns 1 and 3 indicate a positive correlation between MSA average monthly rents and the nursing care Herfindahl index, whereas the FE estimates in columns 2 and 4 suggest that an increase in ownership concentration has a positive impact on rents in the nursing care market. Furthermore, the ordinary least squares standard errors, and the fixed effects robust standard errors determine that these coefficients are not precisely estimated. The OLS specification in column 2 also suggests that there is a negative correlation between the proportion of for-profit

nursing care units and the monthly rents of these units. The FE specification however shows that the impact of for-profits is in the opposite direction, but this estimate is unreliable. The direction of impact of the interaction variable also varies.

Estimates of the impact of ownership concentration on absorption and absorption growth are provided in Table 3.12 as well. These coefficient estimates also vary widely in magnitude. The OLS standardized coefficients from column 1 suggest that an increase of 1 standard deviation (.0324) in HHI-NC, would decrease absorption by an average of 10 units over the course of a year, and the OLS specification in column 3 indicates an increase in absorption of 58 units of the course of a year. An increase in the proportion of for-profit units also has positive and marginally significant impact on absorption. Results from the FE specification in column 4 however suggests the exact opposite impact, and the sizeable standard errors indicate that these results cannot be used to draw any meaningful implications.

The following section in Table 3.12 reports absorption growth results. Across the four specifications, these results show that the impact of concentration on absorption growth is negative, though the estimates vary substantially in magnitude. The OLS and FE specifications in columns 3 and 4, respectively, suggest that an increase in the proportion of for-profit ownership enhances the concentration impacts of concentration on absorption growth.
The last section in Table 3.12 shows stabilized occupancy results. The FE specification in column 4 that includes the for-profit and interaction variables, suggests that a 100 percent increase in the nursing care HHI decreases stabilized occupancy by more than 200%. The OLS and FE specifications with added controls for for-profit units also suggests that an increased proportion of for-profits decreases stabilized occupancy rates of the nursing care units. Interestingly, the interaction of concentration and profit status however is marginally significant

and the positive sign of the coefficient suggests that an increased proportion of for-profits increases the adverse impact that ownership concentration has on stabilized occupancy in the nursing care markets.

3.6 Conclusion

This study utilized MSA panel data on the supply of private senior rental housing to measure ownership concentration, using a Herfindahl Index (HHI), and to estimate the impacts of concentration on market level rents and occupancy variables. This is, to the best of my knowledge, the first analysis of the impact of ownership concentration in the senior housing market.

There are a number of findings. First, when aggregated together, the market for all senior housing options is not concentrated. Analysis by property classification, however, revealed that the independent living senior housing market was relatively concentrated and that there was more competition in the assisted living and nursing care markets. Pooled ordinary least squares and fixed effects regressions were implemented to assess the impact of ownership concentration on metropolitan monthly rents and occupancy measures. Ownership concentration, as measured by the Herfindahl Index, had significant impacts on rents in the IL and AL housing markets. A 100% percent increase in the HHI increased assisted living rents by 57 percent.

The study also examined whether the profit status and an interaction of concentration and profit status of the housing properties had an observable impact on MSA rents and/or rent growth. Results implied a positive correspondence between the proportion of for-profits and rents and that an increase in the proportion of for-profits enhanced the impact that concentration has on rent growth in the IL markets. The results varied in other property types.

There are a number of caveats to this study. First, the data only covers a relatively short time period, so that the estimates should be thought of as short-run in nature. Entry in the longer run may dissipate any effects of concentration measured here. Second, the period of study included when the economy was in the midst of a severe recession that had substantial impacts on the housing market. Finally, the analysis was not able to pin down the economic mechanism for market power in the independent and assisted living markets and further unraveling the nature of these entry barriers is an important area for new research.

An interesting extension of the analysis would be to explore the utilization of Low Income Housing Tax Credits (LIHTC) to finance the development of these types of structures. LIHTCs are awarded by states on a competitive basis and in accordance with each state's housing priorities. Developers often build senior living residences as a way of scoring additional points on tax credit applications particularly when state agencies make senior housing a priority. Once tax credits are awarded, nearly all developers use a syndicator to sell the tax credits to investors in exchange for upfront capital as opposed to realizing the credits in incremental amounts (10%) over 10 years. LIHTC regulations also require that a partnering ownership structure be formed between the developers, investors, and syndicators of the project. Typically, a Limited Partnership or a Limited Liability Partnership is formed where the creditor/investor has a 99% ownership stake in the project. Given that tax credits are nonrefundable, it is implied that the investors purchasing the credits and assuming ownership of the project have sufficient federal income tax liability, and that they have the capacity to assume the responsibilities and risks associated with ownership of the properties (Eriksen 2009). The amount of capital required to participate in these secondary market transactions which also determine the ownership of the

properties could be an entry barrier in the independent and assisted living markets. This is an important avenue for future research.

Table 3.1: 100 Metropolitan Statistical Areas Available in NIC Data

*****Indicates 31 Large Metropolitan Areas-Primary Markets

*Atlanta, GA	*San Jose, CA	Des Moines, IA	New Orleans, LA
*Baltimore, MD	*Seattle, WA	El Paso, TX	Ogden, UT
*Boston, MA	*St. Louis, MO	Fort Myers, FL	Oklahoma City, OK
*Chicago, IL	*Tampa, FL	Fresno, CA	Omaha, NE
*Cincinnati, OH	*Washington, DC	Grand Rapids, MI	Portland, ME
*Cleveland, OH	Akron, OH	Greensboro, NC	Poughkeepsie, NY
*Dallas, TX	Albany, NY	Greenville, SC	Providence, RI
*Denver, CO	Albuquerque, NM	Harrisburg, PA	Raleigh, NC
*Detroit, MI	Allentown, PA	Hartford, CT	Richmond, VA
*Houston, TX	Augusta, GA	Indianapolis, IN	Rochester, NY
*Kansas City, MO	Austin, TX	Jackson, MS	Salt Lake City, UT
*Las Vegas, NV	Bakersfield, CA	Jacksonville, FL	San Francisco, CA
*Los Angeles, CA	Baton Rouge, LA	Knoxville, TN	Sarasota, FL
*Miami, FL	Birmingham, AL	Lakeland, FL	Scranton, PA
*Minneapolis, MN	Boise, ID	Lancaster, PA	Springfield, MA
*New York, NY	Bridgeport, CT	Little Rock, AR	Stockton, CA
*Orlando, FL	Buffalo, NY	Louisville, KY	Syracuse, NY
*Philadelphia, PA	Charleston, SC	Madison, WI	Toledo, OH
*Phoenix, AZ	Charlotte, NC	McAllen, TX	Tucson, AZ
*Pittsburgh, PA	Chattanooga, TN	Melbourne, FL	Tulsa, OK
*Portland, OR	Colorado Springs, CO	Memphis, TN	Ventura, CA
*Riverside, CA	Columbia, SC	Milwaukee, WI	Virginia Beach, VA
*Sacramento, CA	Columbus, OH	Modesto, CA	Wichita, KS
*San Antonio, TX	Dayton, OH	Nashville, TN	Worcester, MA
*San Diego, CA	Daytona Beach, FL	New Haven, CT	Youngstown, OH
*San Francisco, CA			

Table 3.2: Median MSA Average Monthly Rents by Market Structure and Year

	MSA Average Monthly Rents							
	2006		2008		2010		2012	
Market Structure	**N**	**AMR**	**N**	**AMR**	**N**	**AMR**	**N**	**AMR**
All Senior Housing								
Competitive	1	3293 ()	1	3592 ()	1	3824 ()	1	3939 ()
Un-concentrated	30	2550 (363)	99	2705 (397)	98	2822 (433)	99	2912 (456)
Moderate Concentration	-	-	-	-	1	2809 ()	-	-
Concentrated	-	-	-	-	-	-	-	-
Independent Living								
Competitive	-	-	-	-	-	-	-	-
Un-concentrated	23	2367 (371)	39	2464 (409)	45	2570 (412)	43	2694 (429)
Moderate Concentration	7	2087 (452)	42	2350 (521)	39	2471 (589)	41	2562 (588)
Concentrated	1	2039 ()	19	2281 (426)	16	2314 (436)	16	2430 (417)
Assisted Living								
Competitive	-	-	-	-	-	-	-	-
Un-concentrated	30	3142 (488)	86	3152 (431)	90	3294 (488)	84	3364 (487)
Moderate Concentration	1	4210 ()	11	3222 (732)	7	3045 (463)	13	3289 (667)
Concentrated	-	-	3	3135 (791)	3	3437 (1150)	3	3448 (1241)
Nursing Care								
Competitive	1	315 ()	1	339 ()	1	357 ()	1	376 ()
Un-concentrated	30	206 (206)	91	221 (48)	91	237 (52)	91	248 (56)
Moderate Concentration	-	-	8	196 (30)	7	208 (35)	6	230 (44)
Concentrated	-	-	-	-	1	216 ()	2	213 (19)

Note: Standard deviations are in parenthesis

Table 3.3: Median MSA Average Monthly Rents by Market Structure and Year for Primary Markets

	MSA Average Monthly Rents							
	2006		2008		2010		2012	
Market Structure	**N**	**AMR**	**N**	**AMR**	**N**	**AMR**	**N**	**AMR**
All Senior Housing								
Competitive	1	3293 ()	1	3592 ()	1	3824 ()	1	3939 ()
Un-concentrated	30	2550 (363)	30	2769 (372)	30	2914 (372)	30	2996 (393)
Moderate Concentration	-	-	-	-	-	-	-	-
Concentrated	-	-	-	-	-	-	-	-
Independent Living								
Competitive	-	-	-	-	-	-	-	-
Un-concentrated	23	2367 (371)	23	2547 (403)	26	2676 (415)	25	2797 (438)
Moderate Concentration	7	2087 (452)	7	2300 (324)	4	2572 (370)	5	2649 (351)
Concentrated	1	2039 ()	1	2379 ()	1	2608 ()	1	2719 ()
Assisted Living								
Competitive	-	-	-	-	-	-	-	-
Un-concentrated	30	3142 (487)	29	3375 (473)	31	3473 (545)	30	3525 (562)
Moderate Concentration	1	4210 ()	2	3650 (1154)	-	-	1	2785 ()
Concentrated	-	-	-	-	-	-	-	-
Nursing Care								
Competitive	1	315 ()	1	338 ()	1	357 ()	1	376 ()
Un-concentrated	30	206 (35)	30	224 (39)	30	241 (42)	30	250 (45)
Moderate Concentration	-	-	-	-	-	-	-	-
Concentrated	-	-	-	-	-	-	-	-

Note: Standard deviations are in parenthesis

Table 3.4: Median MSA Rental Growth Rates by Market Structure and Year

	MSA Rent Growth							
	2006		2008		2010		2012	
Market Structure	N	Rent Growth	N	Rent Growth	N	Rent Growth	N	Rent Growth
All Senior Housing								
Competitive	1	.053 ()	1	.034 ()	1	.024 ()	1	.001 ()
Un-concentrated	29	.037 (.008)	31	.033 (.008)	98	.016 (.011)	99	.018 (.011)
Moderate Concentration	-	-	-	-	1	.028 ()	-	-
Concentrated	-	-	-	-	-	-	-	-
Independent Living								
Competitive	-	-	-	-	-	-	-	-
Un-concentrated	23	.034 (.012)	23	.036 (.013	45	.016 (.011)	43	.023 (.012)
Moderate Concentration	6	.038 (.013)	7	.027 (.008)	39	.017 (.017)	41	.024 (.015)
Concentrated	1	.066 ()	1	.042 ()	16	.028 (.025)	16	.012 (.017)
Assisted Living								
Competitive	-	-	-	-	-	-	-	-
Un-concentrated	29	.040 (.011)	29	.029 (.009)	90	.014 (.013)	84	.010 (.017)
Moderate Concentration	1	.028 ()	2	.044 (.017)	7	-.004 (.025)	13	.014 (.018)
Concentrated	-	-	-	-	3	.025 (.041)	3	-.004 (.041)
Nursing Care								
Competitive	1	.037 ()	1	.039 ()	1	.025 ()	1	.030 ()
Un-concentrated	29	.045 (.011)	30	.041 (.009)	91	.033 (.009)	91	.031 (.012)
Moderate Concentration	-	-	-	-	7	.032 (.008)	6	.033 (.017)
Concentrated	-	-	-	-	1	.027 ()	2	.041 ()

Notes: Standard deviations are in parenthesis. Rent growth data for years 2006 and 2008 are only available for the 31 largest metro areas. Las Vegas, NV is missing rent growth information for 2006.

Table 3.5: All Senior Housing
Means and Standard Deviations for MSA Rents, Rent Growth Rates, Absorption, Absorption Growth, Stabilized Occupancy, Ownership Concentration, and the Proportion of For-Profits

Variable	2006	2008	2010	2012
Average Monthly Rent	2574.94	2713.69	2832.12	2922.34
	(381.04)	(405.31)	(440.36)	(405.31)
Rent Growth	.0373	.0328	.0158	.0178
	(.0086)	(.0079)	(.0111)	(.0079)
Absorption	62.81	7.65	29.48	27.86
	(68.12)	(50.95)	(43.41)	(50.95)
Absorption Growth		-1.21	18.31	-2.05
	-	(4.65)	(184.30)	(4.65)
Stabilized Occupancy	.922	.9094	.893	.900
	(.026)	(.0295)	(.267)	(.0295)
HHI	.0240	.0369	.03656	.0371
	(.0088)	(.0165)	(.0168)	(.0165)
Proportion For Profit	.70	.71	.71	.71
	(.11)	(.12)	(.12)	(.12)
Number of MSAs	31	100	100	100

Note: Standard deviations are in parenthesis.

Table 3.6: Independent Living
Means and Standard Deviations for MSA Rents, Rent Growth Rates, Absorption, Absorption Growth, Stabilized Occupancy, Ownership Concentration, and the Proportion of For-Profits

Variable	2006	2008	2010	2012
Average Monthly Rent	2293.70	2382.63	2490.46	2597.96
	(397.68)	(464.21)	(495.28)	(503.08)
Rent Growth	.0331	.0346	.0185	.0229
	(.0129)	(.0120)	(.0165)	(.0141)
Absorption	41.93	6.83	16.60	20.70
	(49.95)	(39.42)	(32.45)	(52.12)
Absorption Growth	-	-.955	-1.19	1.39
		(6.85)	(18.38)	(15.49)
Stabilized Occupancy	.928	.9083	.884	.896
	(.043)	(.08175)	(.050)	(.043)
HHI	.0756	.1286	.1236	.1241
	(.0393)	(.0752)	(.07414)	(.0713)
Proportion For Profit	.55	.58	.58	.58
	(.19)	(.1886)	(.1798)	(.1786)
Number of MSAs	31	100	100	100

Note: Standard deviations are in parenthesis.

Table 3.7: Assisted Living
Means and Standard Deviations for MSA Rents, Rent Growth Rates, Absorption, Absorption Growth, Stabilized Occupancy, Ownership Concentration, and the Proportion of For-Profits

Variable	2006	2008	2010	2012
Average Monthly Rent	3177	3159.43	3281.19	3356.41
	(516.42)	(476.18)	(509.15)	(533.87)
Rent Growth	.0397	.0297	.0126	.0104
	(.0109)	(.001)	(.0157)	(.0178)
Absorption	22.15	.775	13.39	7.4
	(35.48)	(23.73)	(23.71)	(33.49)
Absorption Growth	-	.0728	-.5681	-2.8
		(4.41)	(9.35)	(11.50)
Stabilized Occupancy	.910	.9012	.8984	.9039
	(.0256)	(.0369)	(.0297)	(.0284)
HHI	.0205	.0714	.0686	.0732
	(.0218)	(.0540)	(.0523)	(.0604)
Proportion For Profit	.75	.77	.77	.77
	(.12)	(.12)	(.12)	(.12)
Number of MSAs	31	100	100	100

Note: Standard deviations are in parenthesis.

Table 3.8: Nursing Care
Means and Standard Deviations for MSA Rents, Rent Growth Rates, Absorption, Absorption Growth, Stabilized Occupancy, Ownership Concentration, and the Proportion of For-Profits

Variable	2006	2008	2010	2012
Average Monthly Rent	209.14	219.88	236.18	247.85
	(40.03)	(48.81)	(52.62)	(56.45)
Rent Growth	.044	.041	.0326	.0316
	(.011)	(0089)	(.0092)	(.0124)
Absorption	-19.37	-27.28	-10.46	-3.38
	(66.44)	(44.57)	(31.67)	(71.49)
Absorption Growth		-2.36	-2.33	.1512
		(22.88)	(11.12)	(16.96)
Stabilized Occupancy	.900	.90	.8869	.8815
	(.041)	(.0482)	(.0515)	(.0525)
HHI	.0168	.0582	.0587	.0593
	(.006)	(.0311)	(.0339)	(.0342)
Proportion For Profit	.74	.73	.73	.73
	(.12)	(.1364)	(.1352)	(.13)
Number of MSAs	31	100	100	100

Note: Standard deviations are in parenthesis.

Figure 3.1

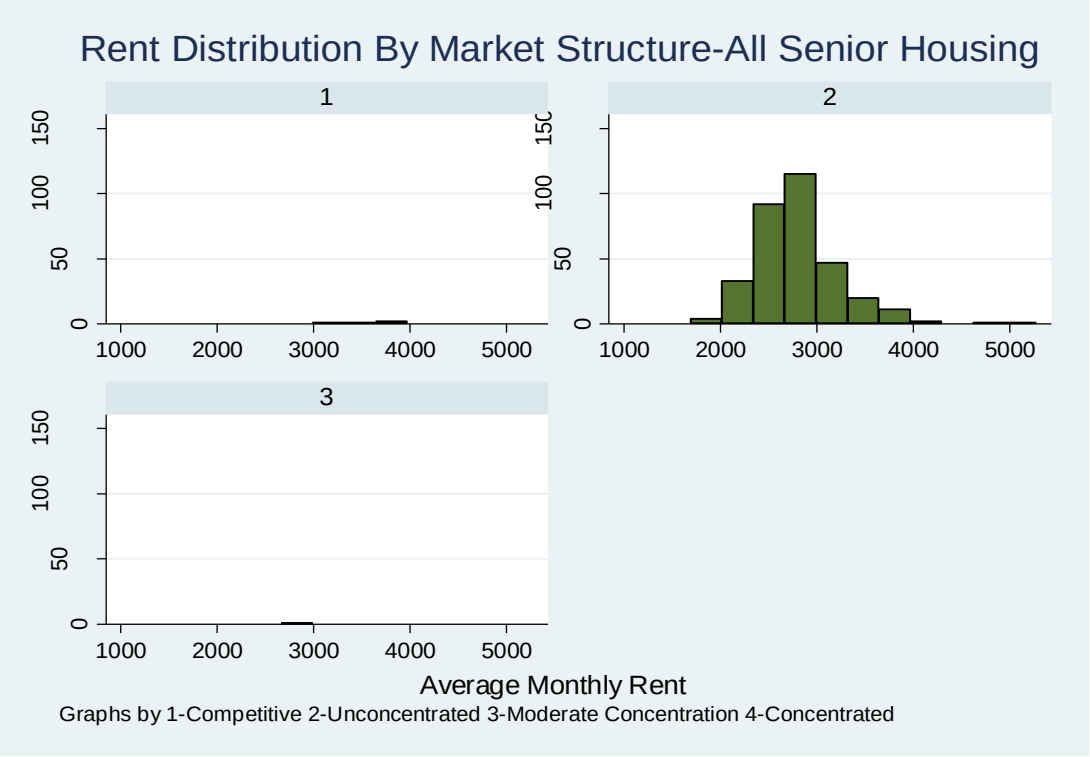

Figure 3.2

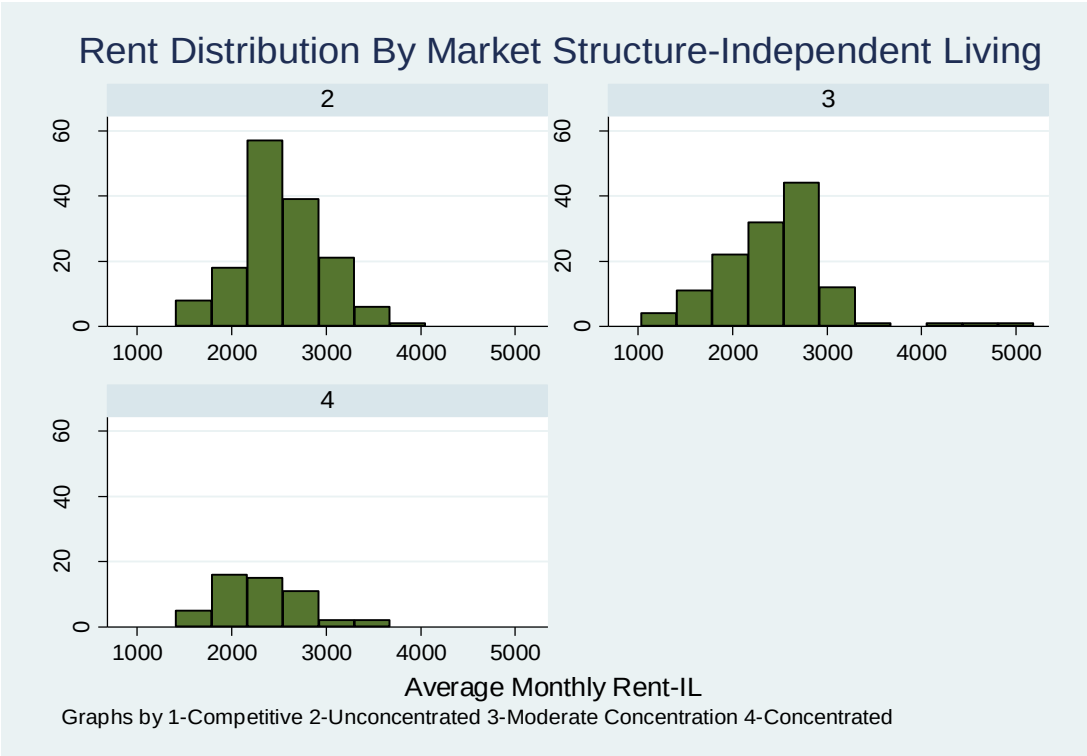

Figure 3.3

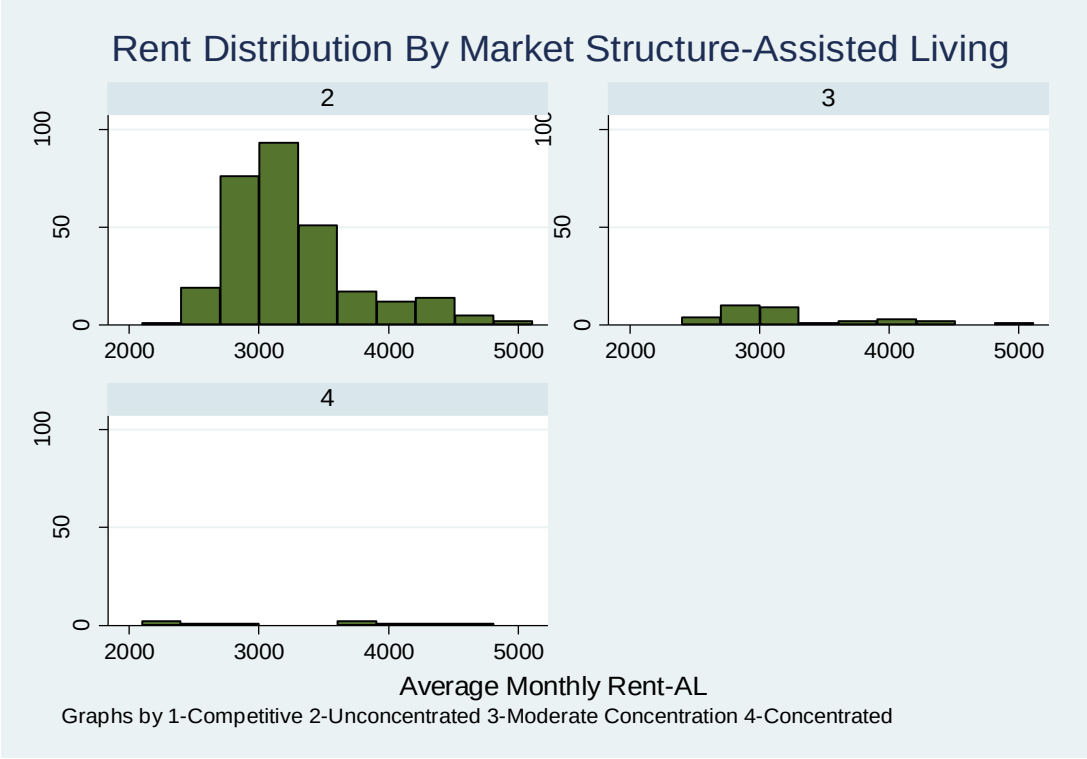

Figure 3.4

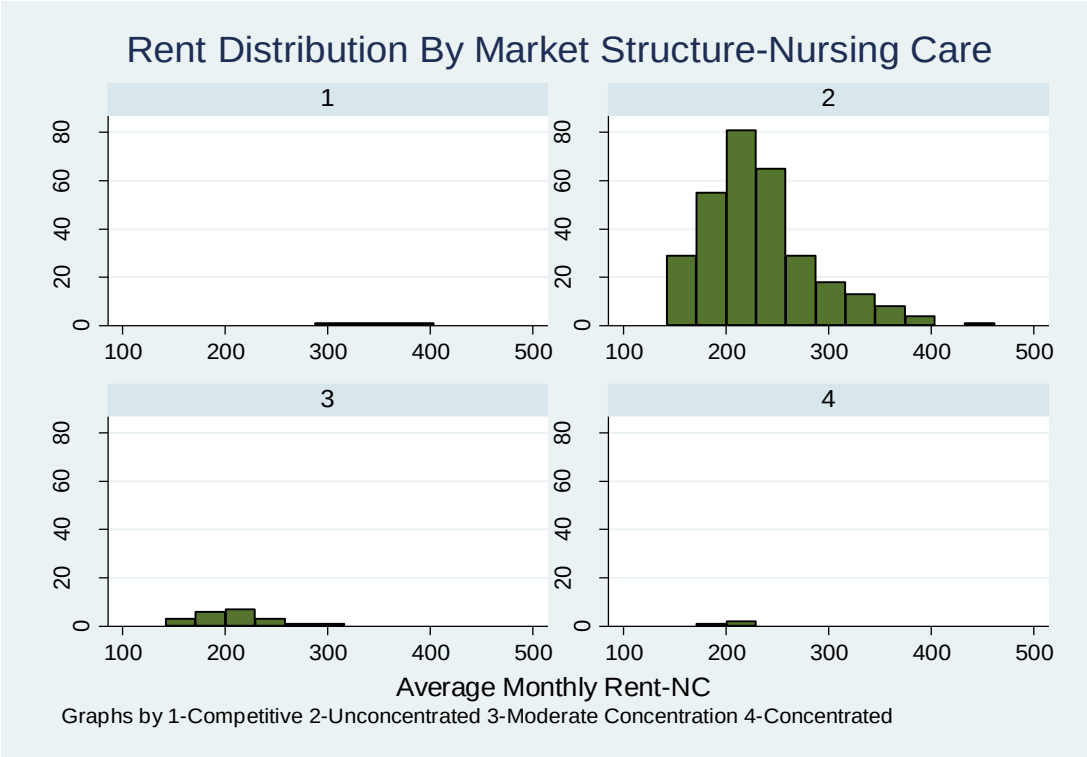

Table 3.9: Panel Estimates of MSA Average Monthly Rent, Rent Growth, Absorption, Absorption Growth, and Stabilized Occupancy for All Senior Housing, Standard Errors in Parenthesis

	Log Average Monthly Rent			
Independent Variables	**(1) Pooled OLS**	**(2) Fixed Effects**	**(3) Pooled OLS**	**(4) Fixed Effects**
HHI	-1.892* (.950)	.056 (1.54)	-7.671 (4.56)	-2.46 (7.17)
Proportion For-Profit			-.135 (.269)	-.259 (.641)
HHI x For Profit			8.31 (6.19)	3.62 (10.24)
Number of Observations	331	331	331	331
	Rent Growth			
HHI	-.152*** (.042)	.630 (.382)	-.072 (.161)	-1.56 (1.39)
Proportion For-Profit			-.005 (.010)	.103 (.159)
HHI x For Profit			-.116 (.227)	3.34 (2.04)
Number of Observations	261	261	261	261
	Absorption			
HHI	-863.89** (283.84)	-2941.22** (1007.28)	1877.12 (1862.55)	-345.67 (5971.28)
Proportion For-Profit			-95.68 (146.76)	262.85 (543.14)
HHI x For Profit			1464.66 (2781.02)	-3731.42 (7914.75)
Number of Observations	331	331	331	331
	Absorption Growth			
HHI	295.43 (320.31)	-797.10 (1205.22)	-104.53 (504.10)	1653.94 (1329.93)
Proportion For-Profit			14.15 (23.55)	835.26 (830.30)
HHI x For Profit			578.85 (1053.32)	-3449.68 (2573.73)
Number of Observations	230	230	230	230
	Stabilized Occupancy			
HHI	.005 (.178)	.923** (.459)	.448 (.510)	-2.86 (2.20)
Proportion For-Profit			-.061 (.037)	.132 (.207)
HHI x For Profit			-.628 (.780)	5.36* (3.17)
Number of Observations	331	331	331	331

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the MSA level. *Significant at 10% Level. **Significant at 5% level. ***Significant at 1% level.

Table 3.10: Panel Estimates of MSA Average Monthly Rent, Rent Growth, Absorption, Absorption Growth, and Stabilized Occupancy for Independent Living Senior Housing, Standard Errors in Parenthesis

	Log Average Monthly Rent			
Independent Variables	**(1) Pooled OLS**	**(2) Fixed Effects**	**(3) Pooled OLS**	**(4) Fixed Effects**
HHI-IL	-.420*	-1.24**	-.992	-1.19
	(.244)	(.399)	(.763)	(1.32)
Proportion For-Profit-IL			.075	.336
			(.190)	(.356)
HHI-IL x For Profit-IL			.854	-.179
			(1.103)	(1.49)
Number of Observations	330	330	330	330
	Rent Growth			
HHI-IL	-.012	.232**	-.104	.195
	(.024)	(.094)	(.064)	(.339)
Proportion For-Profit-IL			-.017	.089
			(.011)	(.077)
HHI-IL x For Profit-IL			.155*	.077
			(.085)	(.380)
Number of Observations	261	261	261	261
	Absorption			
HHI-IL	-148.47**	-363.88**	-269.23	-387.05
	(44.66)	(160.52)	(169.79)	(414.57)
Proportion For-Profit-IL			-48.11	71.62
			(56.31)	(144.9)
HHI-IL x For Profit-IL			207.77	6.86
			(280.34)	(518.71)
Number of Observations	331	331	331	331
	Absorption Growth			
HHI-IL	-19.75**	-2.49	-1.43	211.29*
	(8.55)	(39.54)	(18.89)	(118.99)
Proportion For-Profit-IL			3.75	165.78**
			(6.77)	(69.35)
HHI-IL x For Profit-IL			-30.69	-247.34**
			(35.41)	(119.60)
Number of Observations	231	231	231	231
	Stabilized Occupancy			
HHI-IL	-.057	.407**	-.286*	.148
	(.059)	(.195)	(.160)	(.464)
Proportion For-Profit-IL			-.109**	.041
			(.033)	(.154)
HHI-IL x For Profit-IL			.401*	.314
			(.212)	(.715)
Number of Observations	331	331	331	331

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the MSA level. *Significant at 10% Level. **Significant at 5% level. ***Significant at 1% level.

Table 3.11: Panel Estimates of MSA Average Monthly Rent, Rent Growth, Absorption, Absorption Growth, and Stabilized Occupancy for Assisted Living Senior Housing, Standard Errors in Parenthesis

	Log Average Monthly Rent			
Independent Variables	**(1) Pooled OLS**	**(2) Fixed Effects**	**(3) Pooled OLS**	**(4) Fixed Effects**
HHI-AL	-.279 (.374)	.570*** (.119)	3.71 (2.57)	-.918 (2.44)
Proportion For-Profit-AL			-.016 (.198)	-.422 (.276)
HHI-AL x For Profit-AL			-4.50 (2.94)	1.78 (2.82)
Number of Observations	331	331	331	331
	Rent Growth			
HHI-AL	-.060* (.032)	-.156 (.151)	.281* (.149)	-1.328 (1.82)
Proportion For-Profit-AL			-.009 (.011)	-.027 (.191)
HHI-AL x For Profit-AL			-.385** (.168)	1.384 (2.22)
Number of Observations	261	261	261	261
	Absorption			
HHI-AL	-50.002** (22.40)	-124.65 (98.95)	-301.05 (265.24)	-1730.65* (870.45)
Proportion For-Profit-AL			-21.22 (32.78)	-164.84 (131.263)
HHI-AL x For Profit-AL			294.85 (299.69)	1897* (1010.34)
Number of Observations	331	331	331	331
	Absorption Growth			
HHI-AL	35.63* (19.57)	131.38** (43.78)	120.82 (131.79)	457.62 (602.42)
Proportion For-Profit-AL			5.011 (9.545)	-9.920 (99.24)
HHI-AL x For Profit-AL			-99.83 (152.52)	-383.38 (706.21)
Number of Observations	230	230	230	230
	Stabilized Occupancy			
HHI-AL	-.113 (.071)	-.065 (.051)	1.55*** (.291)	2.45** (.871)
Proportion For-Profit-AL			.046* (.027)	.144 (.119)
HHI-AL x For Profit-AL			-1.90*** (.326)	-2.96** (1.02)
Number of Observations	331	331	331	331

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the MSA level.
*Significant at 10% Level. **Significant at 5% level. ***Significant at 1% level.

Table 3.12: Panel Estimates of MSA Average Monthly Rent, Rent Growth, Absorption, Absorption Growth, and Stabilized Occupancy for Nursing Care, Standard Errors in Parenthesis

	Log Average Monthly Rent			
Independent Variables	**(1) Pooled OLS**	**(2) Fixed Effects**	**(3) Pooled OLS**	**(4) Fixed Effects**
HHI-NC	-.620 (.516)	.897 (.814)	-1.19 (3.02)	4.86 (6.40)
Proportion For-Profit-NC			-.602** (.273)	1.12 (.869)
HHI-NC x For Profit-NC			1.31 (3.51)	-4.69 (7.48)
Number of Observations	331	331	331	331
	Rent Growth			
HHI-NC	-.029 (.023)	.162 (.173)	-.009 (.138)	-.681 (.955)
Proportion For-Profit-NC			-.001 (.010)	-.155 (.155)
HHI-NC x For Profit-NC			-.022 (.164)	1.10 (1.22)
Number of Observations	261	261	261	261
	Absorption			
HHI-NC	306.48** (136.62)	53.58 (498.85)	1801** (861)	-117.225 (4173.58)
Proportion For-Profit-NC			110.44* (65.98)	-488.57 (471.26)
HHI-NC x For Profit-NC			-1869.58* (974.31)	208.51 (4770.16)
Number of Observations	331	331	331	331
	Absorption Growth			
HHI-NC	-26.12 (19.15)	-8.33 (261.18)	-318.16* (177.73)	-286.49 (1323.169)
Proportion For-Profit-NC			-34.33 (21.63)	58.88 (175.36)
HHI-NC x For Profit-NC			376* (213.04)	343.70 (1469.72)
Number of Observations	230	230	230	230
	Stabilized Occupancy			
HHI-NC	-.015 (.163)	-.057 (.132)	.864 (.732)	-2.36* (1.29)
Proportion For-Profit-NC			-.114* (.062)	-.355 (.220)
HHI-NC x For Profit-NC			-.910 (.931)	2.73* (1.46)
Number of Observations	331	331	331	331

Notes: Standard errors are in parentheses. Fixed effects robust standard errors are clustered at the MSA level.
*Significant at 10% Level. **Significant at 5% level. ***Significant at 1% level.

Bibliography

Altonji, J. G., and Card, D. (1989). The effects of immigration on the labor market outcomes of natives. Working Paper No. 3123. The National Bureau of Economic Research.

Bliss, Laura. (2015, August, 25th). 10 years later, there's so much we don't know about where Katrina survivors ended up. *The Atlantic City Lab.* Retrieved October 8, 2015 from www.citylab.com.

Borjas, G. J. (2003). The labor demand curve is downward sloping: reexamining the impact of immigration on the labor market. No. w9755. National Bureau of Economic Research.

Burnett, John. (December 21, 2005). More stories emerge of rapes in post-Katrina chaos. *National Public Radio: Katrina and Beyond*. Retrieved March 28, 2016 from http://www.npr.org/templates/story/story.php?storyId=5063796.

Card, D. (1990). The impact of the Mariel Boatlift on the Miami labor market. *Industrial & Labor Relations Review, 43*(2), 245-257.

Cobb, K. (February 5, 2006). New Orleans failures brought crime to Houston. Houston Chronicle. http://www.chron.com/news/hurricanes/article/New-Orleans-failures-brought-crime-to-Houston-1872067.php. Retrieved March 15, 2016.

Cook, P. J., & Zarkin, G. A. (1985). Crime and the business cycle. Journal of Legal Studies, 14, 115.

Cullen, J. B., & Levitt, S. D. (1999). Crime, urban flight, and the consequences for cities. *Review of Economics and Statistics*, 81(2), 159-169.

DiPasquale, D. (1999). Why don't we know more about housing supply? *The Journal of Real Estate Finance and Economics, 18*(1), 9-23.

DeLozier, E. and Kamp, N. Hurricane Katrina timeline. The Brookings Institution. Retrieved November 17, 2015. from http://www.brookings.edu/fp/projects/homeland/katrinatimeline.pdf,

Eriksen, M. D. (2009). The market price of low-income housing tax credits. *Journal of Urban Economics*, 66(2), 141-149.

Eriksen, M. D., and Ross, A. (2013). The impact of housing vouchers on mobility and neighborhood attributes. *Real Estate Economics, 41*(2), 255-277.

Evans, W. N., L. M. Froeb and G. J. Werden (1993). Endogeneity in the concentration-price relationship: Causes, consequences, and cures. *Journal of Industrial Economics*, 61(4), 431-438.

Falkenberg, Lisa. (2006, January 22). Perry staffers' email recorded Katrina turmoil. Houston Chronicle. Retrieved from http://www.chron.com.

Frey, W. H., Singer, A., and Park, D. (2007). Resettling New Orleans: The first full picture of the Census. Brookings Institution, Metropolitan Policy Program Washington, DC.

Frontline. The Storm: 14 Days a Timeline. Public Broadcasting Service. http://www.pbs.org/wgbh/pages/frontline/storm/etc/cron.html.

Gelinas, Nicole. (2006). Houston's noble experiment. *City Journal*. Retrieved March 12, 2016 from http://www.city-journal.org.

Green, R. K., Malpezzi, S., and Mayo, S. K. (2005). Metropolitan-specific estimates of the price elasticity of supply of housing, and their sources. *American Economic Review*, 334-339.

Groen, J. A., and Polivka, A. E. (2008). Hurricane Katrina Evacuees: Who they are, where they are, and how they are faring. *Monthly Labor Review*. *131*, 32.

Groen, J. A., and Polivka, A. E. (2010). Going home after hurricane Katrina: Determinants of return migration and changes in affected areas. *Demography, 47*(4), 821-844.

Holeywell, R. (August 26, 2015) No, Katrina Evacuees didn't cause a Houston crime wave. The data doesn't support the myth. *Houston Chronicle.* Retrieved March 15, 2016 from http://www.houstonchronicle.com/local/gray-matters/article/No-Katrina-evacuees-didn-t-cause-a-Houston-crime-6464524.php

Joint Hurricane Housing Task Force Communications Team (JHHTF). (2006). *Open Doors: Houston's Housing Program for the Hurricane Evacuees of 2005*. Houston, TX.

Jonassen, W. (August 24, 2012). 7 Years after Katrina, New Orleans is overrun by wild dogs. *The Atlantic.* Retrieved September 28, 2015 from http://www.theatlantic.com/national/archive/2012/08/7-years-after-katrina-new-orleans-is-overrun-by-wild-dogs/261530/.

LeBeau, J. L. (2002). The impact of a hurricane on routine activities and on calls for police service: Charlotte, North Carolina, and Hurricane Hugo. *Crime Prevention & Community Safety, 4*(1), 53-64.

Leitner, M., & Helbich, M. (2011). The impact of hurricanes on crime: A spatio-temporal analysis in the City of Houston, Texas. *Cartography and Geographic Information Science*, 38(2), 213-221.

Lemieux, F. (2014). The impact of a natural disaster on altruistic nehaviour and crime. *Disasters, 38*(3), 483-499.

Linden, L., & Rockoff, J. E. (2008). Estimates of the impact of crime risk on property values from Megan's Laws. *The American Economic Review, 98*(3), 1103-1127.

Lipton, E. (2015). Key Documents Regarding Government Response to Hurricane Katrina. New York Times. Retrieved September 16, 2015 from http://www.nytimes.com/ref/national/nationalspecial/10katrina-docs.html?_r=0.

Lynch, A. K., & Rasmussen, D. W. (2001). Measuring the impact of crime on house prices. *Applied Economics, 33*(15), 1981-1989.

McCarthy, F. (2008). FEMA Disaster Housing and Hurricane Katrina: Overview, Analysis, and Congressional Issues (CRS Report for Congress No. RL34087) Congressional Research. file://max-fsrv.ad.syr.edu/lrealey$/Downloads/19938%20(1).pdf.

Moreno, S. (February 6, 2006). After welcoming evacuees, Houston handles spike in crime. Washington Post. Retrieved March 15, 2016 from http://www.washingtonpost.com/wp-dyn/content/article/2006/02/05/AR2006020500884.html. .

Moretti, E. (2011). Local Labor Markets. *Handbook of Labor Economics, 4*, 1237-1313.

National Conference of State Legislatures. (2013, January) Certificate of Need: State Health Laws and Programs (2013, January). Retrieved September 16, 2015 from http://www.ncsl.org/research/health/con-certificate-of-need-state-laws.aspx

National Home Builders' Association. Housing Seniors in LIHTC Properties. https://www.nahb.org/en/research/nahb-priorities/low-income-housing-tax-credit/housing-seniors-in-lihtc-properties.aspx. Retrieved April 22, 2016.

National Investment Center for Seniors Housing and Care. https://www.nic.org/nic-map/resource-center/glossary/

National Investment Center for Seniors Housing Supply Data 2006-2012.

National Real Estate Investor Special Informational Section. American Seniors Housing Association 50. (2013) Retrieved February 12, 2015 from https://www.seniorshousing.org/filephotos/Senior_Resources/2013_ASHA_50.pdf

Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica: Journal of the Econometric Society*, 1417-1426.

Nyman, J. (1994). The effects of market concentration and excess demand on the price of nursing home care. *The Journal of Industrial Economics*, 42(2), 193-204.

O'Regan, K. and Quigley, J. (2000). Federal policy and the rise of nonprofit housing providers. *Journal of Housing Research 11(2),* 297-317.

Passel, J., and Suro, R. (2005). Rise, peak, and decline: Trends in US. immigration 1992–2004. (No. 53). Washington DC: Pew Hispanic Center.

Plyer, A. (2015). Facts and Features: Katrina Impact. The Data Center. http://www.datacenterresearch.org/data-resources/katrina/facts-for-impact.

Raphael, S., & Winter-Ebmer, R. (2001). Identifying the effect of unemployment on crime. *Journal of Law and Economics*, 44(1), 259-283.

Ruggles, S., Genadek K., Goeken R., Grover J. and Sobek M. (2015). *Integrated Public Use Microdata Series: Version 6.0 [machine-readable database]*. Minneapolis, MN: University of Minnesota.

Sabia, J. (2008). There's no place like home: A hazard model analysis of aging in place among older homeowners in the PSID. *Research on Aging*, 30(1), 3-35.

Saiz, A. (2003). Room in the kitchen for the melting pot: Immigration and rental prices. *Review of Economics and Statistics, 85*(3), 502-521.

Saiz, A. (2007). Immigration and housing rents in American cities. *Journal of Urban Economics, 61*(2), 345-371.

Saiz, A. (2010). The geographic determinants of housing supply. *The Quarterly Journal of Economics, 125*(3), 1253-1296.

Sastry, N. and Gregory, J. (2014). The location of displaced New Orleans residents in the year after Hurricane Katrina. *Demography, 51*(3), 753-775.

Schmalensee, R. (1989). Inter-industry studies of structure and performance. *Handbook of Industrial Organization*, 2, 951-1009.

Settles, T., & Lindsay, B. R. (2011). Crime in Post-Katrina Houston: The effects of moral panic on emergency planning. *Disasters, 35*(1), 200-219.

Singh, V. and Zhu T. (2008). Pricing and market concentration in oligopoly markets. *Marketing Science* 27(6):1020-1035.

State of Illinois. (2005, Sept. 7). Illinois welcomes Hurricane Katrina evacuees; approximately 175 individuals receive medical care, housing tonight; Plane arrives in Metro East. Retrieved October 25, 2015, from http://www3.illinois.gov/PressReleases/

Stevenson, D.G. & Grabowski, D.C. (2010). Sizing up the market for assisted living. *Health Affairs*, 29(1), 35-43.

Susin, S. (2002). Rent vouchers and the price of low-income housing. *Journal of Public Economics, 83*(1), 109-152.

Thaler, R. (1978). A note on the value of crime control: Evidence from the property market. *Journal of Urban Economics, 5*(1), 137-145.

The Data Center. *Neighborhood data: Orleans parish > lower 9th ward district 8> lower ninth ward.* Retrieved October 27, 2015, from http://www.datacenterresearch.org/data-resources/neighborhood-data/district-8/lower-ninth-ward/

Turner, Allen. (August 21, 2015) Ten years later, Katrina Evacuees now part of Houston fabric. *Houston Chronicle.* Retrieved March 15, 2016 from http://www.houstonchronicle.com/news/houston-texas/houston/article/Ten-years-later-Katrina-evacuees-now-part-of-6458412.php. .

U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS). (2006). (Service Assessment). Service Assessment Hurricane Katrina August 23-31, 2005. Silver Spring, Maryland: http://www.nws.noaa.gov/om/assessments/pdfs/Katrina.pdf.

U.S. Department of Homeland Security. (2006). The Federal Response to Hurricane Katrina Lessons Learned. (White House Report). http://www.floods.org/PDF/Katrina_Lessons_Learned_0206.pdf.

U.S. Department of Homeland Security Office of Inspector General. (2006). A Performance Review of FEMA's Disaster Management Activities in Response to Hurricane Katrina. (No. OIG-06-32). https://www.oig.dhs.gov/assets/Mgmt/OIG_06-32_Mar06.pdf

U.S. Department of Housing and Urban Development Office Policy Development and Research. U.S. housing market conditions summary: Fair market rents. Retrieved October 29, 2015, from http://www.huduser.gov/periodicals/USHMC/winter98/summary-2.html

U.S. Department of Housing and Urban Development Office Policy HUD User. Housing Choice Vouchers Fact Sheet . Retrieved October, 28, 2015, from http://www.huduser.gov/portal/ushmc/home.html

U.S. Department of Housing and Urban Development Office Policy HUD User. HUD's Public Housing Program. Retrieved October, 28, 2015, from http://portal.hud.gov/hudportal/HUD?src=/topics/rental_assistance/phprog

U.S. Department of Justice. Herfindahl-Hirschman Index. Retrieved from http://www.justice.gov/atr/public/guidelines/hhi.html

United States Department of Justice, Federal Bureau of Investigation. (September 2012). *Crime in the United States, 2011*. http://www.ucrdatatool.gov/Search/Crime/Crime.cfm. Retrieved March 13, 2016.

Varano, S. P., Schafer, J. A., Cancino, J. M., Decker, S. H., & Greene, J. R. (2010). A tale of three cities: Crime and displacement after Hurricane Katrina. *Journal of Criminal Justice*, 38(1), 42-50.

Weiss, L. W. *Concentration and Price.* (Ed). (1989). MIT Press.

Zahran, S., Shelley, T. O., Peek, L., & Brody, S. D. (2009). Natural disasters and social order: Modeling crime outcomes in Florida. *International Journal of Mass Emergencies and Disasters, 27*(1), 26-52.

VITA
LARHONDA R. EALEY

422 Lodi St., #1
Syracuse, NY 13203

Phone: 315-382-7612
Email: lrealey@maxwell.syr.edu

DOCTORAL STUDIES

Syracuse University
PhD, Economics, Expected May 2016
DISSERATION: "Essays on the Economics of Rental Housing and Crime"

EDUCATION

B.A. Economics/ Minor: Accounting, *summa cum laude*, Tougaloo College, Jackson, MS, 2002

FIELDS

Public Finance, Urban Economics, Applied Microeconomics

TEACHING EXPERIENCE

Assistant Professor, Onondaga Community College, Syracuse, NY, 2011-2016
Courses: *Principles of Microeconomics, Principals of Macroeconomics*

Instructor, Onondaga Community College, Syracuse, NY, 2010-2011
Courses: *Principles of Microeconomics, Principals of Macroeconomics*
Instructor, Cazenovia College, Cazenovia, NY, 2008-2010
Courses: *Macroeconomics, Microeconomics*

Instructor, Syracuse University, Syracuse, NY, 2004-2008
Courses: *Economics for Managers (Masters), Economics Ideas and Issues, Intermediate Economics*

PROFESSIONAL EXPERIENCE

Associate Director, Jubilee Homes of Syracuse Inc., Syracuse, NY, 2007-2011
Jubilee Homes of Syracuse, Inc. is a not-for-profit community development organization whose mission is to revitalize Syracuse's urban communities through housing revitalization, business development, and youth development. As the associate director, I oversaw all agency grant-writing, spearheaded the development of Jubilee's sustainable agriculture and food security initiative, which focused on transforming vacant lots into thriving urban farms and community gardening spaces. I also worked with consultants and community stakeholders and successfully attracted private commercial development into the agency's target area. I interfaced with current and potential homeowners in the organizations' target area to address housing concerns and worked alongside the executive director to plan and implement the new construction and rehabilitation of residential properties. I prepared the organization's annual budget, supervised and

provided direction to the organization's youth programs' staff in the development, planning and implementation of the goals and objectives of numerous projects and initiatives, as well as approved time off requests for payroll purposes, and prepared employee performance evaluations.

Project Coordinator, Jubilee Homes of Syracuse Inc., Syracuse, NY 2004-2007
I wrote and managed program grants, supervised program staff, and developed curriculum to engage teens in entrepreneurship and self-development. I also interfaced with numerous community organizations including the local Workforce Investment Board, Cornell Cooperative Extension, SUNNY College of Environmental Science and Forestry, and local community centers to expand the program and develop plans for an urban farm project.

RESEARCH PAPERS

"The Impact of Migration on Rents: Evidence from Hurricane Katrina" (Job Market Paper)

"The Impact of Market Concentration on Senior Rental Housing"

"The Impact of Hurricane Katrina Evacuations on Crime"

RESEARCH IN PROGRESS

"The Supply of Fringe Banking Formation: Evidence from the Hurricane Katrina Evacuation"
A number of low and moderate-income families are unbanked and rely on fringe banking institutions for services, such as check cashing and pay-day lending. While the demographic characteristics and economic circumstances of households in this market have been widely documented, little is known about the supply of these of financial services. This paper uses the exogenous settlement patterns of Hurricane Katrina evacuees, who were primarily low-to-moderate income families, to destination counties as an exogenous increase in demand, with which to identify the supply of fringe banking services, using a rich panel set from the IRS on count-level migration, FEMA claims at the zip code level, and establishment-level financial services data from the National Establishment Time-Series (NETS) database.

CAMPUS SERVICE

Strategic Planning Taskforce Committee, Onondaga Community College
Diversity Council, Onondaga Community College
Student Orientation Work Group, Onondaga Community College

PROFESSIONAL AFFLIATIONS

American Economic Association
American Association of Women in Community Colleges
Syracuse Cooperative Federal Credit Union, Board of Directors 2014-Present

GRANTS AND FELLOWSHIPS:

Assessment Fellowship, Onondaga Community College, 2014
Future Professorate Fellowship, Syracuse University, 2005
African-American Studies Program Graduate Student Fellowship, Syracuse University, 2002
Economics Department Ph.D. Assistantship, Syracuse University, 2003-2008
American Economic Association Summer Minority Program, Summer 2001, Summer 2002

OTHER SKILLS

Data and Statistical Software Proficiency – Stata, R, Excel, Access
Geographic Information System Software Proficiency- MapInfo Professional
Other- Peachtree