

THE LOCATION OF GOVERNMENT-ASSISTED AFFORDABLE HOUSING:  
FACTORS INFLUENCING RECENT SITING OUTCOMES IN FLORIDA

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By

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ABSTRACT

This thesis builds on prior literature by examining the impact of various factors on the location of new privately-owned, publicly-subsidized affordable housing in Florida. This thesis reports the results of three probit models based on data from the Assisted Housing Inventory (AHI), a dataset compiled by the Florida Housing Data Clearinghouse (FHDC), and the 2000 Census. In particular, this thesis examines the relationship between renter households' rent burden and the location of affordable housing meant, at least in part, to address this need. Presently, this relationship is underdeveloped in the literature. The continued importance of neighborhood factors related to race, socioeconomic status, and urban ecology are considered, as they have been shown to be significant by prior literature.

The statistical models presented show that rental burden plays a smaller role in the location of new affordable housing relative to the other factors previously studied in the literature. This thesis also considers whether this mismatch is desirable as a matter of policies. In addressing these questions, this thesis presents correlations

between rental burden and other neighborhood factors, as preliminary descriptive statistics. These statistics and the results of the statistical models suggest that policies consciously designed to increase the amount of new affordable housing built in neighborhoods where a high percentage of renters experience a moderate rental burden may be warranted. Finally, further research into two topics is warranted to address this policy question: (1) The relationship between rental burden and affordable housing location; and, (2) The distribution of rental burden and the nature of neighborhoods with high rates of rental burden.

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## **Chapter 1. Introduction**

In the 1949 Housing Act, Congress set a national goal of achieving a “decent home and suitable living environment for every American family.” And since 1937, the federal government has provided subsidies for the production of housing that is affordable for those with lower income. (Jackson 1985; Mast 2009) With these subsidies, government assumed a role in determining the location of subsidized housing: first, deciding where housing for beneficiaries should be located directly; and later, approving private development applications including the site selected. Government’s authority over location raises the question whether government is meeting its responsibility to help, or at least not to harm, beneficiaries through these choices.

Historically, the location of subsidized affordable housing has been influenced by a number of factors, some of which—such as racial factors—are now illegal. Evidence suggests that the political strength of neighborhoods within their local jurisdiction, influenced by factors such as race and socioeconomic status, has played a role in the siting of some affordable housing: affordable housing is located in less powerful neighborhoods. Another theory suggests that affordable housing is sited in certain types of neighborhoods: those with aging housing stock of deteriorating value.

Despite this work, the literature has not sufficiently addressed the connection between the location of affordable housing and the need for affordable housing.

The location of affordable housing is important because residential location can significantly impact individuals' life outcomes. Studies have examined the effect of neighborhood characteristics on residents. (see Ellen & Turner 1997; Schwartz 2006: 169-73) These studies are relevant in particular to systematic efforts to improve outcomes for affordable housing beneficiaries by allowing these beneficiaries greater mobility. (Schwartz 2006: 169-73) For instance, because of the *Gautreaux* fair housing lawsuit, a mobility program was developed, in which Chicago public housing residents and those on the waiting list for public housing were given the option to accept vouchers allowing them to move to new neighborhoods. Studies of this program could thus compare a quasi-random sample of families moving out of inner-city neighborhoods. (Rosenbaum 1995) These studies found a set of important benefits for those moving to the suburbs compared with those moving to a different neighborhood in the city. (Ibid.) Newly-suburban adults experienced higher employment rates; newly-suburban children experienced statistically significant increases in college attendance rates; for those that did not attend college, children in the suburbs experienced higher full-time employment rates and wages. (Ibid.) On the other hand, the same studies found evidence of difficulty adjusting to suburban schools, with

higher dropout rates for children in suburban-moving families. (Ibid.) The generalizability of the results of these Gautreaux studies has been questioned (Popkin et al. 2000) and further research into mobility programs supports the conclusion that characteristics of families such as income, employment and education are more important than characteristics of neighborhoods. (Ellen & Turner 1997) Even so, “[t]he bulk of empirical evidence . . . suggests that neighborhoods matter.” (Ibid.: 848).

Unsurprisingly, the methods of providing housing assistance have varied over the decades. The federal government has used “essentially five types of subsidy: public housing, federally supported mortgages, Section 8 project-based subsidies, Section 8 certificates or vouchers [provided to individuals], and tax credit[s]” (Lento 2005). The empirical section of this thesis focuses on the location of privately-owned, publicly-assisted multifamily rental housing targeted to and designed to be affordable for low-income Americans. This category includes three of the five categories of federal aid above, namely subsidized mortgages; project-based subsidy through Section 8 and other programs; and tax credits through the low-income housing tax credit (“LIHTC”), which is the largest affordable housing production program in the country today. This category also includes housing subsidized through state and local programs, including direct grant programs and low-interest public bond financing. In each of the government programs listed above, private owners develop, manage, and site projects;

public actors provide financial subsidy, regulate, and in most cases approve or deny funding requests. Notably, this definition of affordable housing excludes housing that is affordable due in part to government subsidies but not targeted at low-income housing. To broaden the definition to publicly-subsidized, non-low-income housing would embrace the majority of primary residences owned rather than rented, which receive substantial subsidy through the income tax deduction for mortgage interest and other policies. (Schwartz 2006: 69-82; Carliner 1998)

## **Chapter 2. Theoretical Background**

A number of theories predict which characteristics of neighborhoods might influence the location of affordable housing. First, studies of the public housing program lend support to a “political economy” theory of affordable housing location, which theorizes that the political strength of neighborhoods determines whether affordable housing is excluded from these neighborhoods. (Rohe and Freeman 2001)

Public housing was the first major method of affordable housing finance. In this model, the federal government provided direct subsidies to agencies of local government—known as public housing agencies or PHAs—for the construction and operation of affordable housing. (Jackson 1985) Public housing was constructed in areas with lower property values and higher minority concentrations, and assignments to public housing developments were often made in a race-conscious manner. Schill and Wachter (1995) and Jackson (1985) recount ways in which federal and local law and practice led to these outcomes. Critically important, public housing was implemented through local public housing agencies (PHAs), with two important consequences. First, localities could opt to create a PHA, but did not need to; as a result of differences in local needs and federal rules, most PHAs were established in urban areas, and few rural or suburban areas established PHAs. (Jackson 1985: 224-28) Second, local control of site selection allowed for influence from local political concerns (Ibid.). Public and assisted

housing are disfavored land uses, and thus local politics led to siting of this housing in politically marginalized neighborhoods—those with disproportionately many poor and minority residents (Schill and Wachter 1995; Rohe and Freeman 2001 (collecting sources)). Further evidence of the racial bias in the siting of and admission to public housing was collected and relied upon by a series of successful lawsuits under the Fair Housing Act challenging this practice in various cities.<sup>1</sup>

In applying the theory of neighborhood political economy, “it is important to distinguish between assisted housing for families and for the elderly” (Rohe and Freeman 2001). Studies have shown that racial biases affecting the location of public housing influence the location of elderly housing less (Goering et al. 1997). A more recent study also found differences in the size and direction of the influence of various neighborhood characteristics in privately-owned assisted housing between housing dedicated to elderly residents and housing open to families (Rohe and Freeman 2001).

A second theory, “urban ecology,” purports to explain the siting patterns of most urban land use. In this theory, the location of a neighborhood within the

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<sup>1</sup> The first such case was *Gautreaux v. Chicago Housing Authority*, 296 F.Supp. 907, 908 (1969), in which the court held that the Chicago Housing Authority “chose sites for family public housing and adopted tenant assignment procedures [intending to] maintain[] existing patterns of residential separation of [the] races. . .” At least 20 of these cases have been brought successfully. Marcia Marker Feld discusses the analogous case in Yonkers, New York in “The Yonkers Case and Its Implications for the Teaching and Practice of Planning,” *Journal of Planning Education and Research*, vol.8, no.3, 169 (1989). For a list of recent similar cases—including a case involving Jacksonville, Florida decided in 2000—see Houk, Diane L. et. al., “Increasing Access to Low-Poverty Areas by Creating Mixed-Income Housing,” Fair Housing Justice Center, 60-64 (June 2007) available at [http://www.fairhousingjustice.org/ReportPage/Entire\\_Report.pdf](http://www.fairhousingjustice.org/ReportPage/Entire_Report.pdf).

metropolitan area is thought to predict the neighborhood's sociological characteristics and explain its "natural" land use. (see Sampson & Morenoff 1997; Rohe and Freeman 2001) If this theory is correct, aspects of a neighborhood's current land use should be useful in classifying that neighborhood and predicting its future sociology and land use, including the likelihood government-assisted housing will be built in the neighborhood. (Rohe and Freeman 2001) Useful predictive factors include the distance of a neighborhood from the center of the metropolis, the age of the building stock in the neighborhood, the relative prevalence of renters and homeowners, and the vacancy rate. (Ibid.)

In addition to these theories, while federal housing policy is explicitly responsive to the problem of affordability, locations of affordable housing may or may not be related to neighborhood affordable. Policymakers at all level or government, along with a host of private and charitable organizations, take the position that housing which is affordable costs a family less than 30% of household income. Households that pay 50% or more of their income for rent and utilities are generally considered severely burdened by the cost of unaffordable housing. (Habitat for Humanity 2006; Mast 2009) Despite the policy relationship between rent burden and affordable housing, studies on the siting trends of affordable housing have not examined whether

affordable housing is more or less likely to be constructed in neighborhoods where a high proportion of renters experience a high rent burden.

Prior studies also have not examined the characteristics of neighborhoods where rental burden is particularly high. These questions are related to existing policy. For instance, the rules of the LIHTC program provide developers an increased subsidy if they develop in census tracts known as “qualified census tracts” or QCTs (Oakley 2008). These tracts, designated by HUD, are “the lowest income tracts in a metropolitan area” (Ibid.). Exactly what impact encouraging development in these tracts has is unclear. Authors have examined the extent to which this policy may exacerbate the concentration of poverty (see McClure 2006, Oakley 2008). Less attention has been paid to the extent to which this policy may encourage the construction of affordable housing in neighborhoods with high rates of severe rent burden, thus providing a housing benefit without requiring disruption of renters’ existing social networks. The issue of whether affordable housing policy can encourage disruption of existing social networks among the poor has been studied most closely in the distinct context of the HOPE VI program, which funds redevelopment of public housing (see, for instance, Popkin et. al 2004). Ultimately, closer scrutiny of the distribution of severe rental burden could lead to recommendations for more effective policy. Although this is a complex issue, this thesis attempts to take a first step in

incorporating the study of rental burden into consideration of affordable housing's location.

Along with the theoretical issues described above, it is also unclear whether siting in the construction programs that succeeded public housing are racially biased in the same way public housing was. In contemporary construction programs, siting decisions are insulated from political economy in that they are made by private developers, though local or state agencies often retain the power to approve or deny critical subsidies (McClure 2006; Florida Housing Finance Corporation 2009). This could lead to a de-concentration of affordable housing from central cities to suburbs and rural areas. However, land use regulations in suburban and rural areas tend to be more restrictive of multifamily housing, the form which most affordable housing takes, which severely limits this potential for deconcentration (Pendall 2008).

Also, the racial aspect of public housing siting differs from that of other place-based assisted housing in at least two important respects. First, in the historic public housing context explicit racial policies differentiated between blacks and non-blacks. In the modern context, however, the illegality of explicit racial discrimination, the countervailing persistence of minorities' political marginalization, and more complicated racial demographics make the role of race less clear. Very few studies have looked at siting impacts on minorities other than African Americans (Rohe and

Freeman 2001). Second, an important political force leading to racialized siting decisions was the notion that the presence of minorities led neighborhoods to “turn over” or “decline” (Freeman and Rohe 2000; Rohe and Freeman 2001). The public’s acceptance of this notion has not disappeared, (Freeman and Rohe 2000) likely resulting in a similar impact of racial bias on the politics of assisted housing locations.

Thus, empirical questions about the trends in siting of affordable housing remain. In the past, racially motivated siting decisions have had adverse impact on marginalized social groups; whether this practice continues in a different form is of importance, particularly in cities with high proportions of Hispanic residents. Perhaps a reduction in the importance of race and poverty in siting decisions has led to an increase in the importance of factors predicted by the theory of urban ecology. And the relationship between rent burden and affordable housing is of particular relevance given the lack of empirical focus on this issue. The following review of the recent literature highlights the importance of further study of these questions.

### **Chapter 3. Review of the Literature**

A number of recent studies have addressed the question whether some or all of the neighborhood characteristics discussed above predict the location of privately-owned federally assisted housing. In the most rigorous study, Rohe and Freeman (2001) use logit regressions to identify neighborhood characteristics with power to predict the siting of federally-assisted affordable housing built in the 1980s. Three other studies present descriptive statistics of neighborhoods where LIHTC projects were built. These three studies vary somewhat in the timeframe analyzed and the comparisons drawn, but report similar neighborhood characteristics. Additionally, a number of studies have analyzed the location of LIHTC projects at the local level. Of these, a recent study (Oakley 2008) that uses OLS regression and spatial analysis techniques is worthy of special note.

#### **A. Rohe and Freeman (2001)**

Using multivariate regression analysis, Rohe and Freeman (2001) “assess[ed] the role of race and ethnicity in siting of affordable housing in the 1980s.” Their study uses national data on housing assisted under the public housing, Section 8 New Construction, FHA Multifamily and Section 236 programs. Their study also includes early data on the LIHTC program, which was established in 1986.

Rohe and Freeman estimate five separate logit models for different categories of assisted housing: family public housing, elderly public housing, other HUD-assisted family projects, other HUD-assisted elderly projects, and LIHTC projects. They analyze siting decisions based on neighborhood factors, using census tracts as their unit of analysis. In each logit model, the dependent variable is a bivariate variable equal to 1 if a subcategory of assisted housing was built in the census tract during the 1980's and 0 if not. Independent variables include a set of racial factors, a set of socioeconomic status factors, the tract's percent elderly population, and factors related to the urban ecology theory including distance from the central business district, proportion of housing built before 1950 and 1970, and the proportion of vacant units.

Rohe and Freeman's work suggests that the impact of race, once apparently a central factor, may have diminished by the 1980's. The study found the percent of African American population in a census tract was statistically significant only with respect to LIHTC properties. Significantly, the study did not find this variable statistically significant in the siting of any other type of assisted property, including both types of public housing. However, the study did find that an interaction variable between the percent of African American population and percentage of Hispanic population had a high degree of statistical significance for family public housing and other HUD-assisted family housing. The study also found, incidentally, that both

family and elderly public housing was less likely to be built in census tracts with Asian populations. Ultimately, the study's results on whether race persists as a determinant of siting decisions were mixed, but reflect the decline in the importance of race since the explicit and pervasive racial segregation common in the 1950's and 1960's.

Rohe and Freeman's study addressed other siting factors, as well. The study finds that percentage of the population in poverty and the percentage of population over 65 were significant factors in nearly all program types, but that median household income in the census tract generally is not—with the exception of LIHTC projects. Rohe and Freeman also found that neighborhood characteristics related to the theory of urban ecology were statistically significant. For both HUD-assisted family projects and LIHTC projects, housing prices, the tract's percentage of vacancies, the percentage of owned-occupied single-family homes, and the percentage of structures built before 1950 were all statistically significant factors.

#### B. Three National Descriptive LIHTC Studies

Three studies have described characteristics of the neighborhoods in which LIHTC projects are built. (Freeman 2004; McClure 2006; Climaco et al. 2009) These studies look at different time periods and compare neighborhoods where LIHTCs were

built to different groups of neighborhoods. Nevertheless, the studies reach similar conclusions.

Freeman (2004) used data on LIHTC projects built between 1990 and 2000, and compared the neighborhoods where LIHTC projects were built to the neighborhoods where two other types of project-based assisted housing (project based Section 8 and Section 236 projects) were built. McClure (2006) used a wider range of data, studying LIHTC projects built between 1987 and 2002. McClure compared LIHTC neighborhoods to the neighborhoods where recipients of Housing Choice Vouchers resided in 2002. Finally, Climaco et al. (2009) studied LIHTC projects built between 1995 and 2006, and compared LIHTC neighborhoods to the neighborhoods where all households and all rental households—including market-rate households—resided in 2000.

Despite these differences in timeframes and comparison neighborhoods, the studies' results were similar. Both Freeman and Climaco et al. found that LIHTC projects in the timeframes studies were more likely to be built in areas with higher rates of minority residents than projects generally. Both Freeman and McClure found that LIHTC neighborhoods were more likely to be suburban than other assisted projects. For example, Freeman found that 42% of LIHTC projects were built in suburban neighborhoods, compared to 24% of other federally-assisted project-based

units. And both McClure and Climaco et al. found that LIHTC projects were more likely to be located in neighborhoods with high poverty rates than a random distribution of rental units or than all rental households in 2000, respectively. At the same time, both Freeman and McClure found that suburban neighborhoods where LIHTC projects are located break this model. For instance, Freeman found that suburban neighborhoods where LIHTC projects were located were predominantly white, with higher median incomes, lower levels of poverty, and other strong housing characteristics.

These results suggest that race, poverty and distance from central cities continue to be important determinants of assisted housing siting, but that these influences are diminished in the context of the LIHTC program. The force of these results is, of course, limited by the lack of statistical rigor.

### C. Oakley (2008)

A recent study by Oakley (2008) analyzes the factors that determine the location of LIHTC units in four metropolitan areas: New York, Chicago, Atlanta, and Los Angeles. The study reports the results of two distinct analyses in addition to basic descriptive statistics. In the first, Oakley uses an Exploratory Spatial Data Analysis (ESDA) to relate locations of LIHTC project concentration to other locations of

interest, including the distribution of QCTs. In the second, Oakley uses two OLS models for each metropolitan area to analyze the impact of various factors on LIHTC siting.

The results of the ESDA analysis shows variation among the four metropolitan areas in the locational trends of LIHTC projects. Most interesting, Oakley's analysis shows that the degree of overlap between areas with concentrated LIHTC development and the location of QCTs ranges from a high rate of overlap in Chicago to a moderate rate of overlap in New York City and Los Angeles to a low rate of overlap in Atlanta. This implies that the location of QCTs can influence the siting of LIHTC projects, but that other factors may influence siting to a greater degree. At the same time, the ESDA analysis is explicitly exploratory; for instance, the percentage of LIHTC units captured by the ESDA models measure of spatial concentration varies by metropolitan region from a low of 16.6% to a high of 67%. Thus, the implications of this analysis are tentative.

Oakley's OLS models returned mixed results. Notably, models for three of the four metropolitan areas indicate that QCT status is a strong predictor for the location of LIHTC projects. Also, the models incorporate variables associated with both the political economy and urban ecology theories described above. On this score, the study's results vary. For instance, none of the racial variables included in this study are

statistically significant, except in Los Angeles where all racial variables are found to be statistically significant. The significance of variables including poverty rate, vacancy rate, unemployment rate, and median income also vary among metropolitan areas. At best, this study implies that the strongest indicators of affordable housing location vary from metropolitan area to metropolitan area.

#### D. Conclusion

Thus, prior studies explore the impact of racial factors, socioeconomic factors, and factors related to urban ecology in the location of affordable housing. However, the literature does not explore the potential importance of rental burden on siting. Specifically, these studies suggests that race plays an ongoing role in siting decisions even outside of the public housing context, though that role appears much smaller than the explicit discrimination of earlier decades. Also, socioeconomic factors such as poverty or age, and neighborhood characteristics such as vacancy rates and the balance between rented and owned homes, play a role in siting of affordable housing, especially that subsidized by the federal government but built by private developers. In the specific context of the LIHTC program, factors including race, poverty and distance from central cities continue to be important to affordable housing location, but these factors exert a diminished influence.

## **Chapter 4. Hypothesis and Conceptual Approach**

This thesis examines the factors that determine the location of privately-owned, federally assisted affordable housing using comprehensive data on the location of new affordable housing in Florida from 2000 to 2010. I examine a number of neighborhood demographic factors using statistical regression to compare their importance in predicting the location of affordable housing. These demographic factors fall into four broad categories: race; socio-economic status; urban ecology; and rent burden.

While race, socio-economic status, and urban ecology have been studied in prior work, the connection between the location of new affordable housing and neighborhood rent burden has not received focus. Locating housing in neighborhoods with high rates of undue rental burden would seem logical in light of the purpose of affordable housing. Empirical studies show that the lack of affordable housing is particularly acute for families with incomes below 60% of area median income. (see Schwartz 2006: 34-36) Even so, common approaches to describing housing affordability often overlook the spatial match between need and available affordable units. (Ibid: 36). Moreover, little public policy is aimed at directing new affordable housing to neighborhoods with high rental burdens. One exception is the subsidy boost in the LIHTC program for building in qualified census tracts (QCTs), discussed above, which may be related to rental burden. (see Climaco et al. 2009) My probit analysis

thus includes two variables related to the burden experienced by neighborhood renters residing in the neighborhood in 1999; the model investigates the role, if any, that this factor plays in predicting the location of affordable housing. I hypothesize that factors other than rental burden are more important to siting decisions than local housing need. I also describe the correlation between rental burden and other factors in the probit analysis, in a first step toward addressing the complex question of whether incentivizing the construction of new affordable housing in neighborhoods with relatively high rental burden would be helpful or harmful to beneficiaries.

Alongside rental burden, I include factors identified as important by prior studies. As described above, there is strong anecdotal and empirical support for the proposition that, historically, race has played a strong role in the siting of public housing. I hypothesize that race's impact on the siting of privately-owned affordable housing is smaller than for publicly-owned housing (public housing) because private owners are insulated from local politics. Race may continue to have explanatory power with respect to the location of affordable housing, however, because local governments continue to play a role in approving funding applications. Also, race may appear to have explanatory power, in part, because a neighborhood's racial composition is correlated with other variables likely to predict affordable housing location, such as

real estate values and median income. Thus, the included variables related socio-economic status serve as controls to isolate the effect of race.

I further hypothesize that the socio-economic factors related to political economy and identified in prior studies continue to predict affordable housing location today. As discussed, a neighborhood's poverty rate was a statistically significant explanatory factor in Rohe and Freeman's 2001 study, as was median household income for LIHTC projects. I thus include indicators of median household income and the percentage of poverty in the census tract, and I hypothesize that income is negatively correlated with affordable housing starts while poverty rate is positively correlated. My hypothesis is also supported by studies showing that socio-economic factors may also serve as proxies for other explanatory political factors unavailable in Census data. For instance, restrictive local land use rules are more common in suburbs (Shlay and Rossi 1981) where incomes are generally higher (Madden 2003) and PHAs are less common (Jackson 1985). Both land use rules and the lack of a local PHA can severely limit development of affordable housing. (see Jackson 1985: 224-28; HUD 2005)

The impact of urban ecology should remain unchanged between public and private siting decisions. Thus, I hypothesize that neighborhoods with older buildings and neighborhoods in urban areas are more likely to see new affordable housing starts.

Also, especially because the projects examined in this thesis are primarily rental projects, I expect the percentage of renters in a neighborhood to be positively correlated with affordable housing starts.

While these empirical questions have been partially addressed by other scholars, this thesis adds to the literature. First and most importantly, this thesis considers whether neighborhood need as expressed by current rental burden impacts the location of affordable housing and provides some general description of neighborhoods in Florida that experience high rental burden. Second, by using recent data from Florida, this thesis is able to complement prior research by examining: (1) more modern data, (2) in a state with a significant Hispanic population, (3) including not just national but local programs for housing assistance. Thus, this thesis's results should shed light on the validity of the theories described above in the evolving modern context.

## **Chapter 5. Data, Empirical Model, and Variables**

### **A. Sources of Data**

The data for this paper consists of information from 3,154 census tracts in the state of Florida. The dataset combines data from three publicly-available datasets.

Demographic data and general housing stock data were obtained from the 2000 United States Census. The 2000 Census was conducted by the Census Bureau, which is a part of the United States Department of Commerce. Census 2000 data were downloaded from the Census website.

Data on affordable housing was obtained from the Assisted Housing Inventory (AHI), a dataset compiled by the Florida Housing Data Clearinghouse (FHDC). FHDC is a joint project of the Shimberg Center for Housing Studies at the University of Florida and the National Low Income Housing Coalition. The AHI includes project-level data from a variety of sources on assisted housing production from the 1960's until today, including the Department of Housing and Urban Development, the Department of Agriculture Rural Development, the Florida Housing Finance Corporation and local housing finance authorities within the state. The AHI attempts to provide a comprehensive inventory of assisted housing in the state of Florida.

Finally, I computed a variable which estimates the rate of housing growth of a census tract. This variable was computed from the change in Census's estimates of total numbers of housing units in each Florida county from 2000 to 2008. This data is available through the U.S. Census Bureau's website on population estimates.

### B. Empirical Model

This thesis uses three probit models to examine how various factors influence the siting of government-assisted housing other than public housing. The dependent variable in each regression represents government-assisted projects built in Florida between 2000 and 2010 which were not public housing. The independent variables represent socioeconomic, racial, and relative rental cost characteristics of each census tract, along with a set of characteristics related to the theory of urban ecology described above. Finally, three control variables are included to account for differences in size and density of census tracts.

The probit model is most appropriate when the dependent variable is binary. Using an ordinary least squares ("OLS") model with a binary dependent variable, a linear probability model ("LPM"), would allow for the possibility of impossible predicted outcomes larger than 1 or smaller than 0. (Woolridge 2006) An LPM in a relatively unbalanced probit would also return biased coefficients because of the

serious violation of the OLS assumption of homoskedasticity. (Ibid.) A logistic regression model, such as a probit model, solves both of these problems. However, using a relatively unbalanced probit model does provide relatively low statistical power.

More generally, using a binary dependent variable is desirable. In order to use a continuous dependent variable representing the amount of affordable housing produced, an arbitrary decision whether to use number of projects, number of buildings, or number of units would be necessary. This arbitrary decision would undoubtedly affect the results, and thus the question of how likely affordable housing is to be built in a neighborhood is more amenable to study than how much may be built.

Also, the three probit models used in this thesis analyze the likelihood that affordable housing will be built in a neighborhood, given its characteristics reported in the 2000 Census. I use this model rather than year-by-year siting decisions for two reasons. First, data from the Census is more complete and therefore more reliable than similar yearly data in the American Communities Survey. Second, only the Census has the data on rental burden necessary to address related questions. Thus, the three probit models described in more detail below are the best model for this thesis given the limitations in available data.

In keeping with other similar studies, this thesis uses the Census 2000 census tract as the unit of analysis. While the concept of a neighborhood is complex, empirical literature often uses census tract as a proxy for neighborhood. (see Rohe and Freeman 2001) Information in the AHI is described at the project unit of analysis. The data includes project addresses. I added Census tract identifiers to the AHI data using the U.S. Bureau of the Census's online census tract search tool.<sup>2</sup> For projects that the online search tool did not identify, I identified the project location, where possible, using Google maps<sup>3</sup> and those locations were matched to census tracts on the U.S. Census Bureau's maps of census tract boundaries for the 2000 Census.<sup>4</sup>

### C. Dependent Variables

This thesis runs three probit regressions using three separate dependent variables. In the first model, the dependent variable is a binary variable representing whether an affordable housing project was built in the census tract between 2000 and 2010. The variable was constructed by determining the census tracts of all projects in the AHI dataset described above which were built between 2000 and 2010. Because not all projects reported a value for AHI dataset's variable *ApprxYrBlt*, missing data was filled in by using the value for *EarliestYrofFunding* when *ApprxYrBlt* was

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<sup>2</sup> [http://factfinder.census.gov/servlet/AGSGeoAddressServlet?\\_lang=en&\\_programYear=50&\\_treeId=420](http://factfinder.census.gov/servlet/AGSGeoAddressServlet?_lang=en&_programYear=50&_treeId=420)

<sup>3</sup> <http://maps.google.com>

<sup>4</sup> <http://www.census.gov/geo/www/maps/descriptwindows/outline.htm>

missing. For entries where both values were reported, they were generally the same or different by only one year, so substitution for missing values appeared warranted.

In the second model, the dependent variable is a binary variable representing whether an affordable housing project specifically designed to serve elderly tenants was built in the census tract between 2000 and 2010. This variable, *EldAffHsg*, was constructed using a field in the AHI dataset, *Population Served*, which describes any special populations the affordable housing was built to serve. *EldAffHsg* was set to 1 if the affordable housing built in that census tract between 2000 and 2010 had a value equal to or including “Elderly”; otherwise, *EldAffHsg* was set to 0. The census tracts in which *EldAffHsg* is equal to 1 thus represent a subset of the census tracts in which the dependent variable in the first model is equal to 1.

In the third model, the dependent variable—*FamAffHsg*—is a binary variable representing whether a non-elderly, or “family,” affordable housing project was built in the census tract between 2000 and 2010. Again, the *Population Served* field in the AHI dataset was used to create this variable. If a project was built in the census tract in the relevant time frame and that project did not have the text “Elderly” in the *Population Served* field, *FamAffHsg* was set equal to 1. For all other census tracts, *FamAffHsg* equals 0. Both the second and third models are included because, as described above, theorists speculate that elderly affordable housing projects are treated differently as a

matter of political economy. Thus, I hypothesize that the location of elderly developments are less dependent on racial and socioeconomic status factors and more dependent on other factors.

The number of observations in the category of elderly projects is much lower than the number of observations in the other categories of housing projects. For this reason, the model of elderly housing is less precise than the models with the two other dependent variables. Table 1 describes the percent of census tracts in which each type of affordable housing was built between 2000 and 2010.

**Table 1**

<b>Variable</b>	<b>Type of Housing</b>	<b>Percent Census Tracts in Which Housing Built*</b>
<i>AffHsg</i>	All assisted affordable housing	14.3%
<i>EldAffHsg</i>	Elderly housing	2.9%
<i>FamAffHsg</i>	Family / Non-elderly	12.5%

\*The sum of the percents of tracts in which elderly and family affordable housing was built (15.4%) is greater than the percent of tracts in which all assisted affordable housing was built (14.3%) because both types of affordable housing was built in some tracts.

n = 3,154

#### D. Socioeconomic Status Variable

Two variables related to socioeconomic status are included in the model. The first, *MedianIncome*, is equal to the median household income in the census tract in 1999 in nominal dollars. This variable is simply the 2000 Census variable *p053001* renamed. The second variable, *PercPoverty*, was calculated by dividing the population

in the census tract determined to be below the poverty line by the total population in the census tract for whom poverty status was determined, both as identified in the 2000 Census. Table 2 provides summary descriptive statistics relevant to these two variables.

**Table 2**

<b>Variable</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev.</b>
<i>MedianIncome</i>	\$7,595	\$200,001	\$41,377	\$37,462	\$17,529
<i>PercPoverty</i>	0.0%	76.8%	13.1%	9.9%	10.4%

n = 3,154 for *MedianIncome*, 3,148 for *PercPoverty*

E. Race variables

The percent of residents in a census tract self-identifying as a given racial or ethnic group was calculated by dividing the number of individuals identifying as members of that group by the total population of the tract. The resulting variables, *PercBlack*, *PercAsian*, *PercHispanic*, and *PercMR*, represent the percent of residents in a tract that identify as black, Asian, Hispanic, and multiracial, respectively. Table 3 summarizes these variables.

**Table 3**

<b>Variable</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev.</b>
<i>PercBlack</i>	0.0%	99.6%	15.3%	5.7%	22.8%
<i>PercAsian</i>	0.0%	20.6%	1.5%	1.0%	1.8%
<i>PercHispanic</i>	0.0%	95.2%	14.5%	6.6%	19.6%
<i>PercMR</i>	0.0%	26.3%	2.4%	2.0%	2.2%

n = 3,149

#### F. Rental burden variables

I computed three variables representing renter households' economic burden for rent. First, the total number of renter households paying between 30% and 49.99% of their income in rent was divided by the total number of renter households in the tract.<sup>5</sup> This variable, *PercModRentBurd*, represents the percent of renter households with a moderate (but nonetheless excessive) rent burden. Second, the total number of renter households paying more than 50% of their income in rent was divided by the total number of renter households in the tract. This percentage, represented by the variable named *PercRentHvyBurd*, represents the percent of renters with a severe rent burden. Finally, I calculated a third variable, *PercRentBurd*, by adding *PercRentModBurd* and *PercRentHvyBurd* together. Table 3 summarizes these variables.

**Table 4**

<b>Variable</b>	<b>Minimum</b>	<b>99<sup>th</sup></b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Dev.</b>
<i>PercRentModBurd</i>	0.0%	42.7%	100.0%	20.4%	8.2%
<i>PercRentHvyBurd</i>	0.0%	44.4%	72.8%	17.9%	9.3%
<i>PercRentBurd</i>	0.0%	67.3%	100.0%	38.3%	12.2%

n = 3,141

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<sup>5</sup> The variable denoting the total number of renters in the tract is available through the U.S. Census, and was used for computational purposes only. It does not appear in the regression.

### G. Urban ecology variables

The variable *PercRent* represents the percentage of renters in the tract. The percentage was derived by dividing the total number of renters by the total population of the tract. The variable *PercUrb* represents the percentage of the tract that is urban. The percentage was derived by dividing the urban population of the tract by the total population of the tract. For Census 2000, the Census Bureau designated areas as “urban” if they were either a census block or block group with a density of 1,000 persons per square mile or were a “surrounding” census block group with a density of more than 500 persons per square mile. In some additional cases, less densely populated areas are also designated as urban.<sup>6</sup> This variable is summarized in Table 5 below.

The regression also included the Census Bureau’s variable *h035001*, which represents the median year of construction of structures in the census tract. Two variables meant to indicate relative value of real estate in the census tract were included. First, *RentalMedianAsked* is a variable representing the median rent asked in specified vacant-for-rent units in the tract. This variable is taken directly from the 2000 Census (variable *h060001*, renamed for convenience). Second, *HomeownerMedianValue* is a variable representing the median value of specified owner-occupied housing in the tract. Again this variable is taken directly from the

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<sup>6</sup> [http://www.census.gov/geo/www/ua/ua\\_2k.html](http://www.census.gov/geo/www/ua/ua_2k.html)

2000 Census (variable *h076001*, renamed for convenience). Both variables appear to be capped, such that median tract rents asked cannot be reported at higher than \$2,001 and median owner-occupied housing value cannot be reported at higher than \$1,000,001.

Finally, a variable describing the total vacancy rate in the census tract is included. The variable, *VacancyRate*, was calculated from Census 2000 data by dividing the total number of vacant housing units in the census tract by the total number of units in the tract. Summary statistics for all urban ecology variables are provided in Table 5 below.

**Table 5**

<b>Variable</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Dev.</b>
<i>PercRent</i>	0.0%	86.9%	12.2%	8.2%
<i>PercUrb</i>	0.0%	100.0%	88.9%	26.3%
<i>H035001</i> *	1939	1999	1978	11.2
<i>RentalMedianAsked</i> *	\$0	\$2,001	\$536	\$345
<i>HomeownerMedianValue</i>	\$0	\$1,000,001	\$120,499	\$89,849
<i>VacancyRate</i> **	0.0%	82.8%	11.8%	10.0%

n = 3,149

\*n = 3,154

\*\*n=3,146

#### H. Census Tract Control Variables

Three variables were included to control for the size and density variations of census tracts. First, *TotHsg* was taken directly from the 2000 Census (variable *h005001*, renamed for convenience); this variable represents the total number of

housing units in the tract. Second, the Census Bureau's variable *arealand*, which represents the land area within the census tract in square meters, was used. To make the coefficient on *arealand* meaningful, the variable was scaled and *arealand2*, equal to the number of hundreds of million of square meters, was used in the regressions instead. For context, the median 2000 census tract in Florida was roughly five million square meters; the largest 2000 census tract in Florida was roughly 3 billion square meters.

Finally, a calculated variable, *CtyGrwth00\_08*, was included in the regression. This variable represents housing growth in the county from 2000 and 2008 in percentage terms.<sup>7</sup> *CtyGrwth00\_08* was calculated by subtracting the estimated total number of housing units in the county in 2008 from the total number of housing units in the county in 2000. This difference was then divided by the total number of housing units in the county in 2000 to establish the percentage growth of the tract in terms of housing units. The percentage was then applied to all tracts in the county. While this methodology is imprecise, the Census Bureau does not estimate figures for housing units at the tract level.

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<sup>7</sup> Note that Florida has 67 counties. Each county had between 2 and 348 census tracts in the 2000 Census; the median number of census tracts per county was 18 and the mean number of census tracts per county was 47.1. The census tracts were distributed across counties with a standard deviation of 74.8. Thirty counties, or about 45% of counties, had ten or fewer census tracts. Even so, only about 4.4% of census tracts were in counties with ten or fewer census tracts.

## **Chapter 6. Summary of Rent Burden Correlations**

As discussed, rental burden's relationship to affordable housing location is underdeveloped in the literature. In this Chapter, I discuss the correlations between the rental burden variables discussed above and the other variables included in the probit regressions. In general, there is a low degree of correlation between moderate rental burden and other variables, and a greater degree of correlation between severe rental burden and other variables. In particular, severe rental burden is highly correlated with poverty rate, median household income, percent of black residents, and percent of renters in the neighborhood. These high correlations between heavy rental burden and other potentially explanatory factors suggest that results in prior studies about factors correlated with housing location may, in fact, have been overlooking the impact of severe rental burdens on the location of affordable housing. Also, insofar as these correlations describe neighborhoods with high degrees of rental burden, they may have implications for whether policy should encourage or discourage locating affordable housing in such neighborhoods.

Notably, the variable for moderate rental burden (percent renters who spend 30% to 50% of income on rent) has a low correlation with the other variables included in the probit regressions. Moderate rental burden is correlated most closely with the

percent of residents who are urban ( $r = .214$ ), and in no other case is moderate rental burden correlated at a higher value than  $r = .122$ . For all other variables related to the theory of urban ecology, moderate rental burden is not highly correlated: moderate rental burden correlates positively with percent of residents who rent ( $r = .100$ ) and with the median rent asked ( $r = .060$ ) and negatively with the median value of owned homes ( $r = -.040$ ), vacancy rate ( $r = -.010$ ), and median age of structures ( $r = -.068$ ).

Moderate rental burden was also relatively uncorrelated with variables associated with the theory of political economy. The observed correlation between percent minority residents and moderate rental burden was positive and relatively small in all cases: the percent of black residents ( $r = .025$ ), the percent of Hispanic residents ( $r = .122$ ), the percent of Asian residents ( $r = .040$ ), and the percent of multiracial residents ( $r = .110$ ). Similarly, the observed correlation between moderate rental burden and socioeconomic status variables was relatively small. The correlation with poverty rate was positive ( $r = .040$ ), and the correlation with median household income was negative ( $r = -.089$ ).

Perhaps most interesting, the direction of correlation between variables and the rate of severe rental burden (percent renters who spend more than 50% of income on rent) was generally the same as the direction of correlation between variables and the rate of moderate rental burden, and the correlations were more pronounced. For nine of

eleven variables, the correlation was in the same direction and larger, with only two exceptions. In only one case, the percent of Asian residents in a neighborhood, the direction of correlation was reversed ( $r = -.028$  with rate of severe rental burden, compared with  $.040$  with rate of moderate rental burden). In the second case, the rate of vacancies, the magnitude of the correlation was reduced ( $r = -.011$ , compared with  $-.050$ ). In both cases, the difference was also relatively small.

For all other variables, the correlation was in the same direction and in some cases notably larger. For the five remaining variables associated with the theory of urban ecology, the correlations followed this pattern for those positively correlated—the percent of resident who are urban ( $r = .218$ , compared with  $.214$ ), percent of residents who rent ( $r = .232$ , compared with  $.100$ ) and the median rent asked ( $r = .119$ , compared with  $.060$ )—and for those negatively correlated: the median value of owned homes ( $r = -.057$ , compared with  $-.040$ ), and median age of structures ( $r = -.208$ , compared with  $-.068$ ). With the exception of the percent of Asian residents, racial variables also followed this pattern: percent of black residents ( $r = .234$ , compared with  $.025$ ), percent of Hispanic residents ( $r = .189$ , compared with  $.121$ ), and percent of multiracial residents ( $r = .132$ , compared with  $.110$ ). The two socioeconomic status variables also followed this pattern: a much higher degree of positive correlation was observed in the case of poverty ( $r = .339$ , compared with  $.040$ ), and a higher degree of

negative correlation was observed with median income ( $r = -.230$ , compared with  $-.089$ ). Table 6, below, summarizes the correlation between rental burden and other variables.

**Table 6: Correlation between Rental Burden and Other Variables**

	<i>Rate of Mod. Rental Burden</i>	<i>Rate of Severe Rental Burden</i>
<u>Urban Ecology Vars.</u>		
<i>PercRent</i>	.100	.232
<i>PercUrb</i>	.214	.218
<i>H035001</i>	-.068	-.208
<i>OwnedMedVal</i>	-.040	-.057
<i>RentMedAsked</i>	.060	.119
<i>VacancyRate</i>	.050	-.011
<u>Racial Vars.</u>		
<i>PercBlack</i>	.025	.234
<i>PercHispanic</i>	.121	.189
<i>PercAsian</i>	.040	-.028
<i>PercMR</i>	.110	.133
<u>SES Vars.</u>		
Median Income	-.089	-.229
PercPoverty	.040	.339

In sum, these correlations disclose a relatively high degree of correlation between, on the one hand, the percentage of renters who have a heavy rental burden, and on the other hand, factors that prior research has suggested impact the location of affordable housing, especially socioeconomic and certain urban ecology factors. This correlation suggests that prior research may have been overlooking the importance of a high degree of heavy rental burden in the siting of affordable housing. At the same time, prior research has identified sociological and political theories that support the

impact of race, socioeconomic status, and urban ecology on the siting of affordable housing. The theory, however, that the logical fit between beneficiaries of affordable housing programs and their location would be a major force in the location of affordable housing appears less forceful on its face than, for instance, the theory of political economy, which is backed up by the documented history of political marginalization of the poor and racial minorities and related fair housing lawsuits.

I must also, therefore, take seriously the possibility that this correlation is indicative of endogeneity resulting from simultaneity between the severe rental burden variable and other independent variables in the model. Endogeneity can arise when one independent variable is partially determined by one or more other independent variables. Here, a higher degree of heavy rental burden itself may be partially caused by factors related to urban ecology, race, and socioeconomic status. Unfortunately, as discussed in more detail in Chapter 8 below, severe rental burden likely is not highly correlated with factors useful for an instrumental variable model—which could control for this type of endogeneity—and, moreover, the datasets available to me do not contain such a variable.

As a matter of policy, the low correlation between moderate rental burden and other variables suggests that targeting subsidy program aimed at alleviating moderate rental burdens at neighborhoods with higher rates of moderate rental burden, or

allowing project owners to prefer current residents of the neighborhood, could allow beneficiaries to move into new projects, decrease their rental burden, and avoid disruption of social networks and loss of social capital. On the other hand, severe rental burden was correlated with variables, such as high poverty rates and low median household income, that suggest intentionally locating affordable housing in neighborhoods with a high rate of severe rental burden may not be beneficial for project residents. At the same time, the variable representing a high rate of severe rental burden is not perfectly correlated with any factor. This lack of perfect correlation suggests severe rental burden might be a more method of identifying high-need neighborhoods without using indicators of poverty or low median income, as is done with the current LIHTC policy of qualified census tracts (QCTs). All of these recommendations, of course, are necessarily tentative when based on the limited data analyzed above. Further analysis of data at national, state, and metropolitan levels may be warranted, and the ongoing 2010 Census will provide more current data, which would be a convenient resource for further research along these lines.

## **Chapter 7. Probit Regression Results and Interpretation**

The results of the probit models indicates that rates of rental burden play a small role in the location of new affordable housing, especially when compared to other factors previously examined in the literature. The models also partially confirm the results of prior studies with respect to the importance of factors related to race, socioeconomic status, and urban ecology.

The statistical significance of the rental burden variables presents a mixed picture. As to statistical significance, both variables generally are not statistically significant, except in Model 1, relating to all affordable housing, and Model 3, relating to only elderly housing. In these models, an increase in the percentage of renters with a moderate rental burden did increase the likelihood that affordable housing would be built in the census tract, though the relationship was statistically significant at only the 80% level. Also, the two rental burden variables were not jointly significant in any model. Chi square tests reported the joint probability that coefficients are equal to zero as 0.298 in Model 1, 0.505 in Model 2, and 0.300 in Model 3).

Even so, statistical significance may not be the strongest indicator of importance in relatively unbalanced probit models. Absolute values of coefficients must also be interpreted tentatively, particularly because they are sensitive to the scale

of the underlying variable. Taking this issue of scale into consideration, the absolute value of the coefficients on the two rental burden variables appear large in comparison to many of the other single variables in each of the models. In Model 3 related to elderly housing, for instance, the coefficient on the percentage of renters with a moderate rental burden is the third-largest reported coefficient. In Model 1, a one point change in the percentage of renters with a moderate rental burden has about the same absolute value coefficient as a change in median home values of \$1,000,000 (the entire range of the variable in the dataset), a change in median rent asked of \$1,000 per month, or a one point change in the percentage of renters. However, in Model 1 the coefficients on all the variables associated with racial composition are larger than the coefficients on either rental burden variables. Thus, the raw results of the probit model suggests that rental burden may be related to the location of affordable housing, but not in a highly significant way. These rough indications about the importance of rental burden are further explored below in an exploration of hypothetical neighborhoods.

Surprisingly, the variables related to racial characteristics of neighborhoods found a statistically significant relationship with respect to only black residents in Models 1 and 2. Also, the sign of the Hispanic race variable is positive, indicating that affordable housing may be more likely as the rate of Hispanic residents increases, but this result is not statistically significant. This suggests that, in recent years and in a

state with a large Hispanic population, racial disempowerment plays a relatively small role for Hispanics especially when compared to blacks, at least with respect to the issue of where affordable housing will be located.

Both socioeconomic status variables appear predictive of the location of affordable housing, particularly in Models 1 and 2 related to affordable housing generally and family affordable housing, respectively. As incomes increase and the poverty rate decreases, the probability that affordable housing will be sited in the neighborhood decreases. These effects were observed at the 95% confidence level in both Models 1 and 2. However, in Model 3 related to elderly affordable housing only median income was observed as statistically significant, and only at the 80% confidence level.

In general, these results on both racial and socioeconomic variables suggest support for the theory of political economy, in which less powerful neighborhoods receive unwanted land uses. They also suggest support for the theory that elderly affordable housing is seen as less undesirable, though the lack of statistical significance on the coefficients of these variables could also be due to the small number of census tracts where elderly housing was built.

Variables related to urban ecology were also interesting. As one example, the percentage of renters in a neighborhood has a high level of significance in both Models

1 and 2, but a very low degree of statistical significance in Model 3. Inversely, the percentage of residents who live in an urban area was only statistically significant in Model 3. The results of these three probit models are summarized in Table 7.

**Table 7**

Variable	<i>AffHsg</i>		<i>FamAffHsg</i>		<i>EldAffHsg</i>	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
<u>Racial Vars.</u>						
<i>PercBlack</i>	0.8160	<0.000**	0.7753	<0.000**	.3010	0.277
<i>PercHispanic</i>	0.0611	0.736	0.0375	0.842	0.1853	0.538
<i>PercAsian</i>	-1.2243	0.538	-0.2932	0.885	-2.8409	0.432
<i>PercMR</i>	1.4375	0.324	1.7489	0.238	-2.4910	0.352
<u>SES Vars.</u>						
Median Income <sup>†</sup>	-0.0116	0.008**	-0.0108	0.015**	-0.0124	0.193*
<i>PercPoverty</i>	1.0814	0.043**	1.1915	0.029**	.3750	0.671
<u>Urban Ecology</u>						
<i>PercRent</i>	0.5496	0.022*	0.4828	0.030**	0.1952	0.584
<i>PercUrb</i>	0.1275	0.452	0.1110	0.520	0.5555	0.125*
<i>H035001</i>	0.0179	<0.000*	0.0188	<0.000**	0.0092	0.138*
<i>OwnedMedVal</i>	-5.1 x 10 <sup>-7</sup>	0.427	-1.6 x 10 <sup>-7</sup>	0.800	-6.1 x 10 <sup>-6</sup>	0.005**
<i>RentMedAsked</i>	-0.0004	0.002**	-0.0004	0.003**	-0.0002	0.452
<i>VacancyRate</i>	-0.4299	0.297	-.4771	0.266	0.0855	0.901
<u>Rent Burden Vars.</u>						
<i>PercRentModBurd</i>	0.5495	0.191*	0.3110	0.479	1.1226	0.121*
<i>PercRentHvyBurd</i>	-0.2787	0.495	-0.3574	0.398	0.1627	0.817
<u>Control Vars.</u>						
<i>TotHsg</i>	0.0002	<0.000**	0.0002	<0.000**	0.0002	<0.00**
<i>arealand2</i>	-.0396	0.197*	-0.0321	0.283	-0.0186	0.778
<i>CtyGrwth00_08</i>	0.5349	0.034**	0.461	0.078**	0.6473	0.106*

n=3,141

\* statistical significance at or above 80%

\*\*statistical significance at or above 90%

<sup>†</sup>Reported coefficients multiplied by 1,000, approximating a \$1,000 change in household median income

For reference, I also ran each of these models again, substituting *PercRentBurd*, the combined rental burden variable, for the two separate rental burden variables used in the models discussed above. The results are relatively similar, suggesting that the separate models of rental burden provide a more detailed exploration of the impact of rental burden. In particular, the combined measure of rental burden was not statistically significant in any model, echoing the result of the joint probability test in the models where rental burden was considered as two distinct variables. The results of the models with a combined rental burden variable are presented in Table 8, below.

**Table 8**

Variable	<i>AffHsg</i>		<i>FamAffHsg</i>		<i>EldAffHsg</i>	
	Coeff.	P-value	Coeff.	P-value	Coeff.	P-value
<u>Racial Vars.</u>						
<i>PercBlack</i>	0.8138	<0.000**	0.7747	<0.000**	.2966	0.282
<i>PercHispanic</i>	0.0566	0.755	0.0353	0.851	0.1827	0.542
<i>PercAsian</i>	-1.2900	0.517	-0.3382	0.868	-2.9440	0.417
<i>PercMR</i>	1.5278	0.294	1.8098	0.222	-2.3307	0.381
<u>SES Vars.</u>						
Median Income <sup>†</sup>	-0.0114	0.009**	-0.0107	0.016**	-0.0122	0.201
<i>PercPoverty</i>	0.9345	0.074**	1.0720	0.045**	.2084	0.809
<u>Urban Ecology</u>						
<i>PercRent</i>	0.5204	0.015*	0.5027	0.023**	0.2199	0.534
<i>PercUrb</i>	0.1279	0.449	0.1125	0.514	0.5478	0.127*
<i>H035001</i>	0.0180	<0.000*	0.0189	<0.000**	0.0092	0.136*
<i>OwnedMedVal</i>	-5.3 x 10 <sup>-7</sup>	0.408	-1.8 x 10 <sup>-7</sup>	0.781	-6.2 x 10 <sup>-6</sup>	0.004**
<i>RentMedAsked</i>	-0.0004	0.002**	-0.0004	0.003**	-0.0002	0.386
<i>VacancyRate</i>	-0.4133	0.316	-.4637	0.280	0.1006	0.884
<u>Rent Burden Vars.</u>						
<i>PercRentBurd</i>	0.1140	0.713	-0.442	0.891	0.6101	0.261
<u>Control Vars.</u>						
<i>TotHsg</i>	0.0002	<0.000**	0.0002	<0.000**	0.0002	<0.00**
<i>arealand2</i>	-.0396	0.196*	-0.0321	0.282	-0.0190	0.773
<i>CtyGrwth00_08</i>	0.5458	0.030**	0.468	0.074**	0.6722	0.091**

n=3,141

\* statistical significance at or above 80%

\*\*statistical significance at or above 90%

<sup>†</sup>Reported coefficients multiplied by 1,000, approximating a \$1,000 change in household median income

Because variable coefficients in probit models are often difficult to conceptualize, I provide another perspective on these results by calculating the likelihood that affordable housing is located in a given census tract given different

values for different independent variables, essentially comparing two hypothetical neighborhoods. Specifically, Table 9 below reports the predicted probability for a Neighborhood, starting with all variables at their median value and varying the variables in certain variable categories either to the 25th percentile value observed or to the 75th percentile value observed. Because variables within categories have different signs, the highest and lowest values possible in varying a category of variables generally involved some variables held at the 25th percentile and some variables held at the 75th percentile, and vice versa. The differences reported thus describe the importance of varying the category of variables within its interquartile range.

**Table 9**

	<b>Category Low</b>	<b>Category High</b>	<b>Difference</b>
<i>Racial Vars.</i>	9.18%	12.73%	+3.55%
<i>SES Vars.</i>	7.56%	13.44%	+5.88%
<i>Urban Ecology Vars.</i>	5.66%	16.70%	+11.04%
<i>Rental Burden Vars.</i>	9.54%	10.99%	+1.45%

This analysis indicates that rental burden exerts a smaller influence on the location of affordable housing than factors related to other categories more extensive studies in the literature. As discussed more fully in Chapter 8, this result may indicate a need to consider policy changes to align more closely the affordable housing benefit and the group intended to benefit as a matter of geography.

Notably, both SES variables and urban ecology variables have a greater impact on probability of affordable housing siting than racial variables, indicating that race was also relatively unimportant in affordable housing siting in Florida in the past decade. Additionally, when the six variables in the racial and SES categories are taken together, they have less impact than the six variables in the urban ecology category. This lends support to the theory that neighborhood “type” is the main determinant of affordable housing siting. Even so, socioeconomic status of residents and race of residents appear to continue to play a role in determining siting.

## **Chapter 8. Limitations of the Model and Policy Implications**

The findings of this thesis present implications for policy as well as future research. In particular, policies aimed at increasing the amount of new affordable housing built in neighborhoods with high rates of moderate rental burden may be warranted. At the same time, the findings of this thesis are open to further refinement based on certain limitations in the model, discussed below. Further empirical investigation of the relationship between affordable housing location and rental burden is warranted.

### **A. Policy Implications**

Perhaps the most important finding of this thesis is the small independent effect that rental burden plays on affordable housing siting, especially when compared to a neighborhood's racial factors, socioeconomic factors, and factors related to urban ecology. This suggests that the logical connection between need and benefit is not reflected, at the neighborhood level, in the provision of the affordable housing benefit, at least not in new privately-owned, publicly assisted affordable housing. Admittedly, the geographic match between need and benefit would undoubtedly be stronger if analyzed at a larger geographic scale, such as the metropolitan area. But requiring

beneficiaries to move across a metropolitan area may lead to the disruption of their social networks in a similar way to the displacement caused, for some tenants, by HOPE VI redevelopment.

Policymakers should consider ways to strengthen the geographic relationship between new affordable housing and existing need. Specifically, encouraging new construction of affordable housing in neighborhoods with high levels of moderate rental burden could allow beneficiaries to participate in programs while minimizing the distance they must move and the resulting social disruption. The correlations described in Chapter 6 indicate that neighborhoods whose renters experience higher rates of moderate rental burden may not be, in general, neighborhoods that have high poverty rates or low median incomes. Thus, targeting new affordable housing production to these neighborhoods may also provide low-income beneficiaries from outside the neighborhood with an opportunity to move to neighborhoods that may impact residents positively. And the results of the three probit models presented above indicate that the rate of new affordable housing construction is not significantly higher in neighborhoods with high rates of moderate rental burden, all other factors being equal. This suggests that any policy intervention might have an impact on siting decisions.

On the other hand, targeting new production to neighborhoods whose renters experience high rental burdens may come with adverse consequences . The correlations

presented in Chapter 6 also indicate that neighborhoods in which residents have higher rates of renters with severe rental burdens are more likely to have high poverty rates, to have lower median incomes, to have higher concentrations of renters, and to have higher percentages of minority residents. These are neighborhoods in which any benefit conveyed to those renters who are able to keep social networks intact are likely offset by the negative impacts of the neighborhood for all assisted residents. These admittedly preliminary results suggest targeting new affordable housing production to neighborhoods with high rates of severe rental burden would be poor public policy. Further research into this and other related questions is warranted.

Finally, the results for other variables confirm findings in prior studies. For instance, the results related to racial variables show that the higher the percentage of black residents in a neighborhood, the greater the likelihood that new affordable housing will be built in these neighborhoods. This partially confirms the generalizability of the findings in Rohe and Freeman's 2001 study. Ongoing efforts to ensure affordable housing is built in a race-neutral manner are important and require ongoing effort. The results of this thesis indicate that the problems related to racially biased siting of affordable housing experienced in many cities may exist only to a lesser extent in Florida neighborhoods with higher percentages of Hispanic residents.

Also, the continued significance of income and poverty variables should give pause to policymakers and implementing agencies concerned with ensuring that affordable housing not reinforce existing concentrations of poverty.

#### B. Limitations of Correlations and Limitations of Probit Models

The results, analysis, and indications presented in this thesis are tentative and are limited by aspects of the statistical models and underlying data. First, the correlations presented in Chapter 6 provide only an introductory exploration of rental burden. As discussed in more detail below, rental burden itself is a complex concept that deserves study in its own right.

The correlations presented in Chapter 6 may serve as a first step in conceptualizing such a study. The data accessed through the 2000 Census allows this thesis to take a preliminary look at the relationship between high rental burden, generally, and other census tract characteristics. However, the primary policy issue is more specific: high rental burden experienced by those of lower income (see Schwartz 2006: 34-37). More targeted data would allow for a closer examination of this specific angle of the rental burden issue and more specific and practical insights.

As mentioned above, heteroskedasticity continues to present a problem even in a logistic regression model such as a probit, though the issue is much smaller than an LPM model and should not seriously bias the coefficients. (Woolridge 2006: 595)

Also, the unavailability of certain data may give rise to concerns related to omitted variable bias. For instance, no indicator of distance of census tracts from a metropolis's central business district was obtained, even though the urban ecology theory and prior research indicates that this variable may have some explanatory power (see Rohe and Freeman 2001). Similarly, inclusion of the level of zoning and regulatory impediments at the neighborhood level may be warranted, though no database appears to contain a variable operationalizing zoning and other regulatory impediments to affordable housing or rental housing construction comprehensively, and certainly not at the census tract level.

The probit models discussed in this thesis may also suffer from endogeneity between the variable related to severe rental burden—*PercRentHvyBurd*—and other independent variables in the model. An instrumental variable model can control for endogeneity and may be appropriate in future similar studies. Using this method to control for endogeneity in this case, however, is challenging because the percentage of residents with a severe rental burden in a given neighborhood is not a variable readily amenable to instrumentation. A good instrumenting variable must be correlated to the

problematic independent variable and uncorrelated with the errors in the model. Here, because of the complex causes both of the decisions about the location of affordable housing and of renters' situation in paying a high percentage of their income in rent, few if any variables uncorrelated with the error in the probit models described above or similar models would also be highly correlated with *PercRentHvyBurd*. Certainly the datasets available to me do not appear to contain such a variable. Further research on this point is necessary. In particular, in order to fully explore the relationship between rental burden and the location of affordable housing, researchers must study the causes of moderate and severe rental burden. Among the benefits of such research might be the identification or development of a variable useful for instrumenting a variable similar to *PercRentHvyBurd* used in this thesis.

## **Chapter 9. Conclusion**

This thesis builds on prior literature by examining the impact of various factors on the location of new privately-owned, publicly-subsidized affordable housing in Florida. In particular, this thesis examines the relationship between renter households' rent burden and the location of affordable housing meant, at least in part, to address this need. The statistical models presented show that rental burden plays only a small role in the location of new affordable housing, relative to other factors previously studied in the literature. This state of affairs may not be optimal, and policies designed to increase the match between need and benefit may be warranted, especially those consciously designed to increase the amount of new affordable housing built in neighborhoods where a high percentage of renters experience a moderate rental burden. Ultimately, further research into both the relationship between rental burden and affordable housing location and the nature of rental burden itself are warranted. Understanding this complex relationship more fully should help affordable housing policymakers provide more targeted and effective housing benefits to the nation's underhoused.

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