Understanding Residential Location Choices and Housing Search

by

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Abstract

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In this dissertation, two questions that relate to residential location choices and housing search are answered. For residential location choices, drawn upon the life course theory, residential self-selection was unpacked by examining the roles of involuntary past location experiences on later location choices. For housing search, drawn upon concepts of mental map and awareness space, the impacts of housing supply, households' preferences, and the use of different information channels as well as their interactions on the extent of a spatial search for housing were examined.

This research contributes to the existing literature by demonstrating a life-long, cumulative evolution of one's location preference and probing into the formation of a search space for housing. It also has practical significance—the insights gained from this research help us build better specified residential location choice models and construct more realistic choice sets of housing alternatives.

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CHAPTER 1 Introduction

Over the past several decades, sustainable development has become an overwhelming concern in our society. After the implementation of the Clean Air Act Amendments of 1991 and the Intermodal Surface Transportation Efficiency Act of 1990, states and metropolitan planning organizations (MPOs) have been given mandates to integrate land use, transportation, and environmental planning in their decision making processes. Transportation planners and modelers face the challenge of finding strategies to alleviate traffic congestion, while reducing air pollution and energy consumption. Transportation planning focus switched from adding capacity to reducing demand, or automobile usage (Weiner, 1997).

Particular attention is being paid to the possibility of designing policies on built environment to shape individual travel behavior and control aggregate level travel demand. The term "built environment" refers to the human-made physical surroundings that provide us the settings for our daily activities, such as land use. Many academic studies and policy evaluations have established the association between land use and travel behavior, with a central hypothesis that the built environment around one's residential location affects one's travel behavior (e.g., Handy, 1996; Kitamura et al., 1997; Krizek, 2003). These "new urbanism"(or "smart growth") concepts claim that land use policies that facilitate a built environment that is not car-dependent can lead to tangible reductions in motorized vehicle use (Transportation Research Board Conference Proceedings on Smart Growth and Transportation, 2005).

Investigating this land use and travel behavior association requires knowledge on how households choose to locate their residences (within an urban region). Many conceptual and empirical residential location choice models have been developed, most of which use discrete choice theory based on the concept of utility maximization (e.g., Ben-Akiva & Bowman, 1998; Bhat & Guo, 2007; Waddell, 1996). In economics, utility is used to measure customer satisfaction, referring to the total satisfaction received by a consumer from consuming a good or service. These studies have found that households' residential location decisions are influenced by three groups of factors: characteristics of the alternative housing units, built environment characteristics of the neighborhoods, and the household socio-economic status (SES) (Kim et al., 2005; Rouwendal & Nijkamp, 2004; Srour et al., 2002; Timmermans et al., 1996; Waddell, 1996).

Motivation

From an economic perspective, a location decision is likely the result of two forces acting together: households' preferences (demand perspective) and what is available on the housing market (supply perspective). Existing studies on residential location choice, although profound, are deficient on both perspectives. On one hand, people's preferences towards different neighborhoods is only explained by their current socio-economic status (SES)—how these preferences are formed or have evolved over time are almost completely ignored. On the other hand, all households are assumed to be able to choose any vacancy in any neighborhood—constraints from supply are ignored as well.

Formation of residential self-selection

The relationship between the built environment and travel behavior can be bi-directional. For instance, individuals who prefer non-motorized travel modes such as cycling may purposefully choose to live in neighborhoods with high accessibility to non-motorized transportation facilities. Residential self-selection refers to the process in which people self-sort into certain neighborhoods based on desired lifestyles. To a large extent, understanding why people have preferences toward different neighborhoods is similar to understanding how people form their residential self-selection.

Empirical studies have demonstrated the existence of residential self-selection, and succeeded in explaining how it relates to households' current SES (Cervero & Duncan, 2002; Chen et al., 2008; Giuliano & Small, 1993; Krizek, 2003; Mokhtarian & Cao, 2008). However, as the life course theory states: "Past is a prologue to present and future" (Shanahan et al. 2003; Elder and Shanahan 2006). Completely ignoring the past of the person(s) making a housing search decision, as most existing studies did, results in an incomplete and likely biased understanding of residential self-selection. Further, past is not just a single time point; it is a pattern of interaction between person and the social embedding he/she lives in over time that influences the person's later development in life, such as achievements and physical and psychological well-beings (Becker 1964; Wadsworth et al. 1999; VanLaningham et al. 2001). Likewise, in a residential location choice setting, one's preference towards different neighborhoods is likely influenced by one's life-long interaction with one's location experiences.

Housing search and a feasible choice set in a discrete choice model

A household's residential location decision is usually made after a searching process during which household members identify vacancies in the market and assign them utilities based on the members' preferences. As mentioned earlier, most existing residential location studies use discrete choice models. Their choice sets usually include all vacancies inside the study region. In other words, most existing studies assume all households know of all vacancies inside a study region and are able to choose any one of them. However in reality, the housing market is constrained and heterogeneous. Most people do not have the financial ability to afford any house they want. Besides, unlike most other commodities, housing vacancies vary dramatically from one to another on many different attributes. Scholars like Palm (1976) have hence emphasized the unique importance of information sources that households used to identify vacancies during a housing search.

Studies of housing search, most of which done by urban geographers, have already evidenced that households only search residences within a few neighborhoods (Aitken, 1987; Clark & Smith, 1982; Huff, 1986; McPeake, 1998). Housing alternatives that are outside these few neighborhoods or exceed the households' budget limits should not be included in the households' choice sets in discrete choice models.

The spatial extent of a housing search is used to measure the size of a union of all neighborhoods that a household searched in its location decision. Three important factors, household preference, market supply, and the information channels used have been distinctly studied and found relates to this spatial extent. However, very few studies are able to incorporate multiple factors together, not to mention to explore the interactions among them. Another criticism of these studies of

search extent is that they adopt a unitary household assumption—all members in a household act as if they are in complete agreement with each other during a search process.

Objectives

This dissertation aims at filling the gaps in our understanding about residential location choice and housing search. In the first part, the life course theory is adopted to examine the roles of involuntary past location experiences on later location choices. This part also examines whether the influence of a prior experience relates to its own properties, such as length of the experience, and whether it interacts with choice makers' current lifecycles. The second part of this dissertation looks at housing search and its spatial extent. Impacts of several factors, including agreement among household members, households' preferences, housing supply, and the use of different information channels, as well as their interactions, on the spatial extent of housing searches are examined.

Both of these two parts not only will increase our understanding about how people make decisions in residential location choice but also shed light on policy designing. Results from the first part will contribute to the existing literature by demonstrating a life-course evolution of one's spatial preference in a residential location choice context. The results from the second part will provide insights on generating more realistic choice sets for different types of households and probe into the spatial regularity of a search space. Additionally, they will provide practical suggestions for MPOs' work such as the development of an integrated land use and transportation model system and designing of travel surveys.

Dissertation Outline

The rest of the dissertation is organized as follows: In Chapter 2, an introduction and review of the existing studies related to the life course theory and relevant residential location choice studies is provided in section 2.1. It is followed by a discussion of the methodology and research hypotheses. The empirical dataset descriptions and modeling results are presented afterwards. A brief discussion (section 2.6) finishes Chapter 2. Chapter 3 starts with a review of the existing studies in search extent in section 3.1. This is followed by the theoretical framework and research hypotheses discussion, and then a description of the empirical dataset and presentation of the testing results. Chapter 4 includes a brief summary of the main findings from Chapters 2 and 3, and a discussion of their policy implications. Future research directions will also be discussed in this chapter.

CHAPTER 2 Decomposing residential self-selection via a life course perspective

2.1. Introduction

In the past two decades, there has been a surge in the number of empirical studies examining the built environment effect on travel behavior (Badoe & Miller, 2000; Bina et al., 2006; Chatman, 2003; Chen et al., 2008; Handy, 1996; Kitamura et al., 1997; Krizek, 2003; Miller & Ibrahim, 1998; Rodríguez & Joo, 2004). A central issue relates to the control of residential self-selection (Cervero & Duncan, 2002; Krizek, 2003; Mokhtarian & Cao, 2008). Residential self-selection refers to the process in which people self-sort into certain neighborhoods based on desired lifestyles. In other words, the relationship between the built environment and travel behavior can be bi-directional. The built environment effect on travel behavior must be identified after removing the reverse direction. While the existing literature clearly identifies residential self-selection, it has also found a significant role of the built environment on travel behavior, albeit small (Badoe & Miller, 2000; Chen et al., 2008; Giuliano & Small, 1993).

Though profound, the existing literature provides us little information relating to the formation of residential self-selection, for example, why people self-select into certain neighborhoods and what factors contribute to the selection process. This chapter will focus on decomposing residential self-selection, or understanding its formation process. Understanding this formation process not only directly contributes to the existing literature; but also has important implications

in policy—it will shed light on possible ways to influence people to develop residential self-selection towards socially desirable neighborhoods.

To some, understanding the formation of residential self-selection may be similar to answering the question: "what preferences do people have toward different neighborhoods?" To answer this question, an overwhelming majority of the existing studies point to the role of socio-economic and demographic characteristics (SES) (Bina et al., 2006; Clark & Withers, 1999; Kim et al., 2005; So et al., 2001). Lifecycle, representing a sequence of social roles assumed by people at different life stages, is probably the most profound variable identified to explain heterogeneity in residential location choices—singles value job accessibility over other attributes; families with school-age children stress school quality, open space, and safety (Ben-Akiva & Bowman, 1998; Bina et al., 2006; Clark & Withers, 1999; Kendig, 1984; Kim et al., 2005; Nechyba &Strauss, 1998).

Clearly, the role of SES is undisputable. Yet, SES, when taken of a cross-section of the population, ignores the past that led to the current state. In this dissertation, a life course perspective is used to understand the formation of residential self-selection, hypothesizing that past plays a critical role in understanding residential location choices. Though the life course perspective is more than half a century's work in sociology (Elder & Shanahan, 2006), it has only recently migrated into residential location studies. Recent studies suggest an adaptive pattern in location choices—people seek locations they are familiar with (ÆRØ, 2006; Chen et al., 2009). In particular, Chen et al. showed that one's location preference in the current choice can be explained by where one lived most recently.

Chen et al.'s findings toward our understanding the formation of residential self-selection are incomplete. In their work, only a single location—the most recent prior location, is used to represent the past. If the preference in the current choice is similar to that in the prior choice, one's location preference, in theory, could come from a self-selection process that was formed prior to moving to the most recent prior location, thus depleting the role of the most recent prior. The primary purpose of this chapter is to distinguish between prior location influence and residential self-selection and test the hypothesis that prior location influence precedes self-selection.

One may further argue that the magnitude of prior location influence is modified by its own properties: duration and recency of the prior stay. The assertion on duration and recency is motivated by findings in human memory, where the accuracy of retrieval is affected by the intensity and recency of the stimulation (Anderson, 1990; Anderson & Milson, 1989; Bahrick, 1979; Bahrick & Hall, 1991; Bjork & Whitten, 1974; Glenberg, 1976; Greene, 1987; MacKay, 1982).

The existing literature on residential mobility, migration, and location choice all demonstrate the role of family events such as the birth of a child. Chen et al. (2009) showed an interactive effect between prior location influence and presence of children. This dissertation also examines the differentials in prior location influence and duration and recency effects between child-bearing and non-child-bearing households.

The rest of the chapter is organized as follows. In Section 2.2, the pertinent literature in residential location choice is reviewed, particularly those studies relating to theories in life course and human memory. Section 2.3 presents the conceptual framework. The empirical dataset used for this chapter is described in Section 2.4, followed by the study set-up for each hypothesis and corresponding results in Section 2.5. The behavioral and policy implications are discussed in Section 2.6.

2.2. A life course perspective of residential location choices

The central theme of the decades-old life-course theory is: "Past is a prologue to present and future" (Elder & Shanahan, 2006; Shanahan et al., 2003). Past cannot be measured at a single time point; it must be understood as a pattern of the interaction between the context and the person to comprehend how the social embeddings of the individual influences one's human development later in life—including achievements, social involvements, and physical and psychological well-being (Becker, 1964; Elder & Shanahan, 2006; Shanahan et al., 2003; VanLaningham et al., 2001; Wadsworth et al., 1999). The life-course field offers abundant empirical evidence to support this theme, some of which involve migration and residential mobility (e.g., Kulu & Milewski, 2007). In these studies, the life course perspective is largely reduced to examining an important life event, such as the birth of a child (Courgeau, 1989; Sandfur & Scott, 1981). Studies find that migration rates differ by destination (Courgeau, 1989; Kulu, 2008; Lindgren, 2003; Sandfur & Scott, 1981)—the birth of a child significantly decreased the probability of moving to cities but slightly increased the probability of moving to rural areas.

In the literature on residential location choice, most of the studies are cross-sectional, assuming no past influence (Lerman, 1977; Parkes et al., 2002; Quigley, 1976; Segal, 1979). Prior location influence is only a recently-emerged concept. Instead of simply examining the effect of a family event on location choice, it postulates that experiences at prior locations can have an impact on later location choices. A biographical study on residential location decisions of 30 dual career households in UK (Green, 1997) reveals an accustomed attitude developed after being exposed to long commutes. One long-distance commuter commented: "I have got well adjusted to it now … For the work I do it is actually productive time" (p. 652). Another two-hour each way commuter stated: "I think it is part of the price living out here" (p. 652). ÆRØ (2006) termed "prior location influence" as "historical deposition" effect, which referred to the finding that people tend to move to residential districts that are similar to where they grew up. More recently, Chen et al. (2009) used the same terminology and demonstrated the historical deposition influence using the most recent prior location. They found that people become less sensitive after being exposed to a negative attribute (e.g., long commute) and more acquisitive after experiencing a positive attribute in a large amount (e.g., open space). They further argued that continuity is not guaranteed and the effect of prior location experiences can be interrupted by an important life event such as the birth of a child. Their results supported their hypothesis—with the same amount of prior exposure, households with children were found to attach weights of lesser magnitude than households with children on the four attributes examined: commute distance, accessibilities to open space, retail and recreational opportunities.

The life course literature, though powerful in theorizing and demonstrating the significance and relevance of a comprehensive life course perspective in analyzing residential decisions, does not

fully explain why and through what processes prior location experiences have an impact on later location choices. To explain the underlying process of the prior location influence, knowledge and findings in human memory are referenced here. In human memory research, it is believed that humans behave based on cues from the memory, which generally involves three processes: encoding, storage, and retrieval (Baddeley, 1966; 2001). Encoding and storage are for later retrieval and it is the accuracy of retrieval that establishes the linkage between past experiences and later choices. It is believed that the accuracy of retrieval is primarily characterized by two attributes: recency and frequency (Anderson, 1990; Anderson & Milson, 1989). Recency defines the time elapsed between the last time the information was retrieved and the time of the experiment; frequency measures the number of times one is exposed to a piece of information. In residential location choices, this piece of information may be interpreted as a particular land use configuration, for example, a place with many people or a location with a large amount of open space.

The few studies that examined the prior location influence on later location choices (ÆRØ, 2006; Chen et al., 2009; Green, 1997) mostly supported an adaptive behavior pattern—adjusting to the environment, liking it, and then purposefully selecting into such an environment. It is also possible that a particular prior location experience makes one dislike the configuration and avoids it in later choices. In the same study by Green (1997) that told stories supporting an adaptive behavior pattern, there was also a long distance commuter who resented the two-hour commute he had to endure each way and decided to change his residence. Clearly, the influence of prior location experiences can be either adaptive or variety-seeking. In other words, the same locational experience by different people or during different life periods may have diverging

effects. The human memory literature supports the period effect hypothesis—the accuracy of information retrieval varies with different life periods (Berntsen & Rubin, 2002; Rubin et al., 1986). More specifically, it is shown that adults are unable to remember the earliest few years of their childhood—a symptom of childhood amnesia (Rubin et al., 1986). There is also a bump associated with adolescence and early childhood—memories in adolescence and early childhood are remembered better than the more recent ones for adults over 50 years old.

2.3. Accounting for prior location experience

This chapter extends Chen et al. (2009)'s work and applies the random utility theory to analyze residential location choice. In random utility theory, the probability of choosing location j over other locations is equal to the probability that the total utility location j derives for a household is greater than that of other locations, or,

$\Pr[j] = \Pr\left[U_j \geq U_k\right], \forall j, k \in C$[1].

The total utility that location j derives can be decomposed into two components: systematic utility V_j and random error ε_j, or, $U_j = V_j + \varepsilon_j$. V_j can be specified as a linear function of a set of observed attributes x_l, weighed by corresponding β_l: $V_j = \sum_l \beta_l \times f(x_{j,l})$. In short, the dependent variable in a discrete choice model—the probability of a household choosing location j over other locations is a function of U_j, which is a linear function of location j's attributes, i.e., the independent variables.

[1] The notation for household is dropped in this chapter for simplicity.

It is proposed here that β_l changes as one's prior location experience changes. To account for prior location experience, β_l is expressed as:

$$\beta_l = \alpha_1 + \alpha_2 \frac{\partial f(x_{a,l})}{\partial x_{a,l}}, \quad (1)$$

where,

$x_{a,l}$ is the *l*th attribute for a household with prior location *a*,

β_l is the parameter of the *l*th attribute,

α_1 is the base parameter for β_l, and

α_2 is the adjustment parameter for β_l.

Function $f(x_{a,l})$ can be considered as a utility function. According to the law of diminishing marginal utility, $\partial f(x_{a,l})/\partial x_{a,l}$ decreases as $x_{a,l}$ increases—the additional weight coming from the prior location experience diminishes over the value of $x_{a,l}$. Thus, $f(x_{a,l})$ should be concave down. The logarithm function is used to capture the concave down property of $f(x_{a,l})$. The explanatory variables are adjusted by adding one to the *l*th attribute: $f(x_{a,l}) = \log(x_{a,l} + 1)$, to avoid taking the logarithm of zero. The logarithm function has three appealing features. First, when $x_{a,l}$ is zero, $f(x_{a,l})$ is zero as well. Second, $f(x_{a,l})$ is always non-negative, which is consistent with the fact that $x_{a,l}$ is always non-negative. Third, when $x_{a,l}$ increases, $f(x_{a,l})$ increases as well.

Combining with other neighborhood attributes (e.g., school quality), the final utility function of location j for a household with prior location *a* may be expressed as:

$$U_j = \beta_l f(x_{j.l}) + \sum_{m=1}^{M} \gamma_m f(x_{j,m}) + \varepsilon_j$$

$$= \left(\alpha_1 + \alpha_2 \frac{1}{x_{a,l}+1}\right) \log(x_j + 1) + \sum_{m=1}^{M} \gamma_m f(x_{j,m}) + \varepsilon_j, \quad (2)$$

where,

$x_{j,m}$ is the *m*th neighborhood attribute for location *j*, and

γ_m is the parameter for $x_{j,m}$.

Parameter α_1 in equation (2) reflects one's preference toward an attribute without accounting for the prior location influence. Parameter α_2 can be viewed as the adjustment factor, reflecting the modification in β_l resulting from the prior location experience. If either α_1 or α_2 is significant, it indicates the importance of the corresponding attribute in residential location decisions. The source of the impact, however, is different. If α_1 is significant but α_2 is not, it indicates a detachment from one's past—prior location does not play a role. If α_2 is significant but α_1 is not, it suggests a dominant role played by prior location experience. If both are significant, it suggests that a person's preference toward an attribute is modified by the prior location influence.

2.4. Data Source

The target population comprises all households who recently purchased a home and relocated to one of the four counties in the New York City Area: Manhattan, Queens, Nassau, and Suffolk between 2007 and 2009. Figure 1 shows these four counties (outlined by a black boundary). These four counties are selected because spatially, they form an imaginary line from Manhattan with an increasing distance. Manhattan has over 2 million jobs and is the most concentrated employment center in the region (U.S. Bureau of Labor Statistics, 2010).

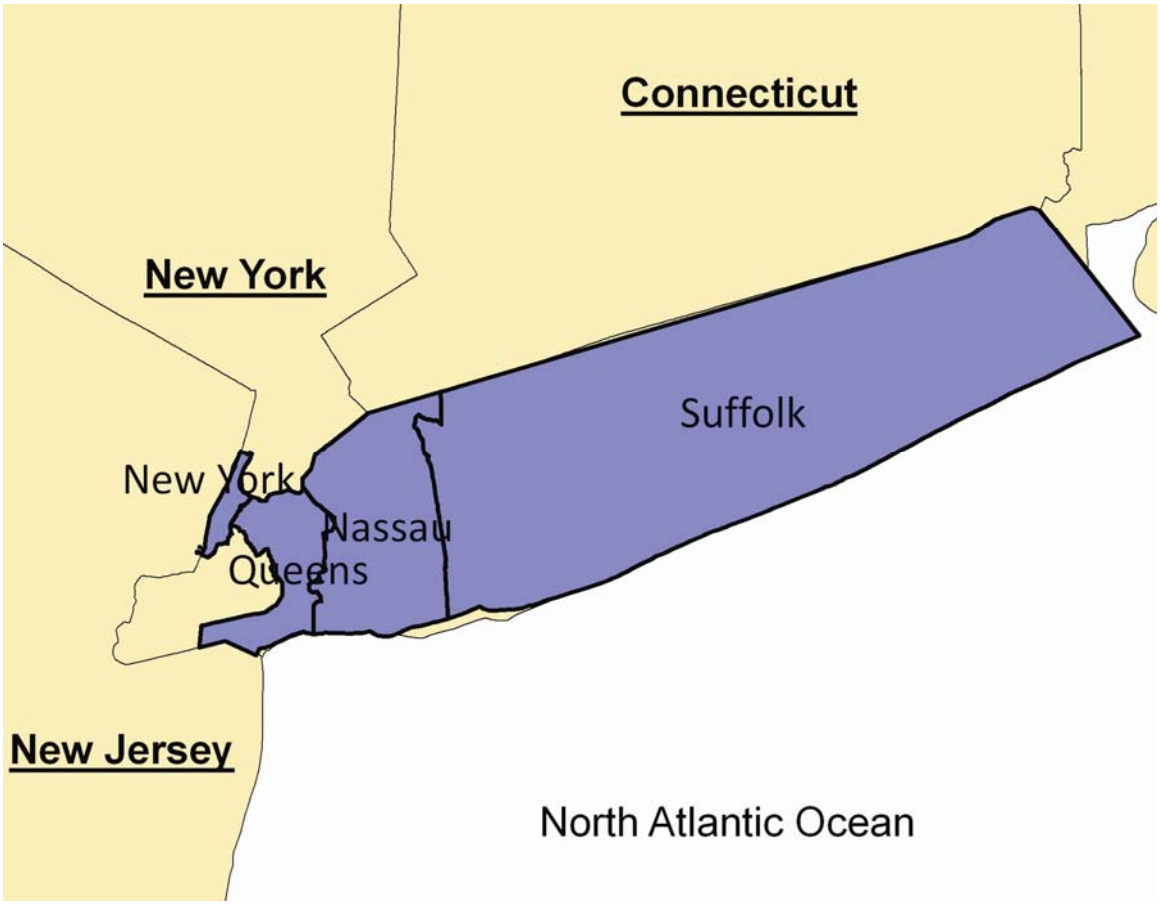


Figure 1 The Four Counties where Sample Subjects Relocated to between 2007 and 2009 (the four counties are outlined by a black boundary)

The average housing prices in these four counties are higher than most of the markets in the country. Between 2007 and 2009, the median sale prices for all housing units were about $1 million, $450,000, $450,000, and $350,000 in Manhattan, Queens, Nassau, and Suffolk respectively (Miller Saumel Inc., 2010). Similarly, household incomes in these four counties are also higher than the rest of the country. In 2007, the median household incomes of the

homebuyers were about $130,000, $71,000, $102,000, and $93,000 in the four counties respectively (US Census Bureau, 2007). To ensure that the selected households indeed had alternative locations to choose from in this high end housing market, two criteria in sampling were applied: 1) household must have an income of $50,000 or greater; and 2) home purchase amount must equal to or exceed $250,000. In addition, given that the criteria considered in a purchase for primary residence are likely different from those for other purposes, it is required that the purchase must be for primary residence only[2]. The data for the target population was purchased from two commercial companies (AccuData and Experian). A survey questionnaire was sent to these target population. Appendix 1 is a complete copy of the questionnaire used in the survey.

Both the mail-out mail-back and the web-based methods were used to administer the survey. After removing those records with duplicate or missing information, the final sample comprises 209 households who purchased a home for primary residence in the four-county region between 2007 and 2009, representing a response rate of about 5%[3].

In the questionnaire, four parts of information were solicited. In Part 1, respondents were asked about their prior residential location experiences. A total of three prior locations were inquired and they are the locations where the respondents lived the longest, the second longest, and the

[2] The original sampling design also tried to exclude single households because another motivation for this dissertation was to examine intra-household dynamics between the husband and the wife. Given the funding limitation, the final sample for homebuyers still has 14 single households with or without children.

[3] The response rate is lower than expected due to two suspected reasons: 1) the questionnaire was about 16 pages long and asked detailed questions about a person's prior locations and search history, requiring a significant amount of cognitive effort (Edwards et al., 2002; Kanuk and Berenson, 1975); and 2) historically, New York City has lower responses than other areas. For example, the response rate to the 2000 census for New York City is among the lowest in the nation (U.S. Census Bureau, 2004).

third longest. For each location, its address was obtained, along with other information, including the time period of the stay, the level of satisfaction while living there, the perceived level of crowdedness, the building height and the most frequently used mode of transportation during the stay. In Part 2, the respondents were asked about their current locations (the locations they just moved to) and their most recent prior locations. The addresses of both locations were obtained, along with other information including the primary reason of the move, the information sources used in finding this home, and the number of other alternatives searched before settling on the current home. Part 3 focused on the search process, in which respondents were asked to list up to three other neighborhoods[4] they seriously considered before deciding upon the current neighborhood. For each neighborhood, they were asked how they heard about the neighborhood, the period of the time they seriously considered it, how different this neighborhood was from their current chosen neighborhood, and why this neighborhood was later dropped from consideration. In Part 4, respondents' socio-demographic information was inquired, including age, gender, education levels, employment status, accessibility to personal vehicles, immigrant status, personality, and weekly time use patterns.

Among the 209 households, there are 100 married couples with children under 18 years old, 95 married couples without children, 2 single households with children, and 12 single households without children. About 160 households (77%) reported three prior locations, in addition to the most recent prior. For the location reported as having the longest duration, the average length of stay was 16 years. The total duration of all reported prior locations covered about 65% of

[4] Respondents were asked about the name of the neighborhood as well as zipcode, if they remembered.

subjects' life spans. Most have prior locations within the state of New York (70%). Out of the 209 households, 181 subjects[5] reported their growth period locations, locations prior to subjects' reaching 19 years old. Among them, 170 subjects belonged to married couple households, with about half (84) having children and another half (86) being childless. On average, they spent 12.7 years at their growth period locations, which are about 17.3 years from moving to the locations selected between 2007 and 2009. These 170 subjects constitute the sample used in this chapter.

Table 1 compares the socio-demographics of the study sample against the homeowners in the four counties. Both are married couple households. The study sample comprises households who purchased a home for primary residence between 2007 and 2009 and those in the four-county region are married couple households who owned a home in 2007. The study sample differs from the homeowners in the four counties in a few aspects. Households in the sample are smaller in size (2.88 vs. 3.22), are more likely to be White (78% vs. 74%) and male (57% vs. 50%), better educated (80% vs. 76% for college degrees), have fewer foreign-borns (20% vs. 31%), and have higher levels of household income (0% vs. 14% for households earning $50,000 or less).

[5]Respondents who completed our survey on behalf of their households.

Table 1 Descriptive Statistics of the Sample and the homeowners in Manhattan, Queens, Nassau, and Suffolk

SES Variables	Sample Subjects	Study Region*
Num. of Households	170	267,683
Percent of Homeowner	100	100
Percent of Married Couple Households	100	100
Percent of Married Couple with Children households (%)	49.41	48.45
Average Household Size	2.88	3.22
Average Age of Householder or Spouse	40.28	41.77
Percent of Ethnicity: White (%)	78.24	74.64
Percent of Ethnicity: Black (%)	4.71	7.73
Percent of Ethnicity: Asian (%)	10.59	10.66
Percent of Ethnicity: Hispanic (%)	4.70	5.47
Percent of Male (%)	57.06	50.00
Percent of Educational attainment Less than Bachelor's Degree (%)	19.53	23.24
Percent of Educational attainment Bachelor's Degree or Higher (%)	80.47	76.76
Percent of Foreign Born (%)	20.00	31.57
Household Income< $50k (%)	0.00	14.95
Household Income $ 50k- 75k (%)	21.37	15.21
Household Income $ 75k- 100k (%)	28.21	14.64
Household Income $100k-125k (%)	11.11	14.65
Household Income $125k-150k (%)	5.98	10.94
Household Income $150k-175k (%)	15.38	7.85
Household Income $175k-200k (%)	0.00	4.93
Household Income $200k-250k (%)	5.13	5.83
Household Income $250k+ (%)	12.82	11.00

* Data on married couple households who are homeowners in the four counties is obtained from American Community Survey (2007). Sampling weights are applied.

The study region for modeling is a seven-county region, including five counties in New York City (Manhattan, Queens, Brooklyn, Bronx, and Staten Island) and Nassau and Suffolk. Zip code is used as a measure for neighborhoods. A total of six zone-level attributes were incorporated in the study to capture the effects of housing, accessibility, and other neighborhood-level attributes. These attributes are: population density, school quality, housing price, network distance to the Central Business District (CBD), percentage of single family and town houses in the neighborhood, and accessibility to open space. Housing price is the average price per room (in 10^3 dollars) calculated from the Census data of 2000[6]. School quality was measured by the percentage of grade 3-8 students who passed level 3 or above on ELA (English Language and Arts) and Math tests in 2007. This data was obtained from New York State Department of Education (New York State Department of Education, 2007). Percentage of single family or town houses is the percentage of residential units that are houses (not apartments) out of all residential units in a neighborhood, using parcel land use data obtained from NYS Office of Real Property Services (New York State Office of Real Property Services, 2008) and NYC Department of Planning (New York City Department of Planning, 2005). Accessibility to open space was calculated using the gravity-based formula, which is the sum of the area size of each facility (park or playground) divided by the street network distance from the facility to a neighborhood centroid. Street network distances were calculated using the Lion Street Database obtained from NYC Department of Planning (New York City Department of Planning, 2005).

[6]It was calculated by dividing the aggregated price by aggregated number of rooms.

2.5. Study Set-up and Results

2.5.1. Prior Location Influence vs. Residential Self-Selection

The use of a single prior location in Chen et al. (2009)'s study makes it hard to conclude that the adaptive behavior identified in their study indeed resulted from the prior location influence, since a pattern of consistently looking for a familiar environment is a prominent trait of residential self-selection. To distinguish between prior location influence and residential self-selection, the influence of the growth period location on the locations which were selected during the 2007-2009 period was examined. Residential locations prior to subjects' reaching 19 years old[7] are most likely involuntary locations not selected by themselves, but by their parents. It is hypothesized that involuntary residential locations experienced early in life can have a lasting effect on people's location preferences later in life. If true, it suggests that the prior location influence precedes residential self-selection—since subjects did not select their childhood locations, the influence exerted from their childhood location experiences cannot be from their self-selection, which, for most people, starts after they become adults and make their own location choices. The utility function to distinguish between prior location influence and self-selection while incorporating other neighborhood attributes may be written as follows:

$$U_j = \left(\alpha_1 + \alpha_2 \frac{1}{x_g+1}\right) \times \log(x_j + 1) + \gamma_1 x_{j,d} + \gamma_2 x_{j,sq} + \gamma_3 x_{j,os} + \gamma_4 x_{j,hp} + \gamma_5 x_{j,st} + \varepsilon_j, \quad (3)$$

[7]I also examined the influence of the growth period locations that subjects stayed at prior to their reaching 14 years old (teenage). The results are very similar to those shown in Table 2 and thus are not shown in the dissertation. Interested faculty members may obtain the results from me.

where, x_g and x_j are population densities of the growth period location and *j*th location during the 2007-2009 period, $x_{j,d}$ is the distance to CBD from *j*th location, $x_{j,sq}$ is the school quality of *j*th location, $x_{j,os}$ is the accessibility to open space for *j*th location, $x_{j,hp}$ is the average housing price at *j*th location, and $x_{j,st}$ is the percentage of single family and town houses at *j*th location.

In Equation (3), the prior location influence is only examined on population density due to the unavailability of historical records on other attributes—the growth period locations dated, on average, 17.3 years ago and population density is one of the few (if not the only) piece of information that can be obtained for past years. This, however, will not affect the validity of the study results for three reasons. First, effects that cannot be captured by population density are likely captured by the other five neighborhood-level attributes. Second, even though population density is only one dimension of the built environment (Cervero & Kockelman, 1997), it is usually correlated with variables measuring other dimensions, such as accessibility. Using the 2005 land use data for the region, the correlation tests show that population density is significantly correlated with accessibility to recreational opportunities (0.47), accessibility to open space (0.44), and accessibility to retail opportunities (0.67). Third, the population density variable is used to illustrate in this dissertation that prior location influence precedes residential self-selection. Hereby, the interpretation of the study results is largely limited to population density and not examining the prior location influence on other variables does not affect the study results.

α_2 is the adjustment parameter identifying the potential influence of the growth period location in the location choices made during the 2007-2009 period. If α_2 is significant, it supports the

hypothesis that involuntary locations experienced early in life can have a lasting impact on later choices and suggests that prior location influence precedes residential self-selection, indirectly supporting that prior location influence contributes to the formation of residential self-selection.

To distinguish between child-bearing and non-child-bearing households, equation (3) is further revised as follows:

$$U_j = \left(\alpha_{1c} + \alpha_{2c}\frac{1}{x_g+1}\right) I(child)\log(x_j+1) + \left(\alpha_{1nc} + \alpha_{2nc}\frac{1}{x_g+1}\right)[1-I(child)]\log(x_j+1) + \gamma_{1c}I(child)x_{j,d} + \gamma_{1nc}[1-I(child)]x_{j,d} + \gamma_{2c}I(child)x_{j,sq} + \gamma_{2nc}[1-I(child)]x_{j,sq} + \gamma_{3c}I(child)x_{j,os} + \gamma_{3nc}[1-I(child)]x_{j,os} + \gamma_4 x_{j,hp} + \gamma_5 x_{j,st} + \varepsilon_j, \quad (4)$$

where, I(child) is an indicator variable that is equal to 1 for child-bearing households (households with children under 18 years old) and 0 otherwise. Sets of parameters (γ_{1c}, γ_{1nc}), (γ_{2c}, γ_{2nc}), and (γ_{3c}, γ_{3nc}) are associated with distance to CBD, school quality, and accessibility to open space for child-bearing and non-child-bearing households respectively. γ_4 and γ_5 are parameters for housing price and percentage of single family and town houses in a neighborhood[8]. Parameters of the interest are α_{1c}, α_{2c}, α_{1nc}, and α_{2nc}, which are the base and adjustment parameters associated with population density for child-bearing households and non-child-bearing households respectively. The contrast between (α_{1c}, α_{2c}) and (α_{1nc},

[8]It is not distinguished between child-bearing and non-child-bearing households for these two factors. This is because test results show similar preferences for the two variables.

α_{2nc}) shows the differential effects that the same prior location experience exerts on child-bearing and non-child-bearing households.

The estimation results of equation (3) (Model 1 in Table 2) show that both α_1 and α_2 are significant at 5% level, supporting the hypothesis that involuntary locations experienced early in life can have a lasting impact on one's later location preferences. Among the other variables, housing price and distance to CBD are not significant. Everything else being equal, neighborhoods with better schools, more open space, and a higher percentage of single family and town houses are valued more than others. The last variable likely captures the design effect of the built environment (Cervero & Kockelman, 1997)—many of the single family and town houses in the study region were built around 1900s and thus neighborhoods with more of them have a unique historic appeal.

Table 2 Coefficients and Standard Errors (in parenthesis) Showing the Influence of Growth Period Locations on Residential Location Choices[1] Made between 2007 and 2009[2]

	Prior Location Effect			Duration & Recency Effects		
	Model 1	Model 2		Model 3	Model 4	
Variables		Child-bearing	Non-child-bearing		Child-bearing	Non-child-bearing
Population Density (2007-09 Period) (10^3/sq. mile)						
α1 (Base: 2007-09 Period)	0.77 (0.14)	1.03 (0.23)	1.12 (0.32)	0.83 (0.24)	0.63 (0.31)	0.80 (0.40)
α2 (Adjustment: Growth Period)	0.87 (0.16)	0.65 (0.31)	0.84 (0.40)	0.98 (0.27)	2.04 (0.87)	2.35 (1.00)
α3 (Duration Effect)				0.73 (0.37)	1.52 (0.64)	1.11 (0.47)
α4 (Recency Effect)				-0.52 (0.24)	-1.38 (0.55)	-0.98 (0.45)
Housing Price ($\$10^3$)	0.21* (0.25)	0.27* (0.26)		0.13* (0.27)	0.05* (0.27)	
School Quality	3.06 (0.71)	3.60 (0.99)	2.64 (0.93)	2.95 (0.72)	3.44 (0.99)	3.06 (0.71)
% of Single Family/Town Houses (%)	1.94 (0.67)	2.12 (0.69)		2.57 (0.73)	2.55 (0.72)	
Distance to CBD (Miles)	-0.36* (0.21)	-0.40* (0.29)	-0.53* (0.28)	-0.63 (0.23)	-0.51* (0.29)	-0.68 (0.29)
Accessibility to Open Space (Sq. Miles/Miles)	1.16 (0.44)	1.85 (0.64)	0.86* (0.61)	1.45 (0.45)	1.97 (0.64)	0.79* (0.61)
Sample Size	170	170		170	170	
Log-Likelihood	-917.4	-916.1		-911.3	-906.9	

1Dependent variables: probabilities of choosing location j.
2Growth period locations: locations prior to subjects' reaching 19 years old.
*: Variables not statistically significant at 5% level.

Mode 2 in Table 2 shows the estimation results of equation (4), which distinguishes between child-bearing and non-child-bearing households. As expected, child-bearing households value school quality and accessibility to open space more than non-child-bearing households.

The estimates of all four parameters associated with population density (α_{1c}, α_{2c}, α_{1nc}, and α_{2nc}) are positive and significant, an expected result suggesting that in general, areas with more population are preferred than those with few people (Abraham & Hunt, 1997). This finding may be related to the fact that metropolitan areas are more populated than rural areas due to the range of opportunities and amenities they offer and population density is likely acting as a proxy variable for a number of amenities that people look for in residential location choices. A closer examination reveals that the adjustment parameter for non-child-bearing households (0.84) is greater than that for child-bearing households (0.65), signaling a larger prior location influence for the former.

Figure 2 illustrates the effect of population density experienced at the growth period location on the preference for locations selected during the 2007-2009 period (on average, 17.3 years later). The horizontal line represents the coefficient when the model is estimated without any prior location influence. The other three curves show the prior location influence—two for child-bearing and non-child-bearing households (equation 4), respectively, and the other for the combined sample (equation 3). Three observations can be made from Figure 2. First, the prior location influence is clear, especially for those who lived in low density while growing up. Second, Figure 2 exhibits the variety-seeking behavior—those who experienced low density during their growth periods sought higher-density locations and vice versa. Third, at all values of

prior population density, non-child-bearing households value density more than child-bearing households, which is consistent with Chen et al. (2009) and is also in line with findings that households with children value open space and are more likely to move to less-dense areas (Clark & Ware, 1997; Krizek, 2003;Nechyba & Strauss, 1998).

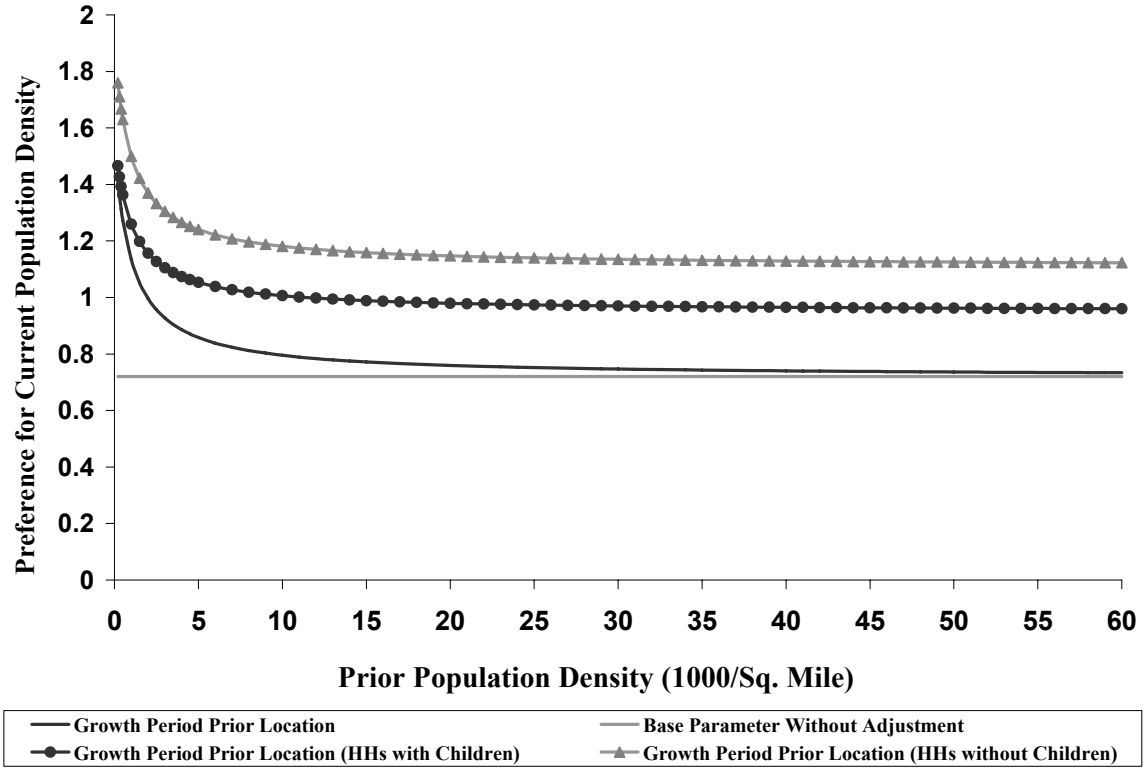


Figure 2 Effects of Growth Period Location on the 2007-09 Period Location Choice

Over the past several decades, population density has significantly increased in many US areas. One may concern that the observed variety-seeking behavior associated with the growth period could be just a reflection of the trend. To ascertain that the identified prior location effect is not

merely a reflection of the trend, two clusters of subjects lived in either high or low density areas during growth period were identified and variety-seeking pattern was confirmed on both groups. This part of result is not included in table 2 because some subjects with middle range prior population densities are excluded. Detail results are included in Appendix 2.

2.5.2. Duration and recency of the stay

Not all locations experienced are the same—the effect that a prior location exerts can be modified by its own properties such as the duration and recency of the prior stay. While the definition of recency is consistent, the duration variable is modified from the frequency concept in human memory literature (Anderson, 1990; Anderson & Milson, 1989). The length of the prior stay indirectly measures the number of times a person is exposed to a particular land use configuration, for example, a dense location. Longer duration or shorter recency is expected to strengthen the prior location influence. To understand how duration and recency may modify prior location influence, equation 3 is modified as follows:

$$U_j = \left(\alpha_1 + \alpha_2 \frac{1}{x_g+1} + \alpha_3 \frac{1}{x_g+1} W_g + \alpha_4 \frac{1}{x_g+1} Z_g\right) \times \log(x_j + 1) + \gamma_1 x_{j,d} + \gamma_2 x_{j,sq} + \gamma_3 x_{j,os} + \gamma_4 x_{j,hp} + \gamma_5 x_{j,st} + \varepsilon_j, \quad (5)$$

where, w_g and z_g refer to the duration and the recency of the stay at the growth period location. If the hypothesis were true, α_3 and α_4 would be significant. In particular, it is expected that α_3 to be positive—the longer the stay, the larger the prior location influence—and α_4 to be negative—the more recent the stay, the larger the effect.

Equation (4) may also be modified to show the differential effects for child-bearing and non-child-bearing households:

$$U_j = \left(\alpha_{1c} + \alpha_{2c}\frac{1}{x_g+1} + \alpha_{3c}\frac{1}{x_g+1}W_g + \alpha_{4c}\frac{1}{x_g+1}Z_g\right) I(child)\log(x_j+1) +$$

$$\left(\alpha_{1nc} + \alpha_{2nc}\frac{1}{x_g+1} + \alpha_{3nc}\frac{1}{x_g+1}W_g + \alpha_{4nc}\frac{1}{x_g+1}Z_g\right)[1 - I(child)]\log(x_j+1) +$$

$$\gamma_{1c}I(child)x_{j,d} + \gamma_{1nc}[1 - I(child)]x_{j,d} + \gamma_{2c}I(child)x_{j,sq} + \gamma_{2nc}[1 - I(child)]x_{j,sq} +$$

$$\gamma_{3c}I(child)x_{j,os} + \gamma_{3nc}[1 - I(child)]x_{j,os} + \gamma_4 x_{j,hp} + \gamma_5 x_{j,st} + \varepsilon_j, \quad (6)$$

The estimation results of equation 5 are shown in Model 3 in Table 2. α_1 and α_2 remain significant. Estimation of α_3 and α_4 are also significant, demonstrating the importance of duration and recency of the prior stay. The estimates on other neighborhood-level characteristics are similar to those in Models 1 and 2—neither housing price nor distance to CBD is significant, but the other three variables (school quality, accessibility to open space, and percentage of single family and town houses) are significant with expected signs.

Figure 3(A) graphically shows these two effects associated with four different prior population densities. The vertical axis denotes the preference toward current population density, or $\left(\alpha_1 + \alpha_2\frac{1}{x_g+1} + \alpha_3\frac{1}{x_g+1}W_g + \alpha_4\frac{1}{x_g+1}Z_g\right)$ in equation 5. The two numbers in parenthesis are duration

and recency in years. The combination on the left side (0, 36)[9] is associated with the lowest preference toward current population density and the one (18, 0) on the right hand side is associated with the largest preference. Figure 3(A) shows complex changes involved in the preference toward current population density, as duration of the prior stay, recency, and prior density change. It is observed that for the same duration and recency, the preferences associated with different levels of prior population density vary: When the stay at the growth period location is within one year and is 36 years away from the current period, preference toward current population density associated with the lowest prior density (5000 persons per square mile) is the lowest among the four prior densities; however, it becomes the largest when the duration increases (the three bundles on the left). The same pattern is observed when the stay at the growth period location is 18 years away from the current time (the middle three bundles). However, the pattern shifts when the stay at the growth period location is within one year from the current time (the three bundles on the right)—the preference associated with the lowest prior population density is the largest among the four prior densities for all durations.

[9] 36 was selected because that is the maximum number of years away from the current time in the sample.

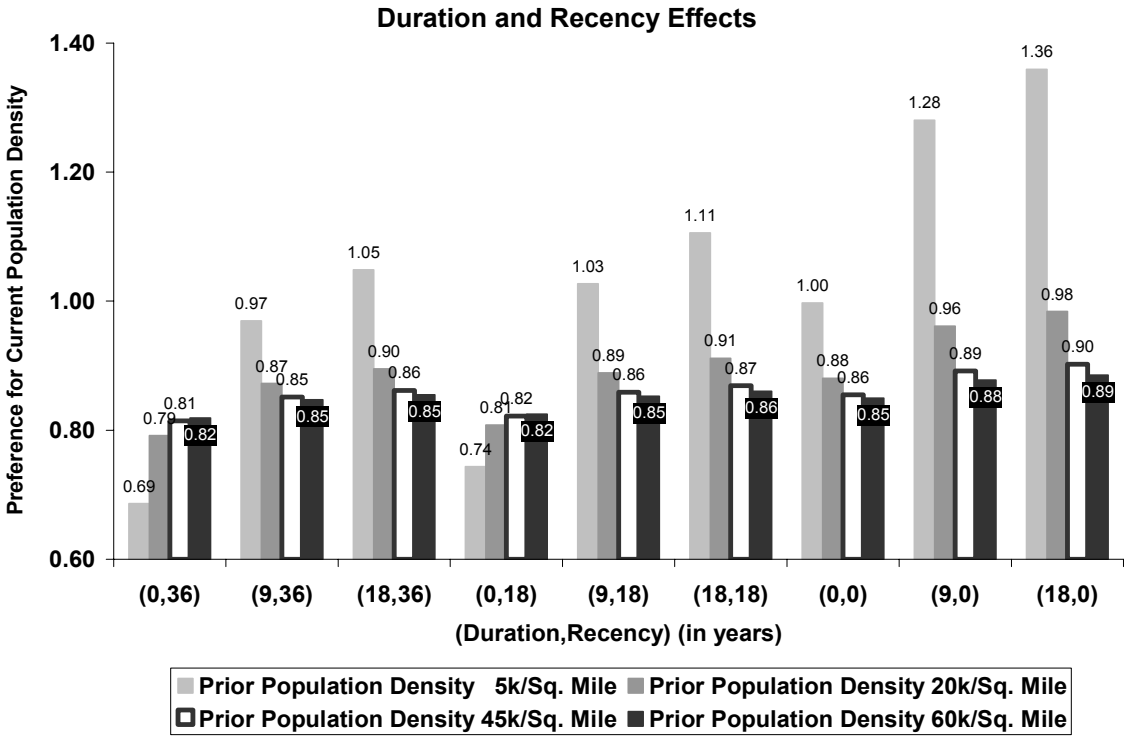


Figure 3A Duration and Recency Effects

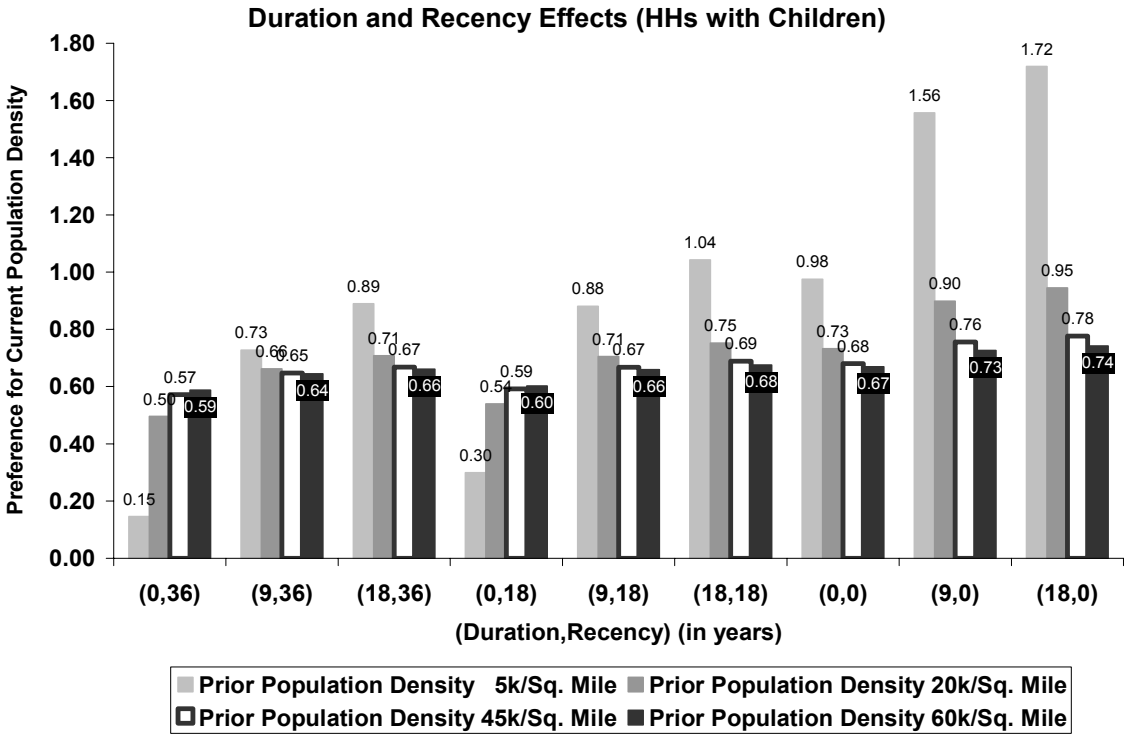


Figure 3B Duration and Recency Effects

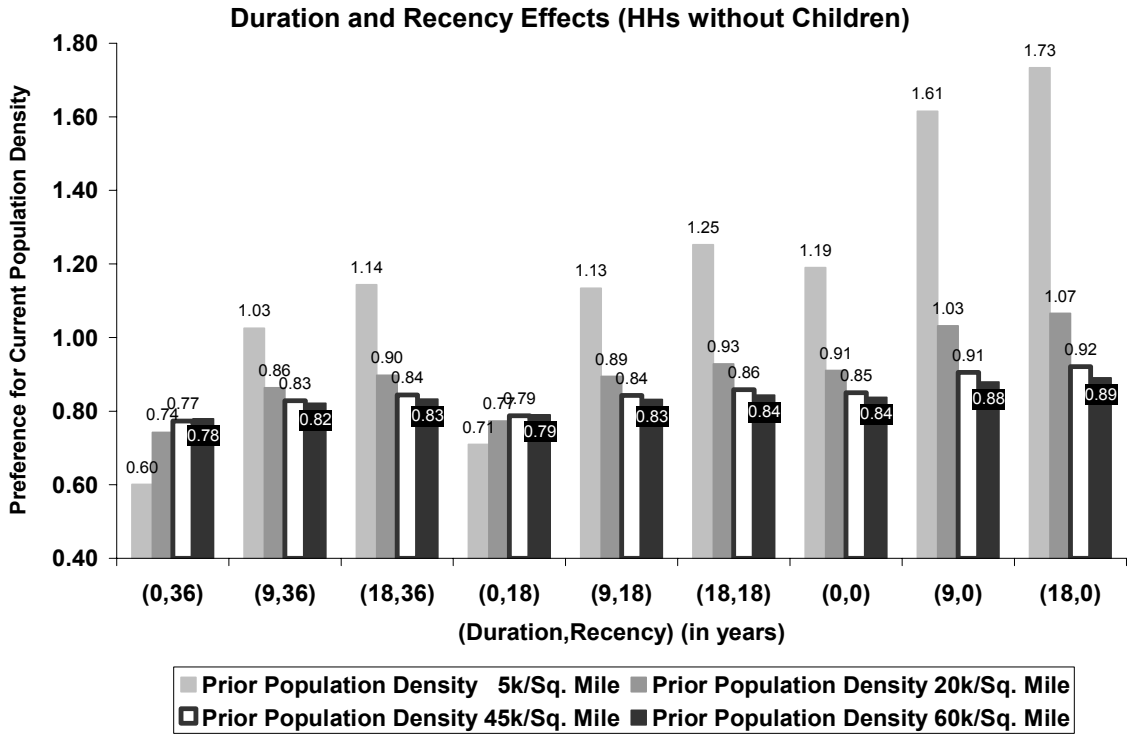


Figure 3C Duration and Recency Effects

The estimation results of equation 6 are shown in Model 4 in Table 2. The adjustment parameter (α_{2nc}) for non-child-bearing households is greater than that (α_{2c}) for child-bearing households, consistent with the earlier result. Furthermore, child-bearing households value school quality more than non-child-bearing households and the variable "percentage of single family and town houses" remains significant. Different from Model 3, accessibility to open space is no longer an important factor for non-child-bearing households and distance to CBD is no longer an important factor for child-bearing households. These results still fall within my expectations.

Figure 3(B) and Figure 3(C) show the same relationships between preference toward current population density and duration of the stay at the growth period location, recency, and prior population density for child-bearing households and non-child-bearing households, respectively. The same patterns as described above are observed in these two figures. The difference between Figure 3(B) and Figure 3(C) is that for the same duration, recency, and prior population density, preferences associated with current population density for households with children are smaller than those for households without children. Again, this result agrees with the earlier finding that the same amount of prior density exposure is associated with a lower level of preference for households with children and a higher value for households without children (Model 2).

2.6. Conclusions

This chapter contributes to the field of residential location choice. It demonstrates that taking a life course perspective to analyze location choice is a fruitful approach in that it allows us to trace the origin of our residential preference/self-selection and understand that its formation is a life-long, dynamic, self-revising, cumulative process incubated in one's social embeddings.

By quantifying the effect of an involuntary location experienced early on subjects' later location choices (on average, 17.3 years later), this is able to show that prior location influence precedes residential self-selection and thus, indirectly, this finding supports that prior location influence plays an important role in the formation of residential self-selection.

It is further demonstrated that prior location influence can be modified by its own properties: duration and recency of the prior stay. The effect of duration appears to be slightly larger than that of recency suggesting that the effects of locations experienced early in life can play an important role in later choices.

By differentiating between child-bearing and non-child-bearing households, the interaction between prior location influence and lifecycle (more specifically, presence of children) is demonstrated. Similarly, there exists a differential in duration and recency effects for the two types of households—the same duration and recency are associated with a lower preference toward current population density for child-bearing households than for non-child-bearing households. These results are consistent with those of Chen et al. (2009), suggesting that prior location influence is weakened during parenthood.

The effect of population density experienced during the growth period is variety-seeking, instead of adaptive, as shown in Chen et al. (2009) using the most recent prior location. More specifically, it is found that those who lived in low-density places during their growth periods sought higher-density locations later in life and those who stayed in high-density locations pursued lower-density locations. From a life course perspective, growth period is also a measure of lifecycle, capturing an important life stage in addition to adulthood with or without children. Thus, it is possible that there exists a period effect specifically associated with the growth period. Yet, if this assertion were true, we understand little about the underlying reasons. Staudinger (2001) proposed a life-review process during which people constantly evaluate their prior life experiences. If one considers an experience as having a negative effect, he/she will adjust the

current behavior in order to prevent the similar experience from happening again (Staudinger, 2001). A recent study showed that people's social well-being and happiness generally increased after adolescence (Stone et al., 2010). They found that stress and anger steeply declined after early 20s. This may suggest that people gradually adapt to the society by becoming more satisfied with their current status, thus improving their psychological well-being after reaching 20s. It is possible that the variety-seeking pattern which is observed in this dissertation may be the long-lasting residual of the stress and anger that accompanied with adolescence. In this case, the life-review theory would suggest that people would want to seek locations that are different from their growth period locations. These speculations need to be (in)validated by more studies that investigate the possibility of such an association in other localities and probe into the underlying psychological or biological reasons.

The study results have implications in policy development. If we know more about people's residential self-selection formation process, will we be in a better position to encourage people to develop more socially-desirable preferences, for example, favoring housing choices in higher-density locations? The study results pose challenges and present opportunities at the same time. The finding that what was experienced spatially early in life has an impact on later life may mean that our effort of trying to encourage people to choose higher-density locations may be of limited success, since America's past is associated with a pursuit for low density. Yet, if we continue to offer socially desirable options to people, over time, preferences toward those options are likely to be developed and maintained. The fact that prior location influence can be either adaptive or variety-seeking may also be used as an advantage for building toward a sustainable future. Even though one may have developed a preference to avoid density in the past,

the presence of variety-seeking behavior resulted from prior location influence suggests that this density-avoidance behavior can be reversed.

The study results provide us insights in improving our data collection practice. Incorporating attributes associated with prior locations not only enriches the behavioral interpretation of residential location choice, but also improves the model performance. The data collected for this study is a cross-sectional retrospective survey during which subjects were asked about their life experiences. A few questions about one's prior location history can be easily amended to most household travel surveys collected by Metropolitan Planning Organizations (MPOs) across the country. These additional variables can potentially significantly improve residential location choice models needed in integrated transportation and land use modeling systems.

Lastly, caution needs to be exercised when interpreting the study results. First, as mentioned earlier, the prior location influence was only examined on population density, thus, findings only apply to the density effect—how exposure to population density at prior locations affects one's preference toward population density in later choices. It is likely that the results can be extended to other dimensions of the built environment, though this speculation needs to be confirmed by additional studies. Second, the study sample differs from the corresponding population in the study region in a number of aspects. Thus, the applicability of the study results to other population segments is unclear. Third, it is important to recognize that segmentation, segregation, and disequilibrium exist in a housing market and residential location choice modeling, ideally, needs to consider constraints in the supply side, for example, the non-availability of preferred housing in certain parts of the market and specific spatial distributions of certain attributes.

These constraints are likely to confound with the true preference function. Therefore, this chapter's results and typical of all studies of residential choice based on actual moves should be viewed as a partial equilibrium in which many constituent elements describing the housing market are assumed exogenous. The lack of consideration of these supply-side constraints in residential location studies is probably due to the lack of corresponding data describing time-stamped availability in various sub-markets. Collection of such data is important. Methodologically, there is a need to develop quasi-dynamic and dynamic models involving reference points, benchmarks, and reflecting spatial externalities (Werczberger, 1991).

CHAPTER 3 Understanding the roles of supply, within-household disagreement, and information channels on the extent of a search

3.1. Introduction

A key concept in many residential location studies which employ discrete choice models (Anas & Chu, 1984; Ben-Akiva & Bowman, 1998; Chen et al., 2009; Quigley, 1976, 1985; Sermons & Koppelman, 2001; Waddell, 1992) is utility maximization. In residential location choices, it is assumed that a household chooses from the choice set a location that maximizes its utility. The requirement on the choice set is that the alternatives must be mutually exclusive, exhaustive, and feasible (Ben-Akiva & Lerman, 1985; Train, 2003)—a typical residential location choice model assumes that the entire region falls into one's choice set and such region often encompasses thousands of zones. In reality, such assumption is often unrealistic (de Palma et al., 2007). This chapter seeks to identify factors that affect the extent of a housing search. It is expected that the results will directly contribute to future research efforts that modify the exclusive, exhaustive, and feasible assumption on the choice set, commonly assumed by many residential choice models.

Empirical studies often find that housing search is limited in space (Aitken, 1987; Barrett, 1976; Clark & Smith, 1982; Donaldson, 1973; Huff, 1986) and biased toward one or a few subareas in a region (Brown & Holmes, 1971; Donaldson, 1973; Huff, 1986; Johnston, 1972). The number of neighborhoods searched ranges from one to seven (Barrett, 1976; Brown & Holmes, 1971)

and on average, people search from 2 to 5 neighborhoods (Aitken, 1987; Clark & Smith, 1982; McPeake, 1998). From an economic perspective, the extent of a search is likely the result of two forces joining together: households' preferences from a demand perspective and what is available in the housing market from a supply perspective.

The current literature on the extent of the search has mostly included household characteristics approximating the effect of the preference function. Characteristics such as household size (Clark & Smith, 1982; McPeake, 1998), income (Donaldson, 1973), and ethnicity (Cronin, 1982; Lake, 1981; Newburger, 1995), have all been found important. These studies implicitly employ a unitary household assumption—multiple members in a household act as if they are in complete agreement with each other during a search process. The unitary assumption is at odds with the real world. In residential mobility studies, compromise is a distinct feature found for households characterized as tied-movers—one member may agree to participate in a move against his/her own best interest but to help achieve a larger gain for the spouse (Bielby & Bielby, 1992; Mincer, 1978). It is conceivable that in the case of tied-movers, disagreement during a housing search is likely, even though one member may compromise eventually.

The role of the housing market, i.e., what is available in the housing market, is much less studied compared to households' preferences. Huff's work is an exception (Huff, 1986). In that study, Huff found that areas with more vacancies were more likely to be searched than those with fewer vacancies, demonstrating the role of the housing market in one's search. Huff did not directly study demand-side factors. Yet, he identified prior location as an important anchor point in housing search—the closer an area is to the prior location, the more likely it is to be searched,

probably because areas close to the prior location likely support a lifestyle similar to what was supported while living at the prior location. Since residential location choices are inherently integrated with lifestyle preferences, the use of the prior location can be considered as an indirect indicator of one's preference.

A housing search is often constrained (Clark & Drever, 2000) with respect to a household's own means (e.g., financial and geographical constraints) and what is available in the housing market. Households can only search for homes that fall within their budgets and housing preferences for people with different levels of income are likely different. On the supply side, "Information is priceless" (Brown & Moore, 1970; Clark & Smith, 1979)—people do not have the perfect knowledge about the housing market; rather, available and suitable vacancies on the market are passed to the households through one or more information channels. Clearly, the use of different information channels affects the extent of a search as well as the likelihood of successfully finding a home (Clark & Smith, 1982; McPeake, 1998; Palm, 1976; Rossi, 1955).

In this chapter, the effect of disagreement between household members in affecting the spatial extent of the search is tested. The hypothesis is that disagreement among household members during search likely results in a larger search space. This is a simplification of the complex negotiations and bargaining processes likely carried out during the search process. Yet, it probes into the role of intra-household dynamics and potentially points to the need of bringing intra-household dynamics into future studies.

Presence of children is probably the most frequently used variable representing intra-household dynamics in the literature. Here the argument is that having children is likely associated with household members' being more agreeable with each other and consequently, an agreeing household with presence of children may have the smallest search space.

If disagreement between household members during a search indeed affects the extent of a search, its role may be further modified by the number of vacancies available in the housing market or the different information channels used. Limited housing supply may further reduce the extent of a search for a household whose members agree with each other, while ample supply may expand a search spatially. Similarly, the use of different information channels may interact with this simple disagreement measure and affect the extent of a search.

Using a dataset collected on a sample of 82 homebuyers in the New York City areas, these hypotheses are tested in this chapter. The results support the hypotheses that not only disagreement expands a search space, but also it interacts with the supply in the housing market as well as the use of information channels. These findings confirm the important roles played by intra-household dynamics in a housing search and call for more studies in this area.

The success of housing policies largely depends on the residential location choices made by countless households. And yet, the results of location choices, to a large extent, are derived from where and how people search. This dissertation is one of the few studies that quantitatively examined how various factors affect the extent of a housing search. In particular, in contrast to the unitary household assumption frequently made by the majority of the literature, it is sought to

understand how disagreement between household members during a search affects the search extent. This dissertation contributes to both the theoretical and the conceptual development of housing search—it demonstrates that intra-household dynamics is an important factor; furthermore, it interacts with household characteristics, housing supply, and the use of various information channels in affecting the search extent. These results are also useful for housing policy evaluations—for example, the models developed in this chapter can be directly used in simulations that mimic the housing search and location choices of individual households.

The rest of the chapter is organized as follows. In Section 3.2, a discussion of the available literature on the extent of a search is provided. This is followed by a discussion of the conceptual framework and related hypotheses in Section 3.3. Section 3.4 describes the empirical dataset. The results and discussions are presented in Sections 3.5 and 3.6.

3.2. Extent of a search

The extent of a search is one of the most studied aspects of a housing search process. One may characterize the extent of a search temporally and spatially. The duration of a search is a frequent measurement of the temporal aspect of the search. A related concept is the intensity of the search, which is measured by the number of vacancies visited by a subject divided by the duration of a search: the higher the value is, the more intensive the search is. The spatial extent of a search has been investigated by researchers using a number of measures, including the number of vacancies visited (Aitken, 1987; Clark & Smith, 1982; McPeake, 1998), the number of areas or neighborhoods searched (Aitken, 1987; Clark & Smith, 1982; Huff, 1986; McPeake, 1998), the

maximum or mean distance among the vacancies searched (Aitken, 1987; Barrett, 1976; Clark & Smith, 1982; Huff, 1986; Maclennan, 1979), and the total area searched (Brown & Holmes, 1971; Donaldson, 1973; Huff, 1986; McCracken, 1975). Some studies use the temporal aspect, for example, the duration of the search, to approximate the spatial characteristics (Clark & Smith, 1982; Maclennan, 1979; McPeake, 1998).

One may understand the extent of a search through the concepts of mental map and awareness space. Mental map is one's own representation of an area. In his *Image of the City*, Lynch described how people perceive, represent, and conceptualize the physical environment they lived in (Lynch, 1960). A resident develops a mental map based on his or her perception of the city and use it as the spatial reference to select locations of activities (e.g., where to shop) and corresponding routes in completing these activities. In other words, one's mental map is constructed largely based on the resident's movement and the experiences he/she accumulated in various corners of the city. Those frequently traveled parts are represented more accurately in the mental map than those less visited. And some parts of the city may simply be blank spaces in one's mental map (Adams, 1969).

Mental maps are embedded in the larger physical world: though the representation of the places, the connections, and the spatial relativity of the real world may be distorted in one's mental map, there is certainly a connection between the two (Craik, 1973). Awareness space is a subset of the mental map. Places that people are either familiar with or are aware of form one's awareness space (Brown & Holmes, 1971). Similarly, the degree of awareness associated with the various places within the awareness place varies depending on the nature of the contact between the

place and the subject—the kind and the duration of the contact (Adams, 1969; Brown & Holmes, 1971; Horton & Reynolds, 1971; Johnston, 1972). In general, places that one has direct experience with (e.g., lived in or visited) are more accurately represented in one's mental map and also have a higher level of awareness associated with them. On the other hand, those places that one has indirect experience with, for example, known through acquaintances or the media, are plausible on one's mental map, but are likely represented fuzzily and thus the subjects would have a low level of awareness about them.

The extent of a search, in particular, its spatial dimension, is highly relevant to the concept of awareness space. Search is likely both biased and limited, conducted in one's awareness space, as many empirical studies have shown. Barrett (1976) investigated all vacancies visited by a sample of over 1,000 movers in the metropolitan Toronto area and reported that over 90% of his sample subjects searched within a 3-mile radius. Clark and Smith (1982) reported that on average households searched in 2.75 neighborhoods in their San Francesco Valley sample. Other studies confirmed that households on average search between 3 and 5 neighborhoods (Aitken, 1987; McPeake, 1998). Donaldson (1973) reported that the housing searches conducted by his sample subjects are biased toward the city center in Christchurch, the second largest urban area in New Zealand. In another study, Johnston (1972) found that in Cedar Rapids, the second largest city in Iowa, his sample subjects tended to search toward a section of the city where some of the "best" suburbs with highest socio-economic and demographic characteristics (SES) are located.

The extent of a search is likely affected by households' preferences toward residences, what is available in the housing market, and the conduit between the two, which is the information channel that people use to learn about the market. All three have been investigated by existing studies. On the demand side, the general consensus is that larger households tend to have a shorter search duration and a smaller search space probably due to the time constraints they face (Clark & Smith, 1982; McPeake, 1998); households who moved to houses searched longer than those who moved to apartments (Michelson, 1977) despite their prior housing type, although this finding is likely confounded with the fact that those moving to houses are more likely to be buyers than those who moved to apartments and the search period for buyers is usually longer than that for renters; higher-income households are likely to search closer to their prior homes, probably because they want to continue to live in nice neighborhoods (Donaldson, 1973); and minorities search for a longer duration but examine fewer vacancies than non-minorities, pointing to the possible role of housing discrimination (Cronin, 1982; Lake, 1981; Newburger, 1995).

The role of information channels is documented in a number of studies (e.g., Brown & Moore, 1970). One study (Palm, 1976) found that brokers tend to recommend areas they are most familiar with and thus potentially bias and expand households' search spaces. Studies comparing the effectiveness of using different channels found that using friends and acquaintances is more likely to result in a successful search than other channels such as realtors (Clark & Smith, 1982; McPeake, 1998; Rossi, 1955).

Few studies have examined both supply and demand factors, in particular the interaction between the two. One study tested both supply-based and demand-based hypotheses (Huff, 1986). In that study, Huff found that: first, areas closer to an important node in a household's activity space, for example, prior home location, are more likely to be searched. Those nodes are referred to as anchor points; second, areas with more vacancies are more likely to be searched. To account for both, he estimated an anchor point model that involved multiple anchor points including centers of the market supply and households' important activity nodes (e.g., work locations) to predict the probability of one's visiting a vacancy. He found that centers of the market supply appear to be more important than other anchor points.

3.3. Conceptual framework and hypotheses

Figure 4 shows a conceptual framework for the search extent. It starts with a mental map, which comprises an awareness space and a blank space containing areas that subjects have little knowledge about. Familiar places in people's awareness spaces likely fall within their activity spaces—those they lived in, visited, or traveled through regularly. There are other places in the awareness space that subjects are aware of but not familiar with—those came to subjects' attention through various informational channels. Information channels including newspaper classifieds, internet, and realtors serve as intermediaries matching households' preferences in housing with what is available on the market. Consequently, the extent of a search is affected by all three factors—what is available in the housing market, the use of information channels, and households' preferences.

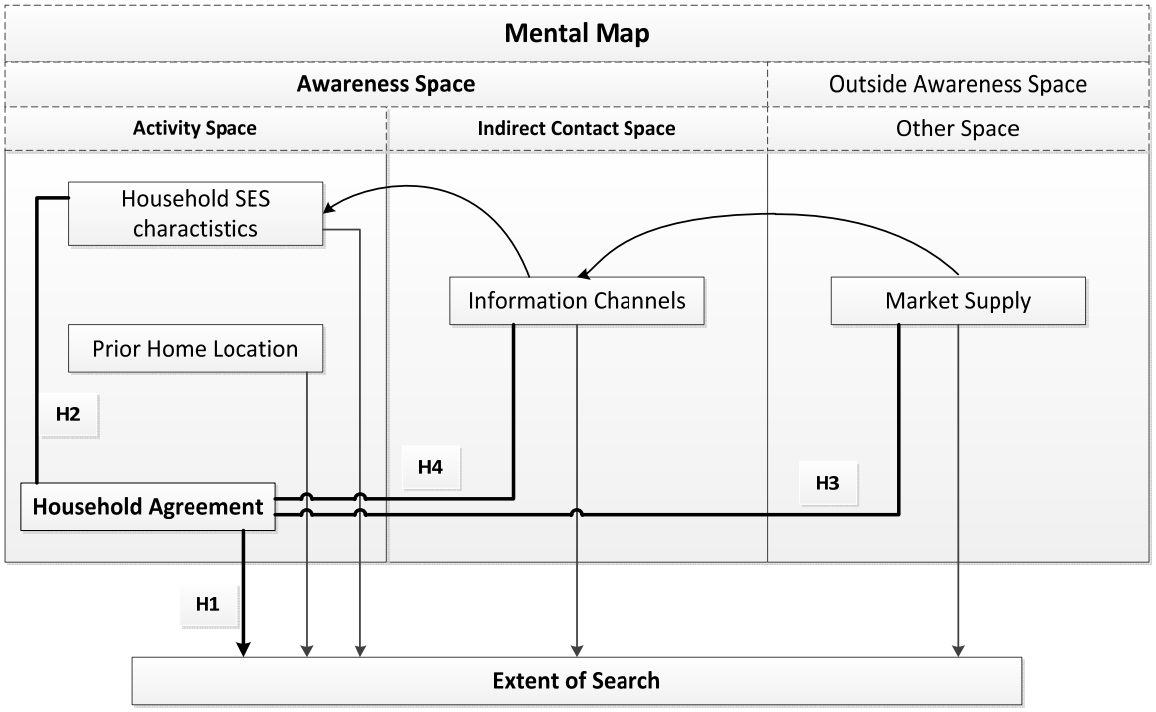


Figure 4 Conceptual Framework on the Extent of the Search

Formally, the following can be written:

$$y = f(D, S, I), \qquad (1)$$

where y is the extent of a search, **D**, **S**, and **I** represent vectors of factors associated with demand, supply, and information channels.

The sum of the sequential distances from the centroid of the 1st searched neighborhood to the centroid of the last searched neighborhood (d_{1f}) is proposed to represent **y**. Different from the measures used in the existing literature in which a circle or an ellipse is drawn to contain all

visited vacancies as well as those unvisited but fall in the boundary (Aitken, 1987; Barrett, 1976; Clark & Smith, 1982; Huff, 1986; Maclennan, 1979), this proposal attempts to capture the actual distance traversed in space in d_{1f}.

In this chapter, zip codes are used to represent neighborhoods due to the lack of a well-accepted neighborhood map. This treatment likely overestimates the average number of neighborhoods to some extent, as some neighborhoods in NYC (e.g., Manhattan) have multiple zip codes.

d_{1f} likely follows an exponential distribution (Figure 5). Therefore, the logarithmic form is used: $\ln(d_{1f})$ as the dependent variable to measure the spatial extent of a search.

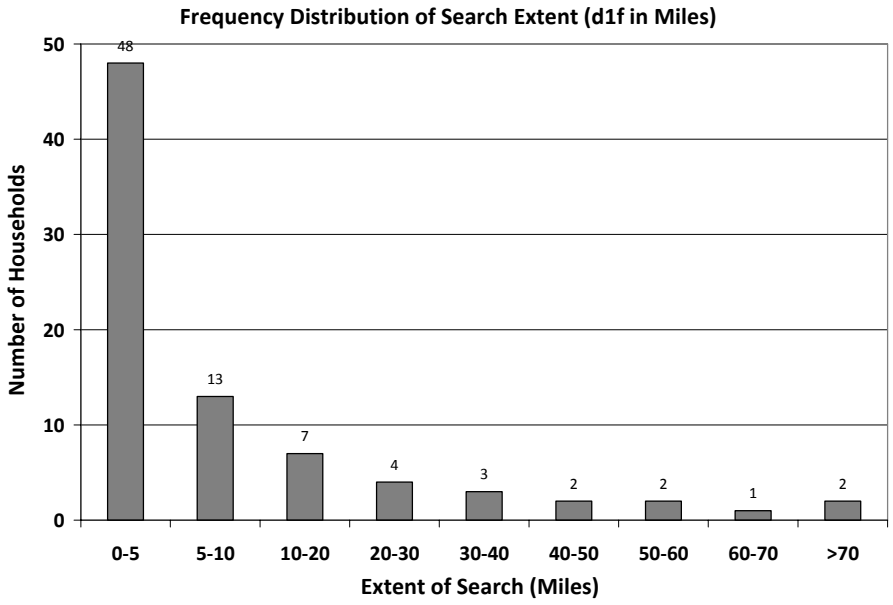


Figure 5 Distribution of Search Extent (d_{1f} in miles)

D is measured by the proximity of a search area to the current location and household characteristics. Proximity to the search area from the current location (denoted as d_{p1}) signals a stronger attachment to the past, likely resulting in a smaller search extent, as the subjects would like to stay within the current neighborhood. A disagreement variable was coded to distinguish households whose members disagree vs. those whose members agree with each other. This variable equals 1 if preferences in neighborhood selection differ between the two adult members during the search process. Every household in the sample also reported their budget for the home purchase with a lower bound and a higher bound. The higher bound is used in this study to represent the effect of a budget. Also, households with children and those without are distinguished. Lastly, a variable is coded to represent the flexibility of household members' working schedules. A value of 1 suggests that at least one member works at home or telecommunicates regularly.

S is measured by a single variable, which is the number of available vacancies that fall within a household's budget (lower and upper bounds) in searched neighborhoods during the time it searched. This supply data for the housing market is provided by streeteasy.com (http://www.streeteasy.com), the largest online firm that provides listings in New York City.

I, the use of information channels, is measured by two dummy variables: dummy variables representing the use of internet and brokers, respectively. Among the four channels used by our subjects—internet, brokers, personal visits, and social contacts, the former two are used twice as frequently as the latter two.

Lastly, the search duration (in months) is included to control the likely positive association between the extent of a search represented by d_{1f} and this variable, so that this association does not confound with the relationships of the interest (the hypotheses).

Four hypotheses (H1-H4 in Figure 4) are tested. First, a household whose members agree with each other in neighborhood selection is likely to have a smaller search space than those who disagree with each other. Second, child-bearing households are likely to have a smaller search space than non-child-bearing households. Furthermore, child-bearing households who agree with each other on the neighborhood selection will have the smallest search space. Third, areas with more listed vacancies have a higher probability of being visited. In other words, households who search in those areas with more vacancies have lesser of a need to go elsewhere and thus are likely to have a smaller search space. Fourth, the use of different information channels may lead to search spaces of varying size—the existing literature has found that using internet improves the intensity of the search (the probability of finding a successful match) (Zumpano et al., 2003); using brokers expands the search space, probably because brokers often recommend places they are familiar with but not necessarily fall into households' budgets or preferences (Clark & Smith, 1982; Palm, 1976).

3.4. Data description

Face-to-face interviews were conducted with 82 households who had at least two adults and purchased a home between 2004 and 2009 in the New York City area. The subjects were solicited using newspaper advertisement, internet, brokers, and public relations offices at newly

developed buildings and through personal recommendations. All subjects were asked to sign a consent form prior to the interview. The interview is semi-structured, touching upon various aspects of the search process, including the reasons of the move, the budget of the purchase, preferences in particular neighborhoods, the search duration, the number of listings visited, the sequence of the visits, the information channel used to each visited listing, and whether household members agreed or disagreed on the types of neighborhoods visited. The interview process does not have a standard set of questions. However, if the above listed specific information about the search process is not mentioned in the interviewees' stories, additional questions were asked to solicit it. Interviewees' stories were recorded, transcribed, and then coded into a set of numerical variables for later data analysis. In addition, socio-demographic information was also collected for the two adult members and they include age, education level, occupation, and race/ethnicity. The coding process for each subject was repeated two times and the coded variables were compared against each other and validated to ensure consistency in coding.

This sample is the result of non-probability sampling and it is not representative of the population in New York City. Table 3 compared characteristics of the sample subjects to those of all married homeowners in New York City. Statistics on the homeowners' population are calculated based on the 2008 American Community Survey for NYC (ACS, 2008). About 74.6% of the sample subjects are white, compared to 70% of them in the homeowners' population in New York City. Thirty-seven percent of the sample subjects have children compared to 48% in the homeowners' population. The average household size in the sample is smaller (2.4) than the average of those in the homeowners' population (3.1) and the sample subjects are also younger

(40 vs. 44). The biggest difference between the sample and the homeowners' population lies in the education attainment level: only about 3% of the sample subjects have an education level of less than college, compared to 40% of the population.

Table 3 Descriptive Statistics of the Study Sample and the Homeowners' Population in New York City

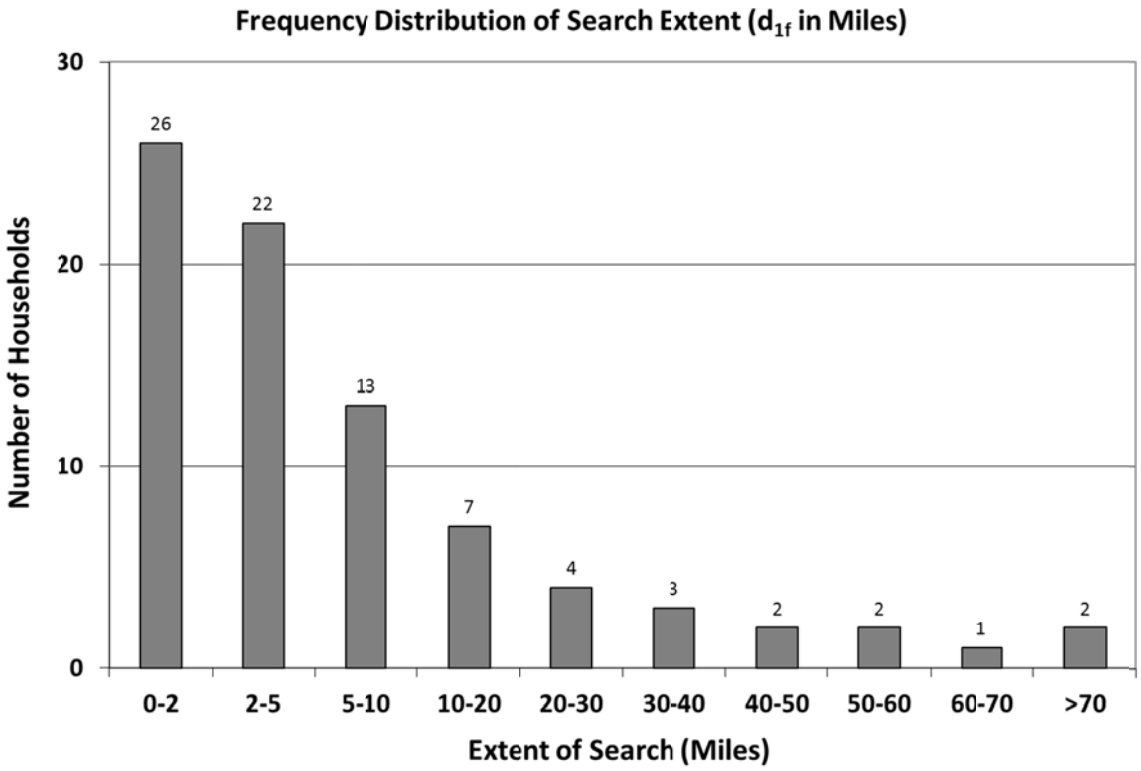
Variables	All Married Homeowners in New York City	Sample Subjects
Number of Households	1,235,092	82
% of Homeowner	100.0	100.0
% of Child-bearing	48.4	37.5
Average Household Size	3.1	2.4
Mean Age	43.9	39.7
% Male	50.0	50.0
Race/Ethnicity (%)		
White	70.7	74.6
Black	10.9	6.6
Asian	8.5	8.6
Hispanic	9.6	7.4
Education Attainment (%)		
Less than College	40.9	2.9
College Degree	44.7	68.6
Higher than College	14.4	28.4

Table 4 shows descriptive statistics on a number of search related attributes. On average, the sample subjects searched 14.8 miles (distance from the 1st searched neighborhood to the final one). Figure 6(a) is a histogram of d_{1f}. 31.7% households in the sample searched less than 2

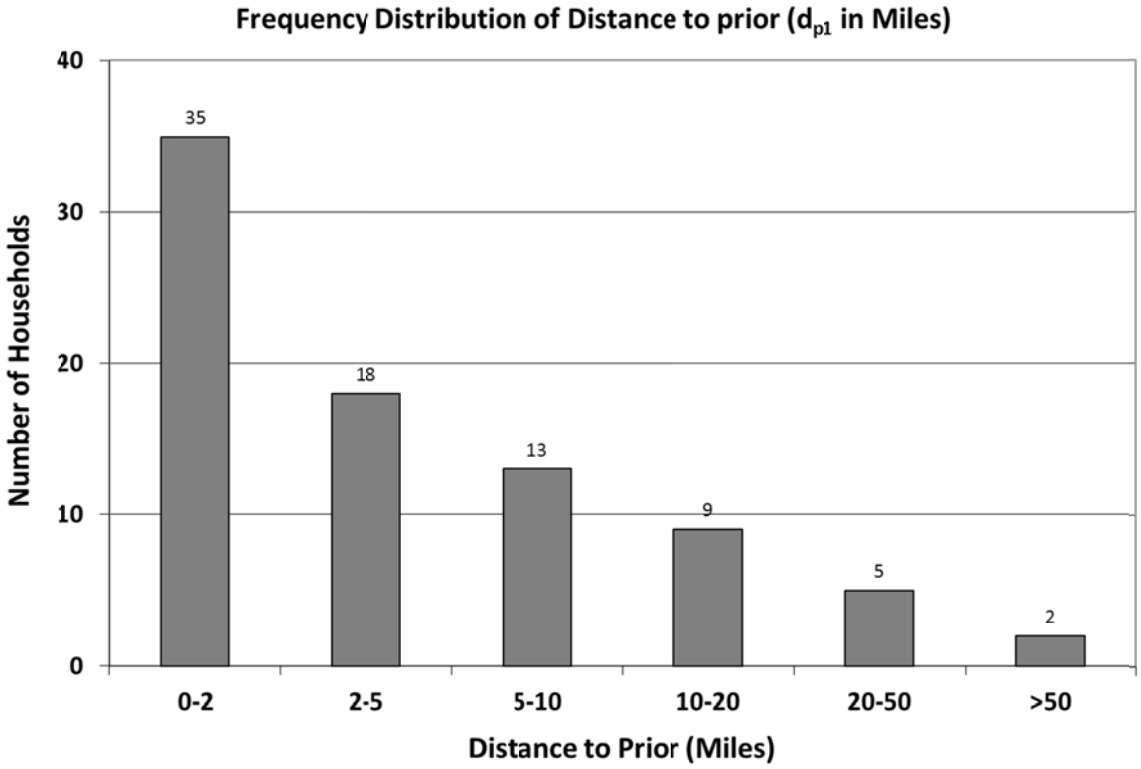
miles, some other 26.8% households searched 2 to 5 miles; some other 15.9% households searched 5 to 10 miles, some other 19.5% households searched 10 to 50 miles, and the rest 6.1% households searched more than 50 miles, with a maximum extent of 92.6 miles. In about half of the households, members agree with each other in the types of neighborhoods to be searched. The mean upper limit of the budget is $710,000 and 17% of the households have at least one member work at home or telecommute regularly. On average, there are about 161 listed vacancies in the area subjects searched during the search period. The sample subjects search an average of 2.85 neighborhoods and 7.18 months, both of which are consistent with the existing literature (Barrett, 1976; Clark & Smith, 1982; McPeake, 1998). The mean distance from the prior home to the 1st searched location (d_{p1}) is 7.9 miles, although this variable has a large standard deviation (23.28 mile). Figure 6(b) is a histogram of d_{p1}. Nearly half (42.7%) of households start their searches less than 2 miles away from their prior homes; some other 22.0% households' first searched locations are 2 to 5 miles away from their prior homes; 15.9% households start their searches at locations 5 to 10 miles away from their prior homes; 11.0% households' first searched locations are 10-20 miles away from their prior homes; and the other 8.5% households start their searches more than 20 miles away from their prior homes, with a maximum distance of 79.4 miles. Almost 80% of the sample subjects used either internet or brokers as their information channels. Moving reasons such as family reasons and dissatisfaction with prior housing are more frequently cited than others.

Table 4 Descriptive Statistics of Search Related Attributes in the Study Sample

Variables	Mean	Std. Dev.
Search extent (d_{1f} in miles)	14.82	36.10
Not agreeing on type of neighborhoods (=1 if not agreeing)	0.42	0.55
Upper limit of purchase budget (in millions of $)	0.71	0.47
Flexible work schedule (=1 if at least one member have flexible schedule)	0.17	0.26
Number of vacancies in searched neighborhoods (in 100s)	1.61	1.95
Number of neighborhoods (in zip code areas)	2.85	1.16
Search length (in months)	7.18	3.45
Distance to prior home (d_{p1} in miles)	7.93	23.28
Information Channels (=1 if a channel is used)		
internet	0.38	0.50
brokers	0.40	0.54
personal visiting	0.13	0.23
social contacts	0.21	0.32
Moving reasons (=1 if a moving reason applies to households)		
family related reasons	0.59	0.47
prior housing	0.43	0.57
prior surrounding environment	0.23	0.34
job related reasons	0.22	0.41
friends/relatives related reasons	0.22	0.40
lifestyle change	0.28	0.42



6(a) Distribution of Search Extent (d_{1f} in miles)



6(b) Distribution of Distance to prior home (d_{p1} in miles)

Figure 6 Distribution of Search Extent (d_{1f}) and Distance to Prior (d_{p1}) in Miles

Table 5 shows the distributions of prior and current home locations at borough[10] level for the sample subjects. Twenty seven households relocated within Manhattan; twelve relocated from Manhattan to Brooklyn; and six relocated from Manhattan to Queens. The rest scattered across the region, including some counties adjacent to but outside of New York City.

[10] Borough is equivalent to county in NYC.

Table 5 Distribution of Prior and Current Home Locations

Prior Home	Current Home						
	Manhattan	Bronx	Brooklyn	Queens	Staten Island	Outside NYC[1]	Total
Manhattan	27	3	12	6	1	2	51
Bronx	1	1	0	0	0	1	3
Brooklyn	2	1	6	1	1	0	11
Queens	3	1	0	3	0	0	7
Staten Island	0	1	0	0	1	0	2
Outside NYC	3	0	3	1	0	1	8
Total	36	7	21	11	3	4	82

[1] These include Hartford county in Connecticut, Bergen and Hudson counties in New Jersey, and Nassau and Westchester counties in New York.

3.5. Results

Four models were estimated to test hypotheses. The results are shown in Table 6, where models 1-4 correspond to the four hypotheses (H1-H4). All four models achieve a satisfactory goodness of fit measure: The adjusted R^2 ranges between 0.34 and 0.40. For disaggregate (individual- or household-level) models, a R^2 of 0.25 or above is considered quite satisfactory (Greene, 1993). Before discussing the results of the hypothesis testing, those of other variables included in the model are first presented.

Table 6 Model Estimation Results (estimated coefficients and standard error in parenthesis)

	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]
Dependent Variable	Extent of Search ($\ln(d_{1f})$)			
Independent Variables (Variables used to test each hypothesis are in bold.)				
Intercept	1.80* (0.68)	1.79* (0.69)	1.77* (0.67)	1.51* (0.69)
Household Characteristics (Demand)				
Not agreeing on the type of neighborhoods to be searched	**0.50*** **(0.23)**	**0.58*** **(0.26)**	**0.65*** **(0.31)**	**0.91*** **(0.45)**
Upper limit of purchase budget (in 10^6\$)	-0.48* (0.24)	-0.48* (0.24)	-0.53* (0.26)	-0.43* (0.22)
Households with children	-0.35 (0.36)	-0.32 (0.49)	-0.34 (0.36)	-0.33 (0.35)
Non-White households	-0.21 (0.21)	-0.21 (0.21)	-0.20 (0.21)	-0.21 (0.21)
At least one member work at home or telecommute regularly	0.93* (0.46)	0.93* (0.46)	0.92* (0.46)	0.75* (0.37)
Search length (in months)	0.11* (0.05)	0.11* (0.05)	0.11* (0.05)	0.11* (0.05)
Distance from prior home to the 1st searched neighborhood ($\ln(d_{p1})$)	0.27* (0.10)	0.27* (0.11)	0.25* (0.12)	0.30* (0.13)
Vacancies on Market (Supply)				
Number of vacancies in searched neighborhoods (in 10^2)	-0.12* (0.05)	-0.12* (0.05)	**-0.07*** **(0.03)**	-0.10* (0.05)
Information Channels				
Using internet	-0.33 (0.37)	-0.34 (0.23)	-0.31 (0.37)	-0.42 (0.38)
Using broker	0.48 (0.34)	0.47 (0.34)	0.46 (0.34)	
Interaction Terms				
Not agreeing on the type of neighborhoods × household with children		**0.96** **(0.72)**		
Number of vacancies in searched neighborhoods × not agreeing on the type of neighborhoods			**-0.12*** **(0.06)**	
Agreeing on the type of neighborhoods × using broker				**0.68*** **(0.34)**
Not agreeing on the type of neighborhoods × using broker				**-0.97*** **(0.39)**
Sample Size	82 households			
Adjusted R-Square	0.336	0.346	0.379	0.400

*: Significant at 5% level.

a: Base model without interaction; b: Interacting not agreeing on the types of neighborhoods with household with children; c: Interacting not agreeing on the types of neighborhoods with supply; d: Interacting not agreeing on the types of neighborhoods with the use of information channels.

Households with a higher budget, or those with more means, have a smaller search space than others. This finding is consistent with the literature (Donaldson, 1973). Probably their ample means make them face fewer obstacles in the search—or the "those we like, we cannot afford them, but those we can afford, we do not like them" sentiment happens less likely.

Having a member work at home or telecommute regularly leads to a larger search space. This is likely because working at home offers more flexibility in terms of time and creates an incentive to do a more thorough search, resulting in a larger search extent. More than one household's members specifically mentioned that the frequency of telecommuting was purposefully increased during the search period to allow more time spent on home searching.

The estimated value for the variable "distance from the prior home (d_{p1})" is significant and positive, suggesting that if the 1st searched neighborhood is far away from the prior location then the subject is likely to entail a larger space in their search. This finding is expected—moving away from prior home means searching in less familiar areas and thus is likely associated with a larger search space as the subjects explore around to improve their awareness and knowledge about those places—and consistent with the current literature (Huff, 1986). Also, how the distance to the prior location is correlated with different reasons of the move was examined and it was found that for all reasons, there is a significant correlation, ranging from 0.35 to 0.47. In addition, those who relocated for family or job related reasons or due to their dissatisfaction with their prior home location start their search closer to their prior homes than those who relocated

due to prior housing or neighborhood dissatisfactions, or relocated to be closer to friends or relatives, or relocated for life style changes.

Households with children tend to have a smaller search space and non-White households tend to have a larger search space, but neither is significant.

The estimated value for the variable measuring the effect of the supply in the housing market: "number of vacancies in the searched neighborhoods", is significant and negative, probably because fewer supplies in one area force people to look further, leading to a larger search space. This finding is consistent with that from Huff's work (Huff, 1986), in which the probability of searching an area is positively correlated with the number of vacancies in that area.

As expected, the use of internet tends to reduce the search space, while the use of brokers tends to expand it, but neither result is significant.

The variable "search duration (in months)" is used as a control variable in the model such that the results of our interest are not contaminated—those households with a larger search space are not because they searched in a longer time period.

Now the results of the hypothesis testing can be discussed. Households whose members agree with each other on the types of neighborhoods to be searched tend to have a smaller search space than those whose members do not (bold in the column of Model 1 in Table 6). This first

hypothesis is supported with a significant positive estimated value associated with the variable "disagreeing on the types of neighborhoods to be searched".

The second hypothesis is tested by three terms (bold in the column of Model 2 in Table 6): the main effects of disagreement among household members and the presence of children, and their interaction. The main effect for the presence of children is not significant while the other two are. The correlation and interaction of presence of children and disagreement among household members on the types of neighborhoods to be searched are also examined. The two variables are weakly negatively correlated with each other (-0.14). Together, they suggest that: first, the two variables are not necessarily related to each other—households with children are not necessarily more or less agreeable with each other than households without children; second, the effect of disagreement is greater than the presence of children; and third, while agreeing households with children have a smaller search space than agreeing households without children, the disagreeing households with children have a larger search space than the disagreeing households without children. The last observation reconfirms the larger role played by disagreement vs. agreement than the presence of children.

The three variables used for testing the third hypothesis: the main effects of disagreement among household members and the number of vacancies in searched neighborhoods, and their interaction, are all significant (bold in the column of Model 3 in Table 6). Figure 7 illustrates the result of testing this hypothesis graphically. As the number of vacancies increases, the search extent decreases for both types of households: those whose members agree vs. those whose members disagree with each other. Yet, the decline in the search extent is slightly larger for

disagreeing households than for agreeing households, signaling the larger effect of market force on the former than on the latter.

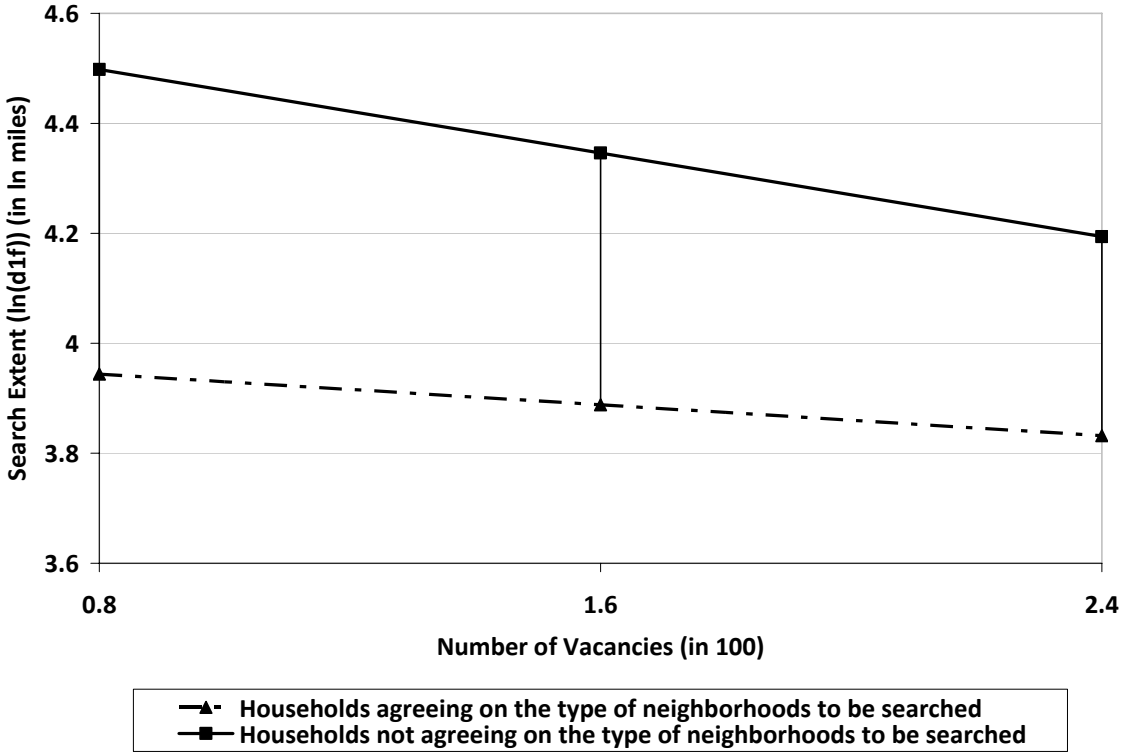


Figure 7 Search Extents (in ln(miles)) with respect to the Number of Vacancies for Agreeing and Disagreeing Households

On the last hypothesis, it is shown that while disagreement between household members remains the same as before, the combination of agreement and using brokers expands the search space and the combination of disagreement and using brokers reduces the search space (bold in the column of Model 4 in Table 6). The finding on the interactive term is quite interesting. Though the exact underlying reasons are unknown, the following explanation is proposed: in the former

case, the broker probably recommended the agreeing household to consider places they were previously not aware of, thus expanding the search space; in the latter case, a broker may act as mediators to the disagreeing household, which may lead to compromises between members and thus a smaller search space.

3.6. Discussions

Using concepts of mental map and awareness space, it is argued in this dissertation that the spatial extent of a housing search can be affected by the supply in the housing market, households' preferences, and the use of information channels as well as their interactions. Furthermore, it is stated that intra-household dynamics could play an important role in the search process. In this dissertation, a simple measure is used to distinguish those households whose members agree vs. disagree with each other on the types of neighborhoods to be searched and it is shown that the former has a significantly smaller search space than the latter. Even though this is a simplistic measure that clearly does not capture complex dynamics played out in the bargaining and negotiations during a housing search, it provides evidence that refutes the common "unitary household" assumption in housing search and location choice studies. The results suggest that looking into the role of intra-household dynamics to understand housing search may be a potentially fruitful effort.

The results of this chapter should be interpreted with caution. The area of the study is New York City, whose housing market likely differs from most parts of the country. In addition, the results are based on a relatively small sample of 82 households and the households in the sample are not

representative of the homeowners' population in New York City—the sample subjects are Whiter, younger, have fewer children, and are much more educated than the general homeowners' population in the city. As mentioned earlier, the largest difference between the study sample and the general homeowners' population in the city is the education level: over 95% of the sample subjects are at least college educated as compared to about 60% in the general population. Geographically, the sample likely represents the Manhattan buyers more than those in other boroughs. Because of these unique attributes, the results are, in theory, only applicable to households with similar attributes as the sample subjects, in particular the highly educated ones. However, it worthy noticing here that the unrepresentativeness of the study sample does not invalidate the results for two reasons. First, on those findings where there are comparable ones in the literature, the two are consistent. For example, the average number of neighborhoods searched and the average search duration for the sample subjects are comparable to those in the literature (Barrett, 1976; McPeake, 1998). And those who purchased a more expensive unit tend to have a smaller search space (Clark & Smith, 1982; Donaldson, 1973). Second, it is not the intent of this dissertation to claim that the results are transferrable to other regions. Rather, the results suggest that intra-household dynamics likely plays an important role in housing search and future studies are needed to dissect and measure the real dynamics played out within a household.

CHAPTER 4 Conclusion

In this dissertation, two questions related to residential location choice as well as housing search are addressed. In chapter 2, by taking a life course perspective, it is demonstrated that prior experience influence precedes residential self-selection and the formation of residential preference/self-selection is probed into: it is a life-long, dynamic, self-revising, cumulative process including interactions between a person and his/her social embeddings. In chapter 3, by proposing a conceptual framework using the concepts of mental map and awareness space, it is demonstrated that the spatial extent of a housing search is jointly determined by the supply in the housing market, households' preferences, and the use of information channels as well as their interactions. Furthermore, it is validated that intra-household dynamics play an important role during a housing search. These findings not only directly contribute to the residential location choice literature, but also benefit regional science and human geography scholars through their understanding of the interactions between people and surrounding physical environment.

Transportation planners use residential location choice models to evaluate how households are likely to change the location of their residences in response to changes in land use and land development policies. Can we design policies to encourage people to relocate to sustainable neighborhoods, such as those with high-density? The results of this dissertation provide new insights in answering this question. The finding that locations experienced early in life can play an important role in later choices posts challenges in persuading those who have already formed density-adverse type of preferences since we cannot alter their pasts. But, on the bright side, a variety-seeking pattern in response to prior location experience is evidenced in this dissertation,

in addition to an adaptive pattern found in a previous study (Chen et al., 2009). The existence of both patterns lights up the prospect for triggering people to develop preferences in the direction that is socially desirable. The finding that the duration effect is slightly larger than the recency effect is also encouraging—if we keep providing socially desirable built environment, overtime, people may eventually develop preferences towards that in the future.

Providing and publicizing quality affordable housing opportunities in a sustainable neighborhood may be a fruitful effort too, as the second part of this dissertation implies that where people search is related to the amount of supply, household preferences, information channels and their interactions. A portfolio of integrated land use, land development and housing policies may be superior for developing sustainable communities.

Future research is suggested by the findings of this dissertation. First, although a variety-seeking pattern is found, we know little about its underlying behavior or psychological forces. I hope to see future research addressing this issue. Also, the co-existence of this variety-seeking pattern and an adaptive pattern found in Chen et al. (2009) raises several questions. Do some people always show a consistent pattern of adaptive/variety-seeking behavior? Are people who always seek familiar environments fundamentally different from those whose lives are always on the move? Are there any consistent differences between these two groups on social well-being? These questions are not only intellectually stimulating but also policy relevant and socially important.

In this dissertation, only a simplified measure is used to represent intra-household dynamics. This clearly does not capture the complex dynamics played out in the bargaining and negotiations within the household during a housing search. More sophisticated representations of this dynamic would improve the studies on not only residential location choices, but other kinds of household decisions.

The results on housing search extent provide evidence on validating the spatial regularity of individual households' search spaces—where would a household search for a home may be directly modeled. Future studies proposing correctly specified search space models will significantly improve the accuracy of our residential location choice models.

Appendixes

Appendix 1 Survey questionnaire used to collect data for chapter 2

A copy of all the questions from the questionnaire used in the survey is included in the following 16 pages. The original page numbers which mentioned in some survey instructions are removed due to formatting conflicts with this dissertation.

What was the main purpose of your purchasing the apartment/ house this questionnaire was delivered to?

1 **Primary residence**

2 **Secondary home (e.g., summer home)**

3 **Investment purpose**

4 **For family members**

Section A - Questions on Three Prior Residential Locations (Not Including the Current Location)

In this section, we will ask you about three locations where you have lived the longest **prior to** your current location. Each page is for a prior residential location; there are three pages in total. You may complete fewer than three pages, if you have lived in fewer than three past locations. Thank you for your cooperation!

Definition of current location: in this questionnaire, current location (as well as current home) refers to the address to which this survey was delivered to.

Have you ever moved from one location to another (including during childhood)?

If **no**, skip to page **B**;
If **yes**, continue to the next page (Page A-1)

A.1.1. How many locations have you lived in **prior to** the home in which you are currently residing?

1 only one 2 a few 3 many

A.1.2. Of the homes indicated in Question A.1.1 above, in which location did you spend **the most** time (including during childhood)?

Street address or intersection _____
City _____ State _____
Zipcode _____ Country _____

A.1.3. In which time period did you live there?

Starting month/year _____ Ending month/year _____

A.1.4. What **was** your level of satisfaction with this location **while you were living there**?

Factors	**Ratings**			
Housing space	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Quality of (pre)schools/day care	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Open space	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Proximity to friends/families	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Commute time	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Access to public transit	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Access to shops	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Access to cultural activities	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Safety	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Variety of housing types	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Visual attractiveness of the area	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Other (**please specify**)	1 satisfied	2 neutral	3 not satisfied	4 didn't care

A.1.5. How **did** you perceive the level of crowdedness of the neighborhood **at that time**?

1 very crowded 2 crowded 3 neutral 4 some people around 5 very few people

A.1.6. What **was** the building height of the home you lived in **during that time**?

1 1 story 2 2 stories 3 3-6 stories 4 7-10 stories 5 > 10 stories

A.1.7. When you went out **at that time**, what **was** your most frequent mode of transportation?

1 car 2 transit 3 walk 4 bike 5 other

A.2.1. Prior to your current home, of the locations indicated in Question A.1.1 on page A-1, in which location did you spend the **2nd most** time (including during childhood)? ***Skip to Section B if you only lived in one location prior to your current home.***

Street address or intersection _____
City _____ State _____
Zipcode _____ Country _____

A.2.2. In which time period did you live there?

Starting month/year _____ Ending month/year _____

A.2.3. What **was** your level of satisfaction with this location **while you were living there**?

Factors	**Ratings**			
Housing space	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Quality of (pre)schools/day care	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Open space	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Proximity to friends/families	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Commute time	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Access to public transit	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Access to shops	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Access to cultural activities	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Safety	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Variety of housing types	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Visual attractiveness of the area	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Other (**please specify**)	1 satisfied	2 neutral	3 not satisfied	4 didn't care

A.2.4. How **did** you perceive the level of crowdedness of the neighborhood **at that time**?

1	2	3	4	5
very crowded	crowded	neutral	some people around	very few people

A.2.5. What **was** the building height of the home you lived in **during that time**?

1	2	3	4	5
1 story	2 stories	3-6 stories	7-10 stories	> 10 stories

A.2.6. When you went out **at that time**, what **was** your most frequent mode of transportation?

1	2	3	4	5
car	transit	walk	bike	other

A.3.1. Prior to your current home, of the locations indicated in Question A.1.1 on page A-1, in which location did you spend the **3rd most** time (including during childhood)? ***Skip to Section B if you only lived in two locations prior to your current home.***

Street address or intersection _____
City _____ State _____
Zipcode _____ Country _____

A.3.2. In which time period did you live there?

Starting month/year _____ Ending month/year _____

A.3.3. What **was** your level of satisfaction with this location **while you were living there**?

Factors	**Ratings**			
Housing space	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Quality of (pre)schools/day care	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Open space	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Proximity to friends/families	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Commute time	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Access to public transit	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Access to shops	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Access to cultural activities	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Safety	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Variety of housing types	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Visual attractiveness of the area	1 satisfied	2 neutral	3 not satisfied	4 didn't care
Other (**please specify**)	1 satisfied	2 neutral	3 not satisfied	4 didn't care

A.3.4. How **did** you perceive the level of crowdedness of the neighborhood **at that time**?

1	2	3	4	5
very crowded	crowded	neutral	some people around	very few people

A.3.5. What **was** the building height of the home you lived in **during that time**?

1	2	3	4	5
1 story	2 stories	3-6 stories	7-10 stories	> 10 stories

A.3.6. When you went out **at that time**, what **was** your most frequent mode of transportation?

1	2	3	4	5
car	transit	walk	bike	other

IMPORTANT INSTRUCTION

Section B - Current Residential Location Choice

In this section, we will ask you questions about your current home. In addition to your opinions, we would also like to know your spouse/partner's opinions during the search process that led to your current home.

Definition of current home: in this questionnaire, current home (as well as current location) refers to the address to which this survey was delivered to.

1. Did you and/or your spouse/partner play a major role in deciding on the location of your current home?

1 Yes
2 No

2. Did someone else (e.g., your relatives or friends) help you financially in acquiring this location? (**Not** including mortgage companies)

1 Yes
2 No

B.1. How many bedrooms and bathrooms are there in your current home?

Number of bedrooms _____ Number of bathrooms _____

B.2. When did you move to your current home?

Year _____ Month _____

B.3. Where did you live most recently, **prior to** your current home?

Street address or intersection _____
City _____ State _____
Zipcode _____ Country _____

B.4. ***Did*** you own or rent your ***previous home*** (the one prior to your current home)?

1 own 2 rent

B.5. What was the primary reason that you moved to your current home?

1 family reasons 2 housing-related reasons
3 job/school related 4 quality of surrounding environment
5 proximity to relatives/friends 6 other (**please specify**) _____
7 involuntary reasons (**please specify**) _____

B.6. How do you perceive the level of crowdedness of your current neighborhood?

1	2	3	4	5
very crowded	crowded	neutral	some people around	very few people

B.7. What is the building height of your current home?

1	2	3	4	5
1 story	2 stories	3-6 stories	7-10 stories	> 10 stories

B.8. How did you learn about your current neighborhood (check all that apply)?

1 from relatives 2 from friends
3 from TV 4 from newspapers
5 from internet searches 6 from colleagues
7 lived there before 8 visited before
9 from advertised flyers/agents 10 other (**please specify**) _____

B.9. How long was your search process that led to your current home?

Number of months _____

B.10. Roughly how many homes did you look at during the search process that led to your current home?

1	2	3	4	5
only 1	2-10	11-30	31-50	>50

B.11. Did you and/or your spouse/partner discuss your housing options with other people (e.g. relatives and friends)?

1 yes 2 no

B.12. What is/are the mode(s) of transportation you use most often? (check all that apply)

1	2	3	4	5
car	public transit	walk	bike	other

B.13. Please rate **your** level of satisfaction with your current home in the following factors:

Factors	**Ratings**			
Housing space	1 satisfied	2 neutral	3 not satisfied	4 don't care
Quality of (pre)schools/ day care	1 satisfied	2 neutral	3 not satisfied	4 don't care
Open space	1 satisfied	2 neutral	3 not satisfied	4 don't care
Proximity to friends/families	1 satisfied	2 neutral	3 not satisfied	4 don't care
Commute time	1 satisfied	2 neutral	3 not satisfied	4 don't care
Access to public transit	1 satisfied	2 neutral	3 not satisfied	4 don't care
Access to shops	1 satisfied	2 neutral	3 not satisfied	4 don't care
Access to cultural activities	1 satisfied	2 neutral	3 not satisfied	4 don't care
Safety	1 satisfied	2 neutral	3 not satisfied	4 don't care
Variety of housing types	1 satisfied	2 neutral	3 not satisfied	4 don't care
Visual attractiveness of the area	1 satisfied	2 neutral	3 not satisfied	4 don't care
Other (**please specify**)	1 satisfied	2 neutral	3 not satisfied	4 don't care

B.14. Overall, comparing your level of satisfaction with your current home **now** and **when you first moved in**, do you think that your level of satisfaction has:

1	2	3
improved	been about the same	declined

B.15. If your level of satisfaction has changed, please explain what happened (e.g. improvements were made, you got used to the way it was, the neighborhood deteriorated, etc.)

_____

B.16. Please rate **your spouse/partner**'s level of satisfaction with your current home in the following factors:

Factors	**Ratings**			
Housing space	1 satisfied	2 neutral	3 not satisfied	4 don't care
Quality of (pre)schools/day care	1 satisfied	2 neutral	3 not satisfied	4 don't care
Open space	1 satisfied	2 neutral	3 not satisfied	4 don't care
Proximity to friends/families	1 satisfied	2 neutral	3 not satisfied	4 don't care
Commute time	1 satisfied	2 neutral	3 not satisfied	4 don't care
Access to public transit	1 satisfied	2 neutral	3 not satisfied	4 don't care
Access to shops	1 satisfied	2 neutral	3 not satisfied	4 don't care
Access to cultural activities	1 satisfied	2 neutral	3 not satisfied	4 don't care
Safety	1 satisfied	2 neutral	3 not satisfied	4 don't care
Variety of housing types	1 satisfied	2 neutral	3 not satisfied	4 don't care
Visual attractiveness of the area	1 satisfied	2 neutral	3 not satisfied	4 don't care
Other (**please specify**)	1 satisfied	2 neutral	3 not satisfied	4 don't care

_____

B.17. Thinking about the ideal home, neighborhood and lifestyle that you and your spouse/partner would like to have in the near future, how much do you and your spouse/partner agree?

1	2	3	4	5
totally agree	mostly agree	half and half	mostly disagree	totally disagree

B.18. Comparing you and your spouse/partner's ideals with your current home and neighborhood, do you think:

1 we both got what we wanted
2 I compromised more
3 my spouse/partner compromised more
4 other (**please specify**) _____

B.19. Considering the rising gasoline price today and in the future, if you could redo your home search, would you still choose to live where you are now?

1 yes 2 no

if no, which neighborhood would you choose then? _____ (neighborhood name)

Section C - Search Process Leading to Your Current Home

In this section, we will ask you questions about the **search process leading to your current home**. We include three pages (starting from the next page). Each page is for an additional neighborhood (**other than your current neighborhood**) that you examined during your search process. These three other neighborhoods should be the three that you considered the most **in addition to your current neighborhood**. You do not have to complete all three pages if you considered fewer than three other neighborhoods. Thank you for your cooperation!

Please answer the following two questions before proceeding.

1. Did you consider both rent and own options when searching for your current home?

1 no, I only looked at own options.
2 yes, I looked at both rent and own options.

2. Did you consider any other neighborhoods besides your current one during your search?

If **no**, skip to page D;
If **yes**, continue to the next page (Page C-1)

C.1.1. We would like to know about other neighborhoods you considered when searching for your current home. List a neighborhood (**other than your current one**) you seriously considered in your search process.

Neighborhood Name _____ Zipcode _____
Town/City _____ State _____

C.1.2. How did you learn about this neighborhood (check all that apply)?

1 from relatives	2 from friends
3 from TV	4 from newspapers
5 from internet searches	6 from colleagues
7 lived there before	8 visited there before
9 from advertised flyers/agents	10 other (**please specify**) _____

C.1.3. When did you start seriously considering this neighborhood during your search process?

Year _____ Month _____

C.1.4. When did you stop considering this neighborhood as your potential residential location?

Year _____ Month _____

C.1.5. How different is this neighborhood compared to the one you selected for your home?

1 totally different	4 a little different
2 very different	5 not different at all
3 somewhat different	

C.1.6. What were the reasons that this neighborhood was not selected? (check all that apply)

1 I do not like the neighborhood	4 too far from work
2 no suitable house	5 too far from my relatives/friends
3 price is not right	6 other (**please specify**) _____

C.1.7. Is there another neighborhood that you seriously considered but have not told us about?

1 yes, ***continue to the next page***
2 no, ***go to page D***

C.2.1. List a neighborhood (other than your **current one** and the **one you listed previously**) you seriously considered in your search process.

Neighborhood Name _____ Zipcode _____
Town/City _____ State _____

C.2.2. How did you learn about this neighborhood (check all that apply)?

1 from relatives
2 from friends
3 from TV
4 from newspapers
5 from internet searches
6 from colleagues
7 lived there before
8 visited there before
9 from advertised flyers/agents
10 other (**please specify**) _____

C.2.3. When did you start seriously considering this neighborhood during your search process?

Year _____ Month _____

C.2.4. When did you stop considering this neighborhood as your potential residential location?

Year _____ Month _____

C.2.5. How different is this neighborhood compared to the one you selected for your home?

1 totally different
2 very different
3 somewhat different
4 a little different
5 not different at all

C.2.6. What were the reasons that this neighborhood was not selected? (check all that apply)

1 I do not like the neighborhood
2 no suitable house
3 price is not right
4 too far from work
5 too far from my relatives/friends
6 other (**please specify**) _____

C.2.7. Is there another neighborhood that you seriously considered but have not told us about?

1 yes, ***continue to the next page***
2 no, ***go to page D***

C.3.1. List a neighborhood (other than your **current one** and the **two** additional neighborhoods you **listed previously**) you seriously considered in your search process.

Neighborhood Name _____ Zipcode _____
Town/City _____ State _____

C.3.2. How did you learn about this neighborhood (check all that apply)?

1 from relatives
2 from friends
3 from TV
4 from newspapers
5 from internet searches
6 from colleagues
7 lived there before
8 visited there before
9 from advertised flyers/agents
10 other (**please specify**) _____

C.3.3. When did you start seriously considering this neighborhood during your search process?

Year _____ Month _____

C.3.4. When did you stop considering this neighborhood as your potential residential location?

Year _____ Month _____

C.3.5. How different is this neighborhood compared to the one you selected for your home?

1 totally different
2 very different
3 somewhat different
4 a little different
5 not different at all

C.3.6. What were the reasons that this neighborhood was not selected? (check all that apply)

1 I do not like the neighborhood
2 no suitable house
3 price is not right
4 too far from work
5 too far from my relatives/friends
6 other (**please specify**) _____

Section D - General Information

In this section, we will ask you questions about you and your household. These questions concern you and your household's socio-demographics and lifestyle. This information helps us understand how housing choices vary across the region's population. All information will be locked in a cabinet on the City College campus and destroyed after the study completes.

Definition of household members: people who live together, and share some activities or some financial resources.

D.1. How old are you? _____ years old

D.2. Are you:

1 Male 2 Female

D.3. Are you:

1 White
2 Black/ African American
3 Hispanic/Latino
4 Asian/ Pacific Islander/Original
5 Native American/ American Indian
6 other (**please specify**) _____

D.4. What is the highest level of schooling you have completed?

1 some grade school or high school
2 high school diploma
3 some college or technical school
4 4-year college/technical school degree
5 some graduate school
6 completed graduate degree(s)

D.5. Do you have access to a personal automobile or motorcycle?

1 yes 2 no

D.6. Please indicate the **number** of persons living in your household (**including yourself**) that fall into the respective **age groups** below:

_____ # of persons (age ≤ 2)
_____ # of persons (age 3-6)
_____ # of persons (age 7-11)
_____ # of persons (age 12-18)
_____ # of persons (age 19-54)
_____ # of persons (age 55+)

if your current home is not for primary residence, go to Question D.19

D.7. What is your current job status?

1 employed full-time 2 employed part-time 3 self-employed

if employed full-time, part-time, or self-employed, go to Question D.8

4 unemployed, ***go to Question D.14***

D.8. Is your workplace somewhere outside of your home?

1 yes, ***go to Question D.9***
2 no, ***go to Question D.11***

D.9. What is your main mode of travel to work? (*main mode* is the mode you spend the most time on during your trip from home to work)

1 car	3 transit	5 bike
2 motorcycle	4 walk	6 other _____

D.10. What is your one-way commute time from home to work? _____ minutes

D.11. How frequently do you work from home or from a local telecommuting office?

1 4-5 days a week	3 1 day every 2 weeks	5 rarely
2 1-3 days a week	4 1 day every month	6 never

D.12. Does your work involve physical activities (e.g. moving things around, walking a lot, etc.)?

1 all of the time	3 a good bit of the time	5 a little of the time
2 most of the time	4 some of the time	6 none of the time

D.13. How much time do you spend at work **every week**? _____ hours

D.14. What is the main mode of travel to work/school for your spouse/partner, if he/she goes to work/school? (***go to question D.16 if not applicable***)

1 car	3 transit	5 bike
2 motorcycle	4 walk	6 other _____

D.15. What is the one way commute time from home to work/school for your spouse/partner and other family members, if he/she goes to work/school? (***go to question D.16 if not applicable***)

_____ minutes for household member 1 (*your spouse/partner if applicable*)

_____ minutes for household member 2 _____ minutes for household member 3

D.16. How much time do you spend on recreational/sports/exercise activities **every week**?
_____ hours

D.17. How many times have you moved (your residential locations) in your adult life?

1 never	3 quite a few times	5 numerous times
2 only a few times	4 many times	

D.18. How often have you and your spouse/partner changed job locations in your/his/her adult life? (**note**: you may change your job location even you do not change your employer)

1 never	3 quite a few times	5 numerous times
2 only a few times	4 many times	

D.19. Do you rent or own the home in which you are currently primary residing?

1 rent	2 own

D.20. Please indicate how well each of the following phrases describes you.

	Hardly at all	Not very well	Moderately well	Very well	Almost completely	Don't know/ Not applicable
a. risk-taking	1	2	3	4	5	6
b. like being outdoors	1	2	3	4	5	6
c. patient	1	2	3	4	5	6
d. like to stay close to home	1	2	3	4	5	6
e. variety-seeking	1	2	3	4	5	6
f. ambitious	1	2	3	4	5	6
g. like moving at high speeds	1	2	3	4	5	6
h. efficient	1	2	3	4	5	6
i. like being independent	1	2	3	4	5	6
j. aggressive	1	2	3	4	5	6
k. adventurous	1	2	3	4	5	6
l. like being in charge	1	2	3	4	5	6
m. spontaneous	1	2	3	4	5	6
n. like being alone	1	2	3	4	5	6
o. restless	1	2	3	4	5	6
p. on time	1	2	3	4	5	6
q. curious	1	2	3	4	5	6
r. open-minded	1	2	3	4	5	6
s. emotional	1	2	3	4	5	6
t. plan ahead	1	2	3	4	5	6

D.21. What is your ancestry or ethnic origin? _____
(For example: Italian, Norwegian, Korean, Lebanese, Polish, Nigerian, Mexican, and so on.)

D.22. Where were you born?

1 In the United States, and I am the _____ (e.g., 1st, 2nd, 3rd, etc) generation of my family.

2 Outside the United States. — I was born in _____ (***Please print name of foreign country or Puerto Rico, Guam, etc.***), and I came to the United states in **year** _____ through _____ **(*Please print the port of entry, e.g., Newark, or JFK, or the state of entry in case you are not sure about the port).***

THANK YOU! Here are the instructions for returning the survey:

Step 1. Put *both* your completed survey and your signed consent form in the enclosed business reply envelope and seal the envelope.

Step 2. Drop the envelope in a mailbox that is convenient to you.

Appendix 2 Cluster analysis results

In the last three decades, the population in the New York State has increased by 11.3%, from 17.56 million in 1980 to 19.54 million in 2009. In other words, the variety-seeking behavior associated with the growth period could be just a reflection of the trend—places are on average getting more populated during the last several decades. To ascertain that the identified period effect is not merely a reflection of the trend, two clusters were identified: 1) a cluster of subjects who lived in a low density area during the growth period and 2) a cluster of subjects who stayed in a high density area during the growth period.

The selection of clusters is done in SAS with a principle of achieving maximum difference between mean population densities of the two clusters. The average population density during the growth period for cluster 1 of subjects is 15,500 people per square miles while is 38,220 people per square miles for cluster 2 of subjects.

The differential effects of the growth period location between the two clusters on their moves in the 2007-2009 period were investigated. To do this, the following utility function was applied to the dataset containing two clusters of subjects:

$$U_j = \left(\alpha_1 + \alpha_{21}\frac{1}{x_g+1}L_g + \alpha_{22}\frac{1}{x_g+1}H_g\right) \times \log(x_j + 1) + \gamma_1 x_{j,d} + \gamma_2 x_{j,sq} + \gamma_3 x_{j,os} + \gamma_4 x_{j,hp} + \gamma_5 x_{j,st} + \varepsilon_j, \quad (1)$$

where, x_g and x_j are population densities associated with the growth period location and the location the subject moved to during the 2007-2009 period; L_g is a dummy variable that is equal to 1 when prior location a is in the low density cluster and 0 otherwise; H_g is a dummy variable that is equal to 1 when prior location a is in the high density cluster and 0 otherwise. If there is a prior locational effect, the estimates for α_{21} and α_{22} shall have the same sign—those who lived in low-density locations shall behave the same as those who lived in high-density locations. In other words, if the growth period effect were indeed variety-seeking, the low-density group shall seek a high-density location and the high-density group shall seek a low-density location.

Table 7 shows the estimated results of equation (1). α_{21} and α_{22} are significant, supporting the existence of growth period effect. Furthermore, their positivity supports the association of variety-seeking behavior with the growth period. Figure 8 illustrates the growth period effect for the two clusters of subjects. In both cases, variety-seeking behavior is exhibited—exposure to low density during that period makes one place a higher value on density and vice versa. There is a differential between the two groups though: the prior location influence for the low-density group is of much larger magnitude than that for the high-density group—when prior density is less than 20,000 people per square miles, the reverse relationship between current preference for density and prior density is steep; when it comes to the high-density group (prior density larger than 20,000 people per square miles), the reverse relationship is much more flat and after 30,000 people per square miles, the additional effect brought by the prior location influence is muted.

It should be pointed out that results in table 7 are not directly comparable to the results in Chapter 2. First, in order to achieve maximum difference in cluster mean, those subjects lived in locations with middle range prior population densities are not included in either cluster. Second, this model was done at preliminary analysis phase of this dissertation thus some controlling neighborhood variables are not included in the model. However, these facts can't stop us from reaching the conclusion that the observed variety-seeking behavior pattern is not just a reflection of general population growth trend.

Table 7 Coefficients showing the influence of low and high density growth period locations on residential location choices made between 2007 and 2009

Variables	Differential effects of high and low growth period locations
Population Density (2007-09 Period)	
α_1 (Base: 2007-09 Period)	0.39
α_2 (Adjustment: Growth Period)	
α_{21} (Adjustment: Growth Period, Low Density Group)	0.54
α_{22} (Adjustment: Growth Period, High Density Group)	1.07
α_3 (Duration Effect)	
α_4 (Recency Effect)	
Housing Price	0.30*
School Quality	3.60
% of Single Family/Town Houses	1.50
Sample Size	108
Log-likelihood	-591.7

*: variables not statistically significant at 5% level

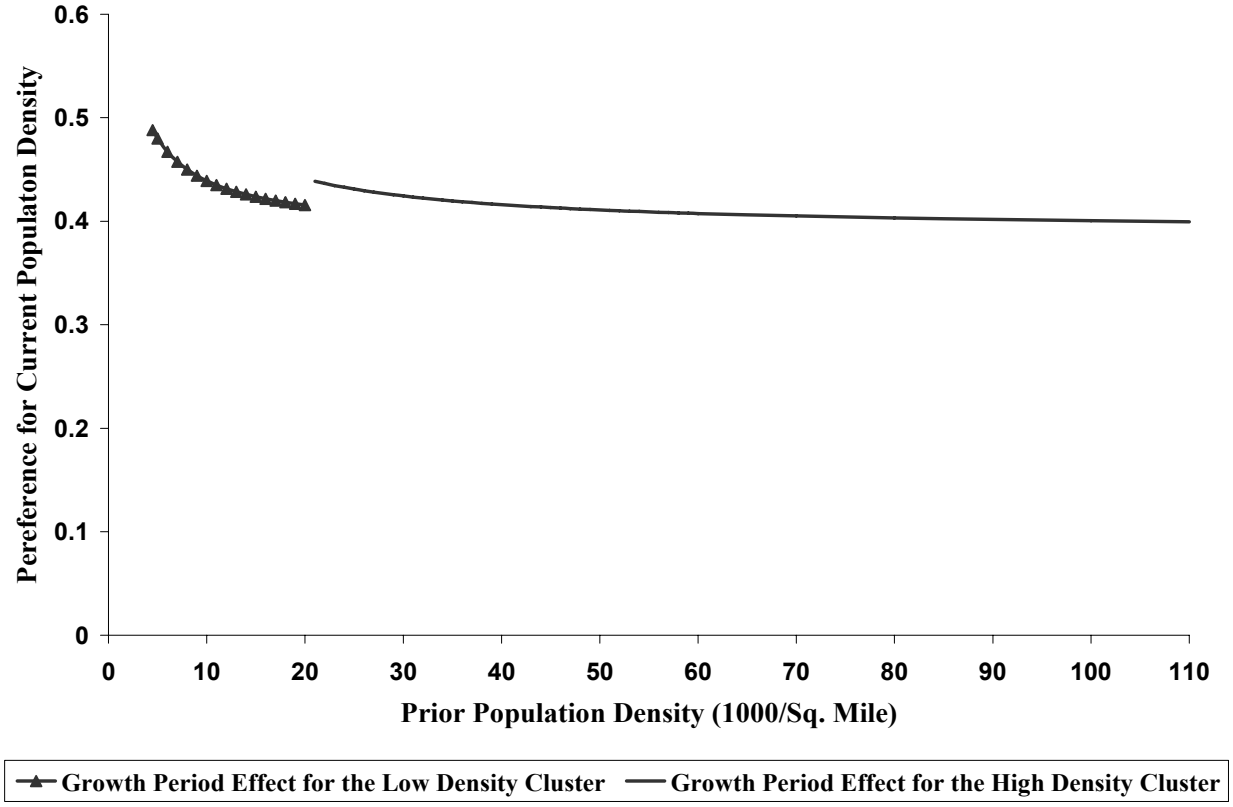


Figure 8 Differential effects of low and high density growth period locations

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