INTERNATIONAL JOURNAL OF
ARCHITECTURAL ENGINEERING AND URBAN RESEARCH
volume 5, issue 1, 2022, 92 – 115.

Investigating the Socioeconomic Factors Influencing Households' Residential Location Choice Using Multinomial Logit Analysis

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Abstract:

Increasing amounts of literature have been published recently on the factors that influence household residential location decisions. These factors include transportation accessibility, physical and environmental aspects of neighborhoods, household socioeconomic characteristics, and others. However, few research has looked at how the attributes of a housing location influence households' choices. As a result, the primary goal of this study is to examine the influencing factors for households' residential location choices. This has been achieved by developing a discrete choice analysis that utilizes a multinomial logit model, using state-wide data from the National Household Travel Survey (NHTS). The key findings of this study reveal that the most influential factors include; household income, race, household size, number of vehicles in the household, type of housing, and the household structure. The critical factors linked with high-income groups include access to school, proximity to work, and closeness to friends and family.

Similarly, when it comes to race, there is a significant disparity between different races. White people, for instance, are more likely to choose their residential locations based on the size and quality of the property. On the other hand, the number of adults in the household correlates with the convenience to work. When the size of the household grows, it is more likely that they will choose their home location depending on whether or not they have friends and family in the new area. In terms of housing types, people who live in a house are more likely to choose their home location based on the size and quality of the property. Apartment dwellers, on the other hand, tend to be more related to different criteria, such as housing cost and neighborhood quality. These findings have several meaningful implications for housing professionals and urban planners to predict how the growth and development of a city will occur. Moreover, it will help to fully understand the significant factors affecting people's behavior when choosing their residential locations.

Keywords: *Residential Location Choice; Housing Determinants; Multinomial Logit Model; National Household Travel Surveys; Discrete Choice Analysis; Urban Transportation Planning*

I. Introduction

Housing and location choices have substantially shaped urban development growth, particularly given the United States' high residential mobility rate [1, 2]. According to U.S. Census data, more than 20% of the population moved into a new residential location yearly, with 42% moving within five years [3]. This increases the demand to understand how this process works and how local planners can control and predict the relocation growth.

A growing body of literature has drawn attention to the factors affecting the choice of residential locations [4-8]. One of the early applications of residential location choice models was developed by Lerman (1976), who developed a logit model of a single household's residential location choice [9], taking into account various explanatory variables such as housing type, automobile ownership, and method of transportation to work. Later, several studies utilized discrete choice analysis in modeling residential location choice. McFadden (1978) has been considered one of the earliest scholars to apply a discrete choice framework to a residential location choice model [10]. More recent studies include this approach in a different way [11-13]; they differ in their model structures, modeling of choice dimensions, and choice of explanatory variables.

Several studies have focused on distinct aspects when addressing the issue of residential location models [14-22]. A substantial amount of research investigates the role of transportation systems and transportation accessibility on location choice[1, 12, 16, 17, 24-28]. Most of these studies discussed how households choose between different residential locations and considered changes in transportation, level of service, and neighborhood quality as significant variables. The findings of these studies demonstrated that when considering new houses, households make considerable compromises between transportation services and other public service elements.

Besides the transportation aspects, another amount of research has been conducted to investigate several factors that influence households' housing and location decisions. These include neighborhood characteristics, residential density, size and

quality of the house, and price of the housing stock [3, 4, 19, 25, 28-38].

Furthermore, others developed logit models to capture the influence of workplace choice on choosing residential locations [25, 39, 40]. Their results confirmed the assumption that the choice of the workplace is an exogenous variable. Moreover, the findings demonstrated the presence of residential clustering based on socio-demographic factors, life stage, and ethnicity. In a subsequent study, Waddell (2015) studied the impacts of the number of workers in the household, residential mobility, and housing tenure on the choice of a residential location. According to the findings, home ownership and the number of workers in the household both influence household decisions. Similarly, another researcher, using a nested logit model, explored the correlation between the activity schedules of household members and residential location choice [40, 41]. The results statistically invalidated the impact of daily activity schedules on residential locations.

Other studies focused on the socioeconomic characteristics of households, such as age, race, income, and family ties [17, 19, 31, 38, 42-52]. For instance, some studies created a multinomial logit model of household location selection. According to their findings, race is the crucial choice determinant among other socio-demographic characteristics of households [42]. In addition, the quality of public services such as schools, health care, and amenities services has been considered another factor affecting residential location choices [2, 29, 36, 37, 40, 53]. Other factors, such as family ties, have been considered in the literature to investigate the impacts of family ties in choosing housing locations [54-56].

However, as presented in this section, little is known about the significant socioeconomic factors affecting the location choice decision and how the attributes of the residential location are associated with the individual households' characteristics. Therefore, the primary goal of this research is to investigate the socioeconomic factors influencing a household's residential location choice. This will be achieved using a discrete choice analysis methodology and a multinomial logit model.

The majority of conventional housing allocation models are based on assumptions about understanding the relationships between housing locations, employment, and market conditions [30, 32, 57]. Few studies address how the socio-economic characteristics of individual households might affect their models. Therefore, this research contributes to residential relocation models by addressing the factors influencing households' decisions in choosing their residential locations. This article also analyzes which of these determinants (such as cost, convenience to schools and work, quality of the neighborhood, etc.) should have more weight in developing residential location models.

The results would help urban planners predict how the growth and development of a city will occur. Moreover, it is crucial to fully understand the significant determinants affecting people's behavior when choosing residential locations. To this end, this paper uses a multinomial logit choice model to analyze the determinants affecting where people choose to live and associate those factors with other socioeconomic variables.

II. Methodology and Data

This paper analyzes the factors affecting where people choose to relocate. To accomplish this goal, a Multinomial Logit Model

(MNL) has been utilized to estimate the probability of each factor influencing a household's choice of residential location. The detailed derivation of the model can be found in Akiva's classical book (1985) [9]. The MNL falls within the utility maximization approach where the key assumption is that people would make choices that maximize their utility. The utility is represented by a random variable which consists of a deterministic part and an error term.

More precisely, the utility that individual n identifies with alternative i in the choice set Cn is provided by:

$$U_{qi} = V_{qi} + \varepsilon_{qi} \qquad (1)$$

Where V_{qi} is the deterministic element of the utility, and ε_{qi} is the random term, capturing unmeasured attributes. As a result, the probability that decision-maker q chooses alternative I from the choice set C_q is:

$$P(i) = P(Uqi \geq Uqj, \forall j \in Cq) \qquad (2)$$

If we further assume that ε_{qi} is independent and identically distributed (IID), then the V_{qi}, the deterministic part of the utility, is often specified by a regression equation:

$$V_{in} = \beta_0 + \sum \beta_i \times X_{in} \qquad (3)$$

Where β_i is the regression coefficient and X_{in} is the explanatory variable which usually represents the attributes associated with the alternative i and the characteristics of the decision maker.

The dependent variable for the analysis was about the primary reason for choosing a current house location. As shown in Table 1, the choice set consists of a number of alternatives (7 alternatives) which are the significant attributes affecting residential location choice: cost/price of the home, quality and size of the home, convenience to work, quality of school system,

neighborhood quality, closeness to friends & family, and other factors.

Table 1. The choice set and the explanatory variables for the model

Response	Attributes/ Alternatives	Explanatory Variables
What is the major reason you chose your current house location?	1 Cost/price of the home 2 Size and Quality of home 3 Convenience to work 4 School system 5 Neighborhood quality 6 Closeness to friends & family 7 Other reasons	1 Household income Category: (Low (below $25,000), Medium (25,000-60,000), High (higher than 60,000)) 2 Race of household respondents: (White, Black, and other) 3 Count of household members 4 Number of adults 5 Number of workers 6 Count of household vehicles 7 Number of drivers in the household 8 Housing unit owned (Own/Rent) 9 urban/rural Region 10 Type of housing unit: (Single House, Duplex& townhouse, Apartment, Others) 11 Structure of the Household: (Single, Single parent with Children, Couple with children, Couple without children& other)

2.1 Data and Variables

This study uses secondary data collected from the 2017 National Household Travel Survey (NHTS) about travel and transportation patterns. This study utilizes state-wide household

data for the state of Florida, as a case study, with a total sample size of about 15,884 households. The state was classified into seven central regions (six urban (non-rural) regions and one rural region). In this paper, the focus is only on the six urban areas presented in Table 2 and the sample sizes (completed households). The unit of the analysis is the individual household, and it uses the available responses for the purpose of this paper.

Table 2. Urban counties by region, with target sample sizes

FDOT Region	Number of households	Sample size
1	545,158	1,200
2	613,890	1,234
3	424,149	1,200
4	2,150,666	4,116
5	1,040,095	1,999
6	1,196,954	2,250
Total	5,970,912	11,999

The NHTS data used in this study include:

- Education level, income, housing characteristics, and other demographic information of household members.
- Personal information about each household member, such as education level, income, gender, and other socioeconomic information.
- The year, make, model, and estimated yearly mileage of each household vehicle.
- Information describing the characteristics of the geographic region where the sample household and sample participants work.

III. Results

Table 3 shows the frequency distribution for the choice variable. Selected alternatives are from 01-07. Moreover, there are some other positive and negative values. For example, 97 means "other" alternatives, while the numeric negative (-1) predominates and is labeled "appropriate skip," indicating that several respondents skipped the question preceding this one. Generally, the negative values mean; -1 appropriate or acceptable skip, -7 refused, -8 do not know, and -9 not ascertained. Therefore, these values have been removed from the dataset for data cleaning.

Table 3. Frequency distribution for the choice variable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1	12207	76.9	76.9	76.9
	-7	5	.0	.0	76.9
	-8	30	.2	.2	77.1
	-9	10	.1	.1	77.1
	01	479	3.0	3.0	80.1
	02	167	1.1	1.1	81.2
	03	160	1.0	1.0	82.2
	04	95	.6	.6	82.8
	05	727	4.6	4.6	87.4
	06	476	3.0	3.0	90.4
	07	83	.5	.5	90.9
	08	141	.9	.9	91.8
	09	495	3.1	3.1	94.9
	10	16	.1	.1	95.0
	11	218	1.4	1.4	96.4
	12	7	.0	.0	96.4
	97	568	3.6	3.6	100.0
	Total	15884	100.0	100.0	

For the sample shares, after data cleaning, the sample size becomes about 3308 households. As shown in Table 4, the sample shares show that 852 Households (25.8%) choose other reasons for relocation, such as closeness to public transport and

retail, weather, and others. Next, 648 Households (19.6%) answered that they select a residential location based on neighborhood quality. Similarly, three alternatives have very close values of 13.7 %, 13.4%, and 13.4% for convenience to work, cost of home, and closeness to friends and family, respectively. Some results seem to have small values. That was the main reason the alternatives have been aggregated into the major determinants based on the sample shares frequencies.

Table 4. Sample shares for the choice variable

Alternatives			Sample Share
Valid	Cost/price of the home	443	13.4%
	Home Size& Quality	298	9.0%
	School system	169	5.1%
	Convenient to work	454	13.7%
	Neighborhood quality	648	19.6%
	Close to friends & family	444	13.4%
	Others	852	25.8%
	Total	3308	100%

3.1 Final Model Structure& Specifications

During the analysis, six major groupings of variables were considered:1) Household income, 2) Race, 3) Household size attributes, 4) Home ownership, 5) Type of housing units 6) Structure of the household. Within each of these groups, there are several different variables, as presented in Table 2. The process was based on eliminating statistically insignificant variables to develop the final specification for this model. The final results from the MNL model of the factors affecting the residential relocation choice are presented in Table 5. A positive (or negative) coefficient on a variable implies that increasing the

variable has the impact of increasing (or decreasing) the utility of choosing a residential location based on those or other factors.

Table 5. Final model results and specifications

Explanatory variables	Cost/Price		Home size & Quality		School System		Convenient to Work		Neighborhood Quality		Closeness to friends& family	
	Param	t stat	Param	t stat	Param	t stat	Param	t stat	Param	t stat	Param	t stat
Constants (β0, β1, β2, β3, β4, β5)	-.571	-4.99	-2.15	-5.86	-2.41	-8.97	-.815	-3.65	-.804	-3.50	-.360	-1.77
White (β6)	--	--	0.954	2.694	--	--	--	--	--	--	--	--
White (β7)	--	--	--	--	--	--	--	--	-.716	-3.73	--	--
HighINC (β8, β9, β10, β11)	-.551	-3.10	--	--	1.355	4.463	.5912	3.850	--	--	.8004	4.412
NumAdlt (β12)	--	--	--	--	--	--	.1876	1.972	--	--	--	--
HHSize (β13)	--	--	--	--	--	--	--	--	--	--	-.158	-1.99
NumVehl (β14)	--	--	--	--	--	--	--	--	.188	2.411	--	--
Shouse (β15, β16, β17)	--	--	.6771	3.524	--	--	--	--	.662	3.316	-.621	-3.35
Apt (β18, β19, β20)	.5103	2.168	--	--	--	--	--	--	.941	3.317	-.944	-3.53
Sparent (β21, β21)	--	--	--	--	-1.32	-6.31	-1.18	-4.52	--	--	--	--
Number of cases					3308							
Log-likelihood at convergence					- 2521.248							
Log-likelihood for constants-only model					- 2631.8095							

3.2 Variable Effects

A. Household Income Categories

The only variable in this set that seems to be statistically significant is the high-income category. It can be argued that

there is a substantial relationship between high-income groups and several factors in the choice set. According to the findings, high-income people are more likely to choose their residence location depending on factors such as convenience to school, convenience to work, and closeness to friends and family. As presented in Table 6, this variable has a positive relationship with several factors, indicating that an increase in income increases the probability of choosing those factors. On the other hand, the high-income group seems to be statistically significant with the cost of the house. Since the parameters have a negative coefficient, those with high incomes are less likely to consider pricing as one of their determining factors when choosing their residential location. That means people in low- and medium-income groups have more sensitivity regard to the price of the house, which has reasonable and intuitive sense. That might explain why the low-income variable was statistically insignificant in the final model.

Table 6. Household income categories.

Explanatory variables	Cost/Price		School System		Convenient to Work		Closeness to friends& family	
	Param	t stat	Param	t stat	Param	t stat	Param	t stat
HighINC (β8, β9, β10, β11)	-.551	-3.10	1.355	4.463	.5912	3.850	.8004	4.412

B. Household Race

This set of variables seems to be statistically significant at a 95% confidence level. We may infer a significant difference between white, black, and other races when choosing their residential locations. Table 7 shows that white people appear to be statistically significant in the final model.

According to the findings, home size and neighborhood quality are the most critical attributes connected with white people. This implies that white people are more likely to choose their residential locations based on the size and quality of the house. White people, in contrast, have a negative relationship with the neighborhood quality factor. On the other hand, other races proved to be statistically insignificant, implying a slight difference between the choices available to people of other races than white. Although it makes intuitive sense that various groups of individuals may have different preferences, it can be claimed that our model attempted to catch this strong relationship between other races and choice factors.

Table 7. Household race

Explanatory variables	Home size & Quality		Neighborhood Quality		Closeness to friends& family	
	Param	t stat	Param	t stat	Param	t stat
White (β6)	0.954	2.694	--	--	--	--
White (β7)	--	--	-.716	-3.73	--	--

C. Household Size Attributes

Three key variables appear to have a statistically significant influence on this set of variables (Table 8). Firstly, the number of adults in the household was shown to be statistically significant with regard to the convenience to work factor. That is justified and straightforward since it implies that increasing the number of adults in the household increases the likelihood that they will choose their residential location based on its proximity to work. Secondly, household size (the total number of households) appears to be statistically significant as well. This variable seems to have a stronger relationship with the factor of closeness to family and friends. Meaning, that increasing the size of the

household increases the likelihood that they will choose their residential location depending on whether or not they have friends and family in the new location.

Table 8. Household size attributes.

Explanatory variables	School System		Convenient to Work		Neighborhood Quality		Closeness to friends& family	
	Param	t stat	Param	t stat	Param	t stat	Param	t stat
NumAdlt (β12)	--	--	.1876	1.972	--	--	--	--
HHSize (β13)	--	--	--	--	--	--	-.158	-1.99
NumVehl (β14)	--	--	--	--	.188	2.41	--	--

Finally, the number of vehicles per family appears to be associated with and statistically significant with the neighborhood quality factor. That is, those who own more vehicles are more likely to choose their house based on the quality of the neighborhood. This also illustrates why high-income households are statistically insignificant for neighborhood quality. That might provide some justification, as high-income people and the number of vehicles appear to be significantly correlated.

D. Home Ownership

The results identified that this homeownership variable appears statistically insignificant at a 95% confidence level. It can be inferred that there is no significant difference in residential location preferences between people who own or rent their homes. In other words, home ownership does not appear to have a distinct probability regarding the factors influencing residential household choice.

E. Type of Housing Units

As indicated in Table 9, two housing unit variables appear to have a statistically significant influence on this set of variables. Firstly, people who live in a single-family house are more likely to choose their home location based on the size and quality of the house, as well as the quality of the neighborhood. Furthermore, the results show a negative relationship between this variable and closeness to friends and family. As a result, people who live in a single-family home are less likely to consider where their friends and family reside when deciding where to live.

Table 9. Type of housing units.

Explanatory variables	Cost/Price		Home size & Quality		Neighborhood Quality		Closeness to friends& family	
	Param	t stat	Param	t stat	Param	t stat	Param	t stat
S-house (β15, β16, β17)	--	--	.6771	3.524	.6629	3.316	-.621	-3.35
Apt (β18, β19, β20)	.5103	2.168	--	--	.9417	3.317	-.944	-3.53

On the other hand, people who live in apartments appear to be more associated with other variables, such as the property's cost and the neighborhood's quality. This might also make intuitive sense. One interpretation is that people who live in apartments are more likely to be in the middle- or lower-income group. As a result, cost is one of the key variables influencing their choice to relocate. Furthermore, one of the key considerations while choosing to reside in an apartment is the quality of the neighborhood. The accessible amenities and facilities are major determinants when deciding whether to reside in an apartment. Furthermore, the findings show a negative relationship between this variable and closeness to friends and family. As a result,

people who live in apartments are less likely to consider where their friends and family reside when choosing their residential locations.

F. Structure of The Household

According to the influence of this set of variables, only the variable of single-parent household was statistically significant in the final model (Table 10). As a result, single-parent families are less likely to choose their home location based on its proximity to work. In other words, for single-parent households, the effect of other factors is more likely than proximity to work. That might provide intuitive and reasonable results. That might be interpreted as single parents having more responsibilities to their children and being the sole ones responsible for their care. As a result, they may consider additional factors, such as the safety of their children or other circumstances. Other factors in this set of variables, such as single-person households, couples with and without children, and other household types, were shown to be statistically insignificant.

Table 10. Structure of the household.

Explanatory variables	Home size & Quality		School System		Convenient to Work	
	Param	t stat	Param	t stat	Param	t stat
S-parent (β21, β21)	--	--	-1.324	-6.31	-1.183	-4.52

IV. Discussions

The primary findings of this study are consistent with earlier research and shed light on crucial macro-factors influencing residential location choices. The results revealed that the most significant variables in choosing a residential location are household income, race, family size, number of vehicles in the household, type of housing, and household structure. These

findings are consistent with earlier research [11, 31, 32, 38, 42-44, 48, 50, 58]. Several other key factors, on the other hand, are determined to be insignificant. Access to public transportation, home ownership, and the number of workers in the household, for example, were not represented by our model. This differs from previous studies that found those factors to be significant [1, 3, 7, 16, 21, 25, 35, 39, 59].

When linking those characteristics to the driving factors of housing location choice, we observe that the factors associated with a high-income group include access to school, proximity to work, and closeness to friends and family. Meanwhile, the results indicate that those with a high income are less likely to consider cost as a factor when deciding where to live. Regarding the race variable, the analysis shows a substantial difference between white and other races when it comes to choosing their residence locations. According to the findings, the primary determinants associated with white individuals are house size and neighborhood quality. This entails that white individuals are more likely to choose their residential locations depending on the size and quality of the property.

For the household size factors, the results discovered that the number of adults in the household has a substantial relationship with the convenience of working. That implies, that when the number of adults in the household grows, they will choose their residential location depending on its proximity to work. Second, the findings indicate that household size appears to have a more significant influence on the factor of closeness to family and friends. That means increasing the size of the household increases the likelihood that they will choose their residence location based on whether they have friends and family in the

new location or not. Finally, when it comes to the number of vehicles per household, the findings demonstrate that those who own more vehicles are more likely to choose their home based on the quality of the neighborhood.

In terms of housing units, this research's analysis shows that people who live in a single-family house are more likely to choose their home location based on the size and quality of the house, as well as the quality of the neighborhood. Furthermore, the findings show that people who live in a single-family home are less likely to consider where their friends and family reside when deciding where to live. On the other hand, people who live in apartments appear to be more associated with other factors such as housing cost and neighborhood quality.

The study's primary limitations are twofold; First, the final sample size was modest compared to the original NHTS dataset. The issue is that the data contains an excessive number of missing values and suitable skip items. Second, considering additional significant factors may improve the robustness of present models. As a result, the following features provide useful areas for future research. More factors might be added to the present models. Moreover, the model could not capture the spatial component of the variables. Thus, more analysis is required to determine whether there is any spatial pattern or clustering in the data, which may be accomplished by evaluating the dataset's spatial dependence.

V. Conclusion

This study examines the factors that influence household decision-making and how location qualities are associated with individual households' socio-economic characteristics. Thus, the main objective of this research is to evaluate the significant

factors influencing residential location choice. This has been accomplished through discrete choice analysis methods and a multinomial logit model. The primary findings of this study indicated that household income, race, household size, number of vehicles in the household, housing type, and household structure are critical variables in choosing a residential location.

According to the findings, the key factors linked with high-income groups include access to school, proximity to work, and closeness to friends and family. When it comes to race, there is a significant disparity between races when it comes to choosing their residential locations. White people, for instance, are more likely to choose their residential locations based on the size and quality of the property.

On the other hand, the number of adults in the household correlates with the convenience to work. That means that when the number of adults in the household grows, they will choose their home based on its proximity to work. Furthermore, the size of the household appears to have a more significant impact on the factor of proximity to family and friends. That is, when the size of the household grows, it is more likely that they will choose their home location depending on whether or not they have friends and family in the new area. In terms of housing types, people who live in a single-family house are more likely to choose their home location based on the size and quality of the house, as well as the quality of the neighborhood, when it comes to housing types. Apartment dwellers, on the other hand, tend to be more related to other criteria such as housing cost and neighborhood quality. Finally, when it comes to the number of vehicles per household, the findings demonstrate that those who

own more vehicles are more likely to choose their home based on the quality of the neighborhood.

The findings of this study have several meaningful implications for housing studies, urban planning, and community development. This study attempts to answer what factors influence households' decisions in choosing their residential locations. Furthermore, it will assist in completely comprehending the key factors influencing people's behavior while deciding where to live. This would aid in developing more dependable models based on those factors.

VI. References

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