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Macro-Level Factors Shaping Residential Location Choices: Examining the Impacts of Density and Land-Use Mix

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Abstract: Many published papers have delved into the factors affecting the residential location choices of households using various logit models. Nonetheless, only a few pieces of literature have attempted to examine those associative attributes from a macroscopic view. Thus, this article investigates the factors that influence households' preference to reside in densely populated locations or regions with a wide variety of land-use types using ordered choice models (ORM). This study proposes three indicators that are reflective of residential areas, namely population density, housing density, and land-use mix index, based on prior research. Population density and housing density are modeled at census block and tract levels to explore households' sensitivity to different geographical scales. Regarding land use, this research classifies the diversity index into four categories: uniform, moderately diverse, more diverse, and the most diverse. Similarly, the study is predicated on 0.25-mile and 0.5-mile buffer zones. The findings are consistent with earlier research and highlight macro-level issues that influence residential location decisions. As for the residential preference for housing density, significant factors are the structure of households, the number of vehicles per household, and household income. Regarding the residential choices of population density, significant attributes refer to demographic characteristics, household income, and housing types. Concerning the residential choices based on land-use mix, the most influential factors turn out to be the interacting terms between demographics and housing-related index, household income, and housing-related indexes.

Keywords: residential choice; ordered choice model; population density; housing density; land-use mix

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1. Introduction

The analysis of residential location choice is of great importance and interest in the explanation of urban growth and households' travel activity patterns [1]. Different urban forms, compactness or suburbanization, are essentially due to residents' preferences regarding where to live. Thus, a better understanding of the drivers behind households' choices benefits the policymaking on urban development and congestion-related mitigations. In other words, residence location modeling plays a pivotal role in the model systems of land use–transport interaction [2]. Accordingly, it is of utmost necessity to examine a whole range of important factors affecting where residents choose to live.

Much effort has been made to analyze the choices of residential locations using discrete choice modeling. Numerous factors affecting residential locations, such as demographic information, travel patterns, neighborhood characteristics, and spatial interactions between residential lands and workplaces, have been delved into for the past decades.

As an early explorer in this field, Lerman examined the relationships between residential locations and the travel patterns and socioeconomic characteristics of households. For the sake of explaining residential demand, Lerman designed a logit model consisting of households' combined choices, such as locality, commuting mode, car ownership, and so on [3,4]. His model was later improved and implemented, empirically and theoretically, by other scholars and governmental agencies. A crucial enhancement of Lerman's model is the integration of accessibility represented by travel time and cost for working commute into the original one. Specifically, the expected maximum utility serves as a measurement of accessibility. This approach, though, was criticized for its inability to account for the correlation of people's trip decisions on a daily basis [3].

Accordingly, an activity-based travel model based on a daily activity schedule was introduced to better the residential choice simulations by Ben-Akiva and Bowman in 1995 [5]. They proposed an intergrade framework of residential, activity, and travel decisions. Their framework specifies three dynamic components during households' decision-making process in the considerations of residential locations—i.e., urban development (land use policies and real estate growth), household (mobility and lifestyle), and transport system performance. In other words, the activity-based choice model integrates the components of the utility related to a given residential location and the expected maximum utility among schedules available to household members. Nevertheless, this model inadequately addresses other important factors when people consider residential locality. For example, the degree of land-use mix surrounding residential locations plays a pivotal rule in households' decision-making. In addition, its daily-based feature weakens the model accuracy over a longer period of time.

Neighborhood characteristics are receiving much more attention in the analysis of residential location modeling [1,6]. While the concept of neighborhood is extensively studied among a variety of disciplines, there exists very little research about the explicit definition of spatial neighborhood. Additionally, traditional study units for land use and transport modeling, zip code areas, and census tract are criticized for the lack of theoretical justification of using these administrative boundaries. Instead of artificially fixed boundaries, a neighborhood is conceptualized as a multi-scale structure [6–9]. The traditional grouped alternative choice model for residential locations, though, fails to take into consideration the hierarchical neighborhood.

As a result, Guo and Bhat contended that the accessibility to public facilities serves as an alternative to describe neighborhood features, thereby identifying the spatial dimension of neighborhood at the operational level. Most importantly, "The concept of neighborhood and its definition are, therefore, central to residential location choice analysis" [1]. Hence, Guo and Bhat came up with the multi-scale logit model to analyze the residential locations of households, making possible the spatial representation of hierarchical neighborhood. Specifically, census units, circular units, and network bands serve as three representations of structural neighborhood. However, this definition fails to generate a universal form of multi-scale neighborhood, weakening its ability to apply this concept into distinct study areas.

Additionally, recent studies on lifestyle enriched the scope of the classic conceptualizations of residential choice [7,10–13]. Especially in the arena of knowledge cities, much research effort has been expended on what primarily contribute to the economic growth. Therefore, links have been established between knowledge workers and economic prosperity in European countries [14]. Regarding residential choice, cultural amenities and lifestyle are proven to play an essential role in the process of decision-making of knowledge workers [14–16]. Frenkel et al. empirically justified the importance of knowledge workers' lifestyle in the actual residential choice using a multiple nominal model and nested logit model. Specifically, they constructed eight groups of independent variables including lifestyle elements—i.e., culture and recreation, sport, and family activities—to estimate the probability of residential choice of knowledge workers [14]. Nevertheless, these studies primarily focus on the lifestyle patterns and residential preferences of knowledge workers, altogether ignoring other important demographic groups such as low-income persons and minorities.

The choice models of residential location are heavily criticized due to their limited ability to effectively represent spatial correlations among choice alternatives. The concept of spatial correlation, considered as the first law of geography, first emerged in the field of discrete choice model to enhance the traditional multinomial logit (MNL) model [17,18]. It is evident that, likely, the property of independence from irrelevant alternatives (IIA) is violated when it comes to the alternatives featured by size and locational characteristics [19]. Accordingly, the nested logit (NL) model, which assumes a hierarchical structure of choice sets, was introduced to account for the alternative correlation. The NL model, however, suffers from its potential arbitrariness regarding the specification of each cluster or nest of alternatives [20]. More advanced choice models than MNL and NL models are worked out by several researchers, taking in considerations correlated components such as error terms and the autocorrelated element of utility [10,21–24]. A substantial improvement in the area of discrete choice analysis is the conceptualization of generalized extreme value (GEV). Under the framework of GEV, different choice alternatives are adaptably substitutable [25]. Based on this, Sener et al. developed the generalized spatially correlated logit model (GSCL) to account for diversely spatial autocorrelation [25].

There has been a rapidly increasing interest in the effort to explore the factors linked with residential location choices [13,26–29]. A growing body of literature has attempted to dig into how the whole spectrum of sociodemographic and additional attributes influence residential location choice [13,30,31]. Nevertheless, very few attempts have been done to investigate those associative attributes from a macroscopic view. Thus, this paper basically focuses on what are the crucial determinants of sociodemographic in households' propensity to live in highly populated areas or diversified land-use regions. In other words, the current article strives to delve into who chooses to live in areas of high population or housing density compared with those who do otherwise. In addition, much effort is placed on how different extents of land-use diversity influence households' residential preferences.

Recently, there has been a growing interest in understanding the factors that impact residential location choices. While there is a significant body of literature exploring the influence of sociodemographic and other attributes on this decision, few studies have taken a macroscopic approach to these associative attributes. This research seeks to address this gap by examining the crucial determinants of household propensity to live in highly populated or diversified land-use regions. Specifically, this study aims to investigate who is more likely to choose to live in densely populated areas compared to less populated areas, and to what extent land-use diversity influences residential preferences. By taking this unique approach, this paper contributes to the originality of research in this field.

2. Materials and Methods

2.1. Data Sources

The study area of this paper focuses on is the region of Miami–Fort Lauderdale–Pompano Beach (Core Based Statistical Area), which includes Broward, Palm Beach, and Miami Dade County, in Florida, the United States. The data considered in this study are twofold. First, our analysis is chiefly based on the 2017 National Household Travel Survey (NHTS) data which are designed and processed by Federal Highway Administration (FHA). Information regarding the travel behavior and sociodemographic of responding households is provided by the 2017 NHTS. The term 'households' used in this study denotes the civilian and non-institutionalized population, which is also the focus group of the NHTS. In other words, the population living in motels, hotels, and group quarters is excluded from the sampling process of the NHTS to ensure unbiased analysis results. Second, we also used the findings coming from the land-use parcel data created by the Florida Department of Revenue. In addition, these data were processed by the Institute of Transportation Engineers, University of Florida to accommodate current research. Information regarding land-use types and transit accessibility is offered by this data source.

These data were organized and cleaned through the following steps. First, an initial sample of 3980 households with detailed information regarding household sociodemographic and travel behavior was derived from the 2017 NHTS data. Second, the data related to land-use types and transit accessibility were incorporated into this original sample. Last but not the least, each variable included in the merged dataset was screened and inspected in the NCSS software to ensure the completeness of final data used in the modeling process.

In other words, missing data were excluded through data screening. Finally, a final sample of 3026 households was confirmed for this study (Table 1).

Table 1. Descriptive statistics of six types of choice alternatives.

	Choice Sets	Minimum	Mean	Maximum	Standard Deviation	Observations
Block level (1000/square mile)	Housing density index	2.60	3384.20	53,499.14	4752.22	3026
	Population density index	4.64	7268.73	99,411.00	8119.06	3026
Tract level (1000/square mile)	House density index	2.41	2889.06	38,555.15	3295.13	3026
	Population density index	6.93	5673.37	41,911.28	4297.53	3026
0.25-mile buffer area	Land-use mix index	0	0.29	0.89	0.19	3026
0.5-mile buffer area	Land-use mix index	0	0.43	0.93	0.16	3026

The analysis was conducted based on six types of choice sets—i.e., population density index and house density index at the block level or track level, and land use mix index at 0.25-mile or 0.5-mile buffer level. The consideration of identifying the choice sets at different spatial scale was aimed at exploring the impacts of spatially distinct neighborhoods on the individual residence choices. Table 2 provides the statistical descriptions for density-related indexes as well as land-use diversity indicators linked to each household. Additionally, Figure 1 offers an overview of frequency distributions of these indexes.

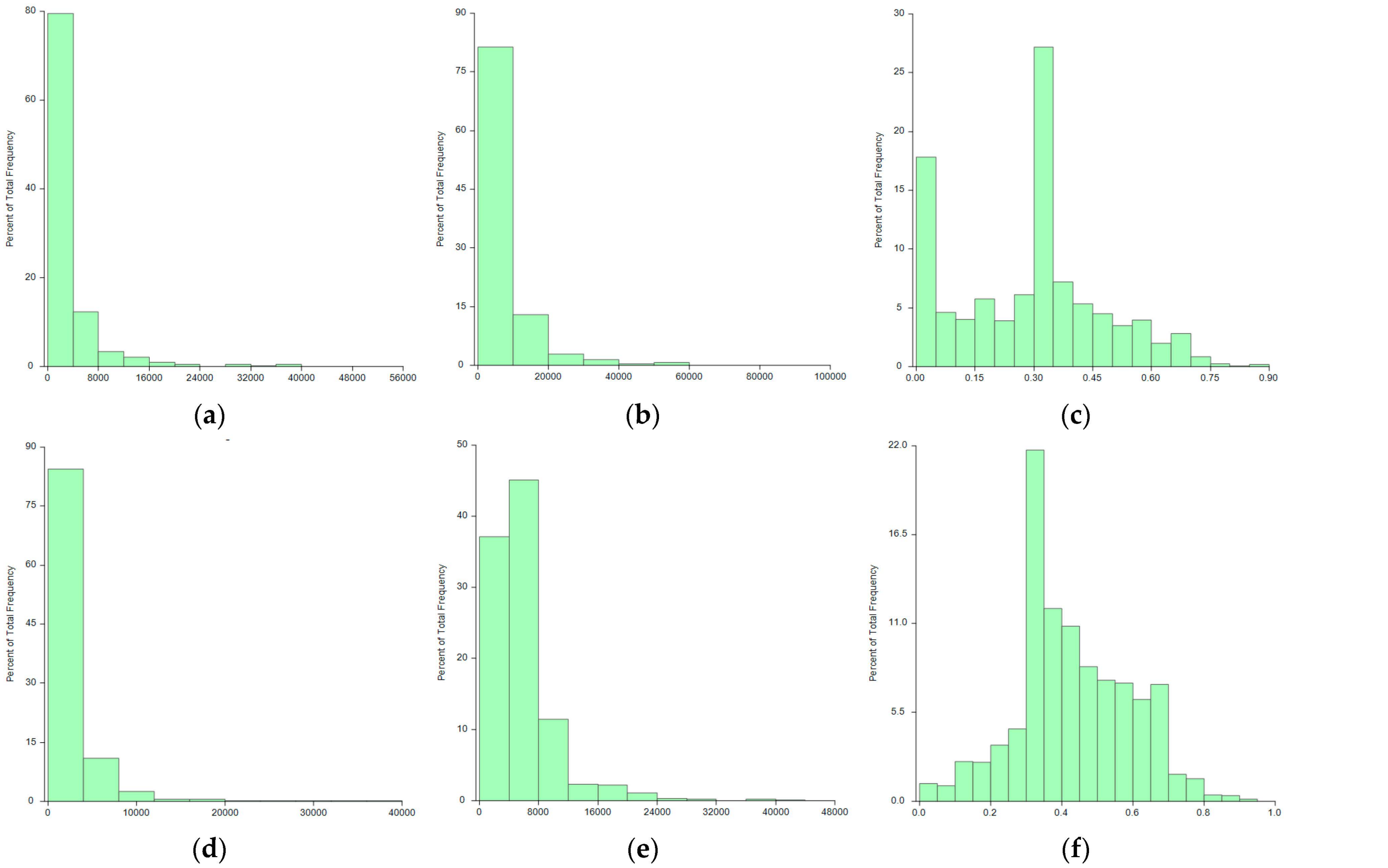

Figure 1. The histograms of six types of choice alternatives: (**a**) Net house density at block level; (**b**) net population density at block level; (**c**) land-use mix index within 0.25-mile buffer; (**d**) net house density at tract level; (**e**) net population density at tract level; (**f**) land-use mix index within 0.5-mile buffer.

Table 2. Categories of density and land-use mix related choice alternatives.

	Choice Sets	Least Dense			Densest
Block level (1000/square mile)	Housing density index	(min, 1171.88)	(1171.89, 2141.69)	(2141.70, 3473.66)	(3473.67, max)
	Market share	756 (24.98%)	758 (25.05%)	759 (25.08%)	753 (24.88%)
	Population density index	(min, 2808.57)	(2810.58, 5300.21)	(5300.22, 8599.48)	(8599.49, max)
	Market share	757 (25.02%)	757 (25.02%)	756 (24.98%)	756 (24.98%)
Tract level (1000/square mile)	Housing density index	(min, 1404.80)	(1404.81, 2140.33)	(2140.34, 3197.09)	(3197.10, max)
	Market share	759 (25.08%)	757 (25.02%)	756 (24.98%)	754 (24.92%)
	Population density index	(min, 3014.76)	(3014.77, 4757.71)	(4757.72, 6924.86)	(6924.87, max)
	Market share	756 (24.98%)	759 (25.08%)	756 (24.98%)	755 (24.95%)
		Least diverse land-use		most diverse land-use	
0.25-mile buffer area	Land-use mix index	(min, 0.13)	(0.14, 0.33)	(0.34, 0.39)	(0.40, max)
	Market share	756 (24.98%)	1142 (37.74%)	374 (12.36%)	754 (24.92%)
0.5-mile buffer area	Land-use mix index	(min, 0.33)	(0.34, 0.41)	(0.42, 0.55)	(0.56, max)
	Market share	898 (29.68%)	618 (20.42%)	756 (24.98%)	754 (24.92%)

As for population and housing density indexes, 4 ordinal categories for each index were calculated and confirmed based on the process of data stratification. For instance, 4 choice options representing housing density index at census block level were generated using 3 quantiles of these data—i.e., 1171.88, 2141.69, and 3473.66. In other words, any households whose housing density index at census block level was equal to or less than 1171.88 thousand per square miles chose the first alternative—that is, the census blocks with the smallest density of housing units compared with the other three options. This same was true of the 3 additional density-related indexes.

Regarding the indicator of land-use diversity, we adopted the framework of land-use diversity designed by Guo (2007), while minor changes were made to accommodate our empirical analysis. In other words, we considered the measure of land-use mix defined by:

$$\text{LUXs} = 1 - \frac{\text{abs}(\text{Rs} - 0.25) + \text{abs}(\text{Cs} - 0.25) + \text{abs}(\text{Is} - 0.25) + \text{abs}(\text{Os} - 0.25)}{1.5} \quad (1)$$

where Rs, Cs, Is, and Os are the fractions of 0.25- or 5-mile buffer area that is residential, commercial, industrial, and other land-use types surrounding a specific household s. According to Guo and Bhat (2004), this land-use mix index ranges from 0 to 1, where 1 refers to a totally mixed land use and 0 shows that the land is purely pertinent to a single land use [32]. Similarly, using data stratification we identified 4 ordinal categories of land-use mix indexes (Table 2). We took the case of the land-use mix index within the 0.25-mile buffer area to a given household. The data were divided into four categories using 25%, 50%, and 75% quantiles—i.e., 0.13, 0.33, and 0.39, respectively. Accordingly, households whose land-use diversity index was within the 0.25-mile buffer equal or less than 0.13 were assumed to choose the alternative of the 0.25-mile area that was least diversified in land use. The same was true of the 0.5-mile land-use mix index.

Because of the correlation nature among similar choice alternatives in our study, we analyzed the residential choice using an ordered-response model (ORM). In fact, numerous published papers have proved the robustness of the ORM in modeling ordinal level dependent variables [32,33]. The ORM formulation was originally proposed by McKelvey and Zavonia in 1975 and adopted in our analysis.

For the sake of model specification, we consider the housing density at census block level, for example. The same conceptualization can be applied to five other ordinal-level dependent variables in this paper. In the case of the housing density index, the mechanism of ordinal-level responses assumes the existence of a potentially continuous propensity of housing density U_q^* for household q. This latent propensity is postulated to be a linear function of a vector of inherent and exogenous variables of the household q, x_q, and an error term ε_q that is independently and identically distributed. The latent propensity U_q^* reflects the reported choice alternatives of housing density index, U_q, via 3 threshold bounds [32]. Simply stated, the propensity U_q^* is represented as:

$$\begin{array}{ll} U_q^* = \beta' x_q + \varepsilon_q,\ \varepsilon_q \sim N(0,1) & \\ U_q = 0 \text{ (not dense)} & \text{if } U_q^* \le 0 \\ U_q = 1 \text{ (somwhat dense)} & \text{if } 0 < U_q^* \le \mu_1 \\ U_q = 2 \text{ (very dense)} & \text{if } \mu_1 < U_q^* \le \mu_2 \\ U_q = 3 \text{ (the densest)} & \text{if } \mu_2 < U_q^* \end{array} \quad (2)$$

In the above equation, x_q includes all the explanatory variables plus a constant intercept. The error terms are normalized to follow a standard normal distribution with a mean of 0 and a variance of 1. Since the constant term is included in the model, the lowest threshold is confirmed to be 0 [33]. In addition, the μ's denote additional threshold bounds. Furthermore, the probability for a household q to live in a census block with a given housing density index that falls into an ordinal category k (k = 0, 1, 2, 3) is calculated based on Equation [2] as:

$$\begin{aligned} P\left[U_q = k\right] &= \Lambda\left(u_k - \beta' x_q\right) - \Lambda\left(u_{k-1} - \beta' x_q\right) \\ &u_{-1} = -\infty,\ u_0 = 0,\ u_3 = +\infty \end{aligned} \quad (3)$$

Last but not the least, a maximum likelihood procedure was conducted to obtain the best-fit vector of coefficient β' that was associated with explanatory variable x. This procedure was completed using the econometric software NLOGIT 5.0.

2.2. Description of Explanatory Variables

Given the data availability and explanatory variables suggested by Guo, Lerman and Frenkel et al. [1,3,14], we identified six categories of exogenous and endogenous attributes of households (Table 3). Next, each group of variables will be discussed briefly.

2.2.1. Demographics

Household demographics are mirrored by three variables—that is, the number of household members, the race of household respondents, and the family structures. The underlying logic for choosing these variables is that household size, ethnic status, and household structures (e.g., presence of children and retirees, etc.) have been found to be statistically significant in zone-based residential models [1,5]. In addition, the raw data were processed to accommodate the modeling process. Specifically, the categorical data were converted into dummy variables. For instance, there are 8 categories of race attributes—e.g., White, African American or Black, Asian, and American Indian or Alaskan Native, etc. Accordingly, the model can understand well the ethnicity of a given respondent on the basis of these dummy variables. For the sake of model construction, the base or reference dummy variable of household ethnicity is Rother—that is, the race of household respondent is any other race type. In addition, the same is true of the family structure attribute regarding data conversion.

2.2.2. Travel-Related Attributes

Travel-related attributes characterized three measures, including the number of vehicles, the category of number of household trips on travel days, and proximity to schools. First, the number of vehicles reflects households' travel mobility—that is, how easily an individual can make a trip from home to destinations. This may affect the residential location decisions. Second, the variable related to households' trips also mirrors the travel mobility of households. Third, whether a household is close to working places describes one aspect of its surrounding built environment, thereby potentially impacting the residential location considerations of households.

Table 3. Description of selected explanatory variables in the data set.

	Name	Description	Data Type
Demographics	hsize	Household size	Counts
		Race (selected)	
	White	The race of household respondent is White	Dummy
	Black	The race of household respondent is African American, Black	
	Asian	The race of household respondent is Asian	
	Indian	The race of household respondent is American Indian, Alaskan Native	
	Rother	The race of household respondent is any other race type	
		Structure of household (selected)	
	sadult	one adult, no children	Dummy
	sretire	one adult, retired, no children	
	sparyc	one adult, youngest child 0–5	
	madunc	2+ adult, no children	
	mretire	2+ adult, retired, no children	
	madyc	2+ adult, youngest child 0–5	
Travel attributes	hhveh	The number of vehicles in households	Counts
	cnht	Category of number of household trips on travel days	
	clwork	Proximity to work	Dummy
Employment and economic indicators	nworker	Number of workers	Counts
		Household income	
	hinc	High-income (total annual income is equal or greater than USD 60,000)	Dummy
	minc	Medium-income (total annual income is between USD 30,000 and USD 59,999)	
	linc	Low-income (total annual income is less than USD 30,000)	
	nadult	Number of adults at least 18 years old	Counts
Housing index	htenure	Housing units owned	Dummy
		The type of housing units	
	dsingle	The type of housing unit is detached single house	Dummy
	Duplex	The type of housing unit is duplex	
	Townh	The type of housing unit is rowhouse or townhouse	
	Apt	The type of housing unit is apartment or condominium	
	Mobhm	The type of housing unit is mobile home or trailer	
	Hothert	The type of housing unit is any other type	
Lifestyle factors	cschool	Close to school	
	cretail	Close to retail services	
	cfriend	Close to friends	
Transit	ctrans	Close to transit	

2.2.3. Employment and Economic Indicators

Three crucial measures of this group were considered based on earlier studies. The number of workers in a household embodies the employment status of family members. The variable of total annual household income serves as an indicator of households' economic characteristics, which has been proven to be decisive in determining the levels of car ownership of individuals [34]. Since car ownership is correlated with residential location decision [35], it is reasonable that there may exist a causal linkage between household income and residential location. The third measure is the number of adults at least 18 years old, which can be regarded as an index of the levels of the workforce represented in households.

As for data structuring, the variable of housing income is initially represented by 18 categories. This study creates 3 dummies according to these income categories—i.e., high-income households with total annual income equal or greater than USD 60,000, medium-income households with total annual income between USD 30,000 and USD 59,999, and low-income families with less than USD 30,000.

2.2.4. Housing-Related Index

The attributes of housing units themselves are, essentially, the reflection of residential locations. In other words, single-family houses are less likely to be located in downtown areas than apartments or condominium in that the land-use development of urban regions are more compact than that of suburban areas. Specifically, the housing-related index consists of two factors: housing tenure status and the type of housing units. Six dummies were generated to reflect the types of housing units.

2.2.5. Lifestyle Factors and Transit Accessibility

A number of measures—i.e., the proximity to schools, friends, and retail services—are used to depict the lifestyle of households. In other words, these attributes are potentially associated with the frequency of educational and recreational activities in households, thereby indirectly affecting residential location considerations. In addition, the dummy variable, proximity to transit, reflects the accessibility of transit services to a given household.

2.2.6. Interacting Terms

A variety of interactions among different groups of factors were explored in the modeling process to capture the effects of interacting terms on the response variables. Specifically, the interactions considered were primarily twofold. First, the economic indicators (e.g., low-income households, etc.) interact with transit and housing indexes such as housing tenure. Second, demographic characteristics such as household size interact with housing indexes.

3. Results

Three categories of models regarding housing, population, and land-use diversity index were estimated using the order-response logit technique. Furthermore, under each category two models were run to examine the impacts of the choice sets with different spatial scales on the estimated results. In addition, six groups of variables and various interacting terms across these groups (mentioned in the last section) were considered and explored in the empirical results. Through a systematic process of excluding statistically insignificant variables, the final results of each model and the direct effects of variables are presented and interpreted in the following sections. In addition, under each category the empirical analysis investigated the model sensitivity to different spatial scales of choice sets.

3.1. Model Results I (Housing Density at Census Block or Tract Level)

The parameter estimates concerning residential choice of housing density are presented in Tables 4 and 5. The effects of independent variables on the residential preferences concerning housing density are interpreted in the following paragraphs.

I. Effects of Demographics

Census block level. The effects of demographics suggest that the structure of households was an important factor in determining the propensity of households to live in areas with high housing density. Specifically, Table 4 indicates that single retired households with no children showed a higher propensity to live in census blocks with a large number of housing units per square mile than other types of households. This is probably due to the fact that a populated community can offer an atmosphere of family to those retired persons without children. In all likelihood, a large community provides better opportunities for these individuals to communicate with neighbors than a small one. This is somewhat inconsistent with the findings of Bhat et al. [32], which indicate that the households with seniors tend to avoid high housing density developments. This inconsistence may partly result from different spatial scales of research objects used in this study and their empirical analysis. Here, we can focus on neighborhood level, or census block. However, at census block level, only the variable representing household structures, as a stand-alone factor, was statistically significant. As for interacting effects, the households with a large number of family members who lived in rowhouses or townhouses tended to live in areas with high housing density. The same was true of big families who own houses.

Census tract level. The effects of household structure on residential choice on housing density at census tract level were similar to the ones at block level—that is, singe retired households preferred those communities with a large quantity of housing units. The effects of race indicate that, at census tract level, American Indian or Alaskan Native families were less likely to reside in areas with high rate of housing density than Asian, Hispanic/Mexican, and White families, and households of other ethnic types. This was partially due to social gentrification issues. In other words, population clustering existed in the communities with similar racial background. Regarding interactions, big households living in apartments or condominiums displayed a higher propensity to live in housing-oriented areas than those dwelling in duplexes. Nonetheless, the variable of household size did not play a crucial role in the residential choice decisions regarding housing density either at census block or tract level.

II. Effects of Travel-Related Attributes

Census block level: It is expected that the level of vehicle ownership in household negatively impacts the likelihood for households to live in areas featuring high housing density developments. This is understandable in that the presence of cars equips the households with the ability to reside in suburbs that are typically more comfortable regarding environmental and living quality but have fewer housing units than urban areas. However, the proximity to work and the household trip variables turned out to be insignificant at census block level.

Census tract level: The effect of car ownership at census tract level was consistent with that at block level. In other words, vehicle ownership can be viewed as an essential element in the residential considerations regarding housing density. In addition, households who travelled more frequently preferred low housing density developments. It is worth noting that whether a household was close to workplaces hardly impacted the residential choice on housing density.

III. Effects of Employment and Economic Indicators

Census block level. The effects of economic indicators showed that high-income households shied away from areas featuring high housing density. However, at census block level, medium- and low-income households were indifferent to housing density. In addition, two terms of interaction between household-income and housing-related indexes were significant. First, low-income families living in detached single houses had lower propensity to live in the regions with a high concentration of housing units than others. Second, when owning their properties, low-income households tended to live in residential areas with high housing density. However, it is surprising to note that the employment indicators, and number of workers and adults (at least 18 years old) in a household barely had impacts on residential considerations concerning housing density.

Census tract level. The effects of household income implied a higher propensity to live in census tracts with large housing density among low-income households relative to medium- and high-income households. Furthermore, compared to medium-income households, high-income ones were less likely to choose areas with high housing density developments as their residences.

IV. Effects of Housing-Related Index

Census block level. Only the housing tenure was found to be significant. Hence, at census block level, there existed no residential choices on housing density among households if one only considered their housing unit types, such as single-family and multiple-family houses. Only when interacting with other variables did some factors concerning housing types impact the residential choices regarding housing density. The effect of housing tenure showed that households who rented tended to live in census blocks with high housing density.

Census tract level. Interestingly, at census tract level the effect of housing tenure disappeared. In other words, households who owned houses or rented them were indifferent to the housing density at census tract level. In addition, the variable of housing type became significant at this spatial scale. Specifically, households dwelling in rowhouses, or townhouses showed higher housing density propensity relative to those living in houses of other types—e.g., detached single houses, apartments, and mobile houses, etc. However, none of the variables in the group of lifestyle and transit accessibility was found to be statistically significant in these two models.

V. Model Fit and Threshold Parameters

The threshold parameters, without any meaningful indications, only served as a link between observed market shares of choices to the propensity for households to live in areas with high housing density. Log likelihood at convergence of two models turned out to be −4054.67 and −3933.88, respectively, whereas log likelihood for the constant-only model was −4194.91. Using such information, the robustness of these two models was confirmed by the likelihood ratio test, while the effects of factors on the dependent variable differed at different spatial scales.

Table 4. Ordered response model of residential choice of housing density at census block level.

Variables	Parameter	T Stat
Demographics with interactions		
Household size interacted with the type of housing unit of rowhouse or townhouse	0.22	8.43
Household size interacted with housing units owned	0.07	2.26
Structures of households (base is any other household type)		
One adult, retired, no children	0.45	4.02
Two or more adults, no children	0.36	3.87
One adult, no children	0.35	3.10
Two or more adults, retired, no children	0.27	3.06
Two or more adults, youngest child 0–5	0.20	1.84
Two or more adults, youngest child 6–15	0.17	1.71
Travel-related attributes		
The number of vehicles in a household	−0.07	−2.45
Employment and economic indicators with interactions		
High-income households (base is medium- and low-income households)	−0.29	−5.54
Low-income households interacted with the housing unit of detached single house	−0.30	−3.63
Low-income households interacted with housing units owned	0.26	3.46
Housing-related index		
Housing units owned	−0.19	−1.96
Number of cases	3026	
Log likelihood at convergence	−4054.67	
Log likelihood for constant-only model	−4194.91	
Mu(1)	0.70	
Mu(2)	1.43	

Table 5. Ordered response model of residential choice of housing density at census tract level.

Variables	Parameter	T Stat
Demographics with interactions		
Household size interacted with the type of housing unit of apartment or condominium	0.17	2.29
Household size interacted with the type of housing unit of duplex	0.13	4.70
Structures of households (base is any other household type)		
One adult, retired, no children	0.11	1.64
Race (base is any other ethnic type)		
American Indian, Alaskan Native	−0.64	−1.97
Asian	−0.42	−2.43
Hispanic/Mexican	−0.23	−1.63
White	−0.19	−3.28
Travel-related attributes		
The number of vehicles in a household	−0.06	−2.05
Category of number of household trips on travel days	−0.01	−2.07
Employment and economic indicators		
Household income (base is the low-income households)		
High-income households	−0.36	−6.53
Medium-income households	−0.10	−1.85
Number of adults at least 18 years old	0.06	1.63
Housing-related index		
The type of housing units (base is any other housing unit type)		
The type of housing unit is rowhouse or townhouse	0.80	15.36
Number of cases	3026	
Log likelihood at convergence	−3933.88	
Log likelihood for constant-only model	−4194.91	
Mu(1)	0.74	
Mu(2)	1.49	

3.2. Model Results II (Population Density at Census Block or Tract Level)

Tables 6 and 7 indicate the parameter estimates concerning residential choice of population density. The impacts of explanatory variables are discussed in the following sections.

I. Effects of Demographics

Census block level. Household structure played a pivotal role in affecting the households' propensity to reside in populated census blocks. Specifically, households with two and more adults and the youngest child between 0–5 years old showed the highest propensity to live in census blocks of high population density than those of any other types. What is more, multiple-adult families with the youngest child between 6–15 years old were more like to live in highly populated areas than those without children. This is partially due to that fact that big families characterized by a broad age range in the household members have diversified needs. For instance, households with an infant may opt to live in a community featuring good child service facilities such as baby-oriented grocery stores, children's hospitals, nurseries, and so on. Typically, these facilities are located in populated areas to accommodate the needs of the majority population. Hence, populated census blocks become the optimal residential locations for these families. As for the older families, the results show that retired households with two or more adults, but no children were more likely to live in populous census blocks than single-person households. Regarding race, the White households preferred census blocks with low population density more than households of other race types. This is probably because the White population is on average richer than other ethnic groups and capable of purchasing large housing units in less populated areas such as suburbs rather than downtown areas.

Table 6. Ordered response model of residential choice of population density at census block level.

Variables	Parameter	T Stat
Demographics		
Structures of households (base is any other household type)		
Two or more adults, youngest child 0–5	0.30	3.75
Two or more adults, youngest child 6–15	0.24	3.33
Two or more adults, retired, no children	0.21	3.94
Race (the base is any other ethnic type)		
White	−0.19	−3.59
Travel-related attributes		
The number of vehicles in a household	−0.06	−2.31
Category of number of household trips on travel days	−0.01	−2.31
Proximity to work	0.16	1.69
Employment and economic indicators		
Household income (the base is low-income households)		
High-income households	−0.41	−7.52
Medium-income households	−0.15	−2.76
Number of adults at least 18 years old	0.14	4.23
Housing-related index		
The type of housing units (the base in any other type)		
The type of housing unit is detached single house	−0.26	−5.70
Lifestyle factors and transit accessibility		
Proximity to friends	−0.19	−1.77
Number of cases	3026	
Log likelihood at convergence	−4089.05	
Log likelihood for constant-only model	−4194.93	
Mu(1)	0.70	
Mu(2)	1.430	

Table 7. Ordered response model of residential choice of housing density at census tract level.

Variables	Parameter	T Stat
Demographics with interactions		
Household size interacted with the type of housing unit of rowhouse or townhouse	0.12	4.98
Household size interacted with the type of housing unit of duplex	0.06	2.28
Structures of households (base is any other household type)		
One adult, youngest child 16–21	0.37	1.56
Two or more adults, youngest child 6–15	0.18	2.61
Race (base is any other ethnic type)		
Asian	−0.56	−3.24
White	−0.46	−8.28
Travel-related attributes		
Category of number of household trips on travel days	−0.01	−2.32
Employment and economic indicators with interactions		
High-income households (base is medium- and low-income households)	−0.31	−6.30
Number of adults at least 18 years old	0.09	3.25
Low-income households interacted with housing units owned	0.27	4.67
Housing-related index		
Housing units owned	−0.44	−5.95
Number of cases	3026	
Log likelihood at convergence	−4002.19	
Log likelihood for constant-only model	−4194.92	
Mu(1)	0.72	
Mu(2)	1.46	

Census tract level. It is interesting to note that single-person households with the youngest child between 16–21 years old showed higher likelihood to reside in densely-populated census tracts relative to those with two or more adults and the youngest child 6–15 years old and households of other structures. In addition, Asian households were found to be less likely to live in populated census tracts than White families and households of other types. Furthermore, compared to other ethnic groups, the White group did not choose to live in populous areas, which is consistent with the findings at census block level. As for interaction effects, the household size interacting with the type of housing units did impact households' propensity to live in populated census tracts.

II. Effects of Travel-Related Attributes

Census block level. All travel-related attributes were significant. Specifically, the negative coefficient indicated that households with high rates of car ownership tended to avoid living in populous census blocks. The household trips had similar effects to vehicle ownership on residential choice of population density. The variable of proximity to work implied that households who were close to work were more likely to live in populated census blocks.

Census tract level. Surprisingly, vehicle ownership and proximity to work were insignificant at census tract level. Only the measure of household trips on travel days was proven to be statistically influential upon residential choice concerning population density. Most importantly, the results at tract level regarding household trips were in accordance with those at block level—i.e., households with high frequency of trips tended to live in sparsely populated census blocks or tracts.

III. Effects of Employment and Economic Indicators

Census block level. The results indicate that high-income households had a lower propensity to live in census blocks with high population densities than medium- and low-income households. What is more, low-income households were most likely to live in densely populated blocks compared with high- and medium-income families. Additionally, an increase in the number of adults at least 18 years old in a household resulted in a similar effect on the household's propensity to reside in the most populated blocks.

Census tract level. The effect of high-income households at tract level was in line with the one at block level. However, medium- and low-income households were unconcerned about the population density at census tract level. Nevertheless, low-income households who owned properties showed higher likelihood of living in populated census tracts than high- and medium-income ones who rented. An increase in the number of adults at least 18 years old in a household resulted in a similar effect on the household's propensity to reside in the most populated tracts.

IV. Effects of Housing-Related Index

Census block level. The finding indicates that individuals whose houses were detached single houses were less like to inhabit a census block with a high rate of population density than those whose housing units were other types. However, the housing tenure variable had little explanatory power at block level.

Census tract level. At a sizable spatial scale, however, the housing unit types were no longer significant in terms of population-related residential choice, but the housing tenure did have obvious impacts at tract level. Specifically, a household owning a house tended to live in a sparsely populated census tract.

V. Effects of Lifestyle Factors and Transit Accessibility

One measure from this group was significant only at census block level. The results show that households who were close to their friends were more likely to inhabit census blocks with a small population density than those who were not.

VI. Model fit and threshold parameters

The log likelihood at convergence of two models turned out to be -4089.05 and -4002.19, respectively, whereas log likelihood for the constant-only model was -4194.9.

Based on the above information, the effectiveness of these two models is justified by the likelihood ratio test, while the effects of factors on the dependent variable differed at different spatial scales.

3.3. Model Results III (Land-Use Diversity Index at 0.25-Mile or 0.5-Mile)

Tables 8 and 9 display the parameter estimates concerning residential choice of land-use diversity. The following sections explain in detail the impacts of explanatory variables on the residential preferences of mixed land use.

Table 8. Ordered response model of residential choice of 0.25-mile land-use diversity.

Variables	Parameter	T Stat
Demographics with interactions		
Household size interacted with the housing unit owned	0.16	4.99
Household size interacted with the type of housing unit is detached single house	−0.15	−7.87
White (the base is any other ethnic type)	−0.16	−2.96
Employment and economic indicators		
High-income households (base is medium and low-income households)	−0.14	−3.33
Number of adults at least 18 years old	−0.09	−2.30
Housing-related index		
Housing units owned	−0.64	−7.20
Lifestyle and transit accessibility		
Proximity to friends	−0.19	−1.81
Number of cases	3026	
Log likelihood at convergence	−3901.85	
Log likelihood for constant-only model	−3991.07	
Mu(1)	1.03	
Mu(2)	1.40	

Table 9. Ordered response model of residential choice of 0.5-mile land-use diversity.

Variables	Parameter	T Stat
Demographics with interactions		
Household size interacted with the type of housing unit owned	0.11	4.07
Household size interacted with housing unit of detached single house	−0.09	−3.97
Race (the base is any other ethnic type)		
Asian	−0.36	−2.09
White	−0.17	−6.59
Structures of households (base is any other household type)		
One adult, youngest child 0–5	−0.70	−1.82
Employment and economic indicators		
Household income (the base is low-income households)		
High-income households	−0.34	−6.59
Medium-income households	−0.13	−2.45
Housing-related index		
Housing units owned	−0.53	−6.58
The type of housing unit is duplex (the base is any other type of housing units)	−0.19	−2.54
Number of cases	3026	
Log likelihood at convergence	−4091.20	
Log likelihood for constant-only model	−4168.91	
Mu(1)	0.56	
Mu(2)	1.25	

I. Effects of demographics

The 0.25-mile scale. First, the White households showed a higher propensity to dwell in an area with a single land-use type within a 0.25-mile buffer than households with any other racial background. This result is intuitively reasonable in that the White group may place more emphasis on individual space than other racial groups and attempt to avoid the potential issues resulting from mixed land use, such as noise and air pollution, crime issues, and so on. Second, the results of interacting terms suggest that a large household with an owned house was more likely to live in a land-use diversified area than others. Furthermore, a big family inhabiting a detached single house would avoid the regions with the developments of diverse land use.

The 0.5-mile scale. First, at this spatial scale, Asian families were more likely to reside in a region with a unique land-use type (probably residential land) than the White ones and households of other types. This is surprising, since in most Asian cities the land use within or surrounding a residential community is highly diversified. These results may be partially because, after coming to the United States, Asian households or their offspring may change their attitudes towards land use related to residence. What is more, the White households also shied away from diversified land use compared to other racial groups, such as American Indian and American Black, etc. The latter finding is in line with the results on the 0.25-mile scale. Third, the single-parent households with the youngest child between 0–5 years old attempted to keep their residences away from areas with mixed land use. The underlying logic is that the issues resulting from mixed land use, such as noise and security problems, may pose more threats to single-parent households with the presence of infants than households of other structural types.

II. Effects of Travel-Related Attributes

None of the travel-related attributes were statistically associated with households' propensity to reside in areas with diversified land-use structures. One probable reason may be that the scales of land-use diversity index were not substantial enough to make possible the potential effects of travel-related variables.

III. Effects of Employment and Economic Indicators

The 0.25-mile scale. The negative coefficients of these measures suggest that employment and economic indicators decreased the households' propensity to live in regions of diverse land use. Specifically, high-income households kept their houses away from mixed land use compared with medium- and low-income ones; medium- and low-income households were indifferent to the 0.25-mile land-use mix. Second, as the number of adults at least 18 years old in a household went up, a family was more likely to reside in an area with a uniform land use.

The 0.5-mile scale. The same was true of the 0.5-mile scale in terms of the effects of household income. In other words, when choosing residential locations, high-income families avoided those places of high rates of land-use diversity compared to medium- and low-income ones. Furthermore, low-income households were more likely to have residences in a highly diversified land-use area than medium-income ones.

IV. Effects of Housing-Related Index

The 0.25-mile scale. When it comes to housing units, the households owning properties preferred areas of single land use more than those renting. Nevertheless, the variable of housing unit type was not significant at the 0.25-mile scale.

The 0.5-mile scale. The same was true of housing tenure at the 0.5-mile scale. In addition, the outcomes indicated that households living in duplexes were more likely to reside in a block with a single land use than those dwelling in other types of housing units, like apartments or townhouses.

V. Effects of Lifestyle Factors and Transit Accessibility

Only one factor (proximity to friends) was significant at the 0.25-mile scale. The effect was that households who were close to friends showed lower propensity to live in a land-use diversified area. However, factors representing family activities and transit accessibility turned out to be insignificant.

VI. Model Fit and Threshold Parameters

The values of log likelihood at convergence of two models were −3901.85 and −3991.07, respectively, whereas the values of log likelihood for the constant-only model were −3991.07 and −4168.91, respectively. Based on the above information, the usefulness of these two models was demonstrated by the likelihood ratio test, while the effects of several factors on the dependent variable differed at different spatial scales.

4. Discussion

The purpose of this article was to investigate the factors that influence households' decisions to reside in populated areas or regions with mixed land use. To achieve this, the authors constructed six models, which led to several significant findings and contributions. The results of the study align with previous research and provide new insights into the macro-level factors that affect residential location choices. Regarding housing density, the household structure, number of vehicles, and income were found to be significant factors. Demographic characteristics, household income, and housing types were crucial in determining residential choices based on population density. For land-use mix, the most influential factors were the interaction between demographics and housing-related indexes, as well as household income and housing-related indexes.

However, several variables were found to be insignificant, such as travel-related attributes in the land-use diversity model. The implications of these findings for urban planning and community development are significant. The study suggests that vehicle dependence is a critical barrier to implementing compact and walk-friendly urban forms. As a result, policymakers must adopt measures to change households' attitudes towards private cars.

The study has some limitations, including issues with the representation of land-use diversity and the need for additional variables to increase the robustness of the models. Future research could explore other variables and redefine the land-use diversity index to compare the results with the current study. Overall, this study provides valuable insights into the factors affecting residential location choices and has important implications for urban planning and community development.

5. Conclusions

In conclusion, this study has provided significant insights into the factors that influence households' preferences to reside in populated areas or regions with mixed land use. The findings of the study have confirmed and extended previous research, shedding light on the crucial macro-level factors that determine residential location choices. The study found that household structure, number of vehicles, income, demographic characteristics, and housing types play important roles in shaping residential choices based on population density, housing density, and land-use mix.

Regarding residential choices based on land-use mix, the most influential factors are the interactions between demographics and housing-related indexes, household income, and housing-related indexes. Some variables were found to be insignificant; for example, in the land-use diversity model, travel-related attributes had little impact on the dependent variables. These findings have significant implications for urban planning and community development, such as the need to change households' attitudes towards private car travel.

The implications of these findings are essential for urban planning and community development. Compact and walk-friendly urban forms are critical for sustainable development, and the study suggests that vehicle dependence is a crucial barrier to implementing these forms. Policymakers must adopt measures to change households' attitudes towards private cars and promote alternative modes of transportation.

Overall, this study contributes to the literature on residential location choices and provides valuable insights for policymakers and urban planners. By understanding the factors that influence households' decisions to reside in certain areas, policymakers can make informed decisions to promote sustainable and livable communities.

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