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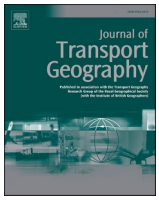

What influences the location choice of establishments? An analysis considering establishment types and activities interactions

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ABSTRACT

Over the years, research on firm location choice has received less attention than residential location choices. Although valuable efforts have been made to model firms' location choices, investigations on the location choice of smaller economic units (establishments) and differences between location determinants of various activities can provide better insights into the interaction between land use and transportation network. This study aims to, first, model the location choice of establishments considering the North American Industrial Classification System (NAICS) sectors and examine the impact of spatial components; second, evaluate how the location determinants of establishments vary across industry sectors; third, assess the interdependence between different establishments' location choices; and fourth, estimate and compare the Willingness to Pay of different activities for better accessibility. A discrete choice model is incorporated to model establishments' location preferences, where first, based on the selected parcel by each establishment, a set of competitive alternatives are generated, creating a constrained choice set, and then, the actual choice of an alternative is estimated using a multinomial logit model. The developed model is implemented on the data collected from the state of Tennessee, USA. Results suggested that spatial location determinants can be categorized into four categories: accessibility, neighborhood characteristics, office profile, and presence of other activities. Moreover, agglomeration, land value, office size, square feet, and surrounding land use conditions are the most important location determinants. The finding of this study provides valuable information to transportation planners on interactions between establishments' locations, demographic conditions, and transportation networks.

1. Introduction

Assessing the spatial pattern of industries and the decision behind the location choice of firms help transportation planners to understand the interaction between transportation networks and the socioeconomic condition of a region. Although the location choice of businesses indicates the job opportunities and directly affects the travel patterns of workers, decisions made by businesses on where to locate are usually given less consideration than the residential location (Balbontin and Hensher, 2021; Thapa et al., 2023). Moreover, most studies in the literature modeled the determinant of firms' location choices, while evaluating the location determinants of smaller economic units, referred as to establishments has received less attention (Chin, 2020). An establishment is a district economic unit that produces goods or services at a single physical location, while a firm is a legal entity that consists of one or more establishments under common ownership (Buczkowska, 2017). Due to this structural difference, the decision-making of establishment on location choice would vary compared to firms' location choices. In another word, since firms might consist of multiple establishments, to maximize the benefit, they will consider criteria for decision-making that maximize the benefit of the group, and not necessarily each individual. While modeling establishment location choice will provide this opportunity to evaluate how establishments can maximize their benefits individually. This paper aims to explore the determinants of business location choices by targeting establishments.

Moreover, it is important for transportation and urban planners to assess which group of establishments are interacting more with the transportation network and demographic conditions of the

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neighborhoods (Nickdoost et al., 2022; Paleti et al., 2021; Riahi Samani et al., 2021). Modeling the location choice of establishments provides more in-depth information regarding the decisions of businesses, and capable planners to understand the differences between the location choice of different activities (e.g., farming, warehouses, retail sectors, etc.) (Chin, 2020; Sharma and Mishra, 2022). However, in literature, empirical evaluation of how the location determinant would vary over establishment types is not well-addressed. This might be partly attributed to data scarcity on establishments' physical attributes and detailed information (Kang, 2020). While there is a substantial amount of research devoted to identifying industry-specific location factors, little is known about the influence that establishment type has on the assessment of location criteria (Kimelberg and Williams, 2013). Moreover, to develop transportation policies and network improvement, it is important to know which type of establishments would interact more with the transportation network, and changes in transportation conditions would have stronger effects on which type of activities. Besides, to understand the decision-making of establishments, it is crucial to understand how they interact which each other, and whether the presence of one establishment would attract or repel other activities (Balbontin and Hensher, 2019). To answer these questions, the current study aims to investigate the location choice of establishments of different types, evaluate how the location determinants vary among different activities, assess the interactions between establishments, and estimate the importance of accessibility for different establishment types. The rest of this paper is organized as follows: section two presents the literature review, literature gaps, and research objective are discussed. Then the methodology applied to develop location choice models and the data collection procedure are provided in section three and four. The model development results are provided in section five, and the location determinants of each NACIS sector are discussed. Finally, the conclusion section presents a summary of the paper and avenues for future research.

2. Background studies

Early studies in the field of business location choice indicated the positive and negative factors in the location choice of firms (Pellenbarg et al., 2002). Balbontin and Hensher (2019) provided an overview of the main business location determinants and characterized them into three main categories: accessibility, office profile such as rent, office size, and business profile such as agglomeration. Among all business location choice determinants, transportation planners are more interested in the influence of accessibility (Abrishami and Chamberlain, 2023; Mohri et al., 2021; Samani and Amador-Jimenez, 2023). Willigers and Van Wee (2011) showed that the presence of a high-speed train service significantly improves the attractiveness of a location for offices in the Netherlands. Weterings and Knoben (2013) found that a closer distance to a train station has a positive influence on businesses' location choices. Jiang et al. (2018) showed that electronic information manufacturing firms tend to choose areas closer to transportation infrastructure, and the effect of airport accessibility is significant. Moreover, studies in the USA mostly focused on the importance of the accessibility to interstate and highways (Kang, 2020; Yuan, 2021).

Another important location determinant is the surrounding geographical environment (Malecki, 2009; Nickdoost and Choi, 2021). Studies showed that the proximity to knowledge sources and local absorptive capacity is the main location determinant for knowledge-based start-ups (Baptista and Mendonça, 2010), and generally, the availability of appropriate labor and the population density have significant effects on the location choices of business (Holl and Mariotti, 2018). Also, assessing the distribution of warehouses in Los Angeles highlighted the association between minority neighborhoods and warehouse locations (Yuan, 2021). Regarding the interaction between businesses' location choices, to the best of our knowledge, no study has evaluated the effect of this variable. Most studies focused on the effect of agglomeration while the results are varied. Several studies found a positive effect of agglomeration on business relocations, suggesting that businesses are more likely to relocate to areas with more agglomeration or levels of specialization (Ye et al., 2019). However, another study suggested that the presence of the same activity reduces the probability of starting a firm (Backman and Karlsson, 2017).

Few studies have addressed the businesses' location choices at the establishment level. Chin (2020) evaluated the location choice of new establishments by focusing on the relationship between the uniqueness of the certain region and spatially bounded characteristics while the results confirmed the importance of economic, demographic, and geographic conditions at the neighborhood level. Kang (2020) investigated warehousing decentralization by comparing the location choices of warehouses built in 1980 with ones established after 2000 in Los Angeles. Chen et al. (2021) investigated the changes in the spatial distribution of new electronic information manufacturing establishments in China. In a recent study, Ahmed et al. (2022) addressed establishments' intra-firm and inter-firm location choices; where the results showed that establishments from the same firm rather locating farther from one another, while still choosing to co-locate with other establishments from the same industry. Also, van der List (2022) developed a mode of location choice for new establishments in Germany, considering taxes, labor markets, and spillovers. Hawkins and Nurul Habib (2022) developed an establishment location choice model at the individual level and found that professional service establishments tend to locate near passenger rail stations, while industrial establishments tend to locate near major highways.

In literature, studies rarely compare the location determinants of different activities. Kimelberg and Williams (2013) compared the most important location factors for three different industries, office, manufacturing, and retail. Using the data collected from surveys, they found that office respondents are significantly more likely to assign higher ratings to quality-of-life factors, such as crime rates, amenities, housing, and schools. Sakai et al. (2020) investigated the location factors for logistics facilities considering activity categories. Results showed the importance of accessibility for the group of facilities that serve retail shops and end-consumers industries. Ahmed et al. (2022) compared the location choices of wholesale and retail trade where the results showed that establishments in the wholesale industry tend to locate in lower population density areas partially due to their larger land footprints while retail establishments that sell everyday goods such as grocery stores tend to locate in high population density areas.

2.1. Literature gaps, objectives, and contributions

This study aims to address four literature gaps. Although the literature on firms' location choices is rich, analyzing the decision behind the smaller economic unit referred as to establishments has received less attention. Hence, the first objective of this study is to model the location choice of a business at the establishment level (Chin, 2020). Moreover, the literature fails to provide a comprehensive comparison of how the location determinant of business varies across different activities. To address this gap, the second objective of this study is to compare the variation between the location determinants of different activities. In this regard, twenty different activities, categorized by North American Industry Classification System (NAICS) are selected as the classification criteria, and multiple discrete choice models will be applied to these twenty categories to evaluate how the determinants of location choice would vary across NAICS sectors. Also, it is crucially important for transportation planners to understand which type of establishments would interact with the transportation network. Therefore, the third objective of the study is to compare the magnitude of the effect of accessibility between different NAICS sectors and evaluates the difference in the Willingness to Pay (WTP) for better accessibility. In addition, the literature fails to show the effect of interactions between different activities in their allocation choice. Hence, the fourth objective of this research is to evaluate how the presence of one activity would affect the

location choice of other activities.

To sum up, this study contributes to the literature by, *first*, modeling the location choice of businesses by targeting establishments of different types; *second*, comparing the location determinants of different activities considering the NAICS sectors; *third*, investigating the interaction between activities by assessing how the presence of one activity would affect the location choice of other activities, and *fourth*, evaluating the importance of accessibility by measuring the WTP of different activities for better accessibility.

3. Methodology

In this study, we use discrete choice modeling to indicate the location determinants of establishments in different NAICS sectors. NAICS categorizes establishments into 20 categories, therefore 20 discrete choice models are developed in this study considering the location attributes (e.g., accessibility, land value, population density, etc.) and individual attributes (e.g., employment, business growth, etc.) as independent variables. Discrete choice models assume that the establishment e_t (where $e_t \epsilon E_t$ and E_t is total establishments of type t) selects the parcel i among a choice set of G sites where $i \in G$, and G is the total number of parcels. The selection of a site can be defined by an unobservable utility function $U_{e_t,i}$, such that, parcel i will be selected over parcel j ($j \in G$) if/only if $U_{e_t,i} > U_{e_t,j}$ ($i \neq j$). The utility ($U_{e_t,i}$) can be formulated as follows:

$$U_{e_t,i} = \beta_i + \sum_n \beta'_{i,n} \times x_n + \sum_m \beta''_{i,m} \times w_m + \varepsilon_i \quad (1)$$

Where β_i is the constant term, x_n is a vector of location i (alternative) attributes, W_m is a vector of the attributes of the establishment e_t, $\beta'_{i,n}$ and $\beta''_{i,m}$ are vectors of the parameters to be estimated using maximum likelihood, ε_i is the error term, and $U_{e_t,i}$ is assumed to be linear. Hence, the probability of selecting an alternative (location/parcel) i by the establishment e_t (which is the general form of the MNL model) can be estimated as follows:

$$P_{e_t,i} = \frac{exp(U_{e_t,i})}{\sum_j exp(U_{e_t,j})} \quad (2)$$

However, when the number of alternatives is large (in this study each parcel in the state of Tennessee can be an alternative), it would be computationally difficult to estimate the model. In addition, it also increases the likelihood that the independence of irrelevant alternatives (IIA) is violated because the unobserved attributes of locations in the same neighborhood are likely to be similar (McFadden, 1977). To overcome this problem (Manski, 1977) proposed a discrete-choice modeling framework incorporating probabilistic choice sets. In this approach, the first step formulates a subset of choice alternatives (C) from the universal choice set (G). This step is referred to as sampling in some studies (Rashidi et al., 2012). The first step can be done by using criteria for selecting the choice set (referred to as labeling) or by random (Ben-Akiva et al., 1985). The actual choice alternatives (C) are unknown; we only observe the chosen alternative (j). With the IIA assumption, parameters can be consistently estimated using only a subset (C) of the alternatives from the universal choice set (G) (McFadden, 1977). In this study, we followed the random sampling approach which is more common in the literature firm location choice, and since it reduces the chance of violating IIA (Kang, 2020). Hence, for each of the chosen alternatives, we randomly selected four alternatives to formulate a choice set (a choice set of 5). To select the choice set size, a trial sample was selected considering 10% of the entire data set, and different models were developed considering choice sets of 2 to 50. It was observed that the beta estimates (coefficients) stabilized for choice sets of 5 and more. Hence, in this study, models are developed considering 5 choice sets (an already selected parcel and four alternatives). Considering the output of the first state, in the second step, conditional on the formulated random choice set (C), an actual choice of an alternative i is estimated which is the probability that an establishment selects a choice at i is $P_{e_t}(i|C)$. The general model is formulated as follows:

$$P_{e_t}(i) = \sum_{C \in G} P_{e_t}(i|C) P_{e_t}(C) \quad (3)$$

4. Case study and data

As a case study, this paper evaluates the location choice of establishments in the state of Tennessee, USA. The population of Tennessee, which comprises 95 counties, was 6,975,218 in 2021, with 4,368,040 of those people working in the state's 315,709 establishments. Fig. 1 illustrates the distribution of different types of establishments in the State of Tennessee in 2021. As Fig. 1 shows, the density of establishments is significantly more in four major cities in the state, Memphis, Nashville, Knoxville, and Chattanooga.

In addition to Fig. 1, the frequency of establishments in each category is presented in Fig. 2. As this figure shows, health care and social assistance, retail trade, and other services are the top three types of establishments with the highest frequency, and mining, management of companies and enterprises, and utilities are the three categories of establishments with the least frequency in the state of Tennessee.

To gain a comprehensive understanding of all determinants of establishments' location choices, the following four sources for data were collected as follows:

Establishment's information: Detailed information regarding the establishments in the state of Tennessee is collected from the InfoUSA data set. InfoUSA provides detailed information for companies from local shops to global enterprises. Establishment information is collected from 2018 to 2021providing a panel data set containing details such as NAICS, Standard Industry Code, owner, address, location, office profile, business profile, credit history, business value, employment, headquarters, and franchise information.

Census data: demographic and socio-economic conditions of the surrounding neighborhood of establishments were collected through the US Census Bureau's 2021 American Community Survey (ACS) summary files that provide estimates of population and housing characteristics from 2017 through 2021. Total population, total employment and unemployment, poverty rate, the population of different ages, education and income groups, individual average income, the number of vacant houses, and house price are collected at the block group level. The state of Tennessee has 4125 block groups, and the data collected are spatially joint to establishments.

Parcel Data: Parcel data refers to a combination of both spatial and nonspatial attribute files, presenting land ownership in a local jurisdiction. Generally, working with parcel data is challenging since the content, currency, structure, and coverage of parcel data sets vary significantly across jurisdictions and regions. These differences create a challenge to obtain a standardized data set (Mishra et al., 2021; Samani et al., 2022b). However, the state of Tennessee provides cleaned and standardized parcel data which is available through the Tennessee Comptroller of Treasury website. Information regarding the land value, building information, land area, and the land use condition of the surrounding neighborhood (i.e., residential, industrial, agricultural, and vacant/developable area) are collected from parcel data.

Transportation network: The transportation network is used to calculate the accessibility of each establishment. In this regard, the distance to the closest interstates entrance, urban highways entrance, all highways (urban and rural), and major arterials are calculated, considering the free flow travel time and the shortest path.

After preparing a cleaned data set, multicollinearity between independent variables is checked to finalize the models' explanatory variables. Independent variables are grouped into four categories: office profile, accessibility, neighborhood characteristics, and the presence of different NAICS sectors. Table 1 describes the independent variables in

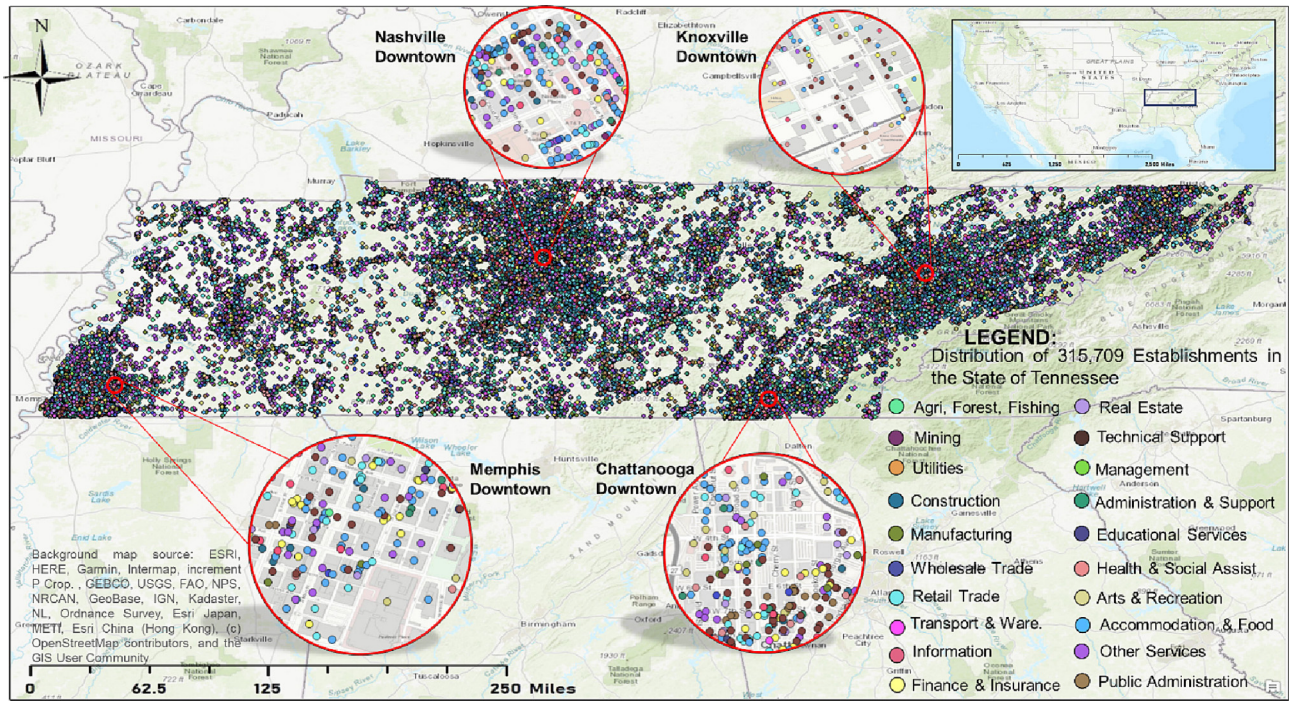

Fig. 1. Spatial distribution of different types of establishments in the State of Tennessee in 2021.

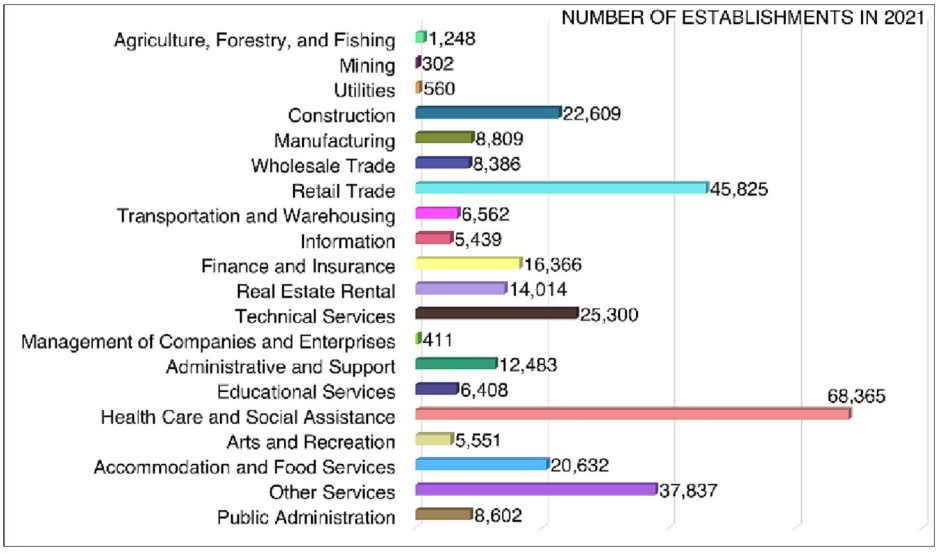

Fig. 2. The frequency of establishments of different types in the state of Tennessee in 2021.

detail.

5. Results

The results of developing 20 discrete choice models (parameter estimates) are presented in the form of charts in Figs. 3 and 4. These figures demonstrate 40 charts, each representing a single explanatory variable, where the y-axis presents the establishment's types (NAICS sectors), and the x-axis presents the value of estimated coefficients for that specific explanatory variable. Presenting the models' results in this form provides a clear view of the difference between the effect of each location determinant (explanatory variables) on the location choices of different establishment types (NAICS sectors). In addition to Figs. 3 and 4, details of all developed models are provided in the form of tables, presenting variables' coefficients and *t*-value, in Appendix B. Parameter selection (eliminating/keeping variables) is followed considering the *t*-value and the improvement in the goodness of fit measures, AIC and R-squared.

5.1. Models' parameter estimates

5.1.1. Office profile

The office profile contains three variables: land value, square feet, and office size. As Fig. 3 shows, *land value* showed negative impacts on the location choice of all types of establishments, where the construction has the highest magnitude. This shows that establishments generally tend to select locations with lower land value. However, the effect of land value was not significant for location choices of establishments

Table 1
Explanatory variables description.

Variable	Type	Unit	Min	Max	Mean
Office Profile					
Land value	Cont.*	Million $	0.001	133	1.2
Square feet	Cont.	(Feet)^2	0	2.8×10^6	11,226
Office size	Cont.	(Feet)^2	0	115	10.2
Accessibility					
Interstates[1]	Cont.	Feet	17.57	87.2×10^4	17.5×10^3
Urban Highways[1]	Cont.	Feet	7.89	46.6×10^4	8.59×10^3
All Highway[1]	Cont.	Feet	5.16	46.6×10^4	7.23×10^3
Major Arterials[1]	Cont.	Feet	3.15	15.9×10^4	0.76×10^3
Neighborhood Characteristics					
Population	Cont.	Pop /(mile)^2	0	13,370	1891.9
Unemployment	Cont.	Pop /(mile)^2	0	750	50.9
Large Households[2]	Cont.	Pop /(mile)^2	0	730	34.9
Highly Educated Population[3]	Cont.	Pop /(mile)^2	0	718	32.1
High-Income HH[4]	Cont.	HH /(mile)^2	0	3909	164.2
Poverty Ratio < 1	Cont.	N/A	0	3302	227.1
Pop <18 Years Old	Cont.	Pop /(mile)^2	0	5126	458.5
Pop >65 Years Old	Cont.	Pop /(mile)^2	0	2826	281.2
Commercial Area[5]	Cont.	Percentage	0	0.98	0.158
Industrial Area[5]	Cont.	Percentage	0	0.69	0.051
Agricultural Area[5]	Cont.	Percentage	0	0.989	0.198
Metropolitan[6]	Cat.**	N/A	0	1	N/A
CSA[7]	Cat.	N/A	0	1	N/A
Interaction between Establishments					
Presence of NAICS[8]	Cat.	N/A	0	1	N/A

* Continuous.
** Categorical.
[1] Travel distance (ft) to the closest entrance is considered.
[2] Households with 5 or more members in block group.
[3] The number of people with a graduate degree or more in the block group.
[4] Households with an annual income of $100,000 or more in the block group.
[5] The percentage of parcels with commercial, industrial, and agricultural land-use at the block group.
[6] If the location is in a metropolitan area.
[7] CSAs are areas where at least 15% of the population from one community will commute to another community for employment or commerce.
[8] Presence of each NAICS within a 1-mile distance, 20 binary variables each presenting presence if one sector.

related to management, utilities, and mining, which can be justifiable due to the type of activities an establishment related to management, mining, or utilities, which mostly depends on the availability of resources. The office's *square feet* showed mixed effects on the location choices. Square feet showed significant positive effects on the location choices of establishments related to public administration, wholesale trade, financial and insurance, information, transportation and warehouse, and agriculture, forestry, and fishing, showing that these types of establishments rather larger places, as many of these establishments require large storages. However, establishments related to real estate, management, health and social assistance, and construction prefer a location with smaller square feet. The *number of offices* showed negative signs for the most type of establishments. Most activities preferred to select locations with a smaller number of offices. Other services, accommodation and food, and real estate showed the largest magnitude. However, establishments related to public administration, health and social assistance, and technical services prefer locations with more professional offices, which is justifiable since these types of activities usually have a high number of employees and prefer to have places with more offices.

5.1.2. Accessibility

Four variables represent accessibility in this study: distances to the interstate entrance, urban highways, all highways (urban and rural), and major arterials. As Fig. 3 shows, *distance to interstates* showed significant and negative signs in modeling the location choice of establishments related to management, health and social assistance, constructions, other services, retail trade, and mining. These types of establishments tend to select locations close to interstates. These results might be affected by the type of case study as interstates are not stretched all over the state of Tennessee. *Distance to urban highways* showed significant effects on the location choices of wholesale trade, arts and recreation, management, other services, mining, transportation and warehouses, and health and social assistance. Moreover, the coefficients of *distance to all highways* were significant for utilities, public administration, administrative and support, wholesale trade, construction, and accommodation and food. These results showed the importance of accessibility to highways for establishments that have heavy truck traffic (e.g., wholesale trade, transportation and warehousing, and mining). The last accessibility measure is *the distance to major arterials*, where decisions made by establishments of different types showed more correlation with accessibility. Distance to major arterials showed significant effects on the location choices of wholesale trade, technical services, transportation and warehouse, administrative and support, public admin, manufacturing, construction, retail trade, health and social assistance, and accommodation and food. Compared to other measures of accessibility, distance to major arterials showed the largest magnitudes in modeling establishments' location choices, and among all types of establishments, wholesale trade had the largest coefficient magnitude for distance to major arterials. Generally, it can be inferred that establishments that interact with their customers directly, value the accessibility to major arterials more than other types of activities. Among all types of establishments, only location choice models of construction, wholesale trade, and health and social assistance showed significant coefficients for three variables related to accessibility.

5.1.3. Neighborhood attributes

Various variables related to neighborhood attributes were tested in this study to provide a comprehensive insight into the correlation between the location choice of establishments and the surrounding environment. In addition to the variables provided in Table 1, many variables (e.g., employment, population average income, gender, and ethnicity) were eliminated due to multicollinearity or insignificance coefficients. *Population density* is the first variable showing a significant coefficient in the developed models while it had mixed effects across different NAICS sectors. However, as Fig. 3 shows, the magnitudes of its effect are low, and wholesale trade shows the highest negative magnitude. These results are justifiable as establishments related to wholesale trade tend to locate in lower-density areas as they need better access to highways, large square feet, and low land prices. On the other hand, educational services and food and accommodation showed the largest positive coefficient, showing the high interaction of these types of establishments with the neighborhood population.

The *density of unemployment* is the next variable that showed significant effects in modeling establishments related to mining, educational services, health and social assistance, arts and recreation, and other services. Except for health and social assistance, increases in the density of unemployment increase the chance of selecting a location. As Fig. 3 shows, establishments related to mining are usually located in areas with high unemployment rates, this large magnitude, shows the interaction between the establishment lotion choice and neighborhood conditions clearly, whereas activities related to mining are usually located in areas with low welfare index.

The *density of high-income households* and the population with a

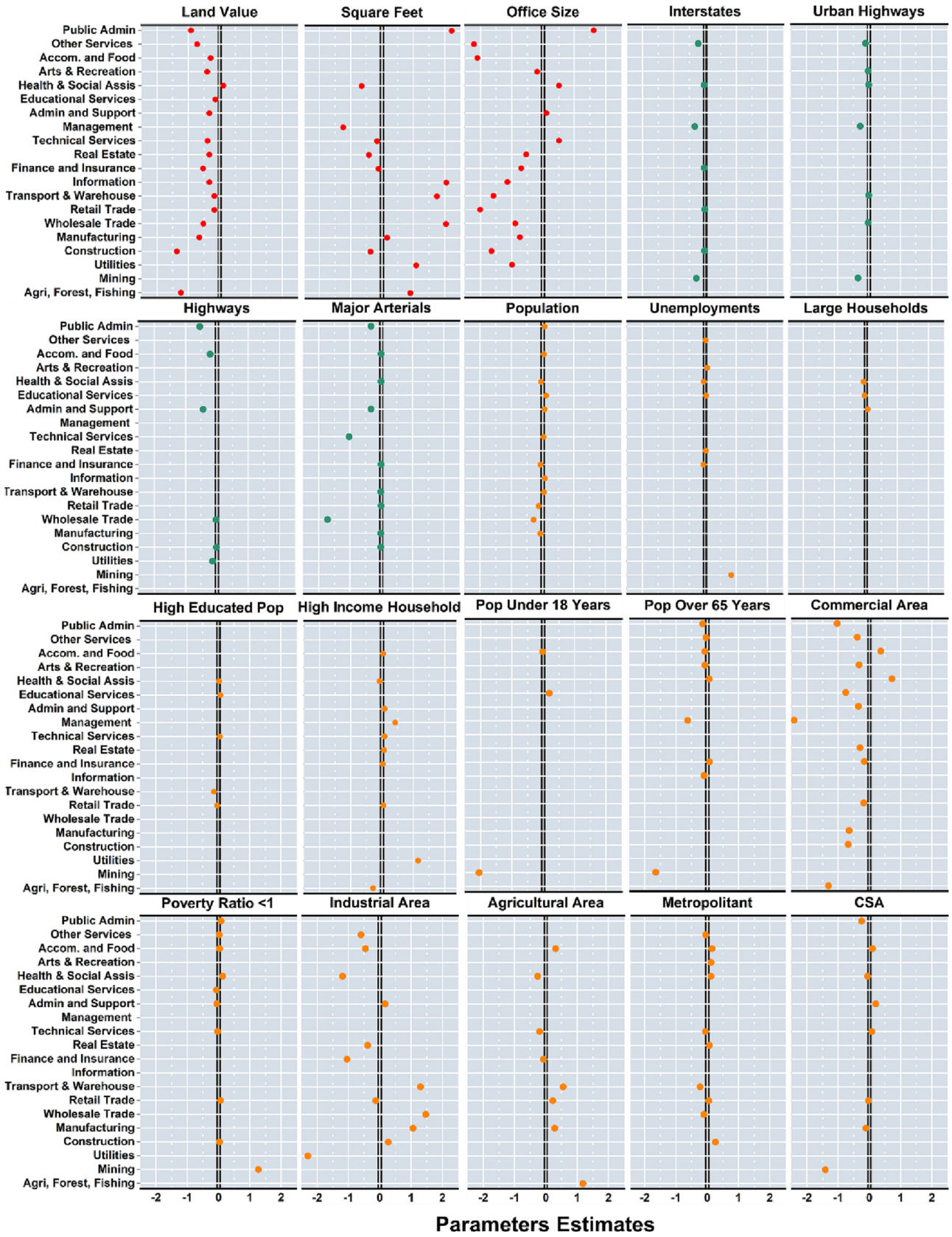

Fig. 3. Parameter estimates of the developed model for accessibility, office profile, and neighborhood attributes.

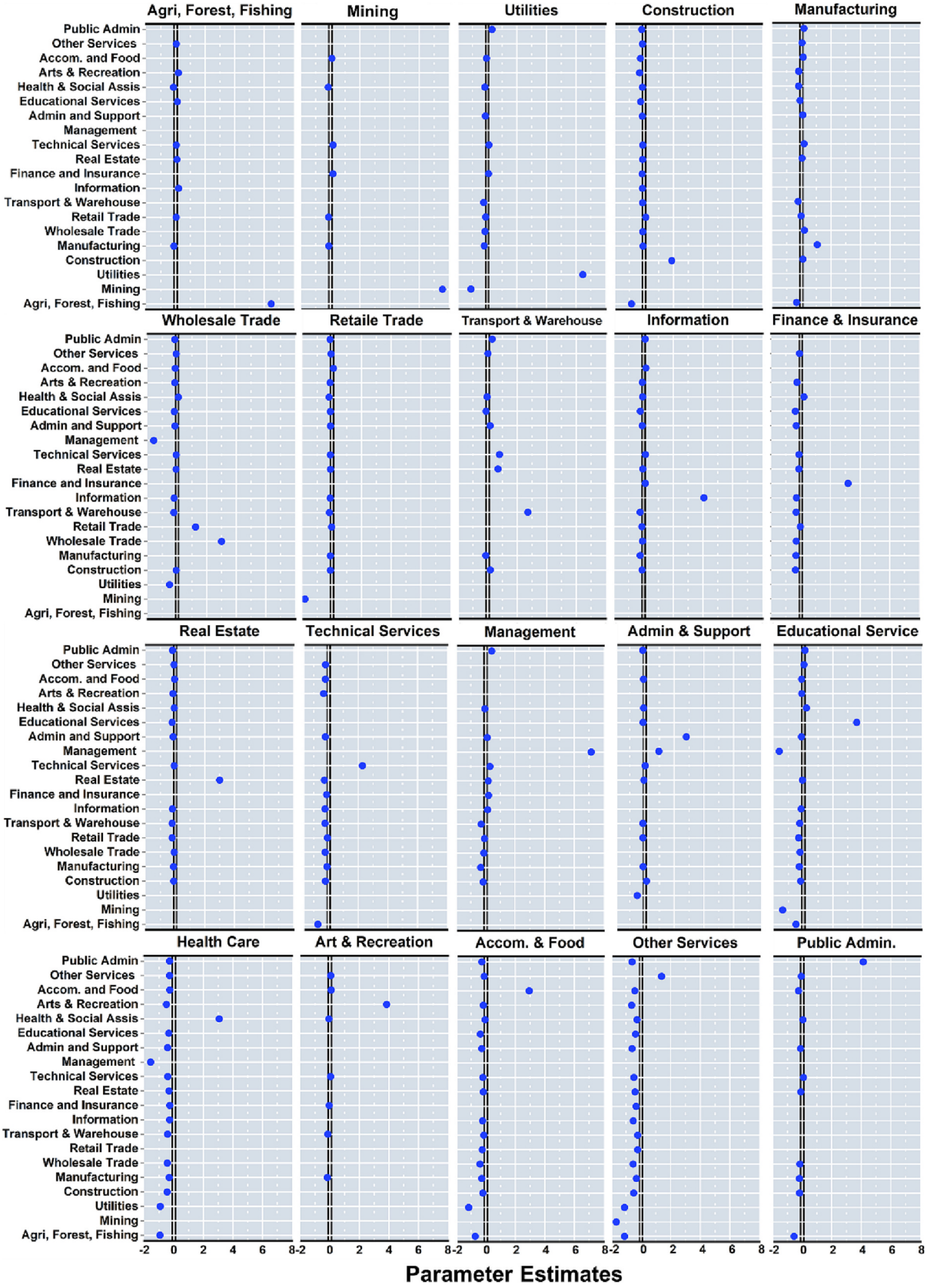

Fig. 4. Parameter estimates of the developed model for interactions between establishments.

poverty ratio < 1 are the two tested variables related to the financial condition of the neighborhood. Establishments related to utilities and management will be attracted to the neighborhoods with a higher density of households with high incomes. Moreover, the density of high-income households has negative impacts on the location choice of agriculture. The *poverty ratio < 1* showed significant coefficients for modeling the location choices of establishments related to public administration, other services, accommodation and food, health and social assistance, educational service, administrative and support, technical services, retail trade, construction, and mining. However, expect the coefficient for modeling the location choices of mining, the poverty ratio showed a low magnitude. The large magnitude of the effect of the poverty ratio on mining, emphasizes the fact that establishments related to mining are located in areas with low welfare indexes. In addition, the *density of large households* was tested which showed significant effects on the location choices of the establishments related to health and social assistance, educational services, and administrative and support, while the magnitude of the effect was low. Also, the *density of highly educated population* was tested which showed significant effects on the location choices of establishments that require access to the skilled and educated population such as health and social assistance, educational services, and technical services, while similar to the density of large households, the magnitudes of the coefficients were low.

The *density of population under 18* and *over 65 years old* were tested to investigate the effect of population age on the location choices of establishments. The population under 18 showed significant coefficients in modeling location choices of mining, educational services, and accommodation and food, where the attractiveness of a location for mining related establishments reduces with increases in the density of the population under 18 while establishments related to educational services would rather areas with a high density of population under 18. This point also can be inferred that educational services attract households with students to be located near them. In addition, the density of the population over 65 showed a mixed effect on the location choices of establishments while mining and management showed the largest negative magnitudes, and the coefficient of the population over 65 was positive for health and social assistance and finance and insurance, two significantly important activities for this age group.

Among all variables related to neighborhood attributes, variables representing the land use conditions showed the largest magnitude on the location choices. The percentage of *commercial areas* showed significant coefficients in most types of establishments, but technical services, finance and insurance, information, utilities, and mining. Also, the effect of commercial areas percentage was positive only for accommodation and food and health and social assistance, and the increases in the percentage of commercial areas reduce the attractiveness of a location for other types of establishments. The percentage of *industrial areas* showed significant negative effects in modeling the location choice of utilities, health and social assistance, other services, and retail trade. These results emphasize the required atmosphere for these types of establishments. For instance, it is understandable that establishments related to health care and social assistance would rather not be close to industrial areas. In contrast, increases in the percentage of industrial areas raise the attractiveness of a location for establishments related to Wholesale trade, transportation and warehouse, and manufacturing. The percentage of *agricultural areas* showed significant positive effects on the location choice of agriculture, transportation and warehouse, wholesale trade, manufacturing, accommodation and food, and retail trade.

Finally, the effect of the type of area was assessed by adding *metropolitan* and *CSA* variables to the models. Establishments related to accommodation and food, arts and recreation, health and social assistance, real estate, retail trade, and construction rather locating in a metropolitan area as the coefficients of the binary variable for metropolitan showed significant positive value. Also, establishments related to other services, technical services, transportation and warehouses, and wholesale trade tend to select a location that is not in a metropolitan area. In addition, the *CSA* area showed significant negative effects on the location choice of establishments related to mining, public administration, health and social assistance, retail trade, and manufacturing, showing that these types of activities usually tend to locate in areas with high transit from other location (mostly far from the downtown). However, positive coefficients were observed in molding the action choices of establishments related to accommodation and food, administrative and support, and technical services, showing that areas with high commute rates from other neighborhoods showed a positive effect on the location choice of these types of establishments.

5.1.4. Interaction between NAICS

The interactions between the location choice of establishments are modeled such that the effect of the presence of a type of establishment is assessed on the location choice of other establishments. Fig. 4 provides the parameter estimated for the coefficients of the interactions between different types of establishments. As this figure shows, the presence of activities showed significant effects on the location choice of most types of establishments. The interesting point is the large positive magnitude of the presence of similar activities on the location choices of establishments of different types. For instance, in modeling the location choice of establishment related to agriculture, forest, and fishing, although the presence of other activities such as manufacturing, retail trade, information, real estate, technical services, educational services, health care and social assistance, arts and recreation, and other services are significant, the magnitude of the effect of the presence of same activities (agriculture, forest, and fishing) is significantly larger than the coefficients of the presence of other types of establishments. In addition, the presence of some types of establishments would repel other establishments to select a parcel close to them. Establishments related to agriculture, mining, and utility are the best examples. On the other hand, in some cases the presence of one type of activity would attract others, for instance, the presence of management would attract establishments related to administration and support.

5.2. Elasticity analysis

Applying discrete choice models provides information regarding the significant determinant but cannot show the magnitude of the effect of each determinant in the location choice process. Therefore, we estimate the elasticity for each significant variable. Elasticities are generally calculated to measure the magnitude of a specific variable's impact on outcome probabilities (Samani et al., 2022a; Samani and Mishra, 2022). Elasticity is estimated from the partial derivative for each observation n as follows:

$$E_{x_{ki}}^{P(i)} = \frac{\partial P(i)}{\partial x_{ki}} \times \frac{x_{ki}}{P(i)} \tag{4}$$

where $P(i)$ is the probability of outcome i and x_{ki} indicates the value of variable k for outcome i. By taking the partial derivative, Eq. (4) becomes as follows:

$$E_{x_{ki}}^{P(i)} = [1 - P(i)]\, \beta_{ki}\, x_{ki} \tag{5}$$

Where β_{ki} is the coefficient of variable k for outcome i. Elasticity estimated from Eq. (5) is only convenient for continuous variables and is not valid for indicator variables. Since our independent variables are mixed of continuous and categorical variables a pseudo-elasticity needs to be calculated to estimate an approximate elasticity of categorical variables. The pseudo-elasticity can be defined as:

$$E_{x_{ki}}^{\lambda_i} = \frac{exp(\Delta\, \beta_i\, x_i) \sum_{\forall I} exp(\beta_{kI}\, x_{kI})}{exp(\Delta\, \beta_i\, x_i) \sum_{\forall I} exp(\beta_{kI}\, x_{kI}) + \sum_{\forall I \neq I_n} exp(\beta_{kI}\, x_{kI})} - 1 \tag{6}$$

Where x_{kI} *is* the value of variable k for outcome i, λ_i is the expected

frequency for observation i; β_i is a vector of estimable parameters; x_i is a vector of explanatory parameters; I_n indicates the set of alternate outcomes with x_k in the function that determines the outcome, and I is the set of all possible outcomes. Elasticity provided in Eq. 6, is known as direct elasticities because they accurately capture the impact that a change in a variable controlling the chance of an alternate outcome, outcome i, has on the likelihood that outcome i will be selected (Washington et al., 2020). The results of the elasticity analysis are provided in Fig. 5 This figure provides the elasticity analysis result in the form of a heat map such that, the positive effects are indicated in blue color, and negative the effects are presented in red color. In the following subsections, the elasticity analysis of the significant variables is provided. However, for brevity, we focus more on variables that showed an elasticity larger than ±5%.

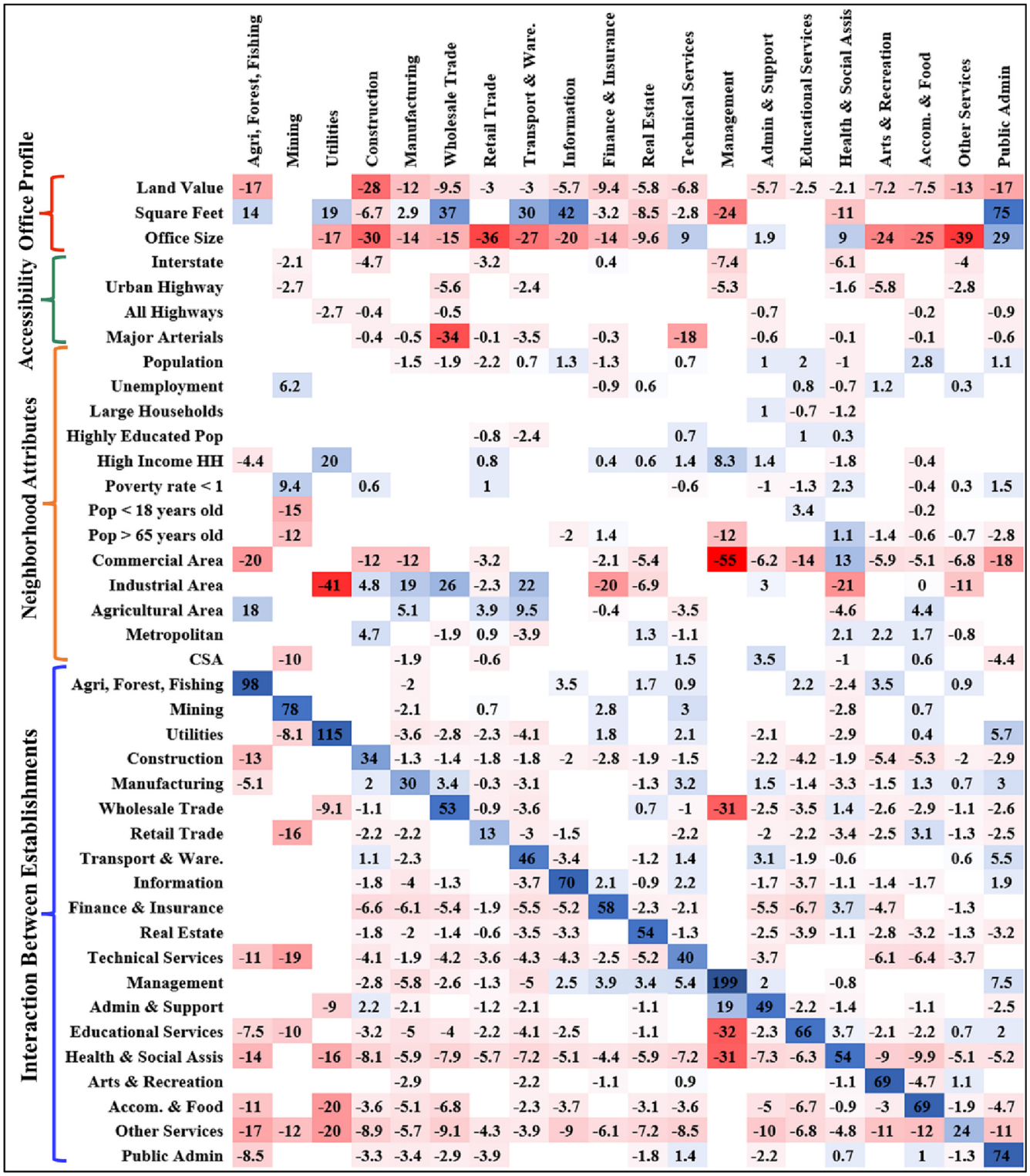

Fig. 5. The results of elasticity analysis for all developed models.

5.2.1. Office profile

Elasticity analysis for *land value* showed that the largest magnitude belongs to construction, such that 1% increase in the land price, would reduce the probability of selecting a location by construction-related establishments by up to 28%. The importance of land price for construction is understandable due to the fact that it would directly affect the revenue of the establishment. The second sensitive activity to the land price was agriculture which showed −14% elasticity. Manufacturing and wholesale trade are the third and fourth most sensitive activities to the land price, where the elasticity shows −12% and − 9.5% respectively. The largest effect of office *square feet* was observed in public administration, such that a 1% increase in the office square feet would increase the probability of selecting a location up to 75%. Then establishments related to information, wholesale trade, and transportation and warehousing showed the largest elasticity (42%, 37%, and 30%). While management with −24% showed the largest negative effect. Generally, establishments that required large space showed high elasticity to land price and square feet. As Fig. 5 shows, other services and real estate with elasticities of −39% and − 36% respectively had the largest negative sensitivity to *the office size*, and public administration had the largest positive elasticity (29%), which shows the required condition for this type of activity.

5.2.2. Accessibility

As Fig. 5 shows, establishments related to management showed the largest sensitivity to *distance to the interstate* (−9.41%). After management, health and social assistance with −6.05%, and construction with −4.72% had the highest elasticity. Establishments related to wholesale trade showed the highest sensitivity to the *distance to urban highways*, such that 1% increase in the distance to urban highways reduces the chance of selecting a location by a wholesale trade business up to 7.61%. These results show the specific condition of the wholesale trades where two factors, being in an urban area and having access to highways (due to high traffic of trucks), come to play an important role. Arts and recreation with −5.81% and management with −5.32% had the second and third largest sensitivity to urban highways, respectively. Elasticity analysis showed that only the decisions of establishments related to utilities will be affected by >1% with changes in *the distance to all highways*. Finally, *distance to major arterials* showed a − 33.5% effect on the location choice of wholesale trade, and the location selected by technical services showed −18.4% affected by 1% increase in the distance to major arterials. Generally, the wholesale trade shows high interaction with transportation networks which will be discussed further.

5.2.3. Neighborhood attributes

Elasticity analysis showed that mining-related establishments have the highest sensitivity to the *density of unemployment* (6.2%). *High-income households* showed strong effects on the location of establishments related to utilities and management whereas the elasticity analysis showed 20% and 8.3% respectively, showing these types of establishments would rather be located in well-established and high-profile neighborhoods. Also, a *low poverty ratio* increases the chance of selecting a location by mining related establishments by 9.4%. Moreover, increases in the *population under 18* reduce the chance of selecting a location for establishments related to mining by 15% and rise the chance of the presence of educational services by 3.4%. In addition, a location with a large *population of over 65* years old has a 12% lower chance to be selected for establishments related to mining and management.

Among all variables related to neighborhood attributes, the surrounding land use conditions showed the largest elasticity in the location choice of the establishments. Elasticity analyses for models of establishments related to management showed that 1% increase in the percentage of *commercial areas* would reduce the chance of selecting a location by up to 55%. After management, agriculture, public administration, constriction, and manufacturing showed the highest elasticity (−20%, −18%, −12%, and − 12% respectively). These results are in line with the preferences of these types of establishments on selecting a location with lower prices and larger square feet, as both factors are not usually available in an area with high commercial land use. In contrast, increases in *commercial areas* increase the likelihood of selecting a location by health and social assistance by up to 13%. As Fig. 5 shows, establishments related to utilities showed the largest sensitivity (−41%) and health and social assistance and other services respectively showed −21% and − 11% to the percentage of *industrial areas*. This is in line with the nature of these types of establishments, which requires to be far from industrial areas. In contrast, 1% increase in the industrial areas increases the location choice of Wholesale trade, transportation and warehouse, and manufacturing by 26%, 22%, and 19% respectively. These high elasticities can be interpreted as, first, these types of establishments can be categorized into industrial establishments, therefore they tend to be located in the same environment, second, they tend to be close to other industries to reduce their logistics costs. Elasticity analysis showed that the magnitudes of the effects of *agricultural areas* on location choices of agriculture, transportation and warehouse, wholesale trade, manufacturing, accommodation and food, and retail trade, are 18%, 9.5%, and 8.8% respectively. Finally, if a location is in a metropolitan area, it will have a higher chance to be selected by establishments related to construction where the elasticity analysis shows 5.2%, which is understandable as most construction establishments are located in urban areas.

5.2.4. Interaction between NAICS

As Fig. 5 shows, the presence of similar activity has a large significant positive effect on the location choices of all types of establishments, such that, the presence of similar activity would increase the chance of selecting a location for establishments related to management by 199%. After management, establishments related to utilities (115%), agriculture, forestry, fishing (98%), mining (78%), and information (70.1%) showed the largest sensitivity to the presence of similar activities. Retail trade showed the lowest sensitivity to the presence of similar activity where the elasticity was 13%. Fig. 5 highlights the significant negative effects of the presence of educational services (32%), health, and social assistance (31%), and wholesale trade (31%) on the location choice of establishments related to management. However, the presence of establishments related to administration and support increases the probability of selecting a location for management by 19%. The interactions between agriculture, forest, and fishing with other services (17%) and construction (13%) were significantly negative. The presence of technical services and retail trade would reduce the probability of selecting a location by mining respectively up to 19% and 16%. The presence of other services, accommodation and food, and health and social assistance would affect the location choice of establishments related to the utility by −20%, −20%, and − 16% respectively. The interactions between establishments related to construction, manufacturing, retail trade, transportation and warehousing, information, finance and insurance, real estate, and technical services with other establishments were relatively weak as they all show <10% effects. Lastly, the presence of an establishment in the category of other services reduces the probability of selecting a location by admins and support (−10%), arts and recreation (−11%), accommodation and food (−12%), and public administration (−11%).

5.3. Willingness to pay

Estimating the willingness to pay (WTP) is one of the most important behavioral post-analyses of choice studies. WTP reveals how much a decision-maker (here an establishment) is willing to pay for an improvement in another attribute. In this study, WTP is incorporated to evaluate the importance of accessibility to the transportation network and the presence of different activities for different types of establishments and is calculated considering the land value. Considering Eq. (1),

the WTP for attribute m can be estimated using Eq. (7) (Breidert et al., 2006):

$$WTP_{m,i} = \frac{\partial U_{e,i} / \partial x_{m,i}}{U_{e,i} / \partial x_{LV,i}} = \frac{\beta_{m,i}}{\beta_{LV,i}} \quad (7)$$

where $x_{LV,ni}$ refers to the land value attribute and $\beta_{LV,ni}$ indicates the coefficients of the land value attribute. One of the main goals of this study is to understand which types of establishments tend to pay more for better accessibility to transportation networks. In this regard, the WTP of different types of establishments for better accessibility to interstates' entrances, urban highways' entrances, all highways, and major arterials, were calculated for establishments that showed significant coefficients for both land value and accessibility attributes. Fig. 6 presents the results of calculating WTP for better accessibility to the transportation network for different types of establishments.

As Fig. 6 shows, the WTPs of the wholesale trade and technical services section for better accessibility to major arterials are relatively high; such that, respectively, they are willing to pay $2.97 and $2.42 for a location that is one foot closer to a major arterial. Moreover, WTP for access to a major arterial is the most repeated in Fig. 6, showing that it is very important for all types of establishments to have better accessibility to major arterials, especially for types of activities that are in touch with their customers directly, such as wholesale trade and technical services. Wholesale trade is the only activity that showed positive WTP for better accessibility to both urban and all highways. Establishments related to health and social assistance showed the highest WTP for better accessibility to interstate entrances ($0.79), showing how accessibility to freeways and highspeed corridors is important for this type of establishment. Also, since establishments related to health care and social assistance are distributed usually in big cities (please see Appendix A), shorter distances to interstates provide better access to health care related facilities for smaller cities and suburban neighborhoods. Retail trade has the second highest WTP for interstate access, where WTP shows $0.27 for a location one foot closer to an interstate entrance. Establishments related to administration and support showed the highest WTP for a location closer to all highways ($0.37 for each foot). Establishments related to finance and insurance showed the only negative WTP for better accessibility ($-0.17). As Fig. 6 shows, in this type of establishment, a closer distance to interstates reduces the attractiveness of a location for selection. This result is understandable as finance and insurance usually do not have heavy truck traffic, and on the other hand, other results showed that they tend to be in areas with high elderly population density and residential areas, which usually are not close to interstates. Moreover, establishments related to wholesale trade, transportation and warehousing, health and social assistance, arts and recreation, and other services, show WTPs of less than $0.25 for better access to urban highways. To sum up, considering WTPs for all types of accessibility, wholesale trade, technical services, and health care and social assistance showed the highest total WTP to have better access to the transportation network.

In addition to estimating WTP for better accessibility, WTP is estimated for the presence of different types of activities, in the form of a heat map in Fig. 7. In this figure, in addition to the value of WTP, green and red colors are assigned to positive and negative WTPs correspondingly. In order to make Figs. 6 and 7 comparable, the WTPs for the effect of the presence of different types of activities are calculated for each foot, hence a unit change (from mile to foot) is applied to Eq. 7. Fig. 7. should be interpreted as, the amount of money each type of establishments (columns) is willing to pay to be one foot closer to establishment types listed in the rows. For instance, an establishment related to agriculture, forestry, and fishing is willing to pay $98.8 to get one foot closer to an establishment with the same type and the WTP for a location reduces by $13 for each foot getting closer to an establishment related to construction. Similar to the results of conducting elasticity analysis, Fig. 7 emphasizes the strong effect of the presence of similar activity in the neighborhood. The highest WTP belongs to educational services where they are willing to pay $488 for each foot getting closer to a place where the same activity exists. The second and third highest positive WTPs belong to health and social assistance and wholesale trade where these two establishment types are willing to pay $484 and $259 to be located next to an establishment with the same type. In addition to the importance of agglomeration, Fig. 7 highlights the importance of the presence of educational services on the WTP of establishments related to health and social assistance (WTP is $33.1). On the other hand, the presence of some activities would reduce the WTP of an establishment to be located close to them. The largest negative WTP belongs to educational services, such that one foot closer to establishments related to finance and insurance, accommodation and food, and other services reduces the WTPs by $50.1. Moreover, the presence of establishments related to health and social assistance reduces the WTP of establishments related to wholesale trade by $46.8.

6. Implications for research and practice

The results of modeling the location choices of different types of establishments highlighted the importance of the presence of the same

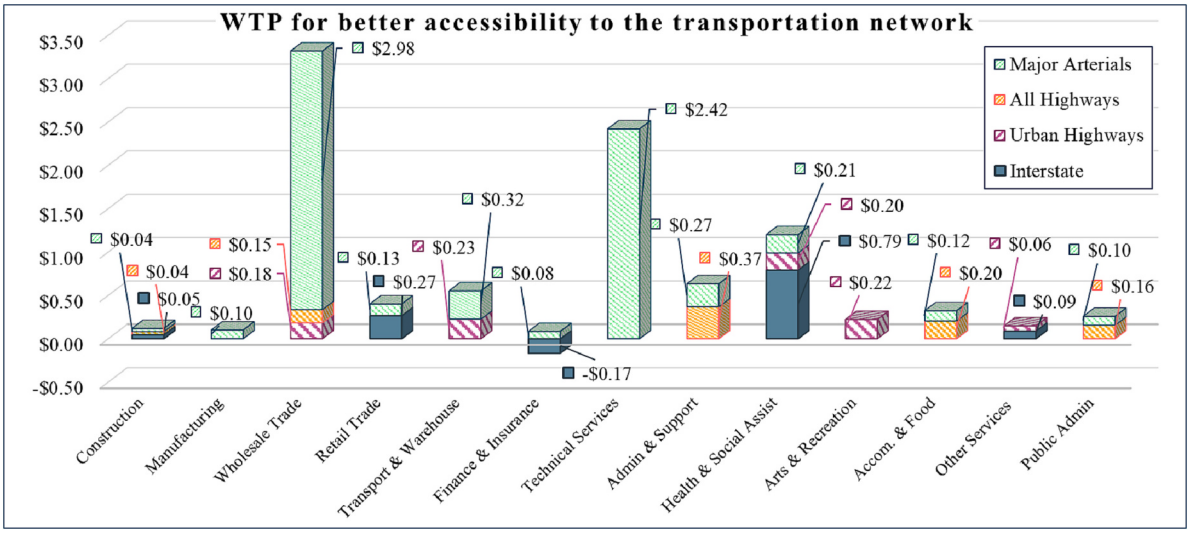

Fig. 6. Willingness to Pay (WTP) for better accessibility of different establishment types.

	Agri, Forest & Fishing	Construction	Manufacturing	Wholesale Trade	Retail Trade	Transport & Warehouse	Information	Finance & Insurance	Real Estate	Technical Services	Admin & Support	Educational Services	Health & Social Assist	Arts & Recreation	Accom. & Food	Other Services	Public Admin
Agri, Forest, Fishing	$98.8		-$3.2		$4.5		$11.5		$5.2	$2.4		$16.2	-$22.1	$9.0		$1.3	
Mining			-$3.5		-$14.5			$5.7		$8.3			-$23.7		$5.9		
Utilities			-$5.8	-$12.9	-$11.1	-$26.7		$3.2		$5.8	-$6.9		-$25.3		-$3.3		$6.6
Construction	-$13.0	$22.7	-$2.0	-$7.7	$13.4	-$11.1	-$6.3	-$4.6	-$5.7	-$4.4	-$6.9	-$31.1	-$17.4	-$14.2	-$15.7	-$2.9	-$3.3
Manufacturing	-$5.0	$1.2	$31	$17.2	-$2.2	-$24.5			-$2.3	$8.7	$5.2	-$12.2	-$30.0	-$5.7	$7.8	$1.1	
Wholesale Trade		-$0.7		$259	$139	-$24.5	-$11.5		$4.0	-$2.9	-$8.0	-$25.7	$12.6	-$7.1	-$7.8	-$1.6	-$3.1
Retail Trade		-$1.4	-$3.5		$83.6	-$20.1	-$7.5			-$5.8	-$6.3	-$16.2	-$31.6	-$6.6	$5.9	-$1.8	-$2.9
Transport & Ware.		$2.2	-$3.5			$303	$4.6		-$4.0	$3.9	$9.8	-$13.5	-$4.7				$6.4
Information		-$1.2	-$6.4	-$6.0	-$12.3	-$24.5	$233	$4.3	-$2.9	$6.3	-$5.2	-$28.4	-$9.5	-$3.8	$10.4		$2.3
Finance & Insurance		-$4.3	-$9.6	-$26.7	-$3.3	-$35.7	-$17.2	$114	-$7.5	-$5.8	-$17.8	-$50.1	$33.1	-$12.3		-$2.1	
Real Estate		-$1.2	-$3.2	-$6.0	-$23.4	-$23.4	-$10.9		$172	-$3.4	-$8.0	-$28.4	-$11.0	-$7.1	-$2.6	-$2.1	-$3.7
Technical Services	-$11.1	-$2.7	-$3.2	-$20.7	-$8.9	-$27.9	-$14.3	-$5.0	-$16.6	$110	-$12.6			-$16.1	-$14.4	-$5.5	
Management		-$1.9	-$9.3	-$9.5	-$7.8	-$32.3	$8.6	$7.5	$10.9	$14.6	$6.9		-$6.3				$8.6
Admin & Support		$1.4	-$3.2		-$14.5	-$14.5			-$3.4		$161	-$16.2	-$12.6		-$5.9		-$2.9
Educational Services	-$7.6	-$2.2	-$7.9	-$18.9	-$35.7	-$26.7	-$8.6		-$3.4		-$7.5	$488	$33.1	-$5.2	-$7.8	$1.1	$2.3
Health & Social Assist	-$14.4	-$5.4	-$9.3	-$37.9		-$46.8	-$16.6	-$10.0	-$18.9	-$19.9	-$24.1	-$46.0	$484	-$23.7	-$18.3	-$7.6	-$6.0
Arts & Recreation			-$4.7			-$14.5		-$1.4		$2.4			-$9.5	$181	$5.9	$1.6	
Accom. & Food	-$11.0	-$2.4	-$8.2	-$33.6	-$27.9	-$15.6	-$12.6		-$9.8	-$9.7	-$16.1	-$50.1	-$7.9	-$8.0	$192	-$2.9	-$5.6
Other Services	-$17.0	-$5.9	-$9.0	-$45.6	-$24.5	-$24.5	-$29.8	-$11.8	-$23.0	-$23.3	-$34.4	-$50.1	-$42.6	-$29.8	-$27.4	$36.1	-$12.4
Public Admin	-$8.6	-$2.2	-$5.5	-$13.8					-$5.7	$3.9	-$6.9		$6.3		-$17.0	-$1.8	$85

Fig. 7. Willingness to Pay (WTP) for the presence of different types of activities.

activity in selecting a location, which can be related to agglomeration. The evaluation of the influence of agglomeration on location/relocation choices of establishments is well-addressed in the literature and the results of this study are in line with Guimaraes et al. (2003), Gabe and Bell (2004), De Bok and Van Oort (2011), Lee and Hwang (2016), Wu et al. (2019) and Ye et al. (2019) who showed the positive effect of the presence of similar activities in selecting a location. For establishments that required a specific source, i.e., agriculture, forestry, and fishing (NAICS 11) and mining (NAICS 21), the presence of more than one establishment of the same type is obvious due to the need for a specific source. This study showed that the presence of the same activity showed the most positive parameter in attracting an establishment to select a location for all establishment types, except public administration. In addition, among all types of establishments, retail trade showed the lowest sensitivity to the presence of similar activity, showing less interest in competition in this type of establishment compared to others. In literature, Backman and Karlsson (2017) stated that the presence of the same business will reduce the likelihood of new firms' location choices.

Moreover, the presence of other services (NAICS 81) and health care and social assistance (NAICS 62) in a location would significantly reduce the interest of all other types of establishments to select a parcel close to them. In addition, the interactions between establishments related to agriculture, forestry, and fishing (NAICS 11), mining (NAICS 21), and utility (NAICS 22) were significantly negative which shows the nature of these activities and can be inferred that these types of establishments would rather be far from other activities. The presence of logistic facilities, which is categorized under NAICS 48–49, transportation and warehousing, showed positive effects on the location choices of establishments related to construction (NAICS 23), technical services, administrative and support (NAICS 56), other services (NAICS 81), and public administration (NAICS 92), which compared to literature, we expected to observe a more significant effect. For instance, Sakai et al. (2020) incorporated the relationship between logistic providers, industrial logistics, and distributors, and showed the significant effects of closer distance to logistic facilities on the location choices of firms.

The neighborhood attributes, which contains a combination of demographic and land use condition, had significant effects on the decision made by establishments. The percentage of commercial, industrial, and agricultural areas in the block group, which is showing what type of land use is more prevalent in the neighborhood, showed large significant effects on the location choices compared to other neighborhood-related determinants. This is emphasizing the importance of policy-makers decisions in assigning a specific land use to a neighborhood and designing the growth plan in attracting or repelling activities. In other words, the dominant land use in an area would affect the location choice of establishments of all types. In literature, the effect of land use conditions was evaluated in terms of land use diversity (Limtanakool et al., 2006) or the degree of land use (Bodenmann, 2004) while the results were highly dependent on the case study.

Moreover, interpreting the results of the developed model showed the independency between demographic conditions and location choice of establishments. In the models of the location choices of establishments related to mining (NAICS 21), the selection of locations with high unemployment rates and high poverty rates, and low populations under 18 and over 65 was significant. Also, interpreting the effects of population age shows the correlation between establishments related to educational services (NAICS 61) and the population under 18, and the connection between the population over 65 and establishments related to health care and social assistance (NAICS 62) and finance and insurance (NAICS 52).

The results of current studies supported the results of the study conducted by (Bodenmann and Axhausen, 2012 and Hensher et al. (2017) and who stated that the population with graduate degrees has a positive effect on firms' location choice. We showed that establishments related to educational services (NAICS 61), technical services (NAICS 54), and health care and social assistance (NAICS 62) are located close to areas with a high educated population. Also, the results of this study are in line with the findings of Chin (2020), who showed the importance of economic, demographic, and geographic conditions at the neighborhood level. Moreover, the results of this study showed significant interactions between the neighborhood environment and establishments' location choices which suggests considering establishment decision-

making on the integrated land use transport models. A good example could be the interaction between the neighborhood's properties and the location choice of establishments related to mining (NAICS 22). In recent years, Hensher et al. (2019) proposed an integrated land-use transport model that incorporates the simultaneous locations of firms and jobs. The results of the current study can be incorporated into the land use transport model development.

A surprising result of this study was the little effect of accessibility on the location choice compared to the effects of office profile and neighborhood conditions. The distance to major arterials was the most significant accessibility measure, and the accessibility of interstate and highways did not show a very large effect on the decision made by establishments. The results of evaluating the effect of distance to interstates are in line with Gabe and Bell (2004) who showed the negative effect of distance to interstates on the number of businesses investing per location at the municipality level. Accessibility measures were only among the top three important location determinants for establishments related to wholesale trade (NAICS 42) and technical services (NAICS 54). One possible reason behind this small effect can be related to the study area since interstates and highways are not passing through all counties and cities in the state of Tennessee.

To sum up, Table 2 provides the top three most important positive and negative location determinants for each type of establishment, which provide a general view of the difference between the location determinants of different activities. As this table shows, the presence of the same activity, office size, land value, land use conditions, and presence of establishments related to NAICSs 62 and 81 are the most repeated location determinants. Table 2 shows that the presence of similar activity is the most important positive parameter in establishments' location choices, except for public administration (NAICS 92), where the square feet is the first positive parameter. Also, this table emphasizes the importance of land-use conditions, as the percentage of agricultural, commercial, and industrial areas appear as the top three important parameters in the majority of activity types. The land value is also one of the most repeated negative parameters in the location choices of different types of establishments. Distance to transportation network only appears in three types of establishments. The distance to major arterials is the most important negative parameter in the location choices of establishments related to wholesale trade (NAICS 42) and technical services (NAICS 54), and the distance to interstates entrance is the third most important variable in the location choices of health care and social assistance. Locating in a metropolitan area appears only for establishments related to construction (NAICS 23) and is the second most positive parameter. In addition, location in a CSA area is the third positive factor in the location choices of establishments related to real estate (NAICS 53) and administrative and support (NAICS 56). Table 2 can also help transportation planners by providing important variables required for developing an integrated land-use transportation model. The location determinants provided in this table can be further incorporated into modeling and estimating the number of job opportunities created, as suggested by Hensher et al. (2019).

To help the transportation planner to understand the importance of accessibility for establishments, this study evaluated the WTP for better accessibility. Wholesale trade, technical services, and health and social assistance are the most important establishments categories that transportation planners should focus on as the WTP of these types of establishments for better accessibility to major arterials and the interstate was much more than other types of establishments. Moreover, in general, the importance of major arterials over other types of roads, especially for establishments that are directly in touch with their customers, needs to be considered in their decision-making and budget assignments.

7. Conclusion

This paper aimed to understand and evaluate the location choice of establishments, the smallest economic unit, to assess how the location determinants would vary across different establishment types. A discrete choice model was applied to model the location choice, where first, the choice sets (alternatives) are modeled, and then the actual choice of each establishment is modeled, using a multinomial logit model. Using

Table 2
Top three strongest positive and negative location determinants for each type of establishment.

Establishment	Positive	Negative	Establishment	Positive	Negative
Agriculture, Forestry, Fishing (NAICS 11)	1. Similar activity*	1. Commercial area	**Real Estate (NAICS 53)**	1. Similar activity	1. Office size
	2. Agricultural area	2. Land value		2. NAICS 51	2. Square feet
	3. Square feet	3. NAICS 81		3. CSA	3. NAICS 81
Mining (NAICS 21)	1. Similar activity	1. NAICS 54	**Technical Services (NAICS 54)**	1. Similar activity	1. Major arterials
	2. Poverty rate	2. NAICS 44–45		2. Office size	2. NAICS 81
	3. Unemployment	3. Population < 18		3. NAICS 31–33	3. Land value
Utilities (NAICS 22)	1. Similar activity	1. Industrial area	**Management of Companies (NAICS 55)**	1. Similar activity	1. Commercial area
	2. High-income HH	2. NAICS 81		2. NAICS 56	2. Square feet
	3. Square feet	3. NAICS 72		3. Office size	3. Population > 65
Construction (NAICS 23)	1. Similar activity	1. Office size	**Administrative & Support (NAICS 56)**	1. Similar activity	1. NAICS 81
	2. Metropolitan	2. Land value		2. Presence of 72	2. NAICS 62
	3. Industrial area	3. Commercial area		3. CSA	3. Land value
Manufacturing (NAICS 31–33)	1. Similar activity	1. Office size	**Educational Services (NAICS 61)**	1. Similar activity	1. Commercial area
	2. Industrial area	2. Land value		2. Population < 18	2. NAICS 81
	3. Agricultural area	3. Commercial area		3. Total population	3. NAICS 51
Wholesale Trade (NAICS 42)	1. Similar activity	1. Major arterials	**Health & Social Assistance (NAICS 62)**	1. Similar activity	1. Industrial area
	2. Square feet	2. Office size		2. Commercial area	2. Square feet
	3. Industrial area	3. Land value		3. Office size	3. Interstates
Retail Trade (NAICS 44–45)	1. Similar activity	1. Office size	**Arts & Recreation (NAICS 71)**	1. Similar activity	1. Office size
	2. Agricultural area	2. NAICS 62		2. NAICS 11	2. NAICS 81
	3. Commercial rea	3. Land value		3. Metropolitan	3. Land value
Transport & Warehousing (NAICS 48–49)	1. Similar activity	1. Office size	**Accommodation & Food (NAICS 72)**	1. Similar activity	1. Office size
	2. Square feet	2. NAICS 62		2. Agricultural area	2. NAICS 81
	3. Industrial area	3. Land value		3. Population	3. Land value
Information (NAICS 51)	1. Similar activity	1. Office size	**Other Services (NAICS 81)**	1. Similar activity	1. Office size
	2. Square feet	2. NAICS 81		2. Unemployment	2. Land value
	3. NAICS 11	3. Land value		3. NAICS 71	3. Commercial area
Finance & Insurance (NAICS 52)	1. Similar activity	1. Agricultural area	**Public Administration (NAICS 92)**	1. Square feet	1. Commercial area
	2. NAICS 21	2. Office size		2. Similar activity	2. Land value
	3. NAICS 51	3. Land value		3. Office size	3. NAICS 81

* Presence of establishment with the same NAICS code.

the data collected for the state of Tennessee, models were developed to indicate the significant parameters in the location choice of establishments.

Then elasticity analysis was conducted to evaluate the magnitude of each significant parameter. The location determinants of establishments are classified into four categories, office profile, accessibility, neighborhood attributes, and interaction between establishments, and showed that the location determinants of establishments vary across different NAICS sectors. Elasticity analysis showed that the presence of the same activity, land value, office size, square feet, and land use conditions are the most important and most repeated location determinants of establishments of different types. Moreover, the presence of establishments related to other services (NAICS 81) and health and social assistance (NAICS 62) had consistent negative effects on the location choice of others as the results showed that other types of establishments do not prefer to select a location close to these two types of establishments.

Among accessibility variables, the distance to major arterials showed a significant effect on the location choices. To indicate the importance of accessibility for establishments, willingness to pay was calculated for different types of activities. Results showed that establishments tend to pay more for better accessibility to major arterials, specifically establishments related to wholesale trade (NAICS 42) and technical services (NACIS 54). Moreover, better accessibility to interstates was significant for establishments related to health and social assistance. The importance of major arterials over other types of roads needs to be considered in transportation planners' decision-making and budget assignment as this research showed and compared the significant correlation between the distance to major arterials and other types of roads.

This study is conducted under some limitations. Due to data availability, to model establishment location choices this study had to assume that establishments make their decision individually and independently. While an establishment can be a member of a firm or a franchise. Therefore, in the real world, the decision-making process of this establishment is not occurring independently and depends on the firms' policies and strategies.

Future studies can involve other variables such as crime rate or other office conditions. Due to the scale and the condition of the study area, this research did not consider the effect of accessibility to public transportation, hence future studies can incorporate the accessibility to public transport due to the important role it plays in residential and business location choice. The application of other modeling approaches e.g., latent class models, hybrid models, and/or multilevel models can reveal more details regarding the preference of establishments in location choice. The current study modeled establishments' location choices considering 2-digit NAICS sector classification. Considering the possible significant heterogeneity among establishments with the same 2-digit NAICS sectors, future studies can investigate modeling establishments' location choices at a finer level (e.g., 3-digit NAICS code). This study investigated the effect of the presence of different types of activities within one mile on the location choice of establishments. Two points should be mentioned here, first, 1 mile was arbitrary, and we decided to go with one unit of the distance, second, binary variables were considered for the presence of each type of activity to specifically target the effect of the presence of different types of establishments, and regardless of the number of establishments. Therefore, further investigation can be applied to provide more insight into the interaction between different types of establishments, considering their numbers, types, and logistic policies and approaches. In this study, we incorporated 4 parcels as the choice alternatives for each establishment (creating choice sets of 5), future studies can conduct robustness analysis for selecting the optimal number of choice sets, but doing so in our research was out of the scope. Finally, since this research considered a statewide area as the case study, applying the model to a bigger (national level) or smaller (county or city) study area might lead to different results. Also, the type of variables can be changed, e.g., one important factor in encouraging or discouraging establishments is the national business policy or tax policy which needs to be considered in analyzing the location choices of establishments on a larger scale.

CRediT authorship contribution statement

Ali Riahi Samani: Conceptualization, Methodology, Software, Validation, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Sabyasachee Mishra:** Conceptualization, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Mihalis Golias:** Supervision, Project administration, Funding acquisition. **David J.-H. Lee:** Data curation.

Data availability

The authors do not have permission to share data.

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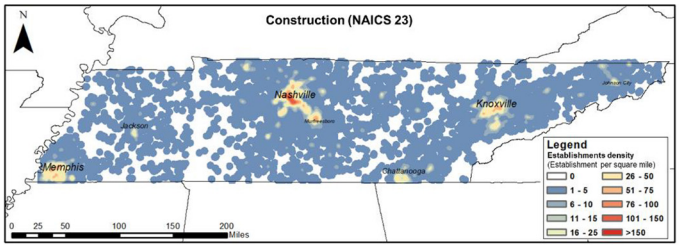
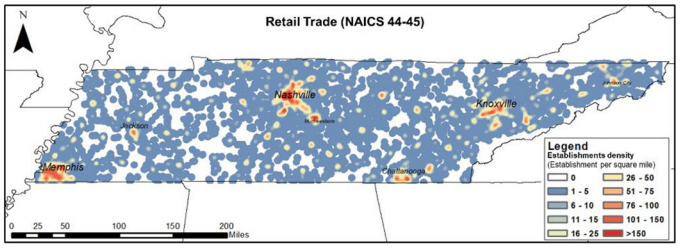
Appendix A. Appendix

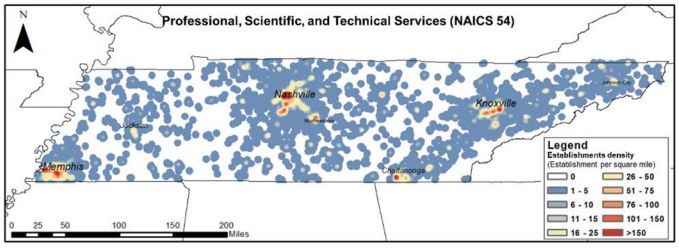
Heat maps, presenting the density and distribution of six types of establishments with the highest number in the state of Tennessee.



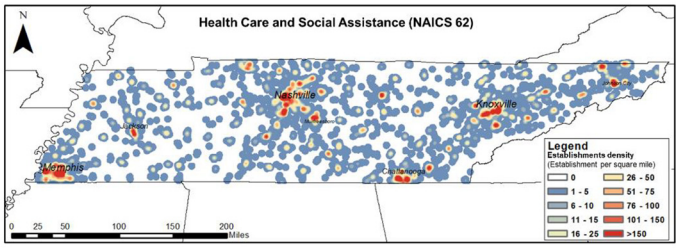
a. Distribution and the density of establishments related to construction (NAICS 23)



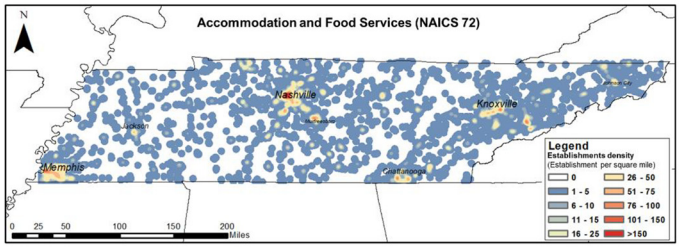
b. Distribution and the density of establishments related to retail trade (NAICS 44-45)



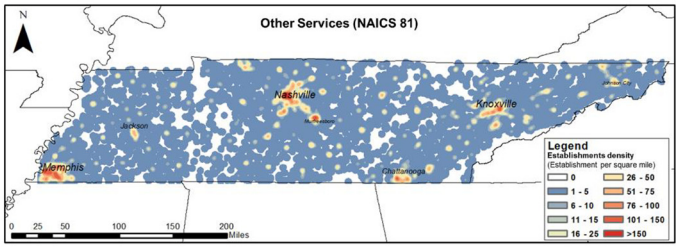
c. Distribution and the density of establishments related to professional, scientific, and technical Services (NAICS 54)



d. Distribution and the density of establishments related to health care and social assistance (NAICS 62)



e. Distribution and the density of establishments related to accommodation and food service (NAICS 72)



f. Distribution and the density of establishments related to other services (except public administration) (NAICS 81)

Appendix B. Appendix

Results of developing MNL on location choices of different types of establishments, coefficient (*t-value*)

Variables	Agri, Forest, Fishing	Mining	Utilities	Construction	Manufacturing
Intercept 2					
Intercept 3					0.29 (2.27)*
Intercept 4			−0.44 (−1.74).	0.25 (0.85).	
Intercept 5	2.99 (2.78)**				
Office Profile					
Land Value	−1.24 (−1.79).			−1.57 (−13.11)***	−0.65 (−5.62)***
Square Feet	0.9 (6.75)***		1.09 (2.50)*	−0.37 (−11.89)***	0.16 (2.56)*
Office Size			−0.99 (−3.52)***	−1.65 (−7.73)***	−0.74 (−13.64)***
Accessibility					
Interstate		−0.25 (−1.80).		−0.06 (−2.52)*	
Urban Highway		−0.32 (−2.24)*			
Highways			−0.38 (−2.01)*	−0.05 (−2.03)*	
Major Arterials				−0.06 (−2.49)*	−0.06 (−2.10)*
Neighborhood attributes					
Population					−0.08 (−4.86)***
Unemployment		0.84 (1.86).			
Large Size HH					
Highly Educated Pop.					
High Income HH	−0.29 (−2.66)**		1.15 (3.22)**		
Poverty rate < 1		1.27 (2.84)**		0.03 (3.65)***	
Pop. < 18 years old		−2.05 (−2.60)**			
Pop. > 65 years old		−1.65 (−3.72)***			
Commercial Area	−1.31 (−2.07)*			−0.68 (−11.66)***	−0.65 (−7.11)***
Industrial Area			−2.3 (−2.22)*	0.27 (3.70)***	1.06 (10.78)***
Agricultural Area	1.18 (3.50)***				0.28 (4.83)***
Metropolitan				0.26 (12.05)***	
CSA		−1.41 (−3.45)***			−0.11 (−3.15)**
Interaction between establishments					
Agri, Forest, Fishing	6.47 (23.70)***				−0.11 (−2.57)*
Mining		10.57 (8.98)***			−0.12 (−2.02)*

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(*continued*)

Variables	Agri, Forest, Fishing	Mining	Utilities	Construction	Manufacturing
Utilities		−1.1 (−1.82).	6.46 (17.96)***		−0.2 (−4.44)***
Construction	−0.85 (−5.10)***			1.88 (81.93)***	−0.07 (−2.25)*
Manufacturing	−0.33 (−1.85).			0.1 (5.06)***	1.07 (40.02)***
Wholesale Trade			−0.51 (−2.43)*	−0.06 (−3.35)***	
Retail Trade		−2.13 (−3.43)***		−0.12 (−6.06)***	−0.12 (−3.58)***
Transport & Ware.				0.18 (10.15)***	−0.12 (−3.83)***
Information				−0.1 (−5.13)***	−0.22 (−6.98)***
Finance & Insurance				−0.36 (−18.15)***	−0.33 (−9.92)***
Real Estate				−0.1 (−4.97)***	−0.11 (−3.30)***
Technical Services	−0.73 (−3.70)***	−2.64 (−3.82)***		−0.22 (−10.47)***	−0.11 (−3.09)**
Management				−0.16 (−5.53)***	−0.32 (−7.52)***
Admin & Support			−0.51 (−2.37)*	0.12 (6.50)***	−0.11 (−3.59)***
Educational Services	−0.5 (−2.84)**	−1.4 (−2.96)**		−0.18 (−9.93)***	−0.27 (−9.44)***
Health & Social Assis	−0.94 (−4.90)***		−0.92 (−3.52)***	−0.45 (−21.62)***	−0.32 (−9.53)***
Arts & Recreation					−0.16 (−5.20)***
Accom. & Food	−0.72 (−3.60)***		−1.16 (−4.25)***	−0.2 (−9.79)***	−0.28 (−8.20)***
Other Services	−1.11 (−5.90)***	−1.67 (−2.74)**	−1.11 (−3.96)***	−0.49 (−21.97)***	−0.31 (−8.66)***
Public Admin	−0.56 (−3.30)***			−0.18 (−10.15)***	−0.19 (−6.81)***
Model specifics					
Log-Likelihood:	−682	−993	−294.3	−4067	−15,907
McFadden R^2:	0.784	0.74	0.823	0.2368	0.306
AIC	1190.3	267.9	658.2	81,527.9	31,969.3
Num. of Observation	9850	2395	5155	165,585	70,675

Variables	Wholesale Trade	Retail Trade	Transport & Ware.	Information	Finance & Insurance
Intercept 2					
Intercept 3		0.04 (1.75).		0.16 (2.02)*	
Intercept 4		0.05 (2.13)*	0.17 (3.38)***		
Intercept 5	−0.09 (−2.51)*				
Office Profile					
Land Value	−0.22 (−5.88)***	−0.17 (−15.73)***	−0.17 (−3.28)**	−0.33 (−7.30)***	−0.53 (−11.84)***
Square Feet	2.04 (8.28)***		1.75 (6.65)***	2.05 (6.23)***	−0.11 (−1.66).
Office Size	−0.89 (−13.69)***	−2.01 (−14.84)***	−1.59 (−3.34)***	−1.14 (−18.63)***	−0.7 (−18.14)***
Accessibility					
Interstate		−0.03 (−3.34)***			0.08 (3.78)***
Urban Highway	−0.04 (−2.69)**		−0.01 (−1.65).		
Highways	−0.04 (−2.13)*				
Major Arterials	−1.96 (−2.55)*	−0.03 (−1.81).	−0.05 (−1.82).		−0.03 (−1.81).
Neighborhood attributes					
Population	−0.29 (−5.04)***	−0.13 (−8.62)***	0.04 (2.27)*	0.07 (4.88)***	−0.07 (−4.39)***
Unemployment					−0.05 (−4.09)***
Large HH					
Highly Educated Pop.		−0.04 (−6.13)***	−0.14 (−6.85)***		
High Income HH		0.04 (4.89)***			0.02 (2.33)*
Poverty rate < 1		0.06 (8.96)***			
Pop. < 18 years old					
Pop. > 65 years old				−0.11 (−6.29)***	0.07 (6.85)***
Commercial Area		−0.18 (−5.20)***			−0.16 (−2.72)**
Industrial Area	1.47 (14.23)***	−0.13 (−2.73)**	1.3 (10.49)***		−1.05 (−11.29)***
Agricultural Area		0.22 (9.17)***	0.55 (8.073)***		−0.08 (−1.87).
Metropolitan	−0.11 (−2.71)**	0.05 (3.29)***	−0.23 (−4.85)***		
CSA		−0.03 (−2.24)*			
Interaction between establishments					
Agri, Forest, Fishing		0.04 (1.75).		0.2 (4.39)***	
Mining		−0.13 (−7.61)***			0.16 (4.80)***
Utilities	−0.15 (−3.34)***	−0.1 (−8.29)***	−0.24 (−4.22)***		0.09 (3.69)***
Construction	−0.09 (−2.47)*	0.12 (10.58)***	−0.1 (−2.49)*	−0.11 (−2.63)**	−0.13 (−6.59)***
Manufacturing	0.2 (7.04)***	−0.02 (−1.79).	−0.22 (−5.89)***		
Wholesale Trade	3.01 (68.56)***	1.25 (71.29)***	−0.22 (−5.80)***	−0.2 (−5.24)***	
Retail Trade		0.75 (55.93)***	−0.18 (−4.30)***	−0.13 (−2.68)**	
Transport & Ware.			2.72 (65.60)***	0.08 (2.17)*	
Information	−0.07 (−2.15)*	−0.11 (−8.13)***	−0.22 (−5.83)***	4.06 (58.78)***	0.12 (6.25)***
Finance & Insurance	−0.31 (−8.79)***	−0.03 (−2.58)**	−0.32 (−7.81)***	−0.3 (−5.86)***	3.19 (72.99)***
Real Estate	−0.07 (−2.19)*	−0.21 (−15.07)***	−0.21 (−5.05)***	−0.19 (−4.18)***	
Technical Services	−0.24 (−6.28)***	−0.08 (−4.68)***	−0.25 (−5.72)***	−0.25 (−4.60)***	−0.14 (−5.20)***
Management	−0.11 (−2.54)*	−0.07 (−5.74)***	−0.29 (−5.54)***	0.15 (3.53)***	0.21 (9.24)***
Admin & Support		−0.13 (−11.89)***	−0.13 (−3.14)**		
Educational Services	−0.22 (−7.38)***	−0.32 (−22.90)***	−0.24 (−6.68)***	−0.15 (−4.12)***	
Health & Social Assis	−0.44 (−12.06)***		−0.42 (−10.07)***	−0.29 (−4.94)***	−0.28 (−9.59)***
Arts & Recreation			−0.13 (−3.46)***		−0.04 (−2.44)*
Accom. & Food	−0.39 (−11.23)***	−0.25 (−15.24)***	−0.14 (−3.24)**	−0.22 (−4.05)***	
Other Services	−0.53 (−12.49)***	−0.22 (−20.89)***	−0.22 (−4.84)***	−0.52 (−7.70)***	−0.33 (−9.83)***
Public Admin	−0.16 (−5.59)***				
Model specifics					

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Variables	Wholesale Trade	Retail Trade	Transport & Ware.	Information	Finance & Insurance
Log-Likelihood:	−1388	−10,333	−10,090	−8886	−33,816
McFadden R^2:	0.371	0.173	0.35851	0.353	0.221
AIC	27,918.3	206,776.3	20,273.37	17,889.41	67,761.06
Num. of Observation	68,520	346,625	48,866	42,705	134,885

Variables	Real Estate	Technical Services	Management	Admin & Support	Educational Services
Intercept 2					
Intercept 3	−0.19 (−1.76).		8.87 (2.49)*		0.65 (2.51)*
Intercept 4	−0.24 (−2.21)*		5.1 (1.8).	0.27 (2.04)*	0.65 (2.48)*
Intercept 5	−0.19 (−1.68).				0.51 (1.94).
Office Profile					
Land Value	−0.33 (−10.44)***	−0.39 (−15.22)***		−0.33 (−8.73)***	−0.14 (−7.95)***
Square Feet	−0.42 (−16.01)***	−0.16 (−5.30)***	−1.24 (−2.81)**		
Office Size	−0.54 (−14.28)***	0.51 (28.78)***		0.11 (4.44)***	
Accessibility					
Interstate			−0.3 (−2.04)*		
Urban Highway			−0.25 (−1.72).		
Highways				−0.4 (−3.77)***	
Major Arterials		−0.94 (−2.74)**		−0.3 (−2.38)*	
Neighborhood attributes					
Population		0.03 (3.80)***		0.06 (3.08)**	0.11 (2.75)**
Unemployment	0.03 (3.44)***				0.04 (2.20)*
Large HH				0.06 (6.05)***	−0.04 (−2.11)*
Highly Educated Pop.		0.04 (6.09)***			0.06 (3.45)***
High Income HH	0.06 (5.10)***	0.08 (10.65)***	0.42 (3.60)***	0.08 (5.59)***	
Poverty rate < 1		−0.03 (−4.05)***		−0.06 (−3.77)***	−0.07 (−3.22)**
Pop. < 18 years old					0.19 (6.55)***
Pop. > 65 years old			−0.63 (−3.56)***		
Commercial Area	−0.3 (−5.10)***		−2.81 (−3.74)***	−0.35 (−4.89)***	−0.76 (−7.28)***
Industrial Area	−0.39 (−4.27)***			0.17 (1.78).	
Agricultural Area		−0.2 (−5.58)***			
Metropolitan	0.07 (2.59)**	−0.06 (−2.66)**			
CSA		0.08 (3.70)***		0.2 (5.90)***	
Interaction between establishments					
Agri, Forest, Fishing	0.09 (3.23)**	0.05 (2.54)*			0.12 (2.49)*
Mining		0.17 (6.63)***			
Utilities		0.12 (5.57)***		−0.12 (−2.92)**	
Construction	−0.1 (−4.42)***	−0.09 (−5.02)***		−0.12 (−4.25)***	−0.23 (−6.16)***
Manufacturing	−0.04 (−1.93).	0.18 (12.12)***		0.09 (3.57)***	−0.09 (−2.56)*
Wholesale Trade	0.07 (3.19)**	−0.06 (−3.65)***	−1.58 (−3.93)***	−0.14 (−5.84)***	−0.19 (−5.65)***
Retail Trade		−0.12 (−6.44)***		−0.11 (−3.86)***	−0.12 (−2.90)**
Transport & Ware.	−0.07 (−3.23)**	0.08 (4.99)***		0.17 (7.50)***	−0.1 (−2.67)**
Information	−0.05 (−2.25)*	0.13 (7.57)***		−0.09 (−3.72)***	−0.21 (−5.86)***
Finance & Insurance	−0.13 (−5.00)***	−0.12 (−6.00)***		−0.31 (−10.96)***	−0.37 (−8.98)***
Real Estate	3.01 (80.99)***	−0.07 (−3.94)***		−0.14 (−5.09)***	−0.21 (−5.51)***
Technical Services	−0.29 (−10.51)***	2.28 (81.55)***		−0.22 (−6.80)***	
Management	0.19 (6.92)***	0.3 (16.20)***	10.15 (10.32)***	0.12 (3.47)***	
Admin & Support	−0.06 (−2. 70)**		0.95 (1.91).	2.81 (77.79)***	−0.12 (−3.20)**
Educational Services	−0.06 (−3.08)**		−1.63 (−3.97)***	−0.13 (−5.46)***	3.61 (69.95)***
Health & Social Assis	−0.33 (−11.52)***	−0.41 (−18.69)***	−1.57 (−2.43)*	−0.42 (−13.74)***	−0.34 (−7.47)***
Arts & Recreation		0.05 (3.22)**			
Accom. & Food	−0.17 (−6.51)***	−0.2 (−10.02)***		−0.28 (−9.49)***	−0.37 (−8.75)***
Other Services	−0.4 (−12.14)***	−0.48 (−19.88)***		−0.6 (−17.23)***	−0.37 (−7.38)***
Public Admin	−0.1 (−5.18)***	0.08 (5.50)***		−0.12 (−5.18)***	
Model specifics					
Log-Likelihood:	−277,784	−69,821	−121.6	−2129	−10,438
McFadden R^2:	0.2025	0.4956	0.8597	0.2523	0.36046
AIC	55,723.65	106,100.8	395.954	42,768.17	21,025.74
Num. of Observation	108,235	191,440	2770	88,480	50,705

Variables	Health & Social Assist	Arts & Recreation	Accom. & Food	Other Services	Public Admin
Intercept 2			0.05 (2.13)*	0.05 (1.94).	
Intercept 3		0.18 (2.26)*		0.06 (2.56)*	
Intercept 4	0.15 (2.35)*	0.14 (1.77).		0.05 (2.1)*	
Intercept 5			0.06 (2.55)*	0.07 (3.18)**	
Office Profile					
Land Value	−0.12 (−30.40)***	−0.4 (−8.14)***	−0.29 (−15.94)***	−0.72 (−14.68)***	−0.92 (−6.75)***
Square Feet	−0.65 (−36.00)***				4.22 (5.88)***
Office Size	0.51 (41.80)***	−0.19 (−5.16)***	−2.1 (−10.7)***	−2.21 (−13.86)***	1.62 (32.00)***
Accessibility					
Interstate	−0.09 (−7.39)***			−0.6 (−4.48)***	
Urban Highway	−0.03 (−1.93).	−0.03 (−2.06)*		−0.3 (−3.16)**	

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Variables	Health & Social Assist	Arts & Recreation	Accom. & Food	Other Services	Public Admin
Highways			−0.6 (−2.93)**		−0.99 (−3.89)***
Major Arterials	−0.03 (−1.88).		−0.03 (−1.69).		−0.9 (−3.05)**
Neighborhood attributes					
Population	−0.05 (−5.25)***		0.04 (2.10)*		0.06 (2.03)*
Unemployment	−0.04 (−6.78)***	0.07 (4.65)***		0.02 (3.86)***	
Large HH	−0.07 (−13.73)***				
Highly Educated Pop.	0.02 (3.58)***				
High Income HH	−0.08 (−10.72)***		0.03 (2.02)*		
Poverty rate < 1	0.13 (19.21)***		0.03 (2.71)**	0.02 (3.73)***	0.08 (3.75)***
Pop. < 18 years old			−0.02 (−2.03)*		
Pop. > 65 years old	0.06 (13.22)***	−0.08 (−4.43)***	−0.08 (−7.66)***	−0.04 (−5.93)***	−0.15 (−7.01)***
Commercial Area	0.72 (26.39)***	−0.33 (−3.25)**	0.36 (6.83)***	−0.39 (−10.70)***	−1.03 (−9.61)***
Industrial Area	−1.19 (−23.59)***		−0.46 (−5.76)***	−0.6 (−11.43)***	
Agricultural Area	−0.26 (−10.29)***		0.31 (7.58)***		
Metropolitan	0.12 (5.25)***	0.12 (2.58)**	0.15 (6.49)***	−0.05 (−3.08)**	
CSA	−0.06 (−3.32)***		0.1 (4.55)***		−0.25 (−7.06)***
Interaction between establishments					
Agri, Forest, Fishing	−0.14 (−9.57)***	0.19 (4.10)***		0.05 (2.84)**	
Mining	−0.15 (−7.74)***		0.09 (2.83)**		
Utilities	−0.16 (−10.49)***		−0.05 (−2.16)*		0.32 (8.35)***
Construction	−0.11 (−9.75)***	−0.3 (−6.89)***	−0.24 (−13.14)***	−0.11 (−8.99)***	−0.16 (−4.06)***
Manufacturing	−0.19 (−19.49)***	−0.12 (−3.32)***	0.12 (7.63)***	0.04 (3.045)**	0.17 (4.87)***
Wholesale Trade	0.08 (8.17)***	−0.15 (−3.84)***	−0.12 (−7.32)***	−0.06 (−5.45)***	−0.15 (−4.24)***
Retail Trade	−0.2 (−16.88)***	−0.14 (−2.92)**	0.09 (4.54)***	−0.07 (−5.319)***	−0.14 (−3.22)**
Transport & Ware.	−0.03 (−3.06)**			0.03 (2.98)**	0.31 (8.90)***
Information	−0.06 (−6.11)***	−0.08 (−2.07)*	0.16 (9.56)***		0.11 (2.89)**
Finance & Insurance	0.21 (16.66)***	−0.26 (−5.55)***		−0.08 (−5.45)***	
Real Estate	−0.07 (−5.67)***	−0.15 (−3.28)**	−0.04 (−1.90).	−0.08 (−5.82)***	−0.18 (−4.47)***
Technical Services		−0.34 (−6.62)***	−0.22 (−10.08)***	−0.21 (−14.74)***	
Management	−0.04 (−3.17)**				0.42 (9.61)***
Admin & Support	−0.08 (−7.53)***		−0.09 (−5.18)***		−0.14 (−3.72)***
Educational Services	0.21 (21.98)***	−0.11 (−3.12)**	−0.12 (−7.33)***	0.04 (3.07)**	0.11 (3.12)**
Health & Social Assis	3.07 (103.94)***	−0.5 (−9.54)***	−0.28 (−11.98)***	−0.29 (−19.37)***	−0.29 (−5.66)***
Arts & Recreation	−0.06 (−6.15)***	3.84 (63.16)***	0.09 (5.54)***	0.06 (5.33)***	
Accom. & Food	−0.05 (−3.99)***	−0.17 (−3.35)***	2.94 (86.17)***	−0.11 (−7.54)***	−0.27 (−5.84)***
Other Services	−0.27 (−16.39)***	−0.63 (−10.60)***	−0.42 (−15.20)***	1.39 (76.31)***	−0.6 (−10.31)***
Public Admin	0.04 (4.26)***		−0.26 (−16.16)***	−0.07 (−6.58)***	4.13 (68.72)***
Model specifics					
Log-Likelihood:	−127,440	−9125.9	−51,596	−88,479	−9258.6
McFadden R^2:	0.18	0.339	0.215	0.175	0.574
AIC	253,311.5	18,391.82	86,500.58	177,114.2	18,645.19
Num. of Observation	486,750	42,925	161,710	297,350	67,520

$p < .1$, *$p < .05$, **$p < 0.01$, and ***$p < .001$

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