FACTORS AFFECTING ON URBAN LOCATION CHOICE DECISIONS OF ENTERPRISES

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Abstract
This paper focuses on analyzing the origin data source to find out the principle motives and preferences which influence the location choice behaviors of individual firms in Tokyo metropolitan area. A modeling framework is developed to analyze decisions regarding location choice for enterprises using a multinomial logit model. In case study, the proposed model is tested for retailers, wholesalers, warehouses and manufacturers. The results indicate that for choosing a location, the number of employees is a more important determinant for manufacturers and warehouses than that for retailers and wholesalers. Additionally, the results indicate that transportation cost and the land prices in a given zone strongly affect the decision making process of all the firms in the metropolitan area.
Keywords: Multinomial Logit Model, Location Decision Behavior, Location Choice Model

1. INTRODUCTION

This study not only aim to investigate all the characteristics of enterprises, zone's attributes, interactions among enterprises and zone alternatives but also develop a model that considers the influence of observable and unobservable factors on the location choice decision of each enterprise and its interaction within dynamic business environments. The individual business location choice decision process is illustrated in the model conceptual framework. In which, a multinomial logit model have been applied to explain these processes in the business dynamic environment. In addition, the maximum likelihood estimation has been used to estimate the parameters of the proposed model.

The next section introduces the literature review of the application of a multinomial logit model. The third section describes the approach taken in this study. The fourth section presents a case study based on data from the Tokyo Metropolitan area. Discussion of the results, the conclusions and recommendations are presented in the fifth section and the sixth section, respectively.

2. LITERATURE REVIEW

Maoh and Kanaroglou (2007) present a microanalytical firm mobility model for the City of Hamilton, Canada, developed with data from the Statistics Canada Business Register. In this article evidence is provided that the willingness to move can be explained by firm's internal characteristics (e.g. age, size, growth and industry type) as well as location factors related to the urban environment where the firm is located. Numerous studies have examined the relative significance of various factors in the business location choice process by developing theoretical models to explain the different facets of the process (Ozmen-Ertekin et al. 2007). In practice, the choice of location is determined by an individual firm, which follows a complex process to evaluate the trade-offs among different locations. The choice of location is generally influenced by factors such as the characteristics of the firm, the attributes of the zones being considered, and transportation accessibility (Ozmen-Ertekin et al. 2007).

Löchl et al. (2010) apply UrbanSim software to modelling hedonic residential rents for land use and transport simulation while considering spatial effects. Spatial simultaneous autoregressive approaches proved to be a reasonable alternative in the analysis, which can be implemented in UrbanSim more easily because of its structure of a single set of resulting parameters in his research. Schirmer et al. (2014) not only considers the role of location in residential location choice models but also proposes a common classification for location

variables and categorize findings from a wide range. His results show that in addition points of interest (e.g., schools, school quality, retail, transport elements) and previous residential locations are attributes that should be included in choice models in transport land-use simulations. Nilsen et al. (2020) indicate that the decision to relocate is influenced by a firm's internal and external characteristics such as agglomeration. His results show that firms prefer areas with good access to skilled and diverse labour marked and are pulled towards larger markets often found in urban areas.

3. METHODOLOGY

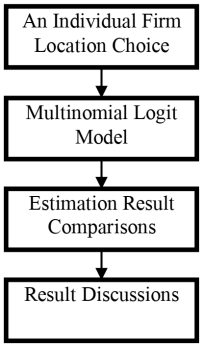
This paper proposes the realistic location choice model to analyze decisions regarding location choice for enterprises using a multinomial logit model.

Table 1 Assumption and Utility Function of Proposed Models

Individual firm location choice models	**Assumptions**		**Formula of utility function** $U_{ni} = V_{ni} + \varepsilon_{ni}$	
	Deterministic Part (V_{ni})	***Error part*** (ε_{ni})	***Deterministic part*** (V_{ni})	***Error part*** (ε_{ni})
MNL Multinomial Logit (MNL)	The responsiveness to attributes of alternatives across individuals is assumed to be homogeneous after controlling for observed individual firm characteristics	IID assumption with Gumbel distribution	V_{ni}	ε_{ni}

Table 1 firstly shows that the random components of the utilities of the zones in the multinomial logit model are assumed to be independent and identically distributed (IID) with a type I extreme value distribution (Johnson and Kotz, 1970). In addition, the responsiveness to attributes of zones across individual firms is assumed to be homogeneous after controlling for observed individual firm characteristics. On the basis of these two assumptions, this paper proposed origin location choice model of an individual firm using the multinomial logit model to develop.

Figure 1 Conceptual Framework of Location Choice Models



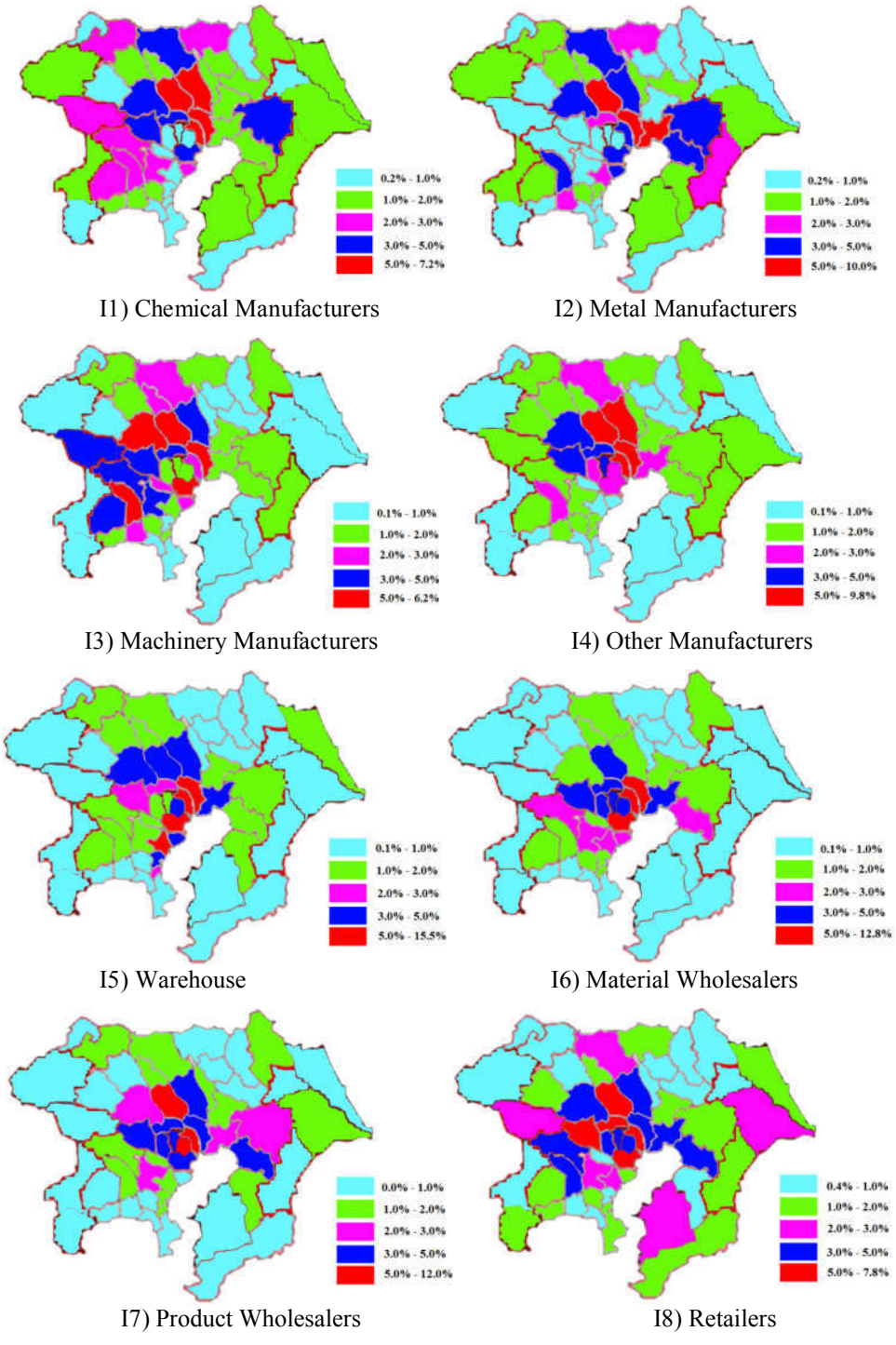
4. DATA COLLECTION FOR CASE STUDY

The attributes of each zone, the characteristics of each individual firm and spatial interactions have been collected from numerous data source. In which, the number of population of the zone was collected from the Population census of Japan. The number of employees of the zone was collected from the Establishment and Enterprise Census. Furthermore, the average land price of zones was collected from the Land Price Survey of Japan. The characteristics of each individual firm were collected from the TMGMS. The address of each individual firm is available in the TMGMS. Therefore, the distance among the firms can be calculated directly from the address of each firm. However, to make simply the computation, the distance among the firms can be calculated on the basis of the distance among C zone types (based on the three digits of city code) which each individual firm belongs to.

The percentage of firms by industry type in each zone is depicted in Figure 2. The zones in the centre of Tokyo prefecture and the nearby zones comprise many light product manufacturers, wholesalers, warehouses, retailers. The heavy product manufacturers

including chemical manufacturers, metal manufacturers, and machinery manufacturers, are located outside the centre of the city, in Tokyo, Saitama, and Kanagawa prefectures. This means that there are many industrial clusters which include heavy and light manufacturer clusters, wholesalers and retailer clusters in the zones of the south part of Saitama and Tokyo city, respectively. This implies that transportation costs resulting from the distance that links input resources, the firm's location and customers or the market can lead industries to agglomerate in certain areas to capture the positive externalities arising from economies of scale and agglomeration in these zones (Fujita and Thisse, 2002). In other words, individual firms, in aiming to minimize their observable spatial transaction costs, have implicitly or explicitly determined that this is best achieved by locating close to other firms within the particular input- output production and consumption hierarchy of which they are parts (Isard and Vietorisz,1955; McCann, 1995).

Figure 2 Percentage of Firms in each Zone for each Industry Type



In addition, the agglomeration of manufacturers, wholesalers and retailers also increases the possibilities of specialization between firms as more specialized tasks in the firms could be outsourced. This is especially true for the workforce as it is often highly specialized, and the agglomeration of firms within the same industry creates a large labour pool of specialists in that particular industry which is an advantage for the individual member of the cluster in each zone (Madsen et al. 2003).

Figure 3 Percent of Firm in each Zone comparing with Other Industry Types

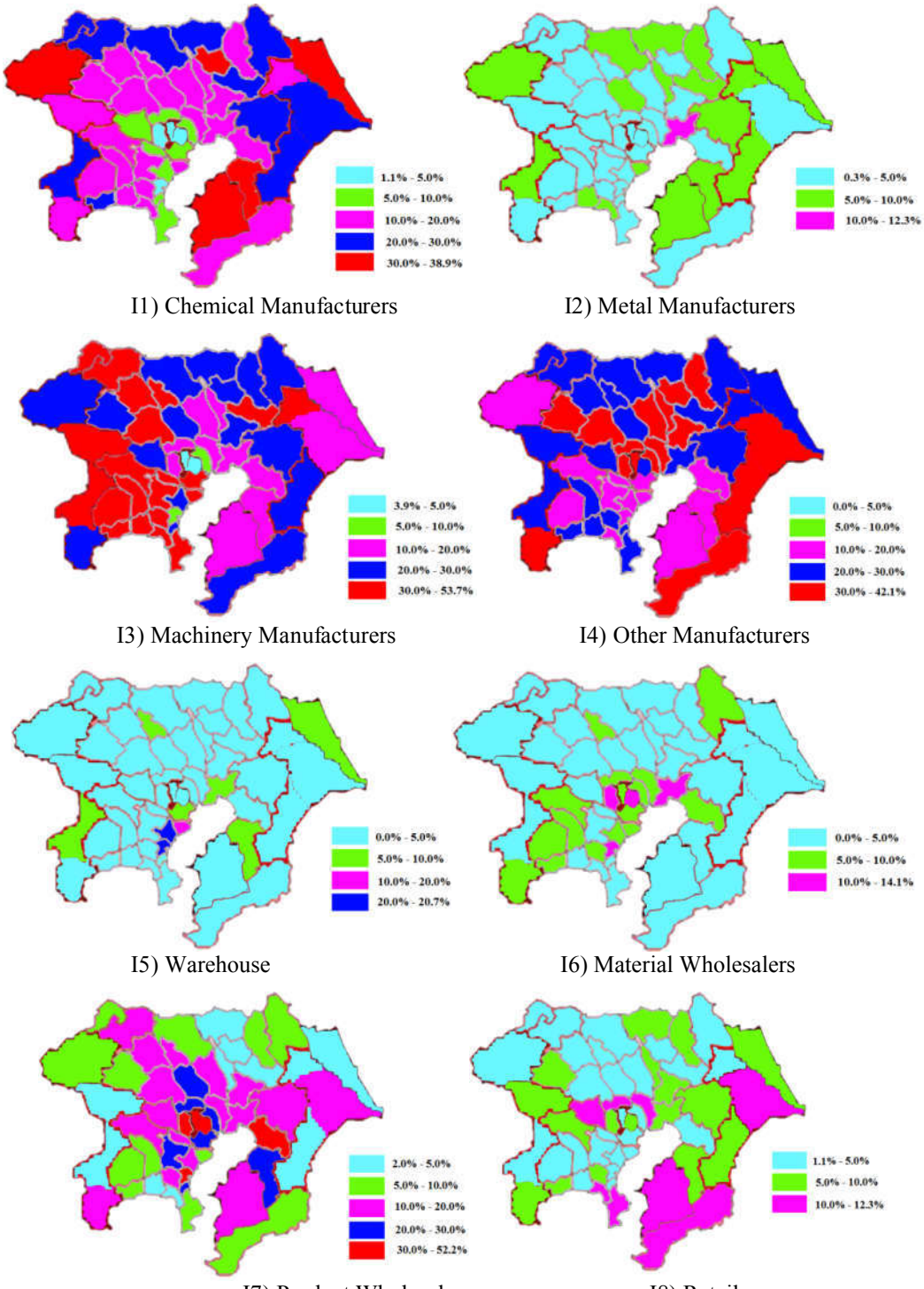


Figure 3 illustrates the proportion of each industry type comparing with the rest other industry types in each zone. Chemical manufacturers, machinery manufacturers, other manufacturers, product wholesalers and retailers keep the main proportion in each zone of Tokyo Metropolitan Area. Figure 3 indicates that manufacturers, wholesalers and retailers are located with a high percentage in contiguous zones which are neighbors. This means that the

zones which located nearby the good attractive zones will be getting more attractive to individual firms in their location choice decisions.

5. RESULTS AND DISCUSSIONS

Table 2 shows the estimation results of the individual firm location choice model by the multinomial logit model for chemical manufacturers, metal manufacturers, machinery manufacturers, other manufacturers, warehouses, material wholesalers, product wholesalers and retailers. The average land price and accessibility of each zone have a statistically significant and negative effect on the zone which is selected as a firm's location for all types of industry. The negative sign of the average land price of each zone means that most firms prefer to choose the zone which has a low land price to maximize their profit. In this research, the accessibility's value of each zone is directly proportional to the average distance to other zones. The value of accessibility of zone for retailers shows that retailer prefers to choose the zone which has a shorter average distance in comparison with that of manufacturers, warehouses or wholesalers. The reason can be explained since generally the density of retailers in a zone is very high and the distribution of the products among retailers is commonly in the short distance.

Table 2 indicates that population density and number of employees of each zone, these factors have a statistically significant and positive effect on that zone being selected as a firm's location for manufacturers, warehouses, wholesalers and retailers. This means that many firms are more likely to locate in zones that have a high population density and a large employee pool. It can be interpreted that the companies can reduce the cost of recruitment that is an important cost for manufacturers and warehouses. With regard to the retailers, they try to locate in the location which is close to the customers to get more benefit. It is straightforward to see that the influence of population density and number of employees of each zone on the firm location choice decision of other manufacturers is the highest. The reason for this is that other manufacturers require a larger number of employees than that of each retailer and product wholesaler.

As regards the distance from firm's location to the nearest IC highway, the parameter's value of manufacturers, warehouses, wholesalers and retailers keep an important role. This can be interpreted that many firms prefer the location which is located close to the IC highway to reduce the travel distance and these firms can reduce the transportation cost which is a very important cost for each firm. Transportation cost also keeps an important role in the firm location choice decision for firms based on the high value of t statistic. The negative sign of transportation cost indicates that a lot of firms prefer the location which has a low transportation cost to their customers, suppliers or other firms.

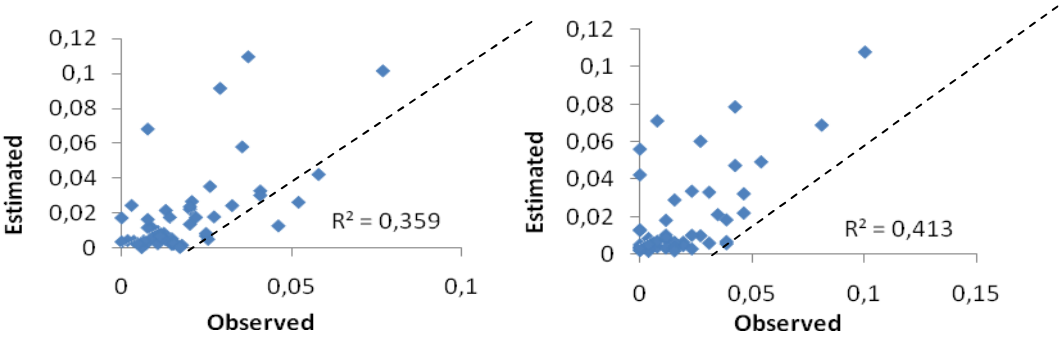
With regard to the number of employees and the floor area of each firm, the t-statistic' values of employee and floor are -0.71 and 0.10 for retailers, respectively. This means that the influence of the number of employees or floor area of each firm on the firm location choice decision for retailers is lower than those of manufacturers, warehouse, material and product wholesalers. It can be interpreted that manufacturers, warehouses and wholesalers require a larger floor area than that of retailers. Moreover, the negative sign of this factor means that the employee number of firms is larger, it will make more difficult for their location choice decision. In addition, the value of transportation cost is lowest for retailers. This can be explained that the weight of commodity is small for retailers and the travel distances of retailers to customers or suppliers are often short in urban areas.

Table 2 Estimation Results of Proposed Model by Multinomial Logit Model

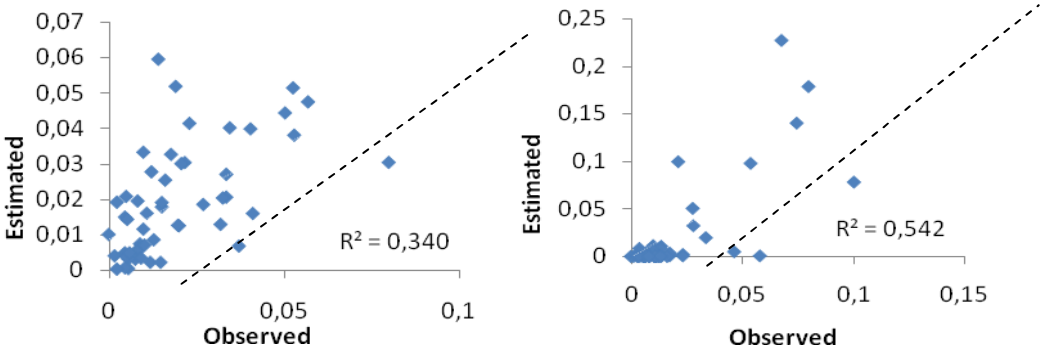
Variables	Chemical Manufacturer	Metal Manufacturer	Machinery Manufacturer	Other Manufacturer
	Coefficients (*t-value*)	Coefficients (*t-value*)	Coefficients (*t-value*)	Coefficients (*t-value*)
Zonal Attributes Variables				
Average land price of zones (1,000 yen/ m^2)	-0.0019 (-10.78)	-0.0033 (-6.69)	-0.0009 (-5.61)	-0.0037 (-17.52)
Population density of zones (in 1,000 persons/ km^2)	0.0356 (1.56)	0.1210 (4.80)	0.1501 (18.69)	0.3091 (23.56)
Accessibility of zones (1,000 m)	-0.0437 (-11.09)	-0.0039 (-0.51)	-0.0643 (-15.36)	-0.0400 (-5.68)
Number of employee of zones (in 1,000 persons)	0.0023 (12.93)	0.0033 (6.65)	0.0005 (2.35)	0.0043 (20.25)
Firm Characteristics Variables				
Distance from Firm to IC Highway (1,000 m)	-0.1909 (-3.38)	-0.1805 (-4.61)	-0.4681 (-6.91)	-0.8586 (-8.90)
Transportation Cost (100,000 yen)	-0.0835 (-5.87)	-0.0216 (-1.47)	-0.0467 (-6.91)	-0.0529 (-4.01)
Number of employee of firms (in persons)	0.0060 (8.95)	-0.0149 (-5.22)	0.0190 (4.82)	0.0208 (8.95)
Floor area of firms (m^2)	-0.4521 (-7.80)	0.0540 (7.83)	-1.5083 (-9.27)	-0.4093 (-4.05)
Number of observation	1300	200	1700	1600
Log-likelihood at convergence	-4709.3	-708.0	-5817.8	-4105.2
Log-likelihood at zero	-5136.6	-790.2	-6717.1	-6321.9
Log likelihood ratio	0.083	0.104	0.133	0.350
AIC test	7.25	7.17	6.85	5.14
Hit Ratio (%)	3.76	9.23	2.52	16.87

Variables	Warehouse	Material Wholesaler	Product Wholesalers	Retailers
	Coefficients (*t-value*)	Coefficients (*t-value*)	Coefficients (*t-value*)	Coefficients (*t-value*)
Zonal Attributes Variables				
Average land price of zones (1,000 yen/ m^2)	-0.0004 (-1.31)	-0.0015 (-5.18)	-0.0009 (-4.96)	-0.0010 (-2.39)
Population density of zones (in 1,000 persons/ km^2)	0.0207 (1.41)	0.1746 (12.36)	0.0740 (7.35)	0.1371 (6.53)
Accessibility of zones (1,000 m)	-0.0122 (-2.04)	-0.0103 (-1.68)	-0.0256 (-5.14)	-0.0328 (-2.89)
Number of employee of zones (in 1,000 persons)	0.0015 (4.55)	0.0017 (5.32)	0.0022 (10.10)	0.0006 (1.57)
Firm Characteristics Variables				
Distance from Firm to IC Highway (1,000 m)	-0.0316 (-1.16)	-0.0449 (-0.92)	-0.5477 (-6.15)	-0.9978 (-8.48)
Transportation Cost (100,000 yen)	-0.0052 (-2.15)	-0.0208 (-2.73)	-0.0033 (-1.75)	-0.5099 (-3.45)
Number of employee of firms (in persons)	0.0037 (1.96)	0.0095 (4.40)	0.0046 (1.16)	-0.0051 (-0.71)
Floor area of firms (m^2)	-0.0119 (-1.30)	0.1374 (1.70)	-0.0088 (-1.06)	0.9672 (0.10)
Number of observation	400	600	1400	220
Log-likelihood at convergence	-1447.3	-1955.1	-4058.6	-719.6
Log-likelihood at zero	-1580.4	-2370.7	-5535.6	-869.2
Log likelihood ratio	0.084	0.175	0.266	0.172
AIC test	7.28	6.54	5.80	6.62
Hit Ratio (%)	14.48	4.03	10.45	10.00

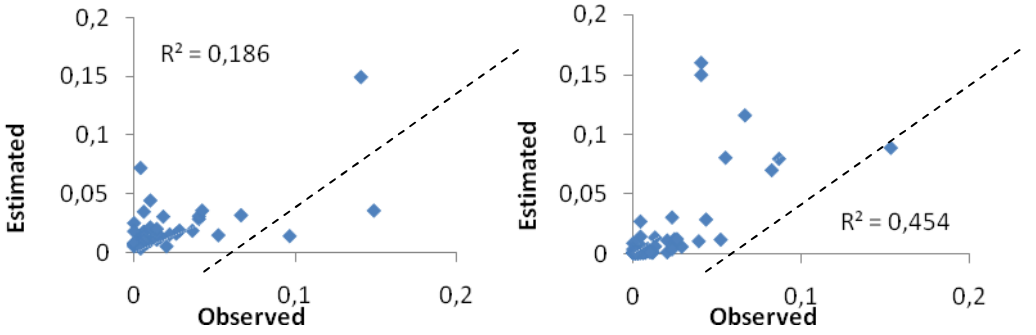
Figure 4 Validation of Estimation Results by Multinomial Logit Model



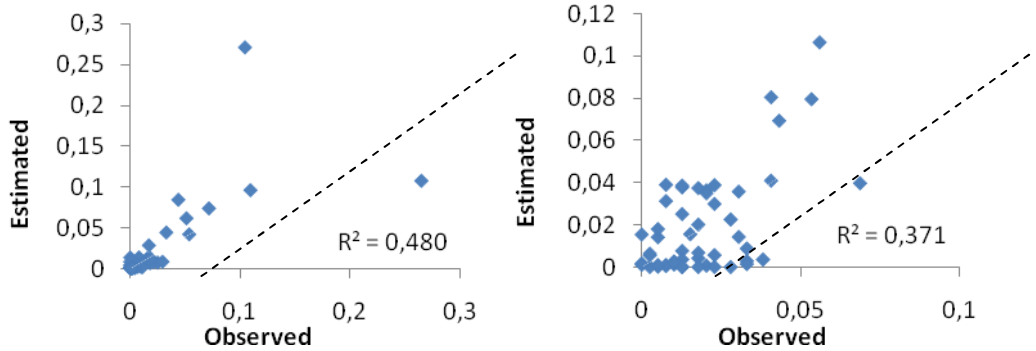
I1) Chemical Manufacturers I2) Metal Manufacturers



I3) Machinery Manufacturers I4) Other Manufacturers



I5) Warehouse I6) Material Wholesalers



I7) Product Wholesalers I8) Retailers

In Figure 4, X axis is the zone choice proportion in observation and Y axis is the zone choice proportion in estimation. Each point in the Figure 4 is represented for each zone. In which, the zone choice proportion in observation is calculated by the number of samples which choose each zone from data source divided the total number of samples. In addition, the zone choice proportion in estimation is calculated based on the number of samples which choose each zone in estimation results divided the number of samples.

6. CONCLUSIONS AND RECOMMENDATIONS

This study has proposed an approach for the enterprise location choice model by a Multinomial Logit Model in an urban area. In addition, the paper also indicate that the location choice decision of enterprises depends on the number of employees in a particular enterprise, transportation cost of each enterprise and the attributes of the zone such as the size of the population and the number of employees in the zone. Moreover, the results suggest that enterprises prefer to locate in zones that have a higher population density and a higher number of employees. Furthermore, the result clarifies the factors that play a key role in the decisions made by companies in selecting a location.

The results of this study can be better in future studies on firm location choice models with considering the location factors that are measured at firm level. The obtained results still leave ample room for improvement because the present study not only is limited to a small data set for the estimation but also not considering the risks of model in over-specified cases. It is expected that a better model performance will be achieved with an improved, larger set of data and specific structures.

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