Assessing the Impact of Pedestrian Traffic volumes on locational Goodwll

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Paper to be submitted to
19th AsRES International Conference
14 − 16 July, 2014, Gold Coast, Australia

This paper is a revised and extended version of a paper that was presented at 12th AsRES International Conference

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Abstract: The effect of passing pedestrians' characteristics on locational goodwill was empirically modeled and tested. The theoretical basis for the study was central place theory, bid rent and, agglomeration theory, and demand externality theory. The data included information on goodwills, retail rents and passing pedestrians' characteristics in 100 retail trade areas in Seoul. As the results, using the regression tree method, the variables does affect locational goowill in the each retail trade area were the volume of pedestrians around 2:00 pm on weekdays, volume of pedestrians around 4:00 pm on weekdays, and volume of pedestrians around 8:00 pm on weekdays. In summary, not only the economic base in the retail trade area but also the volume of passing pedestrians should be considered to determine the locational goodwill.

Key word: Passing Pedestrians, goodwill, Classification and Regression Tree (CART)

1. Introduction

After the Asian Financial Crisis in 1997, the South Korean Government has provided a strict regulation to control the housing market, and the investors put a special emphasis on the rate of return in property investment market. The investors have been more interested in the retail property market which has been less regulated and provided regular rental incomes growth. In the retail property market, the investors focus on the retail stores in city centre and surrounding areas of subway stations which usually have very high volume of pedestrians. The shopping centres in the large housing complex were regraded as a good investment because of the large potential customers in the areas. The property investors were much interested in the indicators that can forecast the rents and risks in the retail property market.

The amount of goodwill is one of the important items in the retail lease contract. The impact of location on rents has been mainly studied in property studies, urban studies, regional economics, and economical geography. The volume of passing pedestrians of retail stores depended on the location, and it is one of important criterion for selection and valuation of a retail store. The volume of passing pedestrians is one of vital indices of the retail areas for property market analysis and property development. It is an important factor in determining goodwills, selection of tenants' mixture, estimation of retail sales outputs, evaluation of shopping strip.

There were not many empirical analyses of the relationships between volume of passing pedestrians and goodwills, as it was very hard to get the related data. Most of the previous researches focus on the populations in the retail trade areas and the distances from workplace or home to retail stores. But, the number of visitors in the shopping centre generated by an anchor store was considered as an important factor to determine the lease conditions for the anchor tenant, including rents, lease period, size of the store, allocation of space, and type of business. The volume of passing pedestrians was recently regarded as one of the important factors in the retail property market. Sirmans and Guidry (1993) selected the volume of passing pedestrians as one of independent variables which influenced on the rents and sales outputs in the retail property market.

This study of relationship between the volume of passing pedestrians and the goodwills would be useful to forecast potential demand of retail stores. It provided necessary information for determining goodwills, estimation of sales outputs, selecting location, decision on type of business, marketing strategy, and competitive activities in the retail property market. This paper consists of the following sections: literature review on goodwills and retail rents in the section 2; a theoretical model in the section 3; data in the section 4; empirical analysis in the section 5; and conclusions in the section 6.

2. Goodwills, Retail Rents and Passing Pedestrians

The factors that influence the goodwills can be classified into the following four levels. Firstly, in the national level, the goodwills are influenced by the factors, such as, inflation, Gross Domestic Products (GDP), interest rates, and commercial lease protection laws. Secondly, on the regional level, the factors that directly and indirectly influence the goodwills are the city's spatial structure, condition of regional economy,

level of price and retail rents of the surrounding housing market, accessibility of major transportation system, and utilization of surrounding land. Thirdly, at the local level, the retail area's purchasing power, supply and demand, competition, volume of passing pedestrians, increase in local population (natural and societal increases), occupancy rate of the surrounding stores, number of households, density of population and household, income level, new housing construction, level of competition and protection, influence the goodwills and retail rents. Lastly, in terms of the property level, goodwills are influenced by the factors such as, distance from the city centre, length and width of shopping strip, distance from public transportation, quality of the building, location of the store within shopping mall, and type of business.

For the goodwills determination models, the reduction matrix of multiple regression analysis was generally used, and the least squares method for deduction equations. The goodwills have associated with tenant profile, gross floor areas of shopping centre, interaction between lease period and percentage rent, relative size of shopping centre, building age, and the presence of anchor stores (Benjamin, Boyle & Sirmans, 1992; Sirmans & Guidry, 1993; William, 2001). Vandell and Cater (2001) explained the types of store locations in a shopping mall with bid-rent curve, and there were diverse aspects of the bid-rent curve with the distance from the centre of the shopping mall and type of store.

Samuelson (1976) defined customer traffic generators as the retail demand externalities, and Sirmans and Guidry (1993) addressed that higher volume of consumer traffic was a prerequisite for the success of a store. Ownbey, Davis and Sundel (1994) pointed out that accessibility factors such as parking and traffic, and visibility factors such as retailer exposure helped to explain the variability of neighborhood shopping centre rents. The combined factors of the distance from the anchor store, the size of major store, and store type were regarded as one independent variable representing the volume of passing pedestrians. There have been few studies that analyzed the volume and characteristics of passing pedestrians as number of independent variables for the retail rents.

Goodwills are determined by the equilibrium between supply and demand for retail property building areas. Different from the housing market, the supply and demand for retail stores should be related the supply and demand of the goods handled in the retail stores. The volume of pedestrians around the stores and total sales outputs can be the

representative variables for demand for stores. The large volume of passing pedestrians can forecast the amount of visitors into the store. Furthermore, an increase of a store's potential total sales outputs means that an increase in demand for the goods in the store. It will be then translated into an increase in demand for the actual retail store. Ultimately, such an increase will result in an increase in the goodwills.

3. Theoretical Model

The goodwill can be formulated with the following combination of variables. The research hypothesis of this study is that 'the goodwills are associated with the volume of passing pedestrians.'

$$\mathbf{GW_{jt} = \mathit{f}\,(TO_{jt},\ GE_{jt},\ TI_{jt},\ WE_{jt})} \qquad \text{-----} \qquad \mathbf{(1)}$$

The dependent variable [$Goodwill_{jt}$] shows the average goodwill per *pyeong* (1 *pyeong* = 3.31 m^2) at the shopping centre [j] and the time period of [t]. Independent variable [TO_{jt}] shows total volume of passing pedestrians in one day; [GE_{jt}] shows total volume of male or female pedestrians in one day; [TI_{jt}] shows volume of passing pedestrian during main time periods; and [WE_{jt}] shows volume of passing pedestrians during weekday or weekend.

3.1 Volume of Passing Pedestrians

The volumes of passing pedestrians are useful data to provide the actual number of pedestrians and their characteristics. The large volume of passing pedestrians is an indicator of the demand side of the market. The data of pedestrians are particularly useful for housing and retail property market rather for industrial property market. The retail stores need large volume of passing pedestrians. A large volume of passing pedestrians is a vital condition for retail trade areas and a guideline for planning of the size of retail trade areas. About 10% of the passing pedestrians are considered as the possible customers to purchase goods from a store. A large volume of passing pedestrians can be generally translated into a high goodwills, and the goodwills are determined by the quality and quantity of the pedestrians regardless of the total sales

outputs. The shops with less volume of passing pedestrians could pay less for goodwills, but they should spend more on marketing efforts. The volume of passing pedestrians is closely associated with the business type of the stores.

3.2 Statistical Characteristics of the Passing Pedestrians

The sales outputs of a store are determined by the quality and quantity of the population around the area. The statistical characteristics of passing pedestrians have influenced on not only the total sales outputs of a store but also its rents and goodwills. The volume of young pedestrians who pass the front of a store and the proportion of female pedestrians in them affect the type of business and goodwills for the store. The volume of pedestrians, their occupations, and peak traffic hours vary according to the main business activities of the particular area where the store is located. The stores located in the city centre have a high number of female shoppers and the stores near business areas a high number of male ones. Male and female pedestrians in their teens, 20s, 30s, and 40s represent the population with high productivity and high spending power and they may increase the retail activities in the area. Especially, the male and female pedestrians in their 20s can increase the retail activities in the area. The goods sold by a particular store as well as its price are influenced by the characteristics of the passing pedestrians (numbers, age, education, job, and culture).

3.4 Volume of Pedestrians by Time Frame

The volume of pedestrians per time frame is important information to identify the time for most and least number of pedestrians. The volume of pedestrians varies according to daily, weekly, seasonal, and yearly cycle. In South Korea, the highest volume of pedestrians would normally occur in early spring, summer holidays, and year-end. The volume of pedestrians in a city centre generally shows two or three peaks in a day, between 8:00 and 9:00 am, between 12:00 pm and 2:00 pm, and between 6:00 and 7:00 pm. The peak hours of the passing pedestrians for a store could vary according to the local characteristics of the shopping area. The shopping areas of the city centre has the peak hours of pedestrians between 6:00 and 7:00 pm, and the shopping centers have the peak hours between 4:00 and 5:00 pm with lot of female pedestrians. The residential areas have the peak hours of pedestrians during commuting hours instead of daytime.

3.5 Volume of Pedestrians by Location

The location of a store determines the total sales outputs and the value of the store. It is also closely associated with the local retail activities. An area with more than 5,000 ~ 6,000 passing pedestrians is the best location for retail stores. Good retail stores are located in the areas with easy customers' access and high volume of pedestrians. Where the front store is facing a subway exit or a bus stop, there would be a high volume of passing pedestrians and a higher goodwills. Hence, the changes in transportation such as new subway and development of bus terminals will influence on the volume of pedestrians in those retail areas nearby.

4. Data

The data for this research were collected in May 2003 and in May 2014 by the Korea Chamber of Commerce and Industry (KCCI) for the major retail trade areas in South Korea. The total sample areas are 100 major retail areas and the collected data were the monthly goodwills per *pyeong* (1 *pyeong* = 3.31 m^2) and the volumes of passing pedestrians. The details of the collected data are shown in the Appendix 2.

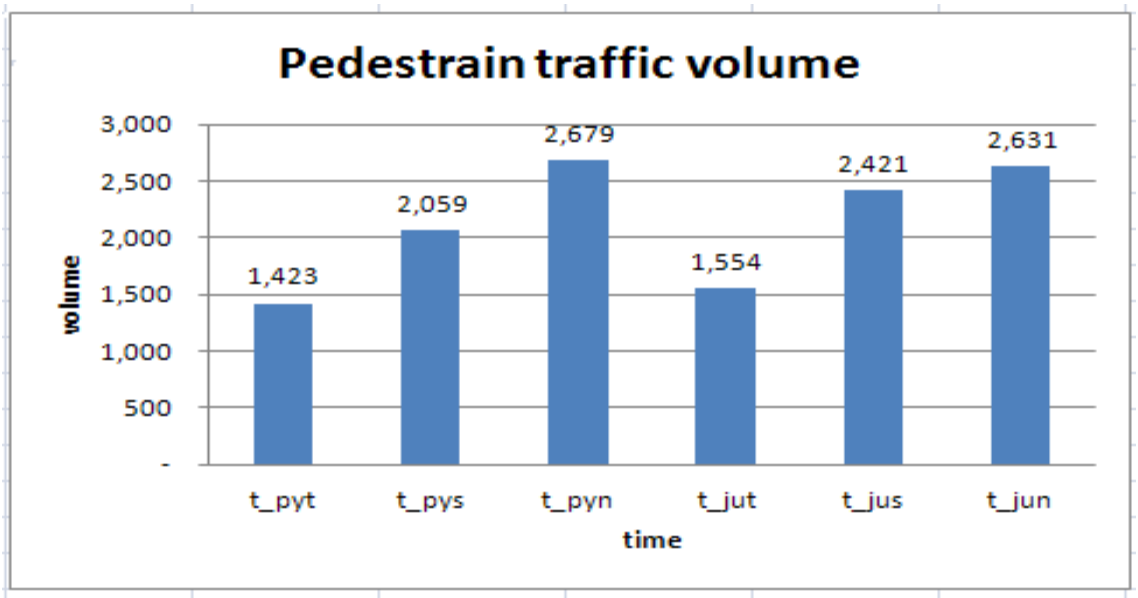
Most of the sample stores are located in the first basement level (B1) of the retail buildings in the 100 major retail areas. The average goodwills were KRW 1,328,881 per *pyeong* (U$ 1,308.91 per 3.3m^2) and the highest goodwills were KRW 2,064,900 per *pyeong* (U$ 2,033.98 per 3.3m^2). The retail areas in Jongro, Kangnam subway station, and Kunkook University subway station show the highest goodwills in Seoul. The guarantee deposits of a store were an average of KRW 112.87 per *pyeong* (U$ 1,111.80 per 3.3m^2) with ranging from 580,000(U$ 571.32 per 3.3m^2) to KRW 2,790,000 *pyeong* (U$ 2,748.23 per 3.3m^2). It means that there were large differences among the retail rents and the guarantee deposits according to the location of a store.

The volume of pedestrians for each study areas was measured on Thursday (weekday) and on Saturday (weekend) between 12:00 pm and 1:00 pm, between 4:00 pm and 5:00 pm, and between 7:00 pm and 8:00 pm respectively. The pedestrians were divided into male and female in their teens, 20s, 30s, and over 40s.

5. Empirical Results

Figure 1 shows the average volume of pedestrians according to the time frame. The highest volume of pedestrians occurred between 7:00 pm and 8:00 pm in weekend and the lowest volume of pedestrians between 12:00 pm and 1:00 pm in weekday. There were more pedestrians in weekend rather than in weekday and there were more pedestrians between 7:00 pm and 8:00 pm rather than around noon in weekday and weekend.

Figure 1: Volume of Pedestrians



Note: t_pyt = total volume of pedestrians around noon in weekday
t_pys = total volume of pedestrians around 4:00 pm in weekday
t_pyn = total volume of pedestrians around 7:00 pm in weekday
t_jut = total volume of pedestrians around noon in weekend
t_jus = total volume of pedestrians around 4:00 pm in weekend

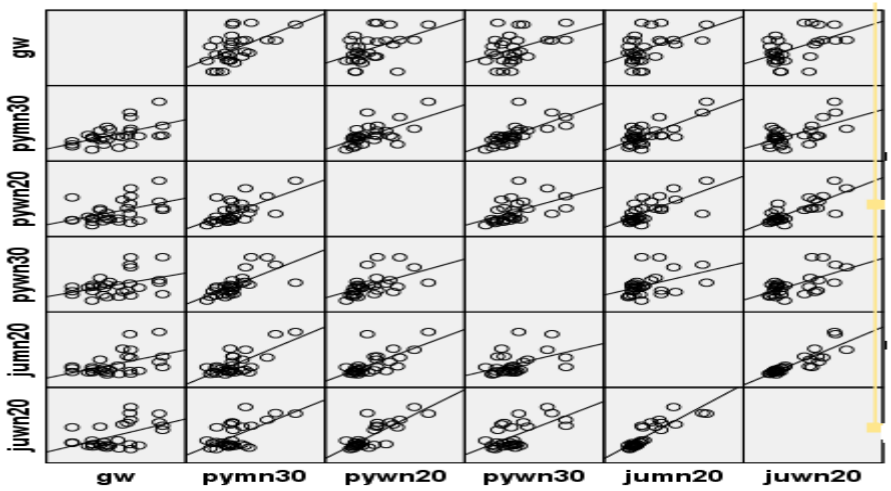
t_jun = total volume of pedestrians around 7:00 pm in weekend

5.1 Analysis of Relationship between the Variables

The correlation analysis was carried out to investigate the relationships between the goodwills and the independent variables. The highest correlation coefficient between the goodwills and the volume of pedestrians was 0.50 (p-value < 0.01) and the null hypothesis can be rejected. The Pearson Correlation Coefficients between the goodwills and the following volumes of pedestrians were: 0.49 (p-value = 0.01) with the volume of male pedestrians in the 20s around noon in weekend; 0.37 (p-value = 0.05) with the volume of female pedestrians in the 20s around noon in weekend ; 0.50 (p-value = 0.05) with the volume of male pedestrians in the 20s around 4:00 pm in weekend ; 0.48 (p-value = 0.05) with the volume of male pedestrians in the 20s around noon in weekdend ; and 0.50 (p-value = 0.05) with the volume of female pedestrians in the 30s around 7:00 pm in weekend ; 0.53 (p-value = 0.05) with the volume of male pedestrians in the 30s around 7:00 pm in weekday ; and 0.45 (p-value = 0.05) with the volume of female pedestrians in the 20s around 7:00 pm in weekday ; also 0.40 (p-value = 0.05) with the volume of female pedestrians in the 30s around 7:00 pm in weekday.

Figure 2 shows that there are weak relationships between the goodwills and the volumes of pedestrians. There are strong relationship between the volume of pedestrians in weekday and one in weekend (correlation coefficient = 0.500, p-value = 0.00).

Figure 2: Scatter Plot Matrix Response Variable and Major Explanatory Variables



Notes:

GW = Average goodwills per *pyeong*

PYMN30 = volume of male pedestrians in 30s around 7:00 pm in weekday

PYWN20 = volume of female pedestrians in 20s around 7:00 pm in weekday

PYWN30 = volume of female pedestrians in 30s around 7:00 pm in weekday

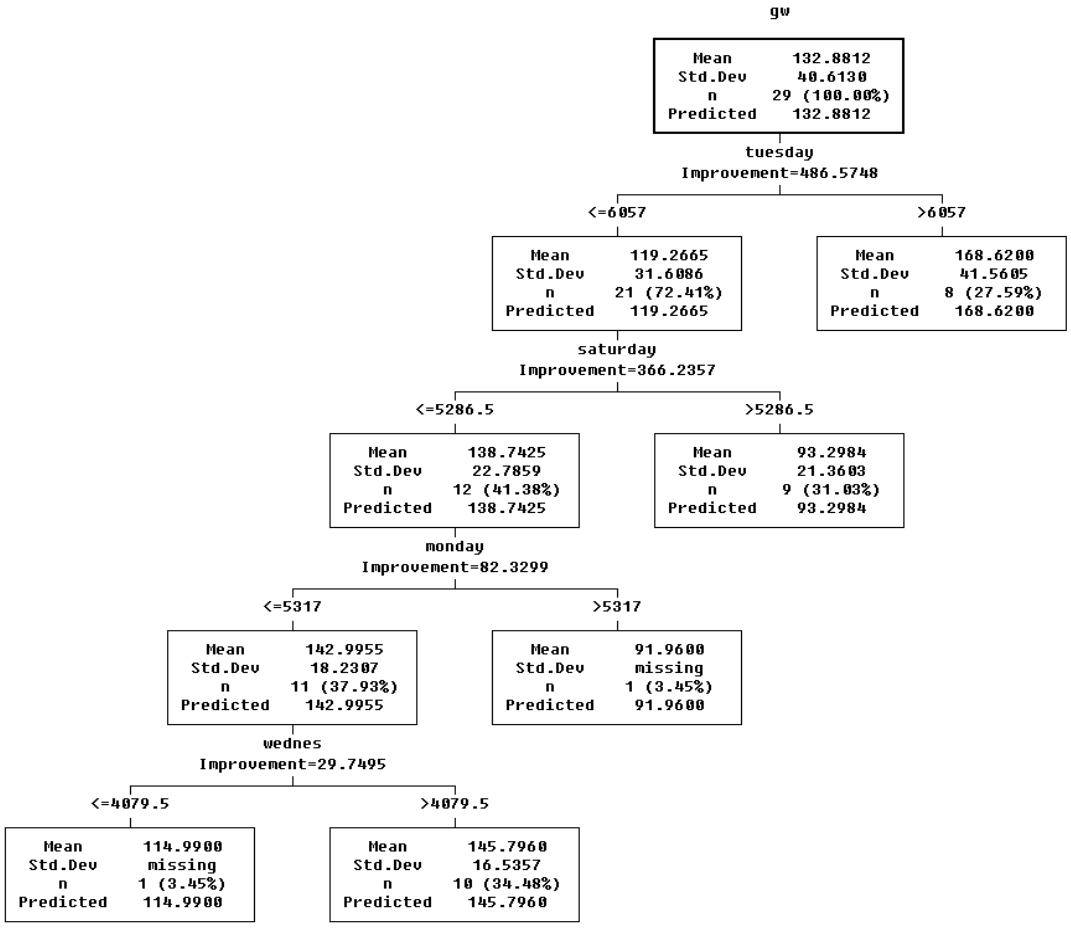
JUMN20 = volume of male pedestrians in 20s around 7:00 pm in weekend

JUWN20 = volume of female pedestrians in 20s around 7:00 pm in weekend

5.2 Classification and Regression Tree (CART)

This study used the Classification and Regression Tree (CART) of SPSS Answer Tree (version 3.1) software. The tree diagram in Figure 3 shows that the first node is split into two child nodes based on total volume of pedestrians in weekday. The cases with more than 6,161.48 passing pedestrians in weekday have higher goodwills (average KRW 1,328,812 per *pyeong* , U$ 1,308.92 per 3.3m^2). The cases with less than 1,544 passing pedestrians in weekday have lower goodwills (average KRW 1,399,000 per *pyeong*, U$ 1,376.70 per 3.3m^2). Hence, the goodwills can be affected by the volume of pedestrians. Then each child node is split into two second child node based on total volume of pedestrians in weekend and the volume of female pedestrians around 7:00 pm in weekend. The tree diagram shows the subsequent splits based on the volume of female pedestrians around 4:00 pm in weekday and total volume of pedestrians in weekend.

Figure 3: Regression Tree (Goodwills **and Volumes of Pedestrians in Weekday and Weekday)**



In Figure 4, the first split variable is the volume of pedestrians on tuesday of weekday and the result decreases in dispersion by 6057 (Improvement = 486.57). It shows that the split significantly lower total dispersion. This means that the volume of pedestrians on Tuesday of weekday is the most important variable to determine the goodwills. The retail trade areas where the volume of pedestrians on Tuesday of weekday less than 6,057 are again split into two areas with the volume of pedestrians on Saturday over 5,286.5 and less 5,286.5. The retail trade areas where the volume of pedestrians on Monday of weekday is less than 5,317 are again split into two areas with the volume of pedestrians in their teens on Wednesday of weekday.

Figure 4: Regression Tree (Goodwills **and Volume of Pedestrians in Time Frame)**

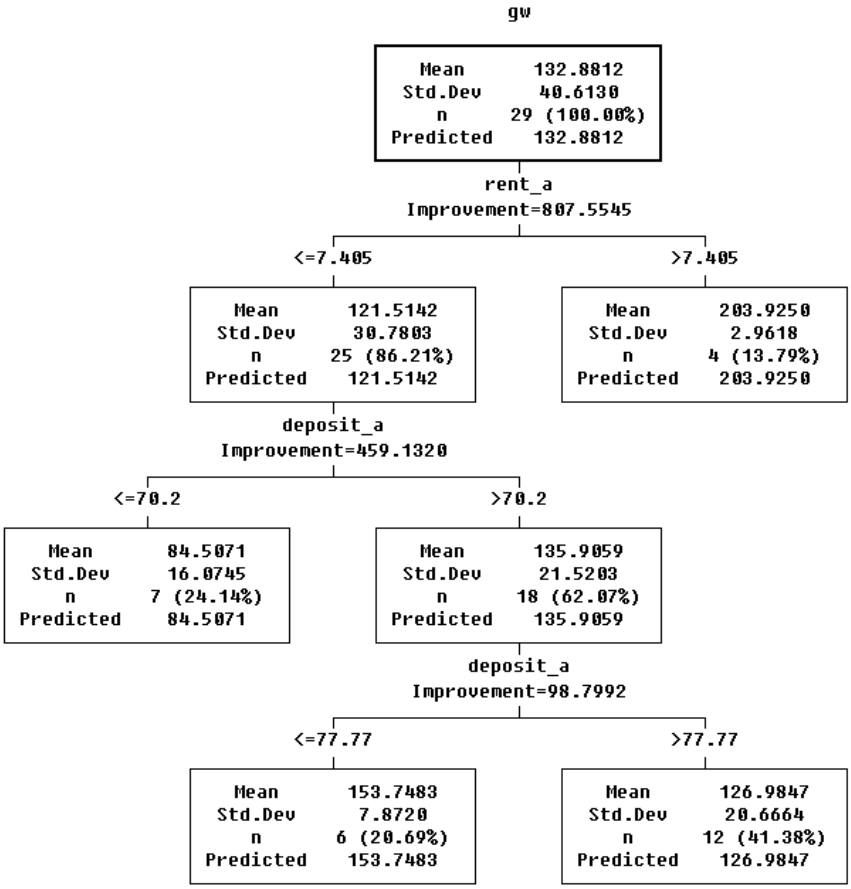


Figure 6 shows a different variable to avoid the same standard in the nodes and to use different classifications, which will maintain the maximum results and replace the optimum separation standard. The substitute variable for goodwill in Figure 5 is the average monthly rents and deposit money per m^2 in the retail trade area (Improvement = 807.55).

Figure 5: Regression Tree using Substitute Effect Variable

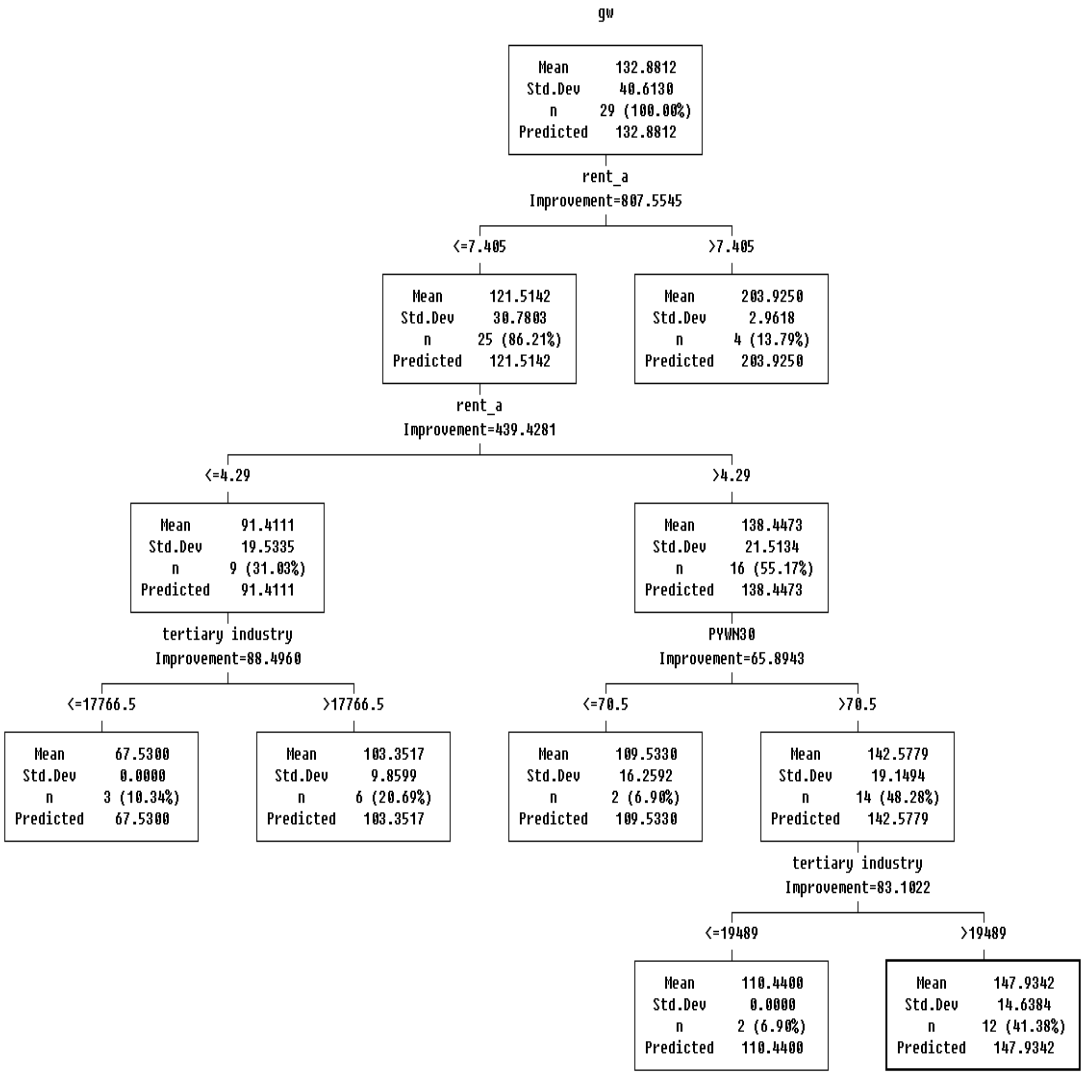


Table 1 show a risk indicator to evaluate the decision tree automatically established to predict the average goodwills. The risk prediction number (1,592.54) indicates the inter-group dispersion of the second generation node that is the result of subtracting the increment of each node from total dispersion. The smaller risk prediction number is preferred. The total dispersion is 1,592.54 (risk forecast for root node) while the dispersion in child node is 76.99. The dispersion rate between the root joint only and the occurrence of a regression tree is 0.048 (76.99/1592.54 = 0.048), and it means that this

regression tree could explain 95.1% (100 – 4.8 = 95.1) more than the result with the root node only.

Table 1: Goodwills Data Risk Indicator

	Risk Statistics	
	Root node	Child node
Value	1,592.54	76.99

6. Conclusions

This study examined the impact of the volume of passing pedestrians on the goodwills. The theoretical model was developed from the central place theory and agglomeration theory for goodwills. The empirical model was tested with the sample of 100 major retail areas in Seoul, South Korea. The date set was analysed with the Classification and Regression Tree (SPSS Answer Tree 3.1) software.

The results show that the goodwills in Seoul can be influenced by the following variables; the volume of pedestrians on Tuesday of weekday (+), the volume of female pedestrians in the 30s around 7:00 pm in weekday (+), the volume of female pedestrians in the 20s around 7:00 pm in weekday (+), and number of the tertiary industry in the retail trade area (+). Among the passing pedestrians, people with high productivities and females are important groups for the goodwills. Hence, the retail property developers should consider not only the number customers and the sales outputs but also the volume of passing pedestrians to estimate the goodwills. The retail property development with pedestrians' convenience will increase the retail activities in that area because of an easy access of passing pedestrians.

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Appendix 1: The Definition of the Variables

Variable		Type of Variable
Response Variable	Goodwill	Continuous data
explanatory Variable	Weekend day male at noon 10s/20s/30s/over 40s	Continuous data
	Weekend day female at noon 10s/20s/30s/over 40s	Continuous data
	Weekend day male at 4 pm 10s/20s/30s/over 40s	Continuous data
	Weekend day female at 7 pm 10s/20s/30s/over 40s	Continuous data
	Weekend day male at7 pm 10s/20s/30s/over 40s	Continuous data
	Weekend day female at 7 pm 10s/20s/30s/over 40s	Continuous data
	weekday male at noon	Continuous data

	10s/20s/30s/over 40s	
	weekday female at noon 10s/20s/30s/over 40s	Continuous data
	weekday male at 4 pm 10s/20s/30s/over 40s	Continuous data
	weekday female at 4 pm 10s/20s/30s/over 40s	Continuous data
	weekday male at 7 pm 10s/20s/30s/over 40s	Continuous data
	weekday female at 7 pm 10s/20s/30s/over 40s	Continuous data

Appendix 2: Descriptive Statistics

variable	Minimum	Maximum	Mean	Std. Deviation
gw	67.53	206.49	132.8812	40.61301
deposit_a	58	279	112.84	63.477
rent_a	3.67	8.41	5.2848	1.49632
jumt10	7	579	115.97	107.542
jumt20	66	910	274.03	197.510
jumt30	56	256	122.90	53.095
jumt40	24	445	155.14	98.352
juwt10	2	775	180.10	175.376
juwt20	42	1460	360.24	280.789
juwt30	64	410	164.14	95.126
juwt40	12	660	181.45	151.247
jums10	3	602	162.55	117.741
jums20	118	1985	517.14	488.929
jums30	24	980	204.38	178.162
jums40	36	695	199.66	126.245
juws10	10	870	213.69	171.349
juws20	172	1770	627.00	500.107
juws30	45	765	264.66	171.029
juws40	48	1180	231.79	211.795
jumn10	1	520	168.21	130.405
jumn20	82	2090	559.59	526.751
jumn30	50	1015	277.41	231.430
jumn40	28	880	197.72	144.269
juwn10	1	580	199.14	141.341
juwn20	117	2105	742.17	595.544
juwn30	42	965	275.31	229.104
juwn40	22	1600	211.38	282.194
pymt10	2	220	60.21	59.272
pymt20	36	1687	274.66	311.131
pymt30	24	220	122.48	55.797
pymt40	6	360	153.10	81.537
pywt10	2	260	61.90	61.426

pywt20	54	1199	340.83	269.193
pywt30	69	592	197.93	114.128
pywt40	30	600	211.72	144.587
pyms10	5	650	146.03	145.690
pyms20	42	1825	367.07	368.678
pyms30	40	455	172.41	106.690
pyms40	24	820	203.48	151.705
pyws10	3	545	176.45	135.743
pyws20	117	2166	522.07	470.562
pyws30	76	596	221.10	105.276
pyws40	12	1200	250.76	223.283
pymn10	6	520	131.21	110.270
pymn20	41	2698	543.10	531.717
pymn30	2	910	286.90	199.384
pymn40	0	720	241.45	155.903
pywn10	0	660	184.76	135.386
pywn20	0	2530	765.52	628.895
pywn30	0	824	293.83	210.390
pywn40	0	1800	232.52	315.995