

Master Thesis:

The relationship between parking price and retail performance in 48 European cities

Name: Jiawen Cai

Student Number: 407666

Supervisor: Giuliano Mingardo

Abstract: Parking is treated as an important part of retail areas, and most researchers believed that there is relationship between parking price and retail performance. This thesis used multiple regression model which based on the data of 48 European cities to research this relationship, and the result of final model provides an empirical evidence for the positive relationship. Even this result seems to be contrary with common sense, but the discussion offers a relative possible explanation. Since high retail performance might represent an attractive city, consumers are willing to pay a higher living cost for it, and high parking price is a part of this living cost. Other possible explanations were also provided. For example, higher parking price might also indicated higher service level, which increases the retail performance. Apart from those results, some limitations in the research need to be concerned, and they also could be a new start point for future research.

Rotterdam, 6th July 2016

Erasmus School of Economics

MSc Economics and Business

Specialization: Urban, Port and Transport Economics

Acknowledgement

First, I would like to express my sincere gratitude to my parents, since they always support me and never asking for anything. Also, thanks for the chance they gave me to experience a better world and to shape a better me. Second, many thanks to Giuliano Mingardo and Jan-Jelle Witte for their helpful explanation and great suggestions, this research can not be carried out without their help. Finally, I want to say thank you to all the difficulty that I met in my graduate studies, I would remember that care and diligence bring luck.

Table of contents

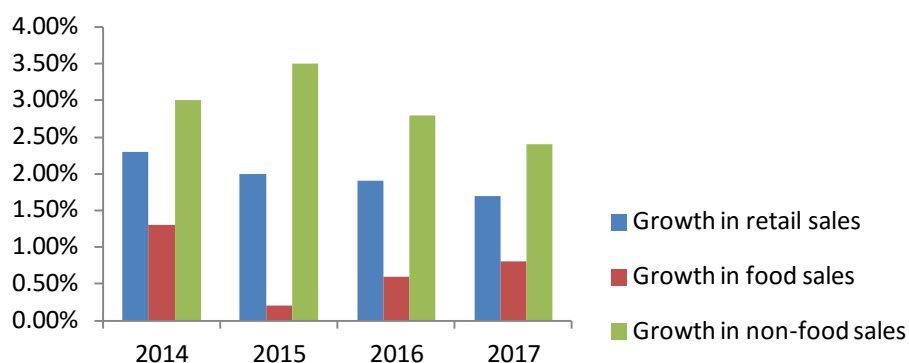
1. Introduction	4
2. Literature review	9
1) Parking is an important item in retail research models	9
2) Parking pricing acts as an effective instrument for congestion	10
3) Parking is a standard of retail service quality	11
4) Parking is a source of competitiveness	12
5) The change of parking policies influences consumers' behavior	14
6) The relationship between parking price and retail performance	17
3. Hypothesis	20
4. Methodology	22
1) Variables determinant and data description	22
2) Model Assumptions	33
3) Multiple regression model	34
4) Multiple regression model improvement	35
5. Results analysis and discussion	37
1) The main result of the study	37
2) Discussion based on the result	40
6. Conclusion	43
1) Conclusion of research	43
2) Limitation and future research	44
Reference	47
Appendix	52
Appendix 1: The rank of retail cities in Europe	52
Appendix 2: Comparison between GDP and GPD per capita	53
Appendix 3: Model improvement	54

1. Introduction

Statista (2016) suggested that retail sales are experiencing a steady growth since 2013 in western Europe after a long period of decline,. The forecast of Centre for Retail Research (2016) indicated that there is a 1.9% and 1.7% retail growth in 2016 and 2017 in Europe respectively. The significant increase, both in food sales and non-food sales (Figure 1-1), are the benefits of the growing economics in European countries. GDP, population and tourism are major factors of economy which influence retail performance (Norman 2016). The increase in GDP and income per household enhance the confidence of consumer to spend more money in different products, make more trips with different purposes and also have higher requirement for service quality. As Kelly and Clinch (2006) mentioned that the trip purpose of a person could be business or leisure activities, and shopping seems to be a vital part of leisure purpose trip. According to Marsden (2006), shopping accounts about 20.1% of different trip purposes in Great Britain tourist transport. This number highlights the crucial position of the retail industry in a city, even in a country.

Because of the surge in the need of trips, different mode of transportation becomes to be the first choice question for consumers. Gruen and Smith (1960) pointed out when only one in ten American consumers had a car, shoppers were already revealing dislike for walking, most of them suggested that they will avoid walking when facing lengthy shopping strips. While the dislike of walking shows on the case, the favor of car also exhibited. On the other research, the survey in 1924 reported that around 80% of shoppers are resistant to the two blocks walking to a store from their car (Longstreth 1998). This result describes the importance of parking facilities for retailers because of the influence effect on consumer behavior. But since the survey was made in almost a hundred years one, the consumers behavior might changed greatly. At the same time, due to consumers' preference of car using, the congestion problem also comes.

Figure 1-1 The retail sales growth in Europe from 2014 to 2017



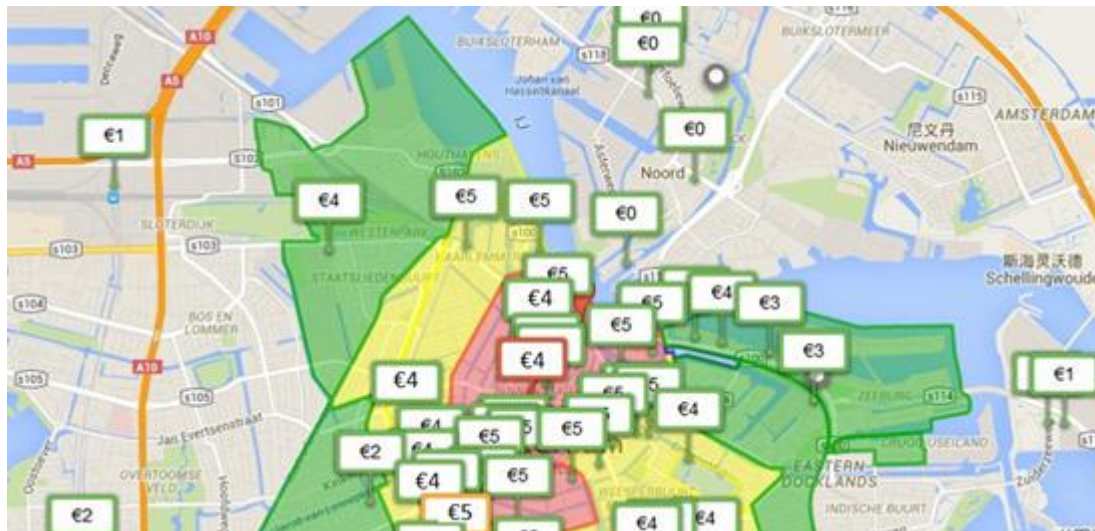
(Source: Centre for Retail Research 2016)

Nowadays, congestion already becomes to be an sever issue in the major retail areas (especially inner-cities) for most European cities, due to the increasing car use, therefore, how to maintain or improve the accessibility of the urban retail areas and alleviate congestion situation is the recurring issue for policy makers(van der Waerden & Timmermans 1998). As Marsden (2006) mentioned, the application of parking pricing and supply restrictions is the most widely accepted and readily method to the limitation of car use, and parking policies was proved that it tackles congestion effectively. Thus, a well-designed parking policies, which included an appropriate parking price, could adjust the unbalance between parking supply and parking demand.

Parking is closely tied to daily activities, and it even motivates leisure, retail, social reasons or non-work trips (Caicedo 2012). Hence, shoppers, those individuals who does not provide with guaranteed parking and paying the parking cost for a privately registered car by themselves without tax benefits, are the casual parkers of the city (Hensher & King 2001). As the major users of parking facilities, the change of parking price is possible to influence their behavior, both in transportation mode and the decision of trips. Figure 1-2 shows the parking price (per hour) distribution in Amsterdam, which indicated the distinct higher price in the city center and lower

price level in suburban or adjacent city. When there is a growth in parking price, consumers are possible to drive and park for free beyond the fringe of city center and travel by public transport to the place, or even they will just cancel the travel (Hensher & King 2001) and switch destination (Marsden 2006).

Figure 1-2 The distribution of parking price per hour in Amsterdam



(Source: parkoperdia.ie 2016)

If the retail industry is fast developing in the place of suburban, out-of-town or adjacent cities, the major city would suffer great loss. Except those places, there is a stronger competitor standing in the front of city retailers. The emergence and development of online-shopping are forcing traditional retail centers to meet the convenient shopping requirement of discerning consumers, and the convenience asks the retail centers to minimize the spatial, temporal and effort costs of shopping (Reimersa & Clulowb 2004). In order to increase competitiveness of a city, maintain or improve the market share in country, or even in global, recognizing the attractiveness of retail industry of the city is vital for both policy makers and retailers. For this reason, developments in parking policy is a crucial part of the economic and transport policy of a city, since it has effects on urban economic development and the competitiveness of the local economy (Caicedo 2012). Therefore, in order to compete with other competitors, remain or increase the position in the market, finding the

relationship between parking price and retail performance is an important issue for policies making.

However, even in common views, parking is an indispensable part of retail areas, there are still several different opinions in the field. Some people supported the positive relationship, since well designed parking policies contribute to the promotion of a more efficient use of transport network(Marsden 2006), and charging parking is an effective method to adjust the unbalance between supply and demand (Hensher & King 2001), thus the effect of better service quality and parking environment could be reflected on consumer choice of shopping destination (Guy 1998) and as a major source of competition with other business (Mcshane & Meyer 1982), it helps a city to compete successfully in the global marketplace (Parikh 2006). On the other side, some opposite views for the relationship suggested that charging for parking can directly influence the behavior of demand for free parking spaces in a commercial area (Caicedo 2012), consumers might switch their shopping destination to a lower parking price retail area. This also is the reason why new publicly-funded parking construction always facing the greatest pressures which come from the business community and from the developers (Mcshane & Meyer 1982). Apart from positive or negative relation, the opinion of no relationship also exists. The research of Teller and Reutterer (2008) indicated that parking exerts no significant effects on the attractiveness on retail areas. As Mcshane and Meyer (1982) said, the real relationship between parking and retail success has not been adequately defined, even many researchers made different survey or study on this topic, it seems that there is no an agreement for this relationship.

In order to fill this gap, this thesis will model the relationship between parking price and urban retail performance. This research made the investigation in 48 European cities, which come from 20 counties with similar or different situations. OLS (Ordinary Least Square) is the method which would be used in this research. Through building a multiple regression model, a positive and significant relationship was found

between parking price and retail performance. For this result, one major explanation is that high retail performance could be a symbol of an attractive city, and people are willing to pay a higher living cost, such as high parking price, to live in this better living environment, thus the relationship shows in a positive direction. But it is noticeable that this effect will be influenced by the change in consumers' transportation mode. The detail interpretation and other possible explanations will be discuss in the part of results analysis.

This paper contributes an empirical evidence to the positive relationship between parking price and retail performance. And it offers a reason to policies makers to adjust parking price and achieve economic goal of the city. The result convinces retailers and developers to stop pressuring on the policies makers and resisting the change of parking policies, since there is no evidence suggested that a higher parking price will decrease the retail performance. And finally, this thesis uses an quantitative method to certify the relationship and provides an insight for future research in this and other related fields.

The remainder part is organized as follows: the second chapter offers an literature reviews for this subject. Third chapter concerns about methodology, which introduced data sources, variables selections, sample characteristics and the model for analyzing. The forth chapter mainly focuses on the results, and there are some discussion for those results. The conclusion will be settled in the fifth chapter. And for the last chapter, some limitations of this research and suggestions for future research will be revealed.

2. Literature review

Since the development of new facilities in adjacent town or city centers, such as parking facilities, could result in a negative impact for urban economics, many proposals for out-of-center retailing development was decided on the basis of building integral car park to impact adversely on the existing center (Thomas & Bromley 2003). The importance of parking for traditional shopping centers was confirmed in the '4 As' strategy by Urban and Economic Development Group (1994), other researchers also provide different viewpoints for parking and retail industry. This chapter will generate an overview for some literatures in the relationship between parking policies, which contain parking pricing, and retail performance.

1) Parking is an important item in retail research models

In order to investigate main effects of retail choice, Pan and Zinkhan (2006) used convenient parking as one of independent variables. The results suggested that there is a relatively strong relationship between shopper's store choice and convenient parking facilities, other predictors in the model includes selection, service quality, store atmosphere, low price levels, convenient location, fast check-out, convenient opening hours and friendliness of sales people. Parking is a crucial dimension in the study of Ruiz (1999). It works with other dimensions (shopping environment and variety and shopping environment and professionalism) to examine the nature of the image of shopping malls. As Berman and Evans (2001) mentioned, retail agglomerations can be characterized by their marketing mix components. And the agglomerations are determined by managerially controllable decision-parameters, for example, retail location, selling style, pricing and merchandise strategy of the retail stores and available parking facilities. Due to the dominant position of car using and the influence of evaluation process of marketing mix on the behavior of customers (such as in site choice and patronage intension), parking also be regarded as a major factor

enhancing shopping convenience in the research of Teller and Reutterer (2008). As a part of site-related factors, parking is posited to impact retail attraction and it also processing with other variables of tenant mix and atmosphere.

Parking is not only was treated as a factor to analyze retail industry, but also was used as a attribute in consumer segmentation. In the approach of El-Adly (2007), the segment of relaxed shoppers was characterized by young shoppers, which is the largest segment and putting great emphasis on parking. Apart from acting as an variable in some studies, there are other researches was made for the change of parking policies.

2) Parking pricing acts as an effective instrument for congestion

Most of European cities are suffering severe congestion problem in center places. Congested urban network and parking facilities surrounding center areas lead to a decline in accessibility for residents, commuters, customers and visitors, at the some time, the quality of service and delivery traffic also reduce (Topp 1991).

Parking pricing is an efficient instrument of policy makers to alleviate congestion in city centers. The viewpoint of parking pricing and supply restrictions application in the study of Marsden (2006) supports this argument and suggested that it is the most widely accepted and readily accepted method of limiting car use. Hensher and King(2001) also concluded that parking pricing is by far the superior instrument to achieve reductions in casual parking in the CBD, since the data analysis exhibited that 97% of variance in CBD parking share attributable to the change of parking prices.

As Hensher and King (2001) proved, parking policies can be used to tackle congestion effectively. It is a cycling issue in transportation policies (van der Waerden, Borgers & Timmermans 1998), well designed parking policies contribute to the

promotion of a more efficient use of the transportation network, lower emissions, higher densities and better or more inclusive urban design, on the opposite, far from mitigating congestion problem, poorly designed parking policies harm a city in various ways and reduce urban economic performance (Marsden 2006). Therefore, designing appropriate parking policies to a city is vital for local government.

3) Parking is a standard of retail service quality

With the increase in consumers' purchasing power, shopping is much more than just buying at the present days--it is an experience in itself (Parihn 2006). For this reason, the development of urban economics create opportunities for organized retail, which means a higher demand from customers for better shopping ambience, superior quality products and improved service (Parihn 2006).

For example, the success of organized retailing in India mainly depends on delivery of services through quality improvement, since retailers considers customer-perceived service quality as one of the key determinants of business (Parihn 2006). The experience in Indian organized retailing offers an empirical evidence to the argument: parking already becomes to be a standard of retail service quality for consumers. Based on this case, Parihn (2006) analyze parking as a part of retail service, and recognized that the gap between perceived service and consumer expectation which lies in the parking policies of retail stores is the largest one. This result might suggested that parking policies have effects on the customers' image to retail stores, and also provide an insight for retail stores that a proper planning or design of parking facilities could helps them to rebuilding or improving their reputation.

The quality of parking service might indicated that consumers can park their car nearby the retail areas, even with higher parking price. This view is supported by a result of survey in 1924, they reported that 80% of shoppers were already resistant to

the prospect of walking 2 blocks to a store from their car (Longstreth 1998). However, it is worth noting that customers' behavior would change greatly during the time duration between 1924 and now, it also is the reason that this evidence is not strong enough.. Apart from less walking distance, a higher parking service quality also includes reducing time cost on searching a vacant parking space within the zone, as the suggestions of economists, the definition of parking price should accord with the external costs of the searching activities (Simićević et al 2012).

Due to the requirement of higher service quality, policies makers and investors could increase parking price according to the investment of service improvement, and consumers would realize the level of parking facilities or environment based on the price level.

4) Parking is a source of competitiveness

Parking, except as a instrument for congestion and a standard of service quality, also is a major source of competitiveness for a city, when facing a fierce competition with other competitors, such as nearby cities, out-of-town shopping centers and online shopping. Since the development of retail industry is quite fast, the research is hard to keep up with its pace, but the researchers at the present still could be inspired by the results and viewpoints in previous research.

The development of downtown business, out-of-town shopping centers and adjacent cities, usually are the strongest competitors for the retailing of city centers, because of the similar retail environment and the competitive advantage which is easy to be imitated. Over the past 25 years, offering free and virtually unlimited parking to all customers is the major advantage of downtown business, such as suburban shopping mall (Mcshane & Meyer 1982), it indeed attracts customers to change their shopping destination from city centers to those out-of-center places and proof the increase

position in market competition. Thus, as Marsden (2006) said, nowadays urban policy in developed countries is focusing on promoting town and city center redevelopment, for this purpose, concerning about the influence of traffic restraint policies such as parking pricing on competition between adjacent urban centers are at the forefront of political concern.

In the past few years, consumers' requirement of convenience in retail areas is confirmed in several studies (Reimerse & Clulowb 2004, Pan & Zinkhan 2006, Marsden 2006, El-Adly 2007 , Teller & Reutterer 2008). The higher level of convenience and service quality makes online shopping becomes to be an new, but powerful competitor for traditional retail industry. As Reimersa and Clulowb (2004) said, the emergence of the Internet and a more discerning consumer has created the need for traditional retail centers to provide a more convenient shopping environment, and the 'convenience' means that retail centers should minimize the spatial, temporal and effort cost when consumers expense their money here. All of ample parking space, uncrowned traffic situation and suitable parking price could be the competitiveness of a traditional retail stores to fight with online shopping.

The findings of Reimersa and Clulowb (2004) alerts retailers and policies makers that the demise of the shopping strip could be linked to its inability to satisfy the needs of a convenience-oriented society, and Parikh (2006) also advised retailers that they must differentiate themselves by meeting the needs of their consumers better than their competitors, and parking availability of retail shopping is quite valuable for customers (Oliver 1981). Therefore, parking policies, which have been recognized as a crucial part of the economic and transport policy of a city, the development will impact upon urban economic performance and the competitiveness of the local economy (Caicedo 2002).

5) The change of parking policies influences consumers' behavior

A survey with over 3000 respondents in 11 shopping centers was undertaken in London, it shows that car drivers spend £ 64 per week on average, which is higher than bus users (£ 63 per week) (Sharp 2005). Thus, there is a perception that visitors who go to shopping centers by car spend more (Marsden 2006). It reflects the decisive position of parking environment for consumers who driving by themselves and states the possibility that the change in parking policies will impact on their shopping behaviors.

Hensher and King (2001) have designed a survey to research the reaction of consumers when parking price increase in CBD. They assumed six possible reactions: no change and accept the price, drive/park elsewhere in CBD, drive/park outside CBD, drive/park for free beyond the fringe of CBD and travel by public transport to CBD and cancel the travel. The results can answer the question of whether people will switch to public transport and continue to travel to their final destination. The acceptance of higher parking prices is another result of this research.

Those studies inspires us that parking measures may affect shopping and travel behavior of consumers at two different levels. The first one is related to the choice of shopping destination (van der Waerden, Borgers & Timmermans 1998), and the other one concerns the effects on modes of transportation.

i. The change of parking policies influence retail store patronage

Because of the development of mobility, shoppers do not necessarily shop at the nearest place to satisfies their requirements for specific goods, and they start to take into account many different aspects of shopping destinations. The attractiveness of the destinations is the standard of assessment of their shopping expenditure (Dennis, Marsland & Cockett 2002). For example, the data of Dennis et al (2002) indicated that the residents of Market Harborough has some comparison goods expenditure in that

market town, but substantially more in Northampton and/or Milton Keynes, this might be a result of more provision of products, lower products / parking price or higher service quality. Oppewal (1995) also confirmed that the shopping destination choice of consumer is influenced by several different attributes, such as ‘distance from home to shopping destination’, ‘choice range or assortment’ of products, ‘price of goods’, ‘quality of products’ and ‘parking situation’. Therefore, as Bodkin and Lord concluded in 1997 that the most important reason of consumers to chose shopping destinations is convenience.

Shopping convenience, which included opening hours, location and parking, was provided by a retailer to increases retail patronage (Pan & Zinkhan 2006). This opinion is supported by other researchers, and they even pointed out the importance of parking in this effect. Teller and Reutterer (2008) suggested that parking affects consumers’ behavior in terms of site choice, buying and patronage intentions in the evaluation process of retail agglomerations. Van der Waerden, Borgers and Timmermans (1998) believed that the variance in consumers spatial store choice behavior is systematically related to the variance in the characteristics of the parking situation surrounding shopping centers, and this relationship has some validity at both macro and micro scale.

The studies of Marsden (2006) showed different reactions of car drivers when they are facing an increase in parking price with different travel purposes. The results exhibited that drivers making leisure and shopping trips have a larger range of options to respond to parking restraint policies, compared with commuters. While the parking price grows, they might reduce frequency of visits, change shopping destination or shorten the shopping time to offset the higher parking cost. Also, under all scenarios of those studies, there are substantial proportions of respondents stated that they would either change destination or even not make the trip at all with different travel purposes. The other survey of Lumpkin and Hunt (1989) for the patronage behavior of the elderly demonstrated that mobility is not a significant influence on the type of

retail store frequented, but it can influence switching patronage between stores of a given type. In order to retain customers and avoiding they change shopping destination, designing parking policies appropriate is a new project for both retailers and policy makers.

ii. The change of parking policies influence consumers' transportation modes

The survey of Simićević et al (2012) revealed that only 38.69% of consumers traveled with shopping purpose do not give up parking when the parking price increase, the rest of respondents will give up car usage under different increasing level in parking price. However, this does not only suggested the abandon of shopping, it is possible that people just switch their transport mode but still go to the same destination. The reason for such modal shift is that the costs of travel to the city center by car is higher than public transport rates, non-commuting drivers seem most likely to trade off price, convenience and duration of parking (Simićević et al 2012). As some literatures declared that more price sensitive parkers have a greater tendency to park further out or shift to public transport use, thus greater attention should be put on analyzing and presenting the accessibility impacts that different parking restraint measures have on travelers of all modes (Marsden 2006). Even most literatures agree with this proposition, there are still some opposite opinions. For example, the survey result of Hensher and King (2001) indicated that this modal switch has low possibility, but this could be a result of some limitation or data bias of this research.

It is noticed that transport demand is a derived demand which stems from an alternate primary objective, hence the variation in accessibility could affect travel behavior (Kelly & Clinch 2009). And the choice of consumers always reflect several qualities, both on retail stores and car parking (Guy 1998).

6) The relationship between parking price and retail performance

Although it is widely accepted that the change of parking policies have impact on the consumers' behavior, there is still lacking a common opinion for the relationship between parking prices, which is a part of parking policies, and urban retail performance. For this reason, this part will summarize two contrary views in the literatures.

- i. There is relationship between parking price and retail performance

Healthy retail sales climate is a urban goal which related to parking strategy applications, after analysis, it is confirmed that a well designed pricing strategy is help to enhanced development potential and improved urban retail climate (Mcshane & Meyer 1982). This results supported that there is a positive relationship between parking price and urban retail performance. The case of Lanelli, South Wales (Thomas & Bromley 2002) suggested the development of parking space transformed the food shopping opportunities and leads to a increase on retail performance of the town center. According to the result of other survey (Simićević et al 2012), approximately 56% parking space users expressed that they would not give up travelling to the CBD by passenger car regardless of the parking price, moreover, the results showed that higher price provided a balance between the supply and demand at the level between 84% and 98% of utilization of the available parking spaces. For this situation, Bonsall and Young (2010) offered a possible explanation that increasing the charge for longer stays leads to an increase in available spaces for short stays, and the retail centers could receive more consumers which helps retail commerce. Hence, based on those opinions, the relationship between parking price and retail performance is positive.

The positive effect is not only a single direction from parking price to the retail performance, some literatures holds the perspective for the other side. Berry et al (2002) suggested the consumers' perceptions of convenience will have a positive influence on their satisfaction with the service. For this opinion, Pan and Zinkhan (2006) indicated that retail facilities can be designed to affect those time and effort

perceptions. As mentioned before, Mcshane & Meyer (1982) suggested that parking pricing is helpful to achieve urban goals, but he also states that the goal is generally a driving force in determining transportation investment and parking policies decisions. The investigation of Kelly and Clinch (2009) is an empirical evidence for this point, due to Thursday evening is a 'Late night shopping' evening in Dublin, the parking price has a lowest elasticity value (0.20) on that day, compared with the rest of the week (average 0.29 for the 6 days),. This result proved that business and service policy plays a role in affecting parking market and consumers' traffic behavior. As van der Waerden et al analyzed, people is possible to choose their preferred retail stores first and then dependent in it to choose the parking, but it also is likely that the choice of parking overwhelms retail store choice.

However, the positive relation is not the only viewpoint, there are some arguments in the contrary side. Caicedo (2012) found that if the price is excessively high there is a negative effects on retail commerce, based on the research of Lockwood (2002). An opinion in changing the way of parking pricing, Caicedo (2012) have written a paper for charging parking by minutes, he concluded that smaller charging blocks, which might be a signal of higher parking price to consumers, is a disincentive for them to make additional shopping activities. Thus, an increase in parking price, which means consumers are facing a higher cost of car travelling, the attractiveness of the zone will decreases (TCRP 2005).

ii. There is no relationship between parking price and retail performance

Some researchers in this field preferred the reverse view that there is no relationship between parking price and retail performance. As Mcshane and Meyer (1982) believed, strategies which provide advantage for short-term parking users are certain to attract more shoppers to retail area, but it is not clear that those policies could enhance retail business. Hu and Saleh (2005) investigated whether the increase parking price is a burden on retailers, the finding shows the trade level ultimately

reverting to normal. Department of the environment, transport and the regions in UK (1998) suggested that the parking restraint policies do not result in dispersal of development for city centers.

Moreover, there is an empirical evidence for this opinion, the investigation in Piccadilly parking location indicated that the consumers who currently park there, they are less likely to park elsewhere in the CBD regardless of parking price, since this parking place is close to their retail activity, and there is virtually no loss in travel to the CBD because of the increasing parking tariffs (Hensher & King 2001) The model of Teller and Reutterer (2008) found that parking exerts no significant effect on either dimension of attractiveness during shopping, compared with it, the tenant mix and the atmosphere are the major factors on distinct dimensions of shopping attractiveness.

Figure out the relationship between parking price and retail performance is quite important for different roles of the society. Publicly-financed parking is a lure to attract private developers, but it also facing a great pressures from the business community (Mcshane & Meyer 1982) and retailers. In order to offer an insight of this part, a model will be built in next chapter, the results in fourth chapter would offer a detail discussion for the relationship.

3. Hypothesis

Based on the views in some literatures, the existence of the relationship is the first question in front of researchers. In order to solve this problem, the major hypothesis for this thesis concerns about the presence of the relationship between parking price and retail performance. Hence, the null hypothesis and alternative hypothesis exhibit below:

H₀: There is no relationship between parking price and retail performance.

H_a: There is relationship between parking price and retail performance.

According to the literature review, it seems that the view of relationship existence occupies a dominant position in the debate. Most researchers believed that there is a relationship between parking price and retail performance, the only argument for them is the sign of this relationship. For seeking the answer of this problem, the alternative hypothesis is divided into two parts:

H_{a1}: There is a significant and positive relationship between parking price and retail performance.

H_{a2}: There is a significant and negative relationship between parking price and retail performance.

A positive relationship could be a result of the increase in the consumers' satisfaction. For getting the return of investment, investors would require an enhancement in the parking price to raise revenue. At the same time, policy makers also use parking pricing to mitigate congestion problem in city centers (Hensher & King 2001). Both the activities of investors and policy makers could create a better shopping environment for consumers and increase attractiveness of the city center, and the retail performance gains from this situation ultimately. Also, this relationship goes on the

other side, a areas with high retail performance could raise the value of a parking place, leading to a higher parking price, and as a indicator of development degree of a city, it also present a attractive city which people would like to pay a higher price to live in here. A negative relationship is more concerns about the intuition of price, since higher price would reduce the demand of parking places, finally forcing people to decrease the frequency of shopping or change the shopping destination.

Detail discussion for the relationship will be provided in the results analysis (Chapter 5), the sign of the relationship will be explained carefully only when the presence of the relationship between two factors is confirmed.

4. Methodology

This chapter is the major part of research, it first describes the data which was used for analysis. Variables determinant, data source, data processing and characteristics of variables was contained in first subchapter. Second, there are some assumptions for the researching model and results discussion, due to the requirement to achieve unbiased estimations and provide a rational explanation for the relationship. Third, this part introduced some related statistical theory to readers and built the model for the research. The improving process of model will be interpreted at the end of this chapter.

1) Variables determinant and data description

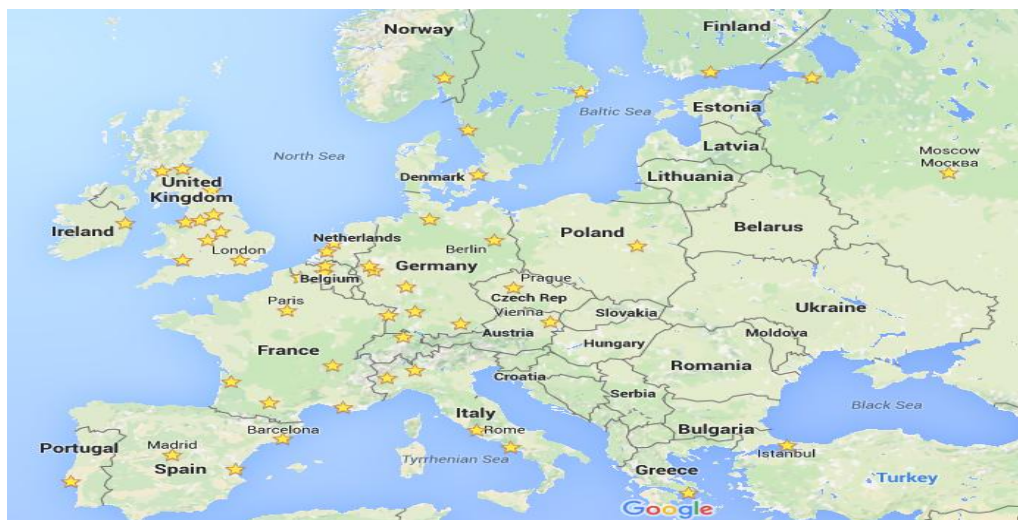
i. Dependent variables

Since the object of this thesis is to find the relationship between parking price and retail performance, and most literatures suggested that parking is an attribute of the attractiveness of retail (Mcshane & Meyer 1982, Simićević et al 2012 & TCRP 2005), retail performance is the best option to be the dependent variable. And parking price would be chosen as the independent variable.

Parking price usually varies between cities, it is better to research the relationship within a urban level, since it is hard to find a parking price which could represent the price level of a country . At the same time, the principle for designing parking policies sometimes is similar within a country for different cities, thus it is not appropriate to limit the research range only in a single county. Combined with several countries with different economic situation and environment would be better to find a relative realistic relationship between parking price and retail performance. For this purpose, the urban retail performance in different countries is the direction for data collection of dependent variable. The HDH (Harper Dennis Hobbs) research reported a Europe's retail centers rank in 2016, which exhibited the top 50 retail cities in Europe (Harper

Dennis Hobbs 2016) (Appendix 1). Those 50 cities come from 20 different countries, such as United Kingdom, France, Germany, Italy, Turkey and Russia, the geographic distribution was shown in Figure 4-1. The rank of market size for each city in 2016 is based on the consumer spending in the retail centers of different cities. However, the monetary unit of original data is pound (Appendix 1), in order to accord with the monetary unit of parking price(€), an exchange rate: £ 1=€1.31367 was used in currency exchange, the detail information of the rank with processed data was showed in Table 4-1. One problem for those data is that the data in London West End and Paris seems to be unreasonable, compared with the data in other cities. And it is hard to defined the range for London West End, since it only is a part of London. At the same time, the number of Paris is too small for the city as a whole, it can not be sure for use. Therefore, those two cities will be dropped out of the database.

Figure 4-1 Geographic distribution of 50 cities

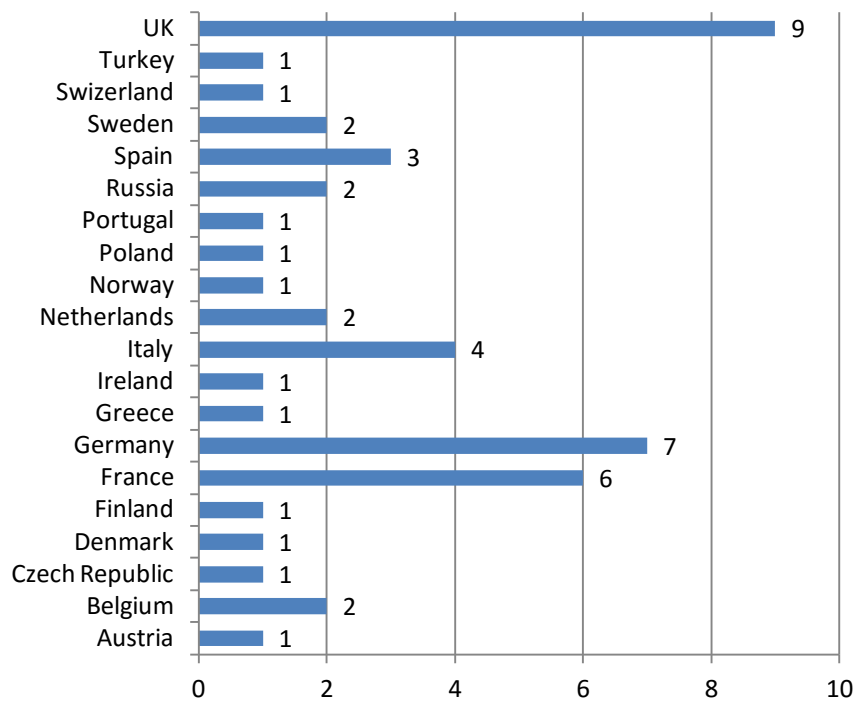


One limitation for the parking price in city level is that there is no a single price for parking in a city. Normally, there are different zones in a city because of the different functions and environments, and parking price varies in the city between those zones. Even in the same zone, it also is hard to obtain a direct parking price. For example, in the surrounding of a retail areas, people is possible to find a cheaper parking price than the parking which is offered by retailers. Thus, this is an limitation in the

research design which should not be neglected. .

Since HDH has made the research for retail cities ranking in continuous years, there is an article for analyzing the reasons of the change in retail city centers rank between the year 2014 and 2016, the author points out the major source of the change is the economic environment, both in national and urban level (Norman 2016). For example, as Figure 4-2 indicated, UK has maximum amount of cities which was included in this ranking (9 cities), the number is relative larger than other countries, compared with Austria, Finland and Ireland who only has one city in the list. A possible explanation for this phenomenon is that economic growth of UK is continuing to outpace the other countries in Europe, and the reputation and development of those retail centers in UK are benefit form the economic growth (Norman 2016). However, since the data in 2014 is not available, the detail information for the difference can not be shown in table.

Figure 4-2 Number of cities in each country



For seeking a relative realistic relationship between parking price and retail performance, and avoid the large biased effect of population on the urban retail performance, after currency exchange, there is a second step for data processing which dividing market size by the amount of population in corresponding city (Table 4-1). The value which was obtained from this step will replace the data of dependent variable. For checking the validity of this step, a new model will be built for it, and through the comparison between model 1 and model 2 (detail information see Appendix 3), we can see that it successfully escape the biased effect from population, and the result of adjusted model shows an significant improvement, the detail explanation of model improvement will be interpreted at the end of this chapter.

Table 4-1 The rank of retail centers of Europe in 2016

Rank	Retail Centre	Country	2016 Market size (consumer spending) (€)	Population	Retail performance (consumer spending/population)
3	Madrid	Spain	6,572,610,532.91	3,165,235	2,076.50
4	Roma	Italy	5,986,861,064.74	2,863,322	2,090.88
5	Munich	Germany	5,897,498,125.90	1,407,836	4,189.05
6	Berlin	Germany	5,846,769,256.55	3,421,829	1,708.67
7	Istanbul	Turkey	5,791,814,195.64	14,000,000	413.70
8	Barcelona	Spain	5,717,466,434.97	3,176,357	1,800.01
9	Zurich	Switzerland	5,641,538,806.75	396,027	14,245.34
10	Milan	Italy	5,628,449,218.81	3,207,006	1,755.05
11	Glasgow	UK	5,592,466,053.27	2,700,000	2,071.28
12	Amsterdam	Netherlands	5,569,972,946.97	1,033,279	5,390.58
13	Moscow	Russia	4,950,751,431.95	12,197,596	405.88
14	Birmingham	UK	4,814,788,745.33	1,096,800	4,389.85
15	Lisbon	Portugal	4,617,734,648.54	1,835,785	2,515.40
16	Manchester	UK	4,556,011,266.51	517,300	8,807.29
17	Hamburg	Germany	4,170,845,218.77	1,746,342	2,388.33
18	Vienna	Austria	4,165,474,429.15	1,741,246	2,392.24
19	Copenhagen	Denmark	4,156,777,989.86	559,440	7,430.25
20	Oslo	Norway	4,135,530,605.14	623,966	6,627.81
21	Leeds	UK	4,074,585,854.79	763,900	5,333.93
22	Marseille	France	4,051,359,023.07	1,177,000	3,442.11
23	Liverpool	UK	4,023,029,633.60	1,068,200	3,766.18
24	Dublin	Ireland	4,022,891,648.56	1,110,627	3,622.18
25	Stockholm	Sweden	3,974,149,812.52	1,889,945	2,102.79
26	Lyon	France	3,960,227,169.61	1,375,000	2,880.17
27	Cologne	Germany	3,937,744,180.22	1,034,175	3,807.62
28	Frankfurt	Germany	3,926,213,117.96	701,350	5,598.08
29	Nottingham	UK	3,895,155,078.92	312,600	12,460.51
30	Turin	Italy	3,825,627,162.31	902,137	4,240.63
31	SaintPeterburg	Russia	3,665,844,703.59	5,191,690	706.10
32	Athens	Greece	3,648,709,383.66	3,627,500	1,005.85
33	Cardiff	UK	3,636,092,175.73	353,000	10,300.54
34	Newcastle upon Tyne	UK	3,630,862,990.08	288,300	12,594.04
35	Prague	Czech Republic	3,621,099,448.48	1,259,079	2,875.99
36	Lille	France	3,536,712,046.39	1,093,000	3,235.78
37	Rotterdam	Netherlands	3,522,539,250.09	978,040	3,601.63
38	Brussels	Belgium	3,487,749,238.27	1,183,841	2,946.13
39	Valencia	Spain	3,374,982,967.87	786,424	4,291.56
40	Naples	Italy	3,356,620,388.18	975,260	3,441.77
41	Düsseldorf	Germany	3,306,529,186.98	598,686	5,522.98
42	Stuttgart	Germany	3,286,977,510.95	604,297	5,439.34
43	Antwerp	Belgium	3,256,289,643.85	513,915	6,336.24
44	Helsinki	Finland	3,242,332,797.33	1,090,616	2,972.94
45	Warsaw	Poland	3,186,895,692.94	1,724,404	1,848.11
46	Bordeaux	France	3,173,373,433.82	881,000	3,602.01
47	Toulouse	France	3,120,826,589.53	924,000	3,377.52
48	Edinburgh	UK	3,049,608,527.34	490,100	6,222.42
49	Strasbourg	France	3,011,181,741.49	275,718	10,921.24
50	Gothenburg	Sweden	2,930,551,747.13	543,000	5,396.96

(Source: Harper Dennis Hobbs 2016 & Eurosta 2016)

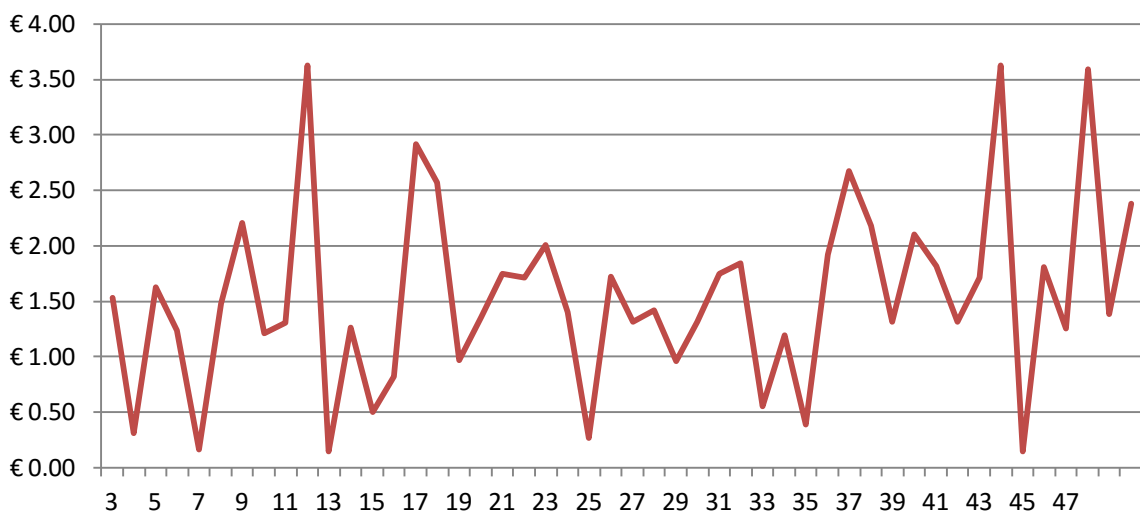
ii. Independent variable

Parking price as the independent variable, is another major object in this research. It requires that the data of parking price should be paired with retail performance in those 48 cities, which mentioned in the dependent variable (Table 4-1). Car Parking Europe (2016) offers the parking rate information of most cities in the database, such as Antwerp, Prague and Amsterdam. But the data of the countries like UK, Turkey, Portugal, Ireland, Greece, Poland and Russia is unavailable in this website. Parkopedia (2016) covers most of the deficiency of cities in UK, Portugal, Ireland, Greece and Poland, the information of Moscow and Saint Petersburg were found on the website of Moscow parking (2016) and an article about parking in St. Petersburg (Kazmina 2013).

The form of collected data is showed on parking price per hour, however, the urban parking price rate usually is a range of price, rather than a single and direct number. This price range includes different kinds of parking places, both of on-street parking and off-street parking. The minimum of parking price was usually charged by on-street parking, and the maximum price level was most asked by parking lot, because of the better environment, higher service level and safety requirement. In order to establish an appropriate independent variable for the model, taking different weights on parking price seems to be an appropriate disposal for the data. The principle of weights determinant comes from some literatures, the American time use survey has collected information about the activities people do during the day and how much time they spend doing them. The result of this survey reported that a employed person, ages between 25 to 54 with children, spends 2.5 hours in leisure per day on average, and food purchase only takes 0.4 hours in it (Bureau of Labor Statistics 2015), this result reminds the time duration for shopping is between 0.4 to 2.5 hours. For this situation and normal standard of parking pricing, the price rate would be divided into three categories: the parking price between 0 to 2 hours, the price for 2-4 hours parking time and the price for over 4 hours parking time. The largest consumer

segment (relax shoppers) indicated that 63% of shoppers spend less than two hours in shopping (El-Adly 2007), this result provides the weight to the category of price between 0 to 2 hours. Since there are relative small possibility for consumers to shop over 4 hours, the set value for the this pricing category is only 5%. And after determined the weights for those two categories, it is easy to obtain the weight for the last one (parking price for 2 to 4 hours parking), which is 32%.

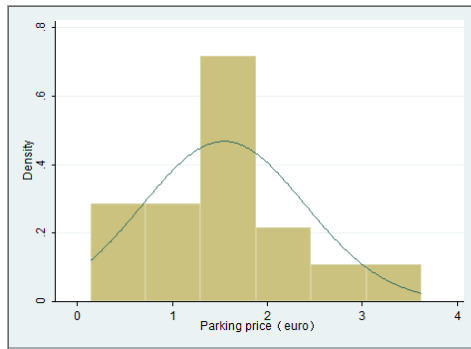
Figure 4-3 Parking price per hour in 50 cities



(Note: the numbers in the horizontal axis is are the ranking number of cities)

After adjustment in the parking price, as Figure 4-3 shows that there is large difference of parking price in cities. Combined Figure 4-3 and Table 4-2, we can see that the highest parking price is €3.63 per hour, which is the parking price in Amsterdam (ranked No.12) and Helsinki (ranked No.44), the cheapest one is €0.14 per hour in the city of Moscow (ranked No.13) and Warsaw (ranked No.45). From those numbers, it is hard to find a clear relationship between parking price and the ranking position of cities, since those cities with highest or lowest parking price level are ranked closely by pairs (No.12 and No.13, No.44 and No.45). In addition to those information, Figure 4-4 indicated that the parking price between €1 to €2 has the highest density, which indicated the general price range in Europe.

Figure 4-4 The density of parking price Table 4-2 General information about the data of parking price



Variable	Obs	Mean	Std. Dev.	Min	Max
parkingprice	48	1.54375	.852375	.14	3.63

iii. Control variables and interaction effects

As mentioned before, Norman (2016) has analyzed the reason for the cities' position change from 2014 to 2016, he pointed that raise in the position usually is a benefit of economic growth, such as Barcelona and Valencia. Thus, GDP as an preferable indicator of urban economics, will be added into the model as a control variable. In order to improve the model, it was concerned that the figures of this variable is relatively large than other variables, GDP per capita was considered to be a better indicator than GDP. However, as is seen from the correlation result in Table 4-3, all of the correlation coefficients between GDP and other variables are under 0.6, which suggested no evidence for multicollinearity, and the variable GDP could be kept in the model. At the same time, the correlation coefficient between GDP per capita and retail performance is quite large (0.8295) (Appendix 2), it indicated that those variables are trying to measure more or less same phenomenon, thus GDP per capita is not suitable to add into final model.

The article also explained that the development of retail centers in Berlin and Marseille reflect the ascendancy of the city as a whole, which is supported by a growing population and strong tourism (Norman 2016). For this explanation, population and tourism are considered as control variables of the researching model for the relationship, and the number of arrival tourists is the indicator of tourism,

which used in the database. Population and GDP are used to describe different standard of city size in the model, unlike the population, GDP is more likely to describe the economic aspect of the city, which is a indicant of local economy, which could differentiate those cities with similar population.

Table 4-3 indicated the correlation between dependent variable and control variables since positive correlation coefficients between variables are under 0.6 and negative coefficients are relative far from -0.6, those variables can be used in the model, and the result confirmed the rationality of their existing.

Table 4-3 Correlation between retail performance and control variables

	retail_per	parkingprice	population	tourism	gdp
retail_per	1.0000				
parkingprice	0.3255	1.0000			
population	-0.4855	-0.0382	1.0000		
tourism	0.2151	-0.1874	-0.2099	1.0000	
gdp	0.0247	-0.3245	-0.1348	0.1420	1.0000

Table 4-4 Correlation between retail performance and modal split

	retail_per	car	pt	walk	bike
retail_per	1.0000				
car	-0.0308	1.0000			
pt	-0.1029	-0.5689	1.0000		
walk	-0.0828	-0.5790	-0.1341	1.0000	
bike	0.3128	-0.3154	-0.2482	0.0133	1.0000

The data of those variables most come from Eurosta (2016). For example, GDP and population was found in the theme of regional economic accounts and regional demographic statistic. But some missing value was replace by the data in the Wikipedia (2016), this website has a specific introduction for each city, which includes amount of population and economic situation. Since most of the data in 2016 is unavailable, the most recent data will be used in the database, and the time duration for most data is between 2010 to 2016. Because the data of tourism in Eurosta is only available in NUTS 2, in order to obtained comparable data, a population share between NUTS 3 and NUTS 2 was used in data collection. For example, if the

population in NUTS 2 is 10 million, and the population in the city of NUTS 3 is 1 million, then the population share 1/10 is used to times the tourists number in NUTS 2, the result is the figure of tourism for the city in NUTS 3. This might be a limitation for the model, but before receiving a more reliable data, the data in the tourism is still kept in the database.

Since numerous researchers supported the point that transportation mode is a important factor of the relation between parking price and retail performance (Simićević et al 2012, Marsden 2006 and Hensher and King 2001 et al). Thus, modal split, which divided the transportation modes into car, walk, bike and public transport and accounting the usage weight in different cities., is used as control variables. Table 4-4 shows the correlation between dependent variable and those transportation variables, due to the correlation coefficients between retail performance and those transportation variables are reasonable, thus those variables will be added into the model. But since bike is not usually to used as an transportation mode for shopping in most cities, it seems that car, walk and public transport are more relevant with our research, thus bike would not be included in the final model. The result of correlation (Table 4-5) confirmed the reasonability for the component of the model, since there is no evidence for the existing of multicollinearity.

Table 4-5 Correlation between all variables

	retail-per	parking-price	population	tourism	gdp	car	walk	pt	bike
retail_per	1.0000								
parkingprice	0.3255	1.0000							
population	-0.4855	-0.0382	1.0000						
tourism	0.2151	-0.1874	-0.2099	1.0000					
gdp	0.0247	-0.3245	-0.1348	0.1420	1.0000				
car	-0.0308	-0.2419	0.1600	0.1004	0.0004	1.0000			
walk	-0.0828	0.2380	0.0394	-0.1501	-0.0823	-0.5790	1.0000		
pt	-0.1029	-0.0795	-0.1842	-0.1381	0.1110	-0.5689	-0.1341	1.0000	
bike	0.3128	0.2704	-0.0582	0.2044	-0.0425	-0.3154	0.0133	-0.2482	1.0000

In order to improve the model, it supposed that interaction effects between parking price and transportation modes could result some effects in retail performance. Thus,

in addition to be control variables, three variables which based on the data of transportation modes and parking price were created, they are parking price*car, parking price*walk and parking price*public transport. It supposed that those interacted variables would influence retail performance with parking price.

For the data source of modal split, most of them come from the website EPOMM (2016), but this modal split tool does not cover all of the cities in the database, missing values still existed. For completing data collection, some data of nearby and similar cities was taken into account. Information about Istanbul was found in a case studies in sustainable urban mobility (Henning 2011) and related data in Moscow is provided by Nelson/Nygaard Consulting Associates (2014). Figures of St. Petersburg is a result of combination of several reports and articles (EMTA 2005, Suchorzkeski 2013 and City clock management 2014).

After finished variables determinant and data collection, this thesis is going to use the software--STATA to run a multiple regression model for the relationship between parking price and retail performance. And Table 4-6 shows the corresponding variable codes for different variables.

Table 4-6 Corresponding data code in STATA to variables

Variable Types	Objects	Data code in STATA
Dependent Variable	Retail performance (consumers' spending/population) (€)	retail_performance
Independent Variable	Parking price (€)	parkingprice
Control Variables	GDP per capita (€/ person)	gdp_per_capita
	Population	population
	Tourism (tourists/year)	tourism
	Car usage (%)	car
	Public transport usage (%)	pt
	Bike usage (%)	bike
	Walk (%)	walk
Interaction	Parking price * Car usage	pprice_car
	Parking price * Public transport usage	pprice_pt
	Parking price * Bike usage	pprice_bike
	Parking price * Walk	pprice_walk

There also is an limitation in control variables, which is the lack of the price level of

the city, and it also is possible to result some biased effect in our result. Because of the inconsistent standard in price level and unavailable data, also GDP is already a indicator of urban economy, this part is not concluded into model, and including price level, such as wage level into the model, could be a new point for future research to improve the research.

2) Model Assumptions

For interpreting the model well and obtaining unbiased estimations, several assumptions are need to be set in front of model.

Zero conditional mean assumption is an important assumption for getting unbiased estimators. It requires that expected value of μ_i is same regardless of the value of x_i , and x_i is uncorrelated with other factors that influence Y_i . In the model of this research, it suggested that the error term μ_i includes all of other factors which was related but not contained in the model. In mathematically, this assumption shows below:

$$E(u_i | x_1, x_2, x_3, \dots, x_i) = 0$$

$$\text{Corr}(\mu_i, x_i) = 0$$

Second, in order to avoid perfect multicollinearity between independent variables, the correlation is checked in the previous subchapter, under normally standard in correlation, it supposed that there is no multicollinearity in our model.

$$x_1 = a + bx_2 + cx_3 + dx_4, \text{ with } a \neq 0, b \neq 0, c \neq 0, d \neq 0$$

Under those assumptions of OLS, the unbiased estimators are obtained, but some omitted variable biased might still exist. And for model result explanation, the

criterion for significance of estimators is set under 5% significant level.

In addition, this research also supposed that the parking price in the independent variable could represent the price level for the city as a whole, the choice of consumers on different types of parking, like on-street parking or off-street parking was supposed no influence on the result. And consumers should be indifferent in this research, when they are facing a variance in policies, the behavior change should be same for all of them, and at the same time, the change in parking behavior because of different stores types also would be treated as indifferent. Thus, the personal preference is not considered as a factor into the model.

3) Multiple regression model

The general purpose of multiple regression is to learn more about the relationship between several independent variables and a dependent variable (StatSoft 2016). For seeking the relationship between parking price and retail performance, and receiving a estimating value for it, a multiple regression model would be used for this research. Certainly, the relationship between independent variables and dependent variable could be positive or negative, in order to explained clearly, a perfectly positive relationship is shown on Figure 4-5, which means the value of dependent variable increases with independent variable. On the contrary, a negative relation (Figure 4-6) suggested that an increase in independent variables results on decrease in dependent variable. However, it is noticeable that there is not a clear direction for the causality between those variables. The relation usually explained through estimators of the model, and a general form of multiple regression model shows below:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_i x_i + \mu$$

Figure 4-5 Scatter plot of positive relationship

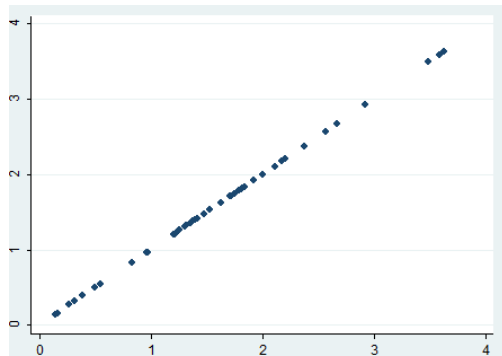
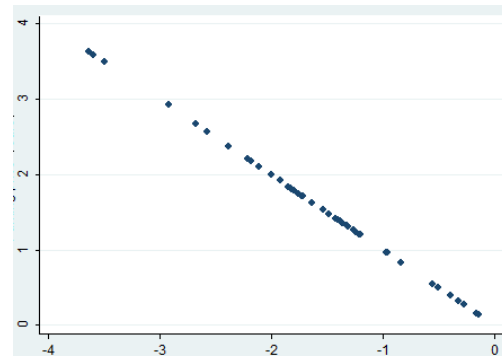


Figure 4-6 Scatter plot of negative relationship



Based on the general form of multiple regression model, the determined variables should be used into the design of researching model. As explained in the subchapter of variables determinant, the formula needs to contain parking price, GDP per capita, population, modal split variables(car , public transport, bike and walk) and the interaction effects between parking price and different kinds of transport modes. The designed model for researching the relationship between parking price and retail performance shows in formula:

$$\begin{aligned}
 \text{Retail performance} = & \beta_0 + \beta_1 \text{parking price} + \beta_2 \text{GDP} + \beta_3 \text{population} \\
 & + \beta_4 \text{tourism} + \beta_5 \text{car} + \beta_6 \text{walk} + \beta_7 \text{public transport} \\
 & + \beta_8 \text{parking price} * \text{car} + \beta_9 \text{parking price} * \text{walk} \\
 & + \beta_{10} \text{parking price} * \text{public transport} + \mu
 \end{aligned}$$

In order to avoid multicollinearity, bike is dummied as a reference variable, thus it is not included in the model formula. This model runs thorough the software STATA 13.0, the result will be shows on next chapter with detail discussion.

4) Multiple regression model improvement

The final model has experienced some adjustments, all of them has mentioned previously. In order to make it clearly, this part provides an overview of the process in

the model improvement, and detail results of those models are exhibited in full in Appendix 3.

The first model uses market size, which based on consumer spending, as the dependent variable directly, and the independent variable and control variables include: parking price, GDP, population, tourism, transportation modes and the interaction effects between parking price and transport modes. All of the variables in this model shows an insignificant relationship with dependent variable, and the value of R-squared is only 0.2238, which is quite low for the model explanatory power.

Under some professional suggestions, for avoiding the large biased effect of population, the dependent variable is changed into the ratio between market size and population, and other variables keep same. After this adjustment, most of the relations become to be significant, and the R-squared increases to 0.7695, which suggested a obvious improvement in the model.

Apart from the successful adjustment, there is a attempt to replace the control variable GDP by GDP per capita, this step is based on the same reason of the adjustment in model 2, however, since the result of correlation suggested GDP is preferable then GDP per capita (Appendix 2), this step is not accepted in the final model.

The result of final model will be shown on the next chapter, and some discussion and possible explanations will be offered with the results.

5. Results analysis and discussion

After several improvement, the result of final model is shows in Table 5-1. This chapter analyzes the relationship between parking price and retail performance based on this result and some discussion for this relation were offered in the second subchapter.

1) The main result of the study

Table 5-1 Result of final model

Dependent variable: retail performance			
Reffessor	Model 1	Model 2	Model 3
Parking price		2.374**	65.301**
		0.023	0.000
GDP	-1.39e-06	4.67E-06	6.31E-06
	0.873	0.591	0.299
Population	-0.203**	-0.189**	-0.110**
	0.001	0.001	0.005
Tourism	0.014	0.044	0.016
	0.82	0.458	0.678
Car	-0.214	-0.13	0.820**
	0.067	0.26	0.000
Walk	-0.261	-0.216	1.189**
	0.066	0.11	0.000
Public transport	-0.286**	-0.203	0.695**
	0.023	0.098	0.000
Parking price * Car			-0.604**
			0.000
Parking price * Walk			-0.897**
			0.000
Parking price * Public transport			-0.618**
			0.000
Intercept	30.651**	18.327	-80.381**
	0.008	0.126	0.000
Summary Statistics			
Adj R-squared	0.245	0.324	0.707
N	48	48	48

Table 5-1 is the model result for the relationship between parking price and retail performance, the figure in boldface is the coefficient of each variable, ‘***’ suggested that the estimator is significant under 5% level, and the number under coefficients are the p-value. In the summary statistics, Adjusted R-squared and numbers of observation (N) are exhibited, and Adj R-squared is used as the standard to compare between models. From this table, a significant difference between model 1 and model 2 is the existence of the independent variable-- parking price. According to the result in model 2, parking price shows a significant positive relationship with retail performance, and this positive relationship also continues to the result of model 3, but the coefficients increases from 2.374 to 65.301. After add the interaction effect into the final model (model 3), the model shows an huge improvement, since the adjusted R-squared rise from 0.324 to 0.707.

The result of model 3 indicated that there is a significant positive relationship between parking price and retail performance. Since the p-value is equal to 0.000 which is less than 0.05, thus the null hypothesis of no relationship between parking price and retail performance was rejected. Under the interaction effects, only interpreting the estimators of parking price is not appropriate, since apart from the coefficient of parking price, the relationship also is influenced by the interaction between parking price and transportation modes. As predicted, the change in parking price has impact on the consumers’ transport mode choice, thus the effect of parking price on retail performance should be: $65.301 * \text{parking price} - 0.604 * \text{parking price} * \text{car} - 0.897 * \text{parking price} * \text{walk} - 0.618 * \text{parking price} * \text{public transport}$. Since the modal split data describes the percentage of population in different transportation modes usage, even one of the modes usage experiences a great increase, due to the change in parking price, the relationship between parking price and retail performance would still remains positive, because of the dominant position of the positive coefficient of parking price. In order to interpret the relationship more clearly, it is better to use typical number into the model, and the relationship is easier to understand for readers.

As the result in Table 5-2, numbers of independent variable and interaction effects under different percentage were taken for interpreting the positive relationship. The result in the final line suggested that the relationship between parking price and retail performance is always positive from low percentage (25%) to high percentage (99%). Thus, we confirmed that the positive relationship between parking price and retail performance, and detail explanation for this relationship will be described in the second subchapter.

Table 5-2 Interpretation combined with interaction effects

Variable	25%	50%	75%	99%
Parking price	1.205	1.41	1.88	3.63
Car	33	42	56	76
Walk	16.55	24	31.5	46
Public transport	18.5	24	34.5	54
Parking price*car	43.305	62.585	94.635	137.94
Parking price*walk	12.29	35.82	57.63	116.16
Parking price*public transport	17.85	31.02	55.155	140.01
Result	52.524315	67.23325	83.21466	171.39621

For other control variables, most of them shows a significant effect on retail performance, such as population (p – value = 0.005). The estimator exhibited a negative effect of population on retail performance ($\beta_3 = -0.11$), this might because of the dislike feeling for crowded place of consumers. Since it increases the possibility of congestion and the existing of pickpockets, which reduce the consumers satisfaction in shopping environment and safety requirement. From this result, it also rejected the conclusion that a larger city, which was indicated by high population number, can increase the parking price, since there is no evidence to support this viewpoint.

Variables of modal split also show significant relation with retail performance.

Compared with cyclist, the car driver, public transport user and pedestrian contribute more to the retail performance, this result was also confirmed by the result of a survey which was made in London (Sharp 2005). All of those results are supported by the statistical evidence, since p-values for the coefficients of those variables are less than 0.05.

Except for the variables with significant relationship, the relationship of GDP and tourism shows insignificance. Since the p-value of GDP is 0.299 and 0.678 for tourism, both of them are larger than 0.05. This result indicated that it is hard to find evidence to support the effect of those variables on dependent variables, and interpreting the coefficients of those variables is unreasonable. This is quite surprise for us, since we suggested GDP as an indicator of urban economics, it is reasonable that under a better economic environment, the retail industry could develop faster than before. But this outcome could be a result of adjustment of dependent variable, because the effect of city size was already considered, and the data processed method in tourism also might be a reason for the insignificance.

2) Discussion based on the result

The positive relationship between parking price and retail performance seems to be contrary with common sense. Because normally, consumers express detestation on high price. As economic theory explained, higher price increases supply, but at the same time, it decreases the consumer demand. However, price also is an indicator for the trade off between consumer's expectation and real environment and service. From this view, we found a most convinced explanation for the positive relationship. Since the performance of a retail center is possible to represent the development degree of the city, high retail performance could be a characteristic of a fascinating city. Thus, under a high retail performance environment, high parking price is more possible to be a part of living cost of this city. And in order to enjoy the better living environment,

consumers are willing to pay a higher price for it compared with other less attractive cities.

Apart from the most reasonable explanation, there are also several possible interpretations for the positive effect of parking price on retail performance. First, parking price is an efficient instrument to mitigate the congestion problem in city center (Hensher & King 2001), some consumers who give up to shop in city centers due to the terrible traffic jam before might choose to return because of the alleviating situation. Second, higher parking price might be a result of increased service quality, such as larger parking place, better security or improvement in other parking facilities. Those improvement offers benefits like reducing searching time for parking space and using better facilities to ensure the safety of both drivers and pedestrian create a better parking and shopping environment. The higher service quality, which is covered under the higher parking price, is possible to become a new attractiveness of the retail areas and finally increases the retail performance.

Those results could be an empirical evidence for policy makers to defense themselves when the change of parking price faces the great pressure by retailers and developers. However, since the relationship indicated more about the positive effect of retail performance on parking price, policy makers need to convince consumers, retailers and developers that this price is suitable for the city. But it is impossible that policy makers could increase parking price unlimitedly, is consumers are unlikely to accept an extraordinary expensive parking price. As Lockwood (2002) has examined, a excessively high price would trigger a negative effect on retail commerce, moreover, this effect will be sharper if this retail centers are competing with others that offer free parking.

Nowadays, not only adjacent cities and out- of- town retail areas are the powerful rivals for urban retail centre. In order to survival in the strong competition, government and retailers need to envisages the inferior position of traditional retail

industry, since online shopping has developed out of our imagination. Under this situation, parking should be put into a important position for the development of traditional retailing , since it is the most significant disadvantage compared with online shopping. In addition to highlight the advantage of shopping centers, creating a preferable parking environment to consumers might be more effective to attract them, and finally increase the competitiveness not only for traditional retailing but also for the city. As some researchers suggested, the design of parking price should based on the urban retail goals (Mcshane & Meyer 1982, Kelly & Clinch 2009), policy makers is better to modify parking policies on the basis of urban retail situation, and finding a balance between consumers' expectation and parking price, translate the parking problem to a attractiveness of the urban retail center, remaining and expanding the market size and reputation in nation or even global.

6. Conclusion

1) Conclusion of research

For decades, it is hard to find an agreement of the relationship between parking price and retail performance in the field. In order to fill this gap, this thesis tries to gain the relation through a multiple regression model, which based on 48 famous retail cities in Europe.

The result of the multiple regression model indicated a positive relationship between parking price and retail performance, and this relationship is not only depends on the parking price, it also concerns about the change in consumers' transportation choice. The switching in the transportation modes is possible to make a reduce in the positive relationship. However, since the significant positive coefficient of parking price takes a dominant position in the results, the relationship would still remains positive.

The positive relationship seems to be adverse with the common sense, since normally higher price will curb demand of consumers. However, in this model, the relationship is more likely from higher retail performance to the higher parking price. Due to a retail centers with relative better performance could be a symbol of a attractive city, people are willing to pay a higher living cost, which includes higher parking price, to study, shop and dwell at this better environment. Thus it can be concluded that the high performing retail area increases the value of nearby parking places, and those places worth a higher price in deed to accord with the local characteristics.

Other possible explanations for the effect of higher parking price on increasing retail performance also are provided in the analysis. A higher parking price might represents a higher service quality, since investors are asking for the return of investment. At the same time, people are benefiting from the improvement on parking facilities, such as reducing searching time on parking place and better safety assurance for both car

drivers and pedestrians, which are the aspects they really concerns about. Higher service quality creates a great increase in consumer satisfaction, which produces a better retail performance.

In order to survive in the rat race, urban retail centers need to compete with those similar rivals firstly, such as adjacent cities and out-of-town shopping centers, since the competitive advantage is easy to replicated by each other. And those places could offer a cheaper or even free parking price than the existing famous city center because of the low population density. In this competition, providing an acceptable parking price is quite important, consumers will not give up retail centers just due to a slightly higher parking price, they only do this when facing a extremely expensive parking price, and as reaction, they will turns to other transportation mode or change their shopping destination. For another powerful competitor, online shopping, retailers need to consider how to provide a better shopping environment for consumers and outstands their advantages. Parking, usually is the disadvantage of traditional retail stores, the improvement of it might have a large positive effect than other advantages. And finally, government are required to design appropriate parking policies to alleviate congestion problem in city centers and make it becomes to be an attractiveness of the city.

2) Limitation and future research

As mentioned before, the result of this thesis could be an empirical evidence for policy makers to defense themselves when facing the great pressure from retailers and developers. However, there are some limitations for this research which requires to use the evidence cautiously. And on the other hand, those limitations also is possible to be a new start point for future research.

First, the sample size is relative small. The data only includes 48 cities in Europe,

even the amount of sample is larger than 20, which is enough to make an estimation for the relationship between parking price and retail performance, it still is a relative small size compared with other rigorous researches. Also, because of the unavailability of data for different variables in years, it is impossible to build a panel data, and under the restrictions of multiple regression model, the direction of causality is hard to define. Because of this limitation, it can not be concluded that the positive effect comes from which side, and it can not be explained the relationship with direction, for instance, a city increases its retail performance then the parking price of this city will also increase. And it also is same for the other side, the viewpoint that a higher parking price can increase the urban retail performance is certainly incorrect, this is entirely groundless and unacceptable. At the same time, there are other unobserved factors, such as wage level, which could influence the result were not included in the model. For getting the direction of the effect and eliminate most biased effect which was not change with time, it is better to use fixed effect model, however, as mentioned at data description part, the unavailability of panel data is the most critical problem in front of research.

For the insignificance in some variables, such as tourism, the unavailable data on NUTS 3 level and the processed method of the data also could trigger some bias on the results.

Thus, we place our hopes on data and information system improvement in the future, and it is better to enlarge the sample size to gain a more receivable estimation which used more perfect and reliable data as the basis.

Second, the determination of dependent variable and independent variable are based on some subjective judgment of author, it is possible to find a better indicator of retail performance than consumer spending. Also, the different weights which taken for the parking price might results on some biased in the estimation, it is possible for researchers to use other method, or even use different categories and detail data in

parking price to measure the relationship between parking price and retail performance.

Third, as mentioned in first point, multiple regression model might not be the best instrument for this research, collecting more detail data and taking different models, such as fixed effect model, is likely to change this result, because it might define the direction of the effect and eliminate some omitted variable biased, or the model includes more factors which improve the result. After comparison, readers and researchers could chose a better model and offer more creative or reliable explanations for the results.

The forth limitation lies into the definition of retail industry. Since there are different types of products, such as food products and non-food products, tangible goods and intangible goods in real world, and this thesis does not provide a clear segmentation for products or stores. As assumptions supposed, the consumers are considered as indifferent in this research, which is quite impossible in reality. Thus, setting up different segmentations for both consumers and retail stores in the research might brings a different result for the relationship, and it also is a suggestion for future research.

Finally, it is possible that there are some factors which might be the major power to influence the retail performance but they are not included in the research. For solving this problem, we suggested that scholars and researchers could create more variables to improve the model, and at the same time, they do not need to limit in the scale of the relationship only between parking price and retail performance, expanding the research objects might produce numerous great literatures for this subject.

Reference

- Berman, B & Evans, JR 2001. 'Retail management: a strategic approach', Upper Saddle River: Prentice Hall International.
- Berry, LL, Seiders, K & Grewal, D 2002, 'Understanding service convenience', *Journal of Marketing*, vol. 66, pp. 1–17.
- Bodkin, CD & Lord, JD 1997, 'Attraction of power shopping centres', *The International Review of Retail, Distribution & Consumer Research*, vol. 7 no. 2, pp. 93-108
- Bonsall, P & Young, W 2010, 'Is there a case for replacing parking charges by road user charges?', *Transport Policy*, vol. 17, pp. 323–332.
- Bureau of Labor Statistics 2015, *American time use survey*. Available from: <http://www.bls.gov/tus/charts/>. [19 June 2016]
- Caicedo, F 2012, 'Charging parking by the minute: What to expect from this parking pricing policy?', *Transport Policy*, vol.19, pp.63-68.
- Car Parking Europe 2016, *Parking rate information in the cities of France, Spain, Italy, Germany, Switzerland, Netherlands, Austria, Denmark, Norway, Sweden, Czech Republic, Belgium and Finland*. Available from: <http://www.car-parking.eu/>. [19 June 2016]
- Centre for Retail Research 2016, *The retail forecast for 2016-2017*. Available from: <http://www.retailresearch.org/retailforecast.php>. [14 June 2016]
- City Clock Magazine 2014, *Cycling modes share data for 700 cities*. Available from: <http://www.cityclock.org/urban-cycling-mode-share/#.V2fLAHCLhDS>. [13 June 2016]
- Dennis, C, Marsland, D & Cockett T 2002, 'Central place practice: shopping centre attractiveness measures, hinterland boundaries and the UK retail hierarchy', *Journal of Retailing and Consumer Services*, vol. 9, pp. 185-199.

- DETR, 1998. 'A New Deal for Transport: Better for Everyone.' Department of the Environment, Transport and the Regions, HMSO, London.
- El-Adly, MI 2007, 'Shopping malls attractiveness: a segmentation approach', *International Journal of Retail & Distribution Management*, vol. 35, Iss.11, pp.936-950.
- EMTA 2005, *New metro line and paying expressway in St. Petersburg*. Available from: <<http://www.emta.com/spip.php?article384&lang=en>>. [13 June 2016]
- Eurostat 2016, *data of GDP, population and tourism*. Available from: <<http://ec.europa.eu/eurostat/data/database>>. [9 June 2016]
- EPOMM 2016, *TEMS-The EPOMM modal split tool*. Available from: <<http://www.epomm.eu/tems/>>. [10 June 2016]
- Gruen, V & Smith, L 1960, 'Shopping Towns USA: the Planning of Shopping Centers' Van Nostrand Reinhold, Melbourne.
- Guy, CM 1998, 'Classification of retail stores and shopping centres: some methodological issues'. *Geojournal* vol.45, pp.255–264.
- Harper Dennis Hobbs 2016, *Retail Centre Reports 2016*. Available from: CoStar. [23 March 2016]
- Henning, M 2011, '*Sustainable urban mobility: the example of Istanbul*', Internationale Zusammenarbeit (GIZ). Available from: <http://www.sutp.org/files/contents/documents/resources/C_Case-Studies/GIZ_SUTP_CS_Sustainable-Urban-Mobility-Istanbul_EN.pdf> [12 June 2016]
- Hensher, DA & King, J 2001, 'Parking demand and responsiveness to supply, pricing and location in the Sydney central business district', *Transportation Research*, Part A, vol. 35, pp. 177-196.
- Hu, S & Saleh, W 2005, 'Impacts of congestion charging on shopping trips in Edinburgh', *Transport Policy*, vol. 12, no. 5, pp. 443–450.
- Kazmina, E 2013, '*Where and how to park in St. Petersburg*', Petersburg. Available from: <<http://petersburg4u.com/where-and-how-to-park-in-st-petersburg>> [19 June 2016]

- Kelly, JA & Clinch, JP 2006, 'Influence of varied parking tariffs on parking occupancy levels by trip purpose', *Transport Policy*, vol.13, pp.487-495.
- Kelly, JA & Clinch, JP 2009, 'Temporal variance of revealed preference on-street parking price elasticity', *Transport Policy*, vol. 16, pp. 193-199.
- Lockwood, J 2002, 'The Lockwood Survey 2002', Urban Management Initiatives, Huddersfield.
- Longstreth, R 1998, 'City center to regional mall: architecture, the automobile and retailing in Los Angeles' MIT press, Cambridge, MA, USA.
- Lumpkin, JR & Hunt, JB 1989, 'Mobility as an influence on retail patronage behavior of the elderly: testing conventional wisdom', *Journal of the Academy of Marketing Science*, vol. 17, no. 1, pp. 1-12.
- Marsden, G 2006, 'The evidence base for parking policies—a review', *Transport policy*, vol.13, pp. 447-457.
- Mcshane, M & Meyer, MD 1982, 'Parking policy and urban goals: linking strategy to needs', *Transportation*, vol.11, pp.131-152.
- Moscow Parking 2016, *Parking information in Moscow*. Available from:<
<http://parking.mos.ru/en/faq/>> [19 June 2016]
- Nelson/Nygaard Consulting Associates 2014, *Moscow multi-modal transportation plan*. Available from:
 <<https://www.ci.moscow.id.us/records/Publications/MotM-Final%20Moscow%20o%20the%20Move.pdf>>.[12 June 2016]
- Norman, P 2006, *Europe's retail centres ranked*. Available from:
 <<http://www.costar.co.uk/en/assets/news/2016/March/Europes-retail-centres-ranked/>>
- Oliver, R 1981, 'Measurement and evaluation of satisfaction processes in retail settings', *Journal of Retailing*, vol. 57, no. 3, pp. 25-48.
- Oppewal, H 1995, *Conjoint experiments and retail planning: modeling consumer choice of shopping centre and retail reactive behaviour*. Thesis, Eindhoven University of Technology Eindhoven, The Netherlands.

- Pan, Y & Zinkhan, GM 2006, 'Determinants of retail patronage: A meta-analytical perspective', *Journal of retailing*, vol.82, no.3, pp.229-243.
- Parikh, D 2006, 'Measuring Retail Service Quality: An Empirical Assessment of the Instrument' *Vikalpa*, vol.31, no.2, pp.45-55.
- Parkopedia 2016, *Parking information in the cities of UK, Turkey, Portugal, Ireland, Greece and Poland*. Available from: <<http://en.parkopedia.co>> [19 June 2016]
- Reimers, V & Clulow, V 2004, 'Retail concentration: a comparison of spatial convenience in shopping strips and shopping centres', *Journal of Retailing and Consumer Service*, vol.11, pp. 207-221.
- Ruiz, F 1999, 'Image of suburban shopping malls and two-stage versus uni-equational modelling of the retail trade attraction: an empirical application', *European Journal of Marketing*, vol. 33 no. 5/6, pp. 512-30.
- Sharp, S 2005. 'Bus priority: Economic impacts on town centers', In Proceedings of the third UK Transport Practitioners Meeting. *University of Aston*, pp. 5-6.
- Simićević, J, Milosavljević, N, Maletić, G & Kaplanović, S 2012, 'Defining parking price based on users' attitudes', *Transport Policy*, vol. 23, pp. 70-78.
- Statista 2016, *Forecast of retail sales growth in western Europe between 2008 and 2016, by volume*. Available from: <<http://www.statista.com/statistics/232402/forecast-for-retail-sales-growth-of-western-europe/>>. [14 June 2016]
- Statsoft 2016, *How to find relationship between variables, multiple regression*. Available from: <<http://www.statsoft.com/Textbook/Multiple-Regression#index>>. [20 June 2016]
- Suchorzewski, W 2013, *Sustainable urban mobility transitional countries*. Available from: <<http://unhabitat.org/wp-content/uploads/2013/06/GRHS.2013.Regional.Transitional.Countries.pdf>>. [13 June 2016]
- Teller, C & Reutterer, T 2008, 'The evolving concept of retail attractiveness: What makes retail agglomerations attractive when customers shop at them?', *Journal of Retailing and Consumer Services*, vol.15, pp.127-143.

- Thomas, CJ & Bromley, RDF 2002, 'The changing competitive relationship between a small town centre and out-of-town retailing: a case of town revival in South Wales', *Urban Studies*, vol. 39, pp. 791–817.
- Topp, HH 1991, 'Parking policies in large cities in Germany', *Transportation*, vol. 18, pp. 3–21.
- Transit Cooperative Research Program 2005, *Traveler Response to Transportation System Changes*, Chapter 13: Parking Pricing and Fees, Washington DC. Transportation Research Board.
- Urban & Economic Development Group 1994. 'Vital and viable town centers: meeting the challenge.' Report of a study undertaken in association with Comedia, Hillier Parker, Bartlett School of Planning, University College London, and Environmental and Transport Planning, Department of the Environment. London: HMSO.
- van der Waerden, P, Borgers, B & Timmermans, H 1998, 'The impact of the parking situation in shopping centres on store choice behaviour', *GeoJournal*, vol.45, pp.309-315.

Appendix

Appendix 1: The rank of retail cities in Europe

Rank	Retail Centre	Country	2016 Market size/consumer spending (£)
1	London West End	UK	8,874,976,742
2	Paris	France	7,916,618,510
3	Madrid	Spain	5,003,533,108
4	Roma	Italy	4,557,701,235
5	Munich	Germany	4,489,670,664
6	Berlin	Germany	4,451,051,590
7	Istanbul	Turkey	4,411,542,040
8	Barcelona	Spain	4,354,912,414
9	Zurich	Switzerland	4,298,265,554
10	Milan	Italy	4,288,292,650
11	Glasgow	UK	4,260,877,222
12	Amsterdam	Netherlands	4,244,419,992
13	Moscow	Russia	3,772,562,013
14	Birmingham	UK	3,668,955,990
15	Lisbon	Portugal	3,518,797,209
16	Manchester	UK	3,472,138,079
17	Hamburg	Germany	3,178,602,874
18	Vienna	Austria	3,174,509,793
19	Copenhagen	Denmark	3,167,882,233
20	Oslo	Norway	3,151,776,818
21	Leeds	UK	3,105,329,513
22	Marseille	France	3,087,627,845
23	Liverpool	UK	3,066,037,408
24	Dublin	Ireland	3,065,784,134
25	Stockholm	Sweden	3,028,638,727
26	Lyon	France	3,018,028,494
27	Cologne	Germany	3,000,894,552
28	Frankfurt	Germany	2,992,106,906
29	Nottingham	UK	2,968,158,229
30	Turin	Italy	2,915,177,063
31	SaintPeterburg	Russia	2,793,420,776
32	Athens	Greece	2,780,363,442
33	Cardiff	UK	2,770,465,495
34	Newcastle upon Tyne	UK	2,766,481,196
35	Prague	Czech Republic	2,759,042,013
36	Lille	France	2,694,744,307
37	Rotterdam	Netherlands	2,683,945,559
38	Brussels	Belgium	2,657,502,386
39	Valencia	Spain	2,571,579,743
40	Naples	Italy	2,557,588,313
41	Düsseldorf	Germany	2,519,421,152
42	Stuttgart	Germany	2,504,523,686
43	Antwerp	Belgium	2,481,295,731
44	Helsinki	Finland	2,470,660,601
45	Warsaw	Poland	2,428,417,476
46	Bordeaux	France	2,418,113,502
47	Toulouse	France	2,377,871,468
48	Edinburgh	UK	2,323,607,832
49	Strasbourg	France	2,294,329,064
50	Gothenburg	Sweden	2,232,894,134

(Source: Harper Dennis Hobbs 2016)

Appendix 2: Comparison between GDP and GPD per capita

Table 1 Correlation between retail performance, parking price, GDP, population and tourism

	retail_per~e	parkin~e	popula~n	tourism	gdp
retail_per~e	1.0000				
parkingprice	0.3255	1.0000			
population	-0.4855	-0.0382	1.0000		
tourism	0.2151	-0.1874	-0.2099	1.0000	
gdp	0.0247	-0.3245	-0.1348	0.1420	1.0000

Table 2 Correlation between retail performance, parking price, GDP per capita, population and tourism

	retail_per~e	parkin~e	tourism	popula~n	gdp_pe~a
retail_per~e	1.0000				
parkingprice	0.3255	1.0000			
tourism	0.2151	-0.1874	1.0000		
population	-0.4855	-0.0382	-0.2099	1.0000	
gdp_per_ca~a	0.8295	0.1893	0.1992	-0.5093	1.0000

Appendix 3: Model improvement

Model 1

The dependent variable is market size, which based on the consumer spending in the urban retail centers, the unit for the data is euro. Independent variable is parking price and other variables shows in the formula:

$$\begin{aligned} \text{Market size} = & \beta_0 + \beta_1 \text{parking price} + \beta_2 \text{GDP} + \beta_3 \text{population} + \beta_4 \text{tourism} \\ & + \beta_5 \text{car usage} + \beta_6 \text{walk} + \beta_7 \text{public transport} + \beta_8 \text{parking price} \\ & * \text{car} + \beta_9 \text{parking price} * \text{walk} + \beta_{10} \text{parking price} \\ & * \text{public transport usage} + \mu \end{aligned}$$

Table 1 The result of model 1

Source	SS	df	MS			
Model	2062.09829	10	206.209829	Number of obs =	48	
Residual	7149.90171	37	193.240587	F(10, 37) =	1.07	
Total	9212	47	196	Prob > F =	0.4109	
				R-squared =	0.2238	
				Adj R-squared =	0.0141	
				Root MSE =	13.901	

marketsize	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
parkingprice	13.39683	38.89299	0.34	0.732	-65.40785	92.20152
population	-.249712	.1554735	-1.61	0.117	-.5647312	.0653072
tourism	.0488985	.1612717	0.30	0.763	-.277869	.375666
gdp	.0000328	.0000251	1.31	0.198	-.0000179	.0000836
car	.3438954	.7226518	0.48	0.637	-1.120336	1.808127
walk	.2815143	1.07723	0.26	0.795	-1.901161	2.46419
pt	.0494513	.6551014	0.08	0.940	-1.27791	1.376813
pprice_car	-.2507899	.4327929	-0.58	0.566	-1.127712	.6261318
pprice_walk	-.1924316	.6267171	-0.31	0.761	-1.462281	1.077418
pprice_pt	-.0765639	.3861224	-0.20	0.844	-.8589222	.7057943
_cons	11.41123	68.7368	0.17	0.869	-127.8628	150.6852

Model 2

Since the low performance of model 1, under some suggestion, the dependent variable is change into market size/population, and other variables remain same with model 1.

$$\text{Retail performance} = \text{Market size}(\text{consumer spending}) \div \text{population}$$

$$\begin{aligned} \text{Retail performance} = & \beta_0 + \beta_1 \text{parking price} + \beta_2 \text{GDP} + \beta_3 \text{population} \\ & + \beta_4 \text{tourism} + \beta_5 \text{car} + \beta_6 \text{walk} + \beta_7 \text{public transport} \\ & + \beta_8 \text{parking price} * \text{car} + \beta_9 \text{parking price} * \text{walk} \\ & + \beta_{10} \text{parking price} * \text{public transport} + \mu \end{aligned}$$

Table 4-2 The result of model 2

Source	SS	df	MS			
Model	1362.35761	10	136.235761	Number of obs =	48	
Residual	408.160886	37	11.0313753	F(10, 37) =	12.35	
Total	1770.51849	47	37.6706063	Prob > F =	0.0000	
				R-squared =	0.7695	
				Adj R-squared =	0.7072	
				Root MSE =	3.3214	

retail_per~e	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
parkingprice	65.30147	9.292595	7.03	0.000	46.47288	84.13005
population	-.1097947	.0371468	-2.96	0.005	-.1850613	-.034528
tourism	.0161486	.0385322	0.42	0.678	-.061925	.0942223
gdp	6.31e-06	5.99e-06	1.05	0.299	-5.82e-06	.0000184
car	.8189594	.1726612	4.74	0.000	.4691146	1.168804
walk	1.189284	.2573796	4.62	0.000	.6677835	1.710785
pt	.6947944	.1565216	4.44	0.000	.3776516	1.011937
pprice_car	-.6043358	.103406	-5.84	0.000	-.8138563	-.3948153
pprcie_walk	-.8974	.1497398	-5.99	0.000	-1.200802	-.5939984
pprice_pt	-.6183657	.0922552	-6.70	0.000	-.8052924	-.431439
_cons	-80.38045	16.42309	-4.89	0.000	-113.6568	-47.1041