The effects of online shopping on the retail real estate market

Master Thesis By

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The effects of online shopping on the retail real estate market

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Preface

This thesis is the final product of my master program Complex Systems Engineering and Management at the Technical University of Delft. In one of the courses during this master program the topic of retail vacancy was introduced, which triggered me to choose this as the topic of my master thesis. The topic proofed to be very actual, as almost every month the bankruptcy of another large retail concern, dominated the headlines.

I would like to thank a number of people for helping me completing this master thesis. First of all, I would like to thank my graduation committee for their constructive feedback and support. I would especially like to thank Erik Louw for meeting with me on a regular basis, his enthusiasm about the topic of my thesis and his advice regarding the possible directions I could explore, are very much appreciated. Furthermore, I would like to thank Petra Heijnen for her advice on the statistical part of my thesis. I would like to thank Willem Korthals Altes for overviewing the bigger picture and giving feedback on how to bring the different elements of my thesis together.

I also would like to thank the province of Zuid-Holland for offering me an internship in the first place, and prolonging my internship, without any problems, when this was required. Within the province of Zuid-Holland I would like to especially thank Jacques Westerink for meeting with me on a weekly basis and supporting me all the way. I would also like to thank my colleagues Aty de Wolf and Floris Hendriksen for their advice on how to deal with retail vacancy from a policy perspective.

Dennis Coster

The Hague, January 2019

Summary

In pre-crisis years the Dutch national retail vacancy rate steadily increased and reached a height of 10,2 percent in 2016. High levels of retail vacancy have the potential to negatively affect the liveability of municipalities. Hence, the province of Zuid-Holland and its associated municipalities are trying to reduce the amount of vacant retail real estate.

In order to effectively reduce retail vacancy rates, it is important to determine the actual causes of the increasing retail vacancy rates. Initially the increasing retail vacancy rates were considered to be related to the inability of the retail real estate market to adjust to the economic crisis. Soon after, other causes, including the growing popularity of online shopping, started to emerge. This research aims to empirically examine whether the increasing retail vacancy rates are caused by the growing popularity of online shopping, or whether the increasing retail vacancy rates are caused by sociodemographic and other consumer behavioural factors. These findings are used to optimise the current retail policy of the province of Zuid-Holland. The main research question is as follows:

What are the effects of online shopping on the retail real estate market, and how should retail policy address these effects?

Correlation analysis and multiple regression analysis are used to determine which factors are related to the decrease in the demand for retail real estate. The results point out that the increase in online expenditures, between 2011 and 2016, is significantly related to a decrease in the demand for retail real estate. In this way our research provides strong empirical evidence that online shopping forms a substitute for traditional in-store shopping. More specifically, the findings reveal that an increase in the online expenditures on non-daily products, between 2011 and 2016, is strongly associated with the decrease in the demand for retail real estate. Contrary, the results do not provide evidence that the change in the online expenditures on daily products, between 2011 and 2016, is related to the change in the demand for retail real estate.

Moreover, our findings also stipulate that municipalities of which the retail sector performed well, between 2011 and 2016, are likely to have experienced an increase in the demand for retail real estate, whereas municipalities of which the retail sector performed poorly, between 2011 and 2016, most likely saw the demand for retail real estate diminish. Additionally, in this research no evidence is found that the demand for retail real estate is influenced by the fluctuations in the economic cycle, the demographic changes or the degree of urbanisation in municipalities.

The province of Zuid-Holland has the ambition to be a leading province in which people enjoy to reside, work and leisure. In order to reach this objective, the province has implemented retail policy aimed at strengthening the strong aspects of the retail real estate market and preserving the fine-grained structure of small shopping areas. Central themes in this retail policy are reinforcement and preservation of existing shopping areas. In this way

the province tries to both retain the current retailers as well as attract additional retailers to reoccupy the currently vacant retail real estate objects.

The results of this research in combination with forecasts regarding online shopping show that the change in the behaviour of consumers, from traditional in-store shopping towards online shopping, is of a structural nature. This indicates that a growth-oriented policy approach does not deal adequately with the high levels of retail vacancy. Consequently, additional retail policy is required.

Through this research it is recommended to implement a reduction-oriented policy approach next to the already existing growth-oriented policy approach. In this way a two-track policy is established, in which the reduction-oriented policy approach aims to reduce the excess of retail real estate in order to bring balance to the demand and supply on the market for retail real estate in the middle-to-long term. On the other hand, the growth-oriented policy approach is kept in place in order to ensure that shopping areas remain attractive and vibrant in the long-term. The implementation of this two-track policy requires a shift in the mind-set of policy makers. Instead of being primarily focused on facilitating the growth of the market for retail real estate, the implementation of this two-track policy requires part of the focus of policy makers to shift towards the reduction of the stock of retail real estate.

The instruments currently available to the province of Zuid-Holland and its associated municipalities only allow for a facilitating role in the reduction of the stock of retail real estate. In order to stimulate the reduction of vacant retail real estate, the second recommendation is to provide these governmental agencies with additional means to ensure that the amount of vacant retail real estate is reduced. One promising instrument is the meter for a meter plus policy. This policy only allows for the development of new retail real estate, under the condition that market parties simultaneously subtract more retail real estate from the market than that they are adding.

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1. Introduction

In the years following the start of the financial crisis in 2007, the Netherlands experienced an increase in retail vacancy (Evers, Tennekes & Dongen, 2014). In pre-crisis years and during the first three years of the financial crisis retail vacancy rates did not exceed the six percent mark (PBL, 2016). Figure 1 shows that from the year 2010 the national retail vacancy rate steadily increased and reached a height of 10.2 percent in 2016, which is the result of the disappearance of many small and large retail concepts from the street scene. Striking examples are the bankruptcies of Free Record Shop, Mexx, Schoenenreus, Macintosh and V&D (Driessen & Van der Heijden, 2016). It took the national retail market until 2017 to show a first sign of recovery with the national retail vacancy rate dropping back below ten percent. However, according to Locatus (2017) and Compendium voor de Living Environment (2017) the reduction of the national retail vacancy rate is merely the result of the reoccupations of the real estate objects in which V&D was situated, rather than it being the sign of a broader recovery of the market for retail real estate.

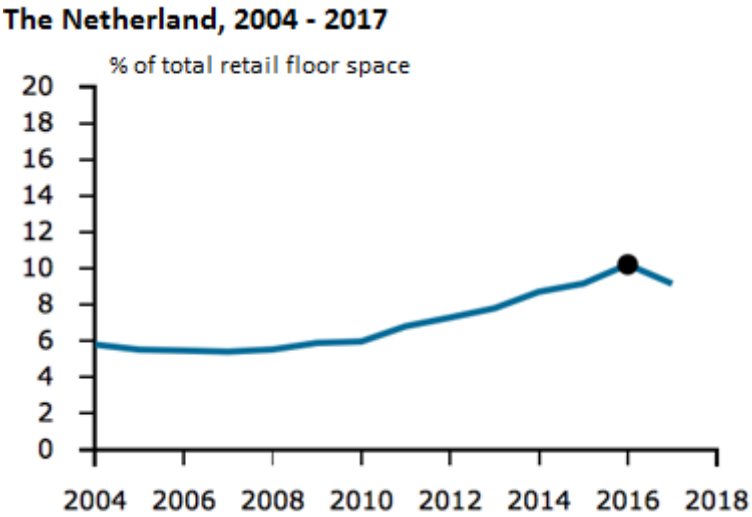

Figure 1: National retail vacancy rate (PBL, 2016)

1.1 Problem analysis

Retail vacancy arises in places where there is a mismatch between the demand for retail real estate and the supply of retail real estate. The problem with retail vacancy is that it often creates negative externalities for its surrounding areas, which could affect the overall liveability of municipalities. Vacancy, for a lot of inhabitants, is being associated with a sense of unsafety (Detailhandel Nederland, 2017). Other negative externalities that are associated with retail vacancy according to Berwyn (2013) are: reduced vibrancy, decreased visual attractiveness, reduced ability to attract customers and investors, increased risk of blight and decline, reduced revenue generated by property owners and reduced tax-income for governments.

To add to this, in a number of Dutch research publications it is mentioned that initial retail vacancy has the potential to result in additional retail vacancy. In this way retail vacancy can be a self-reinforcing phenomenon, which is referred to as the downward retail vacancy spiral. (Van Dongen, Buitelaar & Breedijk, 2013; Evers et al., 2014; Huizinga & Ossokina, 2014; Evers, Tennekes & Van Dongen, 2015; Duijn & Boots, 2016). In figure 2 this downward retail vacancy spiral is displayed. The downward retail vacancy spiral illustrates how initial retail vacancy, through a number of sequential steps, has the potential to lead to additional retail vacancy.

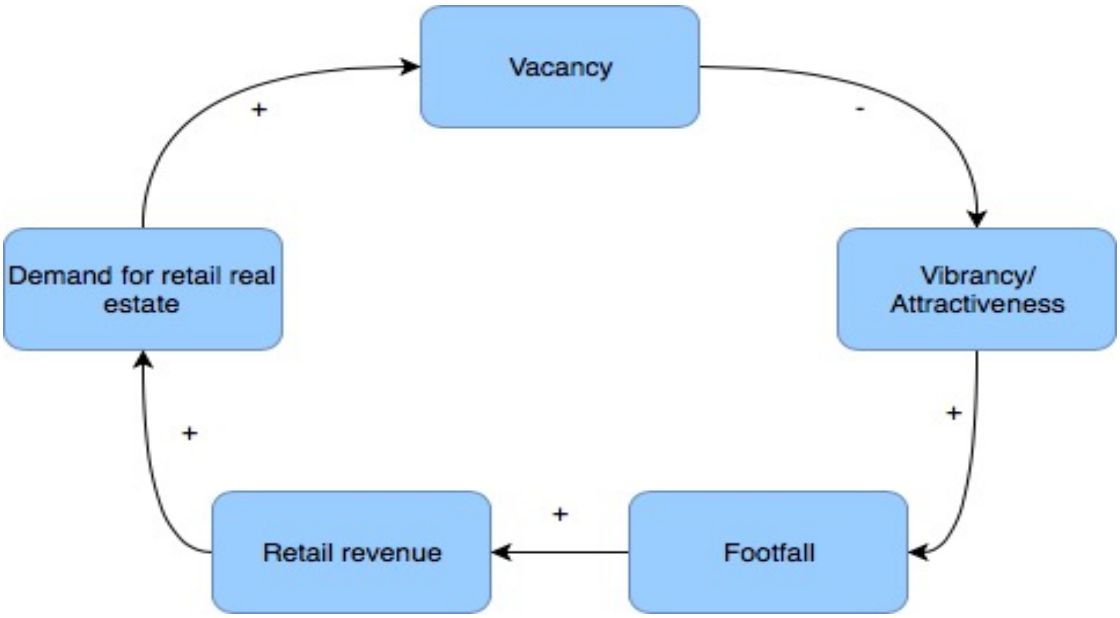

Figure 2: Downward retail vacancy spiral

The downward retail vacancy spiral functions as follows; the decision of an individual retailer to relocate or quit his or her retail activities results in a retail real estate object becoming vacant. Visitors that were initially attracted to the shopping centre by this specific retail activity, might look for alternative shopping areas to make their purchases. Furthermore, the negative externalities associated with this vacant retail real estate object cause shopping centres to lose part of their attractiveness and vibrancy (Woodruffe-Burton, Eccles & Elliott, 2002). These aspects potentially result in a reduction in the number of customers visiting shopping centres, this is referred to as 'footfall'. Reduced footfall leads to a reduction in retail revenue (Koster, Pasidis and van Ommeren, 2017). A reduction in retail revenue creates a less attractive retailing climate, which could lead to more retailers relocating or quitting their retail activities. In case these retail real estate objects are not reoccupied by new retailers they become vacant and the negative spiral is reinforced, leading to additional retail vacancy. The potential of retail vacancy to spin out of control, through this downward spiral, shows the urgency for the involved actors to deal with undesirable high retail vacancy rates.

The urgency of dealing with retail vacancy is recognised throughout all layers of government. The Ministry of Economic Affaires initiated the signing of national 'RetailDeals'.

In 2015 the first RetailDeal was signed by the Ministry and over 50 municipalities (Ministerie van Economische Zaken, 2015). In 2016 the second RetailDeal was signed by the Ministry and all twelve provinces. Both RetailDeals are not regarded as legally binding contracts, but rather as declarations of intent which should help in an integral approach to reduce retail vacancy. Besides this national initiative, provinces and municipalities are taking action to reduce retail vacancy within their own administrative borders.

One province which has a rich history of conducting an active retail policy is Zuid-Holland. In Zuid-Holland this has resulted in focussed retail policies in previous years, an approach that will be continued in in the near future (Hoofdlijnenakkoord 2015-2019, 2015). The goal of the province of Zuid-Holland is to be a leading province in which people enjoy to reside, work and leisure. Proper functioning retail real estate markets are vital in achieving this goal, because attractive and inviting shopping areas are important to the living and business climate of municipalities. Furthermore, attractive city centres form a large source of attraction for tourists and expats. And finally, the retail sector provides job security for many of the province's inhabitants (Provincie Zuid-Holland, 2017).

The aim of the provincial retail policy is to maintain attractive and vibrant shopping areas. The policy vision called 'Visie ruimte en mobiliteit 2014' forms the starting point for the actions which the province of Zuid-Holland currently takes (Provincie Zuid-Holland, 2017). The central theme in this vision is utilising the strength of the strong and vibrant shopping areas and preserving the fine-grained structure of smaller shopping areas. Therefore, the province of Zuid-Holland focusses on the concentration and funnelling of retail activities in the centres of municipalities, cities, villages and neighbourhoods. Promising aspects of the retail markets are being reinforced while retail activities in peripheral shopping centres are no longer permitted.

1.2 Motivation of research

In order to effectively reduce retail vacancy rates, it is important to determine whether the increasing retail vacancy rates are caused by a structural change in the behaviour of consumers or whether the increasing retail vacancy rates are the result of temporary sociodemographic fluctuations. Many scholars point to the increasing popularity of online shopping as being the main cause of the increasing retail vacancy. However, there are also scholars who believe that other factors have caused the recent increasing retail vacancy rates.

One group of scholars argues that traditional in-store shopping trips are replaced by visits to web shops. These scholars regard online shopping as a substitute for traditional in-store shopping (Bean, 2000; Winograd, Conner, Liang and Whitaker, 2000).

Other scholars argue that online activities directly facilitate traditional in-store shopping. This is the case when online advertisements or online incentives result in additional in-store shopping trips. These scholars argue that online shopping is complementary to tradtional in-store shopping (Salomon, 1986; Andersen & Rosen, 2000; Weltevreden & Van Rietbergen, 2007).

Finally, there is a group of scholars who believe that online shopping either has a neutral or a modifying effect on traditional in-store shopping. Neutrality entails that the introduction of online shopping has no effect on the shopping behaviour of consumers (Mokhtarian, 2002; Weltevreden & Van Rietbergen, 2007). One speaks of a modification effect when the use of the internet alters the manner in which consumers make traditional in-store purchases, but it does not lead to a change in the volume of traditional in-store purchases (Ferrel, 2005).

From the substitution perspective it can be derived that the growth of the online shopping market has caused part of the increase in retail vacancy. The other three perspectives suggest that other factors, outside online shopping, have caused the increasing retail vacancy rates. In the literature other frequently mentioned causes of the increase in retail vacancy are the fluctuation of the economic cycle (Burt, 2010; Evers et al., 2014) and the demographic changes (Zhang, Zhu & Ye, 2016).

1.3 Research Objective and Research Questions

The first objective of this research is to examine the effect of the increasing popularity of online shopping on the market for retail real estate. By doing so, we try to contribute to the following scientific debate: does online shopping have a substitution or complementarity, neutrality or modification effect on traditional in-store shopping. Secondly, we want to investigate whether there are other factors, outside online shopping, that contribute to the issues on the market for retail real estate. Thirdly, we want to examine whether the effects of online shopping on the market for retail real estate are different for municipalities with a rural character opposed to municipalities with a more urban character. The final objective is to use the empirical results of this research to arrive at improvements for the retail policy of the province of Zuid-Holland. The overall objective of this research is therefore the following:

> *To design a policy approach that improves the way the province of Zuid-Holland deals with the effects of the growing popularity of online shopping on the retail real estate market.*

Following the research objective, the succeeding main research question will be answered:

> *What are the effects of online shopping on the retail real estate market, and how should retail policy address these effects?*

In order to be able to answer this main research question a number of sub-question have to be answered in addition, these questions are the following:

1. *Which factors, besides online shopping, have an effect on the retail real estate market?*
2. *Does online shopping have a substitution, complementarity, neutrality or modification effect on traditional in-store shopping?*

3. *What are the differences between the effects of online shopping on retail real estate used for the sale of daily products and retail real estate used for the sale of non-daily products?*
4. *What is the effect of different degrees of urbanisation in municipalities on the retail real estate market?*
5. *What should be the focus of future retail policy to address the effects of online shopping on the retail real estate market?*

1.4 Scientific and Societal Relevance

The effects of the growing popularity of online shopping on the market for retail real estate are mainly examined focussing on future developments. Except for Weltevreden (2007) and Weltevreden and Van Rietergen (2009), little empirical research examining the effects of the growing popularity of online shopping on the retail real estate market has been conducted. Therefore, in this research an attempt is made to empirically examine these effects. Additionally, in this research we examine whether there are other factors that have an effect on retail real estate market. This is done with the use of both a correlation analysis and a multiple linear regression analysis. To our knowledge this is the first time something of this nature is being attempted in this field of research. Therefore, the scientific relevance of this research will be high.

Moreover, this research will also have societal relevance, as the results are used to critically review the current provincial retail policy. Where possible suggestions are made to improve the current retail policy, thereby potentially strengthening the market for retail real estate.

1.5 Scope

The focus of this research lies with examining the effects of the growing popularity of online shopping on the market for retail real estate, while at the same time investigating the effects of other factors that are also expected to have an effect on the retail real estate market. Data on the supply side of the retail real estate market and its accompanied retail asset market is only limited accessible. On the other hand, the data on the demand side of the retail real estate market is accessible in ample amounts. Therefore, in order to examine the effects of online shopping, and the other relevant factors incorporated in this research, on the market for retail real estate, the choice is made to focus primarily on the demand side of the retail real estate market.

The interest of the client of this research lies with the province of Zuid-Holland, so this is where the geographical scope is set. However, in order to maximise the statistical power of the analysis data regarding municipalities located in the provinces of Noord-Holland and Utrecht is also included.

1.6 Research methodology

Thus far in this chapter we have introduced the problem of retail vacancy, gave a motivation for the execution of this research, have drafted several research questions, defined the objective and the relevance of this research and substantiated the first choices regarding the scope of this research. In this section the different research methods that are used throughout this research are introduced. In table 1 an overview of the research methods that are used to answer the different sub-questions is presented. In the continuation of this section each research method will be introduced briefly.

Table 1: Relation between research methods and research questions

Research method	Sub-question
Literature study	Sub-question 1: *Which factors, besides online shopping, have an effect on the retail real estate market?*
Correlation analysis / Multiple linear regression analysis	Sub-question 2: *Does online shopping have a substitution, complementarity, neutrality or modification effect on traditional in-store shopping?*
	Sub-question 3: *What are the differences between the effects of online shopping on retail real estate used for the sale of daily products and retail real estate used for the sale of non-daily products?*
	Sub-question 4: *What is the effect of different degrees of urbanisation in municipalities on the retail real estate market?*
Design activities	Sub-question 5: *What should be the focus of future retail policy to address the effects of online shopping on the retail real estate market?*

1.6.1 Literature study

A literature study will be conducted to acquire knowledge about location theories, the retail property market, factors affecting the retail real estate market and current policy measures. The information obtained through this literature study is used to construct a conceptual model that forms the basis for the multiple regression analysis. For this literature study; papers, articles, books, websites, policy documents and other sources are consulted.

In order to get more insight into the origin of the retail real estate market, we started with a literature review on location theories. Two papers in which location theories are reviewed, one by Amcoff (2016) and the second one by Dennis, Marsland and Cockett (2002), are used as a starting point. Both their literature lists are scanned for relevant references.

Through this many different sources, which provide information about different location theories, are acquired. A textbook written by Geltner, Miller, Clayton & Eichholtz (2007) is used to get more insight into the different aspects of the retail property market and the way these aspects interact with one another. Moreover, many papers regarding different factors that have an effect on the retail real estate market are consulted. Furthermore, websites of several organisations are consulted to obtain specific information. Public organisations such as the Dutch Environmental Assessment Agency, in short PBL, and Statistics Netherlands, in short CBS, publish reports on the performance of the retail real estate market. these reports are used to retrieve insights into the current trends on the retail real estate market. The websites of governmental agencies such as The Ministry of Economic Affairs and the province of Zuid-Holland are used to obtain information about current retail policies aimed at addressing vacancy. Lastly, the websites of research organisations such as Locatus, Droogh Trommelen en Partners, in short DTNP, and I & O Research are consulted to obtain important numeric information on the retail real estate market.

1.6.2 Correlation analysis

The 'Pearson's correlation coefficient' is used to analyse the strength and direction of the association between two variables of either interval or ratio level of scale, under the assumption that the relationship between these two variables is linear in nature (Baarda & De Goede, 2011). The Pearson correlation coefficient can take on a maximum value of 1 in case the increase in one variable is equal to the increase in another variable, this is called perfect positive linear correlation. The Pearson correlation coefficient takes on its minimum value of -1 in case an increase of one variable is equal to the decrease in another variable, this is referred to as perfect negative linear correlation. In case the Pearson correlation coefficient takes on the value 0 there is no linear correlation. In case of the presence of any other type of relationship between two variables this is not detected by the Pearson correlation coefficient (Baarda & De Goede, 2011). Moreover, the Pearson correlation coefficient does not contain information about cause and effect.

In this research the Pearson correlation coefficient is, on the one side, used to examine the strength and the direction of relationships between the dependent variable and the corresponding independent variables. On the other side, the Pearson correlation coefficient is used to analyse the strength and direction of relationships between the various independent variables incorporated in the multiple regression models.

1.6.3 Multiple linear regression analysis

Linear regression analysis is a statistical analysis tool for the study of the linear relationships between variables. Simple linear regression analysis tries to ascertain the effect of one variable upon another variable. More specifically, simple regression analysis helps to understand the relationship between independent variables and the dependent variable (Baarda & De Goede, 2011).

Where simple linear regression estimates the effect of one independent variable on the dependent variable, multiple regression analysis allows the researcher to enter multiple independent variables into the regression model at once. This is a very valuable tool for quantifying the impact of several variables simultaneously upon one single dependent variable (Sykes, 1993). Multiple regression can be used for two reasons. The first reason is to predict the value of the dependent variable based on the effects of the independent variables incorporated in the model. The second reason is to determine the model fit and the contribution of each individual independent variable to the overall model fit. In our research, multiple linear regression analysis is used to examine the effect of different factors on the demand for retail real estate. Moreover, we also use multiple linear regression analysis to check whether the effect of certain factors on the demand for retail real estate varies for municipalities with a varying degree of urbanisation. In order to check for this, dummy variables are used.

Statistical analysis tool 'SPSS Statistics' from IBM provides the researcher with the option to choose between several linear regression methods (IBM SPSS Statistics, n.d., § 1). The method used for estimating the effects in this research is the 'stepwise' method. This method aims to gather the best combination of independent variables in predicting the dependent variable. The stepwise method enters and removes independent variables separately into the regression model based upon the partial F-tests which is the *t*-test for the slope parameter. SPSS keeps running these steps until there are no more independent variables left that can be justifiably entered or removed from the stepwise regression model. After the last variable is added or removed SPSS terminates the runs and a multiple regression model containing the best combination of independent variables is estimated. This means that not all independent variables, entered at the start of the analysis, actually end up in the final model (Field, 2000).

1.7 Reading guide

This report continues in chapter 2 with the deepening of the theoretical background. This chapter covers consecutively the location theories, the characteristics of the retail property market and and the factors affecting the demand side of the retail real estate market. This chapter forms the basis of this research as it provides the input for the quantitative phase later on in this research. Next, in chapter 3, the conceptualisation and operationalisation phases take place. In this chapter the relations between the factors, expected to affect the demand for retail real estate, are captured in a conceptual model. Furthermore, the unspecified factors are concretised into specified variables. Moreover, this chapter clarifies the most important modelling choices and assigns appropriate units of measurement to the variables. Subsequently, in chapter 4, the research sample used in this research is explored descriptively. In this chapter the reader is introduced to the characteristics of the research entities, the trends of the most important variables between the years 2011 and 2016, the numeric differences between the characteristics of rural and urban municipalities, the numeric differences between the characteristics of the province of Zuid-Holland and the

provinces of Noord-Holland and Utrecht and the characteristics of the input variables. Next, in chapter 5, the results of the quantitative analyses are presented and discussed. In chapter 6 our findings are used to design a policy approach for the province of Zuid-Holland and its associated municipalities, aimed at dealing with the problems on the market for retail real estate. Afterwards, in chapter 7 the most important findings of this research are summarised and used to answer the main research question. This report finishes with a discussion in chapter 8.

2. Theoretical background

In this chapter the results of the literature study are discussed. These results provide a platform for the continuation of this research as they shed light on the current spatial retail structure, the functioning of the retail property market and the different factors expected to affect the demand for retail real estate. This chapter contributes to answering the following sub-question:

- *Which factors, besides online shopping, have an effect on the retail real estate market?*

In the first section of this chapter several location theories are discussed. These theories provide an explanation for the spatial component of the retail market. In the second section of this chapter the characteristics of the retail property market are analysed using neoclassical demand and supply functions and the four-quadrant model of DiPasquale and Wheaton (1992). This analysis forms the basis for the third and fourth section, in which several factors expected to affect the retail real estate market are introduced. These insights are used to formulate an answer to the first sub-question. This chapter ends with a conclusion in which the main findings are summarised.

2.1 Location theories

Throughout the 20th century many scholars have tried to capture the explanations for the spatial component of the retail real estate market in different location theories. In this paragraph some of the most influential theories are discussed. These location theories help to understand the reasons behind the settlement choices of retailers and the considerations of consumers when deciding which places to visit, in this way providing an explanation for the origination of the current spatial retail structure.

2.1.1 Central place theory

Christaller's (1933) and subsequently Losch's (1940) central place theory is one of the oldest location theories. The original theory of Christaller (1933) and Losch (1940) describes the spatial retail structure from a macro-economic perspective. It considers the size, spacing, number and functional composition of shopping centres in a world where there is a uniform distribution of fully informed consumers, who purchase from retailers that behave rational, competitive and are profit seeking. Another assumption is that travel is uniformly priced and travel in each direction has similar costs. Furthermore, it is assumed that consumers choose the nearest shopping location that supplies the required product and for each individual purchase a single-purpose shopping trip is made (Brown, 1993).

Under the above mentioned assumptions the central place theory predicts that the demand for a particular product will decrease as the distance to the shopping location

increases. The reason behind this is related to the increasing costs of transportation. When the travel distance for the purchase of a specific product becomes too large, the demand will drop to zero. The distance consumers are willing to travel for a specific product is called the 'range' of a good (Brown, 1993). The total number of potential customers that fall within this range is called the catchment area. A sufficient amount of potential customers has to life in a catchment area to ensure that a retailer can generate enough physical interactions before he or she will start selling a particular product. The number of potential physical interactions that are required to exceed the threshold for breaking even, is different for each product. The demand for a particular set of products determines in that way the potential revenue of the retailer and whether or not a business could be profitable.

According to the central place theory a hierarchical network of retail agglomeration will emerge (Christaller, 1933). In this hierarchical network the most diverse range of products is sold in the largest cities in which the most physical interactions take place. In small villages only a small range of products is sold. The reason behind this is that small villages have a smaller catchment area. The products that are sold by retailers in these locations only require a small number of physical interaction. Large cities have a larger catchment area and are therefore more attractive for retailers who sell more exclusive non-daily products that require a larger number of physical interactions (Brown, 1993).

2.1.2 Bid-rent theory

The bid-rent theory, introduced by Alonso (1964), as we now know it finds its origin in the work of Haig (1927). Haig in his study of land use in New York, used a hypothetical uniform piece of land where travel is equally effortless in all directions. Haig argued that the most accessible place would be located in the centre, because the centre has the best access to both labour and customers. In this way undertakings would bid competitively with one another for the most centralised location and thereby creating a natural order of willingness and ability to pay for rent (Brown, 1993).

Using Haig's ideas as a starting point, Alonso (1964) constructed the so called 'Bid-rent curves' comprising of a variety of land use functions. These curves shown in figure 3 identify for each function the amount of rent users are willing to pay for one square meter of floor space located at different distances from the centre. The steepness of the curves indicates how sensitive each function is to a change in accessibility. This theory shows that retailers are prepared to pay the highest rents for locations near the centre, but the amount they are willing to pay falls quickly when the location becomes less accessible. The curves of residential and industrial functions decline less steeply, meaning that they are more willing to trade off the better accessibility of a centralised location for the lower rental price of a lesser accessible location. In general, one is prepared to pay the highest rent levels for retail land uses, therefore they are located closest to the centre. Followed by respectively industrial and residential land uses. Also within each of the land uses certain differentiations can be made. Retailers that generate the highest revenues can afford to pay higher rents than retailers with lower revenues. Evers (2011) has classified different locations within shopping as follows:

- A1 locaiton: the most busy area in a shopping centre.
- A2 location: around 50 to 70 percent of the customers of an A1 location.
- B1 location: around 25 ot 50 percent of the customers of an A1 location.
- B2 location: around 10 to 25 percent of the customers of an A1 locaiton.
- C location: adjoining street.

The highest rents are paid in A-locations. Retailers who are unable or unwilling to pay high rents will occupy retail real estate objects located further away from the centre, these are so called B- or C-locations (Dynamis, 2017). Generally large chain stores occupy retail real estate objects located near the centralised A-locations on the main streets of shopping centres, while single-store retailers often occupy retail real estate objects located closer to the edges of shopping centres in so called 'run-in' streets (Alonso, 1964).

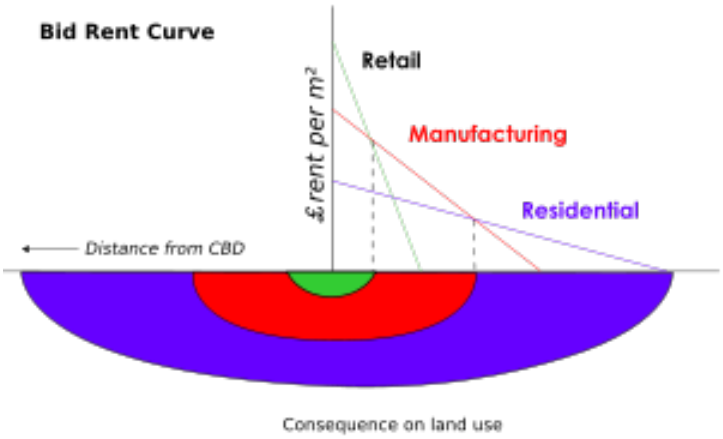

Figure 3: Alonso's Bid-rent curves (Alonso, 1964)

2.1.3 Law of retail gravitation

Inspired by Newton's law of gravity, Reilly (1931) set out to develop a model that could measure the retail activity between two municipalities. His theory, 'The Law of Retail Gravitation' allows us to assign boundaries to trade areas around municipalities based on the distance between two municipalities and the total population of both municipalities. This theory, other than previously mentioned theories, looks at the locational choices of retailers from the perspective of the consumer. In this theory the gravitational forces that shopping centres have on consumers, are the central theme. These gravitational forces consist of four primary criteria (Bolt, 2003, p. 58):

- The number of shopping centres;
- The distance from the shopping centres to the surrounding municipalities;
- The size of the municipalities; and
- The magnitude of the shopping centres.

This theory states that consumers are making their choices based on the distance to different shopping centres, measured in actual travel distance. Furthermore, the size of the municipality plays an important role. According to the law of retail gravitation inhabitants of small municipalities are more inclined to travel longer distances to other municipalities, than the inhabitants of large municipalities. On the other hand, from this theory it can be concluded that the further the distance to a particular municipality, the less inclined consumers are to make purchases in this municipality.

2.1.4 Theory of cumulative attraction

The theory of cumulative attraction introduced by Nelson (1958) aims to explain the trends behind the clustering of stores which sell similar products, from the perspective of the consumer. This theory states that consumers possess the wish to compare products of different stores before the final purchase is made. This is especially relevant for products in which price, quality, fashion and pattern are important considerations. This means that stores selling these types of products will generate more revenue if they are located in close proximity to each other (Nelson, 1958). Especially stores that sell fashion and luxury merchandise benefit from cumulative attraction.

2.1.5 Cumulative causation theory

Myrdal (1956) takes the perspective of the individual retailer when studying locational choices. In this theory cumulative causation is the central concept. The cumulative causation theory assumes that retailers wish to locate in close proximity to each other, because collectively retailers possess more knowledge and resources than an individual retailer (Bolt, 2003). In short, cumulative causation means that one activity will lead to the attraction of other activities, which in that way reinforces the economic structure of that particular area.

2.2 Characteristics of the retail property market

The retail property market consists of two interconnected sub-markets. The first is the market for retail real estate and the second is the retail asset market (Geltner et al., 2007). The distinction between these two markets is especially noticeable when the occupant of a retail real estate object is not also the owner of this retail real estate object. Often on the retail property market the occupant and the owner are two different parties. In this case retailers rent a retail real estate object from the actual property owner on the retail real estate market, while at the same time this retail real estate object is an asset which could be traded on the asset market. Especially in high street locations, more often than not, the property owner and the end-user are two different parties. Smaller retail real estate objects in less centralised shopping locations are more regularly owned by the party who is the end-user at the same time. In this situation the difference between the two different sub-markets is less obvious (Mourouzi-Sivitanidou, 2011). Just like any other market, these two markets also consist of both a demand side and a supply side in which the price mechanism determines the point of intersection between these two sides of the market (Harrison, 1993). In this section special

attention is given to the retail real estate market, as the main focus of this research lies with this part of the retail property market. Consequently, the characteristics of the retail asset market are discussed rather concisely.

2.2.1 Retail real estate market

The retail real estate market is the market in which the right to use property or 'space' is traded. It is often referred to as the rental market. The demand side of the retail real estate market consists of tenants who demand retail properties for 'production purposes'. On the retail real estate market 'production' refers to the selling of goods. The supply side of the retail real estate market consists of real estate owners who rent out property to tenants. The price for the temporary usage of space is often referred to as the rental price. The rental price is determined by both demand and supply on the retail real estate market (Harrison, 1993). The price provides information about the current value of retail real estate and the current status quo between supply and demand. If supply increases and all other aspects stay equal the price will drop and if demand increases and all other aspects stay the same the price will increase (Mourouzi-Sivitanidou, 2011). The retail real estate market cannot be regarded as one integral market, rather it has to be regarded as a large collection of smaller segmented markets. These different retail real estate markets are formed by tenants and owners of retail real estate objects, respectively demanding and supplying specific functional and physical types of retail real estate objects, in different geographical locations and in different price categories. These distinctions mean that the retail real estate market is very type, price and location specific (Geltner et al., 2007).

The demand function of a prefect functioning retail real estate market works like a classical demand curve of the neoclassical economic theory. As shown in figure 4, the demand curve is downward sloping with the demand for retail real estate increasing as the price of retail real estate decreases. The reason for this is that shop keeping becomes more attractive as the operational costs decrease (Geltner et al., 2007).

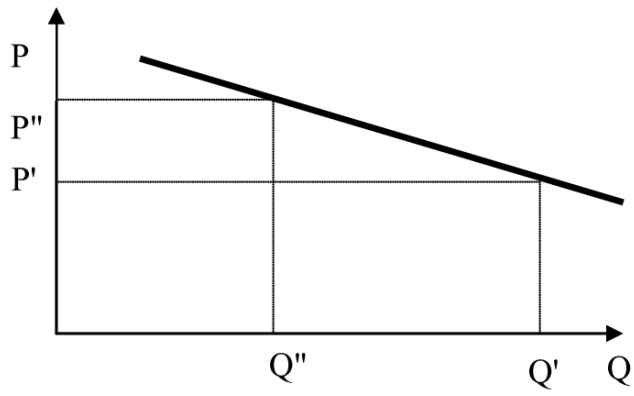

Figure 4: Demand curve retail real estate market (Mourouzi-Sivitanidou, 2011)

The supply function of a perfect functioning retail real estate market works different than a classical supply curve of the neoclassical economic theory. In the neoclassical economic

theory, the supply curve is an upward-sloping continuous line with supply increasing as soon as the price increases. Figure 5 shows a more accurate representation of the shape of the supply curve representing the retail real estate market. This curve as economist refer to it is 'kinked', this means that instead of being continuous the function has a 'corner' in it (Mourouzi-Sivitanidou, 2011). The reason for this is the inelastic character of the supply side of all real estate markets: if demand falls, real estate cannot be reduced in the short to medium term, because of the longevity of real estate. Very rarely do buildings have a lifespan of less than 50 years. Although it is possible to change the functional use of a building, this still proves costly and also takes a considerable amount of time. Therefore, the minimum quantity of supply on the retail real estate market will often be fixed for several years (Geltner et al., 2007).

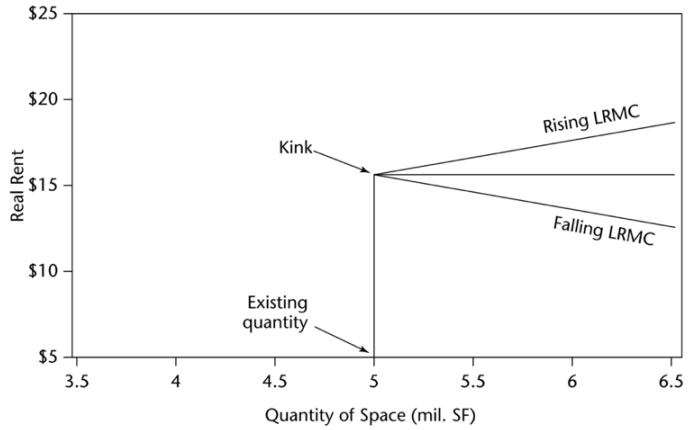

Figure 5: 'Kinked' supply curve retail real estate market (Geltner et al., 2007)

The part to the right of the 'kinked' point on the supply curve illustrates three possible future scenarios (Geltner et al., 2007). In the upward sloping scenario, the development costs of a new unit of retail real estate are higher than the costs of the previously added unit of retail real estate, or the demand for retail real estate in a specific location has increased. In the horizontal scenario the costs of new development are equal to the costs of previous development and the demand for retail real estate stayed level. In the falling scenario the costs of developing a new unit of retail real estate are less than the costs of the previously developed unit of retail real estate, or the demand for retail real estate in a particular location has declined. The scenario with a rising supply curve is the most likely scenario in a real estate market where land parcels are scarce, this is the case in most existing shopping areas. The scenario in which the curve is downward sloping would be likely in a situation where production costs are becoming significantly cheaper than they were before. This occurs in case of technological innovations, or in the case the demand for retail real estate drops in a certain location.

Figure 6 shows both the short-run as well as the long-run equilibrium situation of a perfectly functioning retail real estate market in the case of increasing demand. In the short-run scenario due to the inelasticity of supply, the supply curve is fixed. Therefore, an upward shift of the demand curve leads to a price increase without a change in the quantity of retail

real estate. This means that retailers demanding retail real estate, will have to pay higher prices for the same amount of retail floor space as they would have paid before. In the long-run scenario supply is able to adjust to the increase in demand, what occurs is a move up the supply curve and a shift to the right of the demand curve. This means that in case the demand for retail real estate rises, both the price and the quantity of retail real estate will increase in the long-run.

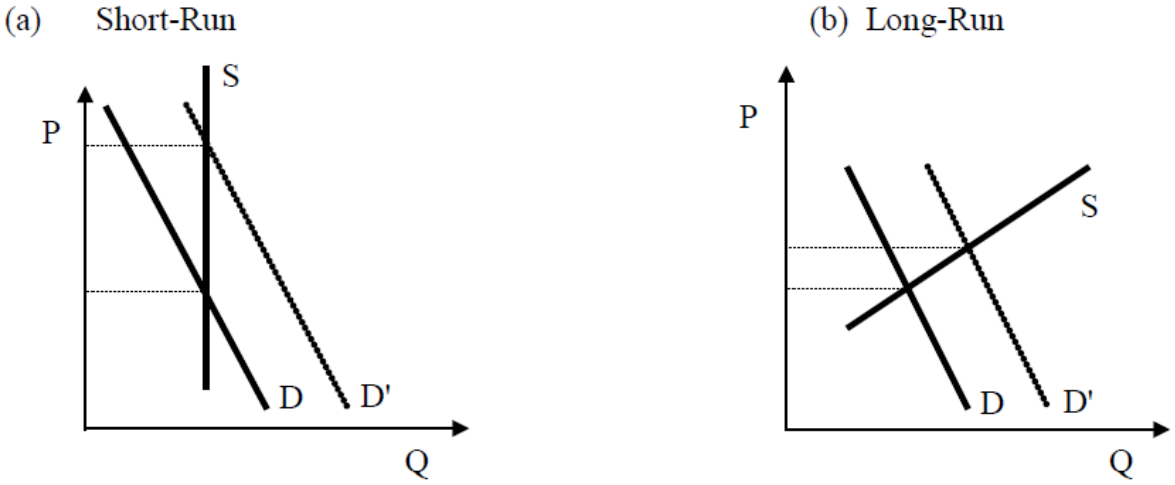

Figure 6: Short-run and long-run equilibrium (Mourouzi-Sivitanidou, 2011)

Due to exogenous shocks and market inefficiencies the retail real estate market may not be at demand-supply equilibrium. These market inefficiencies consist of: a lack of information, construction lags and long-term leases which prevent demand, supply and the price to respond adequately to shocks (Mourouzi-Sivitanidou, 2011). Due to these market inefficiencies, developers are likely to collectively develop too much retail real estate during a certain period, which is likely to lead to an excess of supply once the construction projects are completed. This illustrates the risk of overshooting on the retail real estate market, this process is often referred to as a 'hog cycle' or the 'cobweb theorem' (Geltner et al., 2007; Ezekiel, 1938).

2.2.2 Retail asset market

The retail asset market is het market in which the ownership of retail real estate objects is traded. The retail asset market is therefore often referred to as the 'property' market (Geltner et al., 2007). The demand side of the retail asset market is made up out of investors looking to capture future cash flows, by renting out their property on the retail real estate market. While on the demand side of the retail real estate market tenants are looking for actual floor space for 'production purposes', investors on the retail asset market are only looking to secure future cash flows. Whether this comes from retail property or any other source of income is not necessarily important to them. This makes the retail asset market part of the wider capital market, which means that retail assets are also competing with other types of assets such as bonds, shares, loans and funds. Therefore, the retail asset market is far less location, price and

type specific than the retail real estate market. An investor is not bounded by a specific location and could make transactions on all sorts of assets markets across different countries.

The supply side of the retail asset market is made up out of project developers, contractors, investors and individuals who are either involved in the development of new retail properties, or who own existing retail real estate. The amount of properties they collectively offer for sale determine the supply of retail assets (Geltner et al., 2007).

2.2.3 Linkage between the retail real estate market and the asset market

The retail real estate market and the retail asset market have been described separately in the section above, however both markets are linked to each other. For analysing the linkages between the two markets in the long-run, the four-quadrant framework, shown in figure 7, created by DiPasquale and Wheaton (1992) is used. This framework does not account for real estate shocks in the short-run. Therefore, it is static rather than dynamic in nature.

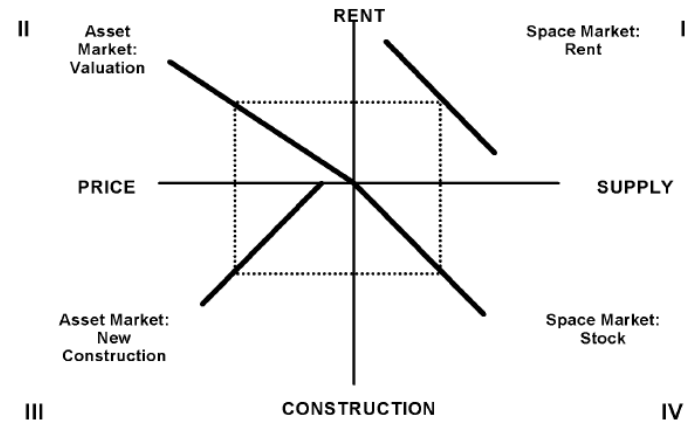

Figure 7: Four-quadrant model (DiPasquale and Wheaton, 1992)

This framework is divided into four quadrants, the two quadrants on the right side of the y-axis represent the retail real estate market and the two quadrants on the left side of the y-axis represent the retail asset market. In the continuation of this section the quadrants are discussed one by one. After which the links between the two markets are elaborated on.

Quadrant I displays the demand side of the retail real estate market. The rental price per unit of space is shown on the y-axis and the quantity of the stock in units of space is shown on the x-axis. The demand curve behaves downward sloping, meaning that the demand for retail real estate increases as the rental price decreases, as was illustrated earlier. Equilibrium occurs when demand equals the stock of retail real estate (DiPasquale and Wheaton, 1992).

In quadrant II the retail asset price valuation is determined. On the y-axis the level of rent per unit space is displayed and on the x-axis the actual price level per unit of space is displayed. Using a gap rate the rental prices of the retail real estate market are used as input to set the actual price valuation of retail assets. The curve is upward sloping, meaning that an increase in rental prices will lead to higher asset prices, assuming the gap rate stays constant. The gap rate is influenced by a number of exogenous factors: interest rates, rates of return on other assets, expectations and risk associated with the future cash flow of assets. A higher gap

rate means that for the same level of rent the price of retail assets will be lower, on the other hand a lower gap rate with consistent rental prices will result in retail asset prices being higher (DiPasquale and Wheaton, 1992).

Quadrant III represents the development of new retail real estate on the retail asset market. With the level of new construction shown on the y-axis and the asset price per unit of retail space on the x-axis. The curve illustrates the replacement costs of retail assets. These costs are assumed to be increasing when the quantity of building activity increases. The curve intersects the price axis at the price per unit space which is required to start some form of new development. The curve will be more inelastic and horizontal when each new constructed unit will result in higher costs due to the scarcity of land or construction thresholds. The curve will be more vertical when the asset price is more elastic and each unit of newly constructed retail space could be added at similar costs. The asset price from the second quadrant determines the level of new construction in the third quadrant, in which replacement costs equal the price of retail assets (DiPasquale and Wheaton, 1992).

Quadrant IV represents the required level of new construction in order to keep the stock of retail real estate at a constant level. On the x-axis the current level of stock is displayed, the y-axis displays the level of new constructed retail units. The level of new construction from the third quadrant is converted in this quadrant into a long-term supply of real estate on the retail real estate market. Changes in the stock are equal to the quantity of new constructed units minus the quantity of transformed or redeveloped retail units. The level of stock from the fourth quadrant is used as a starting condition for the first quadrant in which the rental prices are determined (DiPasquale and Wheaton, 1992).

The model is in equilibrium once the level of stock at the start is equal to the level of stock at the end. The equilibrium is represented in the model by the rectangle dashed box connecting the curves in the four quadrants of the model by DiPasquale and Wheaton (1992). When the initial stock in the model exceeds the final stock than rental prices, asset prices and the level of construction will all rise in order to return to an equilibrium state. In a situation where the initial stock lies below the final stock rental prices, asset prices and construction levels will all have to be lowered in order to return to a stable equilibrium state.

In short, this framework shows that in the short-run rental prices on the retail real estate market are transformed via a gap rate into actual property prices on the retail asset market. Properties with higher rental prices generate larger future cash flows, and are therefore more valuable to investors driving up the prices of retail stores.

The link between the two separate sub-markets is formed by the investors who invest in retail assets on the retail asset market and rent out retail real estate objects on the retail real estate market. An overview of the linkages between the actors on the separate sub-markets and the transactions that take place is illustrated in figure 8.

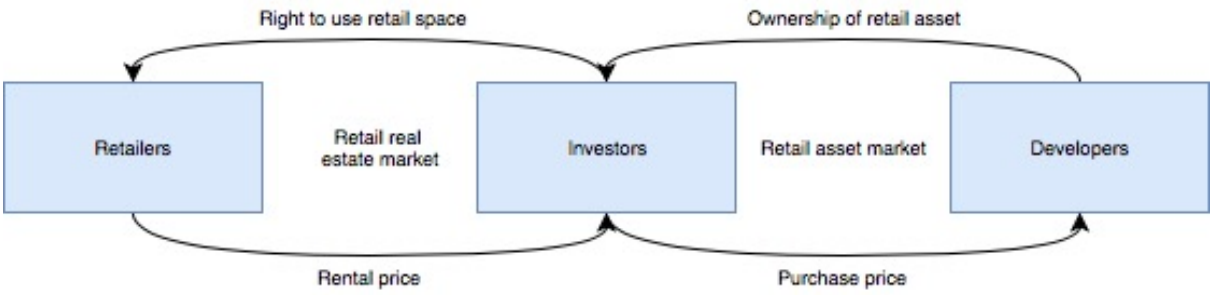

Figure 8: Linkage between the two sub-markets

2.3 Demand side of the retail real estate market

In this section the most important factors that influence the functioning of the demand side of the retail real estate market are discussed. The demand side of the retail real estate market is driven by the size of the population, its wealth and current consumer behavioural trends. More specific according to the literature the amount of retail real estate that is demanded is influenced by the following factors: online shopping (Kumar & Kumari, 2014), retail revenue generated in municipalities (Woodruffe-Burton et al., 2002; Weltevreden & Van Rietbergen, 2007), composition of the population (Zhang et al., 2016; CBS [B], 2017; CBS [C], 2017), economic cycle (Zhang et al., 2016; Teale, 2012; Burt, 2010; Evers et al., 2014), economies of scale (PBL, 2011; DTNP, 2017; Still & Simmonds, 2000; PBL, 2013) and perceived attractiveness (Weltevreden & Van Rietbergen, 2007; Zhang et al., 2016; Berwyn, 2013). These factors will be discussed one by one in the continuation of this section.

2.3.1 Consumer behaviour

Consumer behaviour has a big influence on the demand for retail real estate. Individual consumers are driven by many different reasons. Every person has his or her own motivation to shop where they shop, to purchase what they purchase and the channels they use to make these purchases. The study into consumer behaviour is defined by Solomon (1995) as “the study of the processes involved when individuals or groups select, purchase, use, or dispose of products, services, ideas, or experiences to satisfy needs and desires” (p. 7). Consumer behaviour has changed considerably over the last couple of decades (Kumar & Kumari, 2014). The reasons for recent changes in consumer behaviour are multiple, but are predominantly determined by the introduction of the internet (CBS [A], 2016). The concept of consumer behaviour is captured in two factors: online shopping and retail revenue generated in municipalities.

Online shopping

Perhaps the most severe change to the behaviour of consumers is caused by the introduction of the internet. This enabled the creation of a parallel market for retail purchases called the online shopping market. The effects of online shopping, also referred to as e-commerce, on traditional in-store shopping are widely debated (Tonn & Hemrick, 2004; Farag, Schwanen, Dijst & Faber, 2007). Some scholars argue that online shopping is a substitute for traditional in-store shopping (Buursink, 1996; Weltevreden, 2007). Moreover, other scholars argue that

online shopping and traditional in-store shopping complement each other (Salomon, 1986; Gillespie, Marvin & Green, 2001; Mokhtarian, 2002). Finally, there is a group of scholar who argue that online shopping either has neutral or a modifying effect on traditional in-store shopping (Mokhtarian, 2002; Ferrel, 2005; Weltevreden & Van Rietbergen, 2007).

There are many factors that play a role in the extent of the effects of online shopping on traditional in-store shopping. In their research Weltevreden and Van Rietbergen (2007) observed different shopping centres across the Netherlands, they concluded that the perceived attractiveness of a shopping centre is an important indicator for the extent to which a shopping centre is able to successfully compete with the online shopping market. When consumers feel attracted to a shopping centre, the utility gained from traditional in-store shopping often outweighs the utility gained from online shopping (Monheim, 1998; Bell, 1999). Some aspects of in-store shopping can simply not be replaced by online shopping. Another important factor that determines the extent of the effect that online shopping has on traditional in-store shopping is the nature of the merchandise that is being sold. Retailers who sell products which are also relatively easy to purchase online, will experiences more competition form the online shopping market than retailers who sell products which are not as easy to purchase online (I&O Research, 2016).

To add to this, there is a growing number of research reports in which predictions about the future of online shopping are made. According to I & O Research (2016) in 2016 12,5 percent of the products were purchased through online channels. ING Bank (2017) predicts that this percentage is likely to increase to 25 percent in the year 2025. According to Comarch (2017) the percentage of online purchases is likely to pass the 30 percent mark around the year 2030.

Retail revenue generated in municipalities

Consumer behaviour is not only concerned with the channels through which consumers make purchases, but also with the amount of money consumers spend and the location where consumers shop. These latter two aspects are captured in the factor retail revenue generated in municipalities. The extent of retail revenue that is generated within a municipality depends on a large number of other factors, such as: percentage of income spent on retail activities, number of people living in close proximity, accessibility and attractiveness of the shopping areas within a municipality.

The extent to which municipalities are able to attract visitors tells something about the function a municipality exercises in the region. Municipalities with a supra-regional shopping function are for a large part dependent on the retail revenue generated by visitors, while municipalities with a local shopping function rely predominantly on the retail revenue generated by customers living in close proximity. Changes in the behaviour of consumers could potentially change the ability of municipalities to retain retail spending of consumers living close by and their ability to attract retail spending from visitors.

2.3.2 Composition of the population

The composition of the population is another factor that influences the demand for retail real estate. Locatus (2012) argues that it is not the increase in online shopping but rather the change in the composition of the population that forms the biggest threat to the retail real estate market. In the literature demographic change and ageing of the population are considered to be the two aspects causing the changes in the composition of the population (Van Dam, De Groot & Verwest, 2006: Beets & Fokkema, 2005: Platform 31, 2014). In this section we will analyse both these aspects in more detail. Before analysing these two aspects we will start by introducing a definition of what we understand these aspects to signify, which will be followed by an explanation of the effects the changes in the composition of the population have, according to existing literature, on the demand for retail real estate.

Demographic change

The total decline or increase in the size of the population is determined by the number of newly born people, the number of deceased people and the net migratory balance. Demographic change is generally considered as the absolute change in the size of the population. This is however an underrepresentation; the concept contains many other aspects as well. A more complete definition is provided by Van Dam et al. (2006):

> "Demographic change can be defined in terms of both numbers (inhabitants, households) as well as the composition of the population (according to age, ethnicity) and household composition (according to size, stage of life, income), in which constituent parts of the population change in size" (Van Dam et al., 2006, p. 21)

An increase in the general size of the population signifies a larger potential of clients, which generally results in an increase in the demand for retail real estate. On the other hand, a decreasing size of the population generally leads to a decrease in the demand for retail real estate (Locatus, 2012). As indicated above it is however important to look in more detail at the specific characteristics of the population of a particular region to be able to make such predictions.

Currently especially municipalities in the periphery experience a decline in the general size of their populations. In the coming years it is expected that more and more municipalities will show these symptoms (PBL, 2014). The reasons for this decline are the continuous ageing of the population, which will be discussed later in this section, and the regional migration of mainly young people. The majority of those people migrate to large cities which are economically more attractive. The large cities are therefore expected to experience a continues growth of the number of inhabitants in the coming years (CPB, 2016). Municipalities that have experienced a decline in the size of the population for several years in a row, are dealing with 'structural' decline. Especially if the neighbouring municipalities also experience declining populations this could be problematic. These regions see public facilities such as schools and hospitals close, because there are too few people visiting them. Also retailers in

local shopping centres experience the decline in visitors, meaning their businesses are no longer profitable and they might have to leave that particular shopping area. These processes reinforce each other and contribute to the downward retail vacancy spiral which makes the region even less attractive.

Another demographic trend that is expected to affect the demand for retail real estate is the increasing number of households and the change in household composition. Several reports have devoted attention to the reasons for the relatively strong increase in the amount of households compared to the increase in the general size of the population (Groenemeijer et al, 2016; Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2014; Provincie Zuid-Holland, 2012; Ministerie van Economische Zaken, 2015). The first reasons for the increase in households is the growth of the amount of single households amongst elderly people (Ouderenmonitor, 2016). The second reason is that on average young people spend more time living on their own before committing to a family life (Van Essen, Hazewinkel, Ligtvoer-Janssen & Den Os, 2018). And finally, the increase in the amount of single households is the result of a higher divorce rate (Van Duin, Stoeldraijer & Garssen, 2013).

The effects of the increasing amount of households could be beneficial for part of the demand for retail real estate, because every household needs certain 'standard' products. Other stores might see their revenues drop. Which specific types of stores are affected by this trend, falls beyond the scope of this research.

Aging of the population

There are many definitions for aging of the population. We choose to use the definition provided by Beets and Fokkema (2005) "Aging is the process in which the total amount of people of older age groups (65+) is increasing as a proportion of the total population: the average age of the population is rising". Beets and Fokkema (2005) provide us with four possible explanations for the aging of the population:

- The amount of 0-19-year-old people decreases through a falling fertility rate;
- The amount of senior citizens (65+) increases through rising life expectancies;
- A large group reaches the age of 65 (baby boomers); and
- The amount of 20-64 year olds decreases through excessive migration or through a large epidemic which costs a lot of lives.

According to Van Dam and Daalhuizen (2013) a combination of the first three explanations is the reason behind the current aging of the population in the Netherlands. The process of aging of the population has the potential to affect the demand for retail real estate. Although the current generation of senior citizens is on average considerably richer, better educated, more mobile and more vigorous than the previous generation of senior citizens (Van Dam & Daalhuizen, 2013). This does not necessarily mean that they are as willing to spend as much money on retail products as the younger generations. According to Bureau Stedelijke Planning (2012) the current generation of senior citizens is for example less likely to change their furniture or wardrobe ever year, which is something that younger generations are more inclined to do. On the other hand, the older generation spends on average for

example more money on wellness products and leisure related products such as e-bikes (Platform 31, 2014). A side effect of the aging of the population is the evolution of a society growing up without internet, to a society in which a growing proportion of the population has access to internet and uses it frequently. This means that the number of people who potentially have access to the online shopping market is increasing (Bureau Stedelijke Planning, 2012).

Additionally, the shopping behaviour of senior citizens differs from the shopping behaviour of other population groups. According to Jókövi en Lübke (2004) senior citizens often like to shop close to home, because it offers a sense of safety and it is a place where they socialise. People of younger generations more often like to participate in so called 'fun shopping' activities. This entails that shopping is combined with other leisure activities. In this way shopping often becomes part of day trip for which people are willing to travel to destinations located further away (Evers et al., 2014).

Degree of urbanisation

According to Christaller's (1933) central place theory a minimum number of physical interactions are required in order for retailers to run a successful business. Food related products are purchased on a daily basis, therefore shopkeepers focussed on the sale of daily products generally only need a small number of customers in order to run a successful business. Non-daily products such as clothes and electronics are purchased less frequently, therefore these shopkeepers require a large cliental in order to run a successful business. This is the reason that in rural municipalities in which fewer people live, the focus lies predominantly with the sale of daily products. Generally, in municipalities with a more urbanised character the focus also lies with sale of non-daily products (I & O Research, 2016). According to DTNP (2013) particular types of non-daily products are easily purchased on the internet, while daily products are purchased rarely on the internet. This could potentially lead to differences in the way various types of municipalities are affected by the growth of online shopping (Weltevreden & Van Rietbergen, 2009; Dynamis, 2017).

2.3.3 Economic cycle

The demand for retail real estate is not only determined by the behaviour of consumers and the size of the population but also by the wealth of its consumers. The money consumers spend on retail is referred to as consumer spending. The amount of money that consumers are willing to spend on retail is for a large part determined by the economic cycle. During times of high conjuncture consumer spending is high and retailers are realising higher retail revenues which makes the retail real estate market attractive for new businesses, this is likely to lead to an increased demand for retail real estate. In times of low conjuncture consumer spending is low and retailers are realising lower retail revenues, therefore they might be forced to retract from the retail real estate market (Evers et al., 2014). Furthermore, during times of low conjuncture for the majority of retailers the market in not attractive to enter. Consequently, the demand for retail real estate will drop in times of low conjuncture. Figure

9 shows the so called 'conjunctuurklok', this is a parameter used as an indication for the economic cycle in the Netherlands (CBS [D], 2017). In this parameter all relevant economic information such as buying power, consumer confidence and producer confidence is incorporated and displayed as a deviation from the long-term trend (=0) of the economic cycle. Figure 9 illustrates that the 'conjunctuurklok' behaves capricious between the years 2011 and 2016. This means that during this period the economic cycle fluctuated considerably.

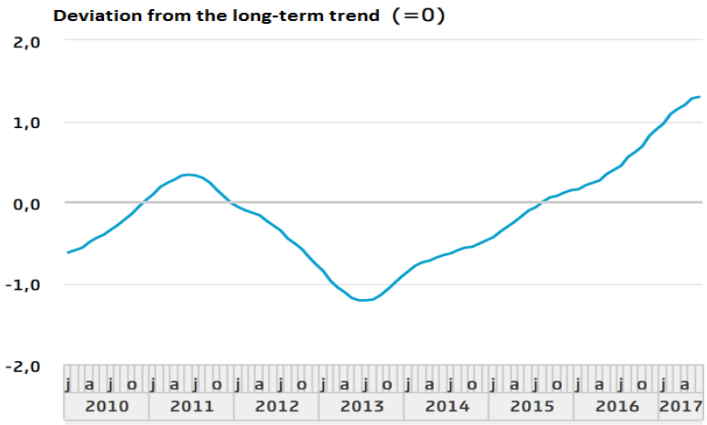

Figure 9: The Netherlands economic conjuncture (CBS [D], 2017)

The economic cycle is an indicator for the economic performance of the Netherlands as a whole. However, this does not necessarily contain information about the economic performance of individual municipalities. Therefore, the economic performance of a municipality is, apart from the economic cycle, also dependent on its specific regional economic performance (Teale, 2012).

2.3.4 Economies of Scale

On the retail real estate market processes of chain formation and scaling up are very common. In the last couple of decades adding square meters of floor space was considered to be the key to successful retailing and therefore shop keepers started demanding larger retail stores. In this way putting growing pressure on the demand side of the retail real estate market (PBL, 2013). According to DTNP (2013) this trend of scaling-up also continued in the post-crisis years. In these years the total floor space of the retail real estate market increased while the total number of retail stores stayed more or less constant. This shows that the process of scaling-up continued during and after the economic crisis. The rapid growth of occupied floor space in the previous decades was justified by the large growth of the population and the growing prosperity. Currently both the growth of the population and the growing prosperity in the Netherlands are slowing down, this means that the foundations behind scaling-up are starting to evaporate (PBL, 2011).

2.3.5 Magnet stores

Another factor on the demand side of the retail real estate market that has an effect on the performances of individual shopping centres is het presence of so called 'magnet stores'. The types of stores that are regarded as magnet stores are: department stores, discount stores

and supermarkets (Still & Simmonds, 2000; Gould, Pashigian & Prendergast, 2005). These types of stores attract customers who only visit a shopping centre, because of the presence of a particular magnet store. In this way these magnet stores create footfall for other nearby located stores (Brown, 1992; Koster et al., 2017). The idea is that customers who make a specific purchase at a magnet store are also seduced to make spontaneous purchases at other stores located in that same shopping centre. This means that the presence of a magnet store increases the demand for retail real estate in that particular shopping centre. Examples of magnet stores on the Dutch retail market are: De Bijenkorf, Primark, Zara, H&M, Albert Heijn and Jumbo.

2.3.6 Perceived attractiveness

The focus of the previous sections is mainly aimed at the effects of physical attributes on the demand for retail real estate. However, there are also psychological factors that influence the performances of shopping centres. This is referred to as the perceived attractiveness. With perceived attractiveness we consider the psychological factors that influence the attitudes of consumers towards specific shopping centres. These factors range from the attitudes of visitors towards tangible aspects such as parking facilities and hospitality facilities (Woodruffe-Burton et al., 2002; Weltevreden & Van Rietbergen, 2007; Teale, 2012), to the attitudes of consumers towards more intangible aspects such as accessibility, the diversity of stores, the ambiance and safety of shopping centres (Jókövi & Lübke, 2004; Weltevreden & Van Rietbergen, 2007; Berwyn, 2103).

2.4 Supply side of the retail real estate market

The supply side of the retail real estate market accounts for all occupied and non-occupied retail units, which is referred to as the stock of retail real estate. Over time through physical, functional and economic depreciation the stock decreases and through the development of new retail real estate the stock increases. The development of new retail real estate is mainly driven by expected profits, which are determined by the availability and cost of factors of production, predictions regarding future demand and prices and perceived market risk (Geltner et al., 2007).

Factors on the supply side of the retail real estate market that influence the attractiveness of the investment climate, and thereby the amount of retail real estate that is being developed, are: incorrect taxations of real estate, rent incentives, the capital market, asset portfolios, risk assessments, fiscal legislation and planning practices (PBL, 2013). In case the demand for retail real estate does not respond to the increase in the supply of retail real estate, the factors mentioned above could contribute to the increase in retail vacancy.

2.5 Conclusion

During the course of this chapter several aspects, that are allied to the retail property market, have been analysed by the means of an extensive literature study. In the continuation of this section we will discuss the most important findings.

In the first section of this chapter several location theories, that influence the current spatial retail structure, have been discussed. The first location theory that we discussed is introduced by Christaller (1933). His Central Place Theory describes the existence of a hierarchical network of retail agglomerations. In this network the largest cities have the largest catchment areas, which create an attractive retailing climate for selling a diverse range of non-daily products. In small villages the catchment areas are a lot smaller, which means that retailers will mostly likely only sell basic daily products. The size of the catchment area determines the number of physical interactions between retailers and consumers, which forms an important criterion for the locational choices of individual retailers.

Alonso's (1964) Bid-rent theory identifies a certain hierarchy within shopping centres. He argues that retailers are willing to pay the highest rents for the best accessible locations. These locations, often centrally located, are primarily occupied by large chain stores. Moving away from the centre the locations become less accessible and are home to individual shop keepers who cannot afford to pay the high rents. This creates a structure of very accessible main streets and less accessible adjacent run-in streets. Evers (2011) used the concept of accessibility to differentiate between A-, B- and C-locations within shopping centres. Main streets are considered as A-locations, while run-in streets are considered as B- or C-locations.

Furthermore, the law of retail gravitation introduced by Reilly (1933) shows that both the size of municipalities and the distance to shopping centres located within these municipalities influences the decisions of consumers. Finally, from the theory of cumulative attraction (Nelson, 1958) and the cumulative causation theory (1956) it becomes clear that the clustering of stores is beneficial from the perspective of both the retailer and the consumer.

In the third and fourth section of this chapter, factors that potentially have an effect on the market for retail real estate are introduced. Together these factors provide an answer to the first sub-question: *Which factors, besides online shopping, have an effect on the retail real estate market?*

In the literature a lot of attention is devoted to the future development of online shopping (Buursink, 1996; Gillespie et al., 2001; Tonn & Hemrick, 2004). Despite this attention, the actual effects of online shopping on the market for retail real estate remain a topic of scientific debate. In the literature four main perspectives are observed: substitution (Buursink, 1996; Weltevreden, 2007, complementarity (Salomon, 1986; Gillespie et al., 2001; Mokhtarian, 2002), neutrality (Mokhtarian, 2002; Weltevreden & Van Rietbergen, 2007) and modification (Ferrel, 2005).

Other factors that have an effect on the demand side of the retail real estate market are: retail revenue generated in municipalities (Weltevreden & Van Rietbergen, 2007; Dynamis, 2017), the composition of the population (Locatus, 2012; Van der Krabben, 2009; Bureau Stedelijke Planning, 2012), the economic cycle (Evers et al., 2014), economies of scale (PBL, 2013), magnet stores (Still & Simmonds, 2000; Gould et al., 2005) and perceived attractiveness (Teale, 2012; Berwyn, 2013)

3. Conceptualisation and Operationalisation

In this chapter the factors that, according to the literature, have the potential to affect the market for retail real estate are conceptualised and operationalised. The objective of this chapter is twofold. The first objective is to present a graphical overview of how the factors, introduced in the previous chapter, are expected to be related to the retail real estate market. The second objective is to operationalise the factors into measurable variables.

In the first section of this chapter we start of by elaborating on the choice to estimate the effect of online shopping, and the other factors discussed in the previous chapter, on the demand for retail real estate, instead of estimating these effects directly on retail vacancy. After which the factors and their expected effects on the demand for retail real estate are graphically displayed in a conceptual model. The data sources which have been consulted to collect the input data for the analysis phase are introduced in the second section of this chapter. Discussion these data sources is useful as they bring about certain data constraints, which determine part of the research scope. In section three the modelling choices are discussed in more detail. The operationalisation of factors into measureable variables takes place in section four. In the last section a complete overview is presented of the variables that are used in the analysis phase of this research.

3.1 Conceptual model

The economic functioning of retail real estate markets is often measured with the use of retail vacancy rates. Retail vacancy is the direct result of the mismatch between the demand for retail real estate and the supply of retail real estate. Figure 10 illustrates how retail vacancy is affected by both the demand for retail real estate and the supply of the retail real estate. Under the assumption that the supply is fixed an increase in the demand for retail space reduces retail vacancy. On the other hand, an increase in the supply of retail space increases retail vacancy, under the assumption that demand is fixed.

Figure 10: Mechanisms on the retail real estate market

In order to determine the effects of online shopping and the other factors incorporated in this research on the market for retail real estate, we would preferably like to examine the effects on retail vacancy directly. As mentioned in the introduction, the accessibility of the data on the supply side of the retail real estate market is limited. Therefore, this research is focused on the demand side of the retail real estate market only. Through the direct link between the demand for retail real estate and retail vacancy, under the assumption that the supply side of the market is fixed, statements about the performance of the market for retail real estate can still be made.

All the factors that have been introduced in the previous chapter which, according to the literature, are expected to affect the demand for retail real estate are displayed in figure 11.

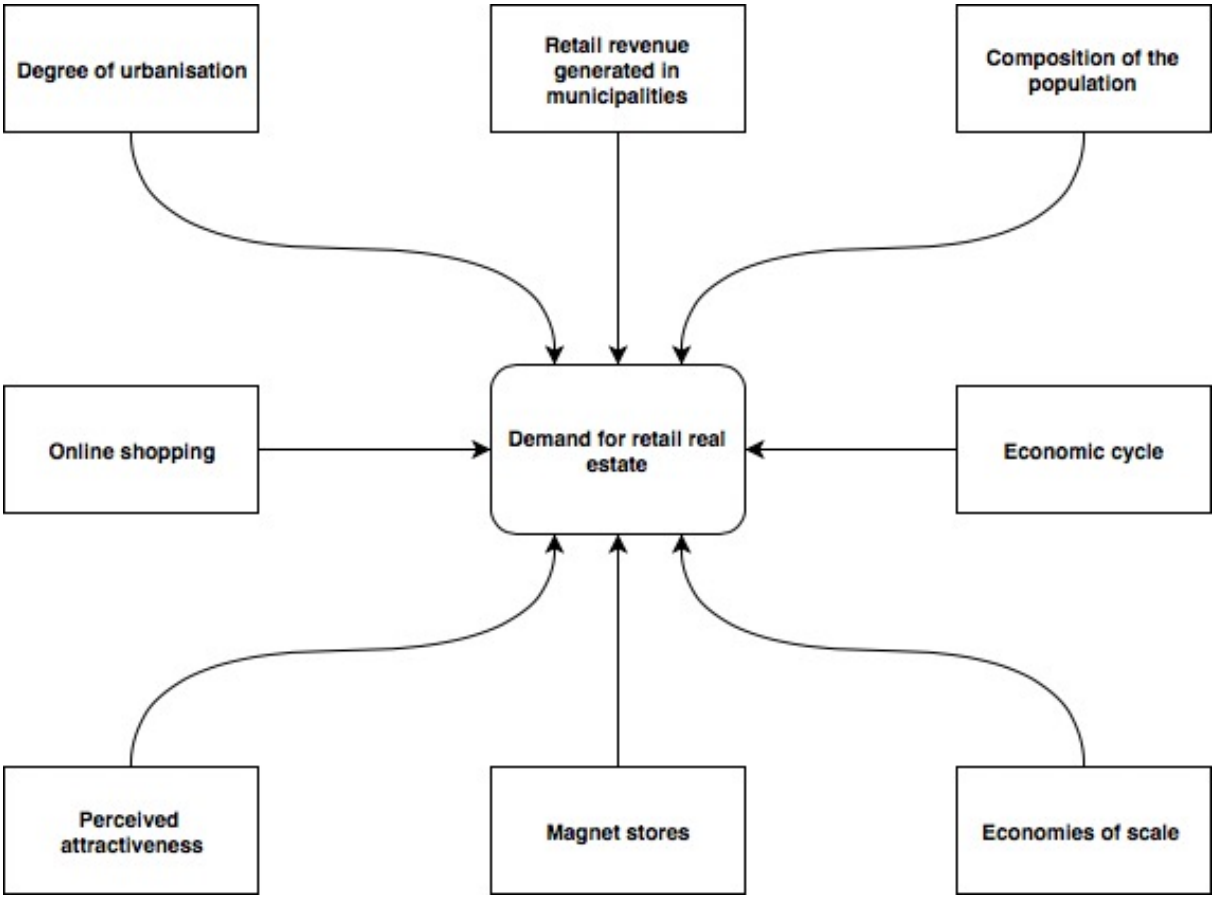

Figure 11: Overview of conceptual factors

The mutual relationships between online shopping and the other independent factors are left out of this conceptual model for reasons of simplicity and clarity. In case the mutual relations between the independent variables are of significant importance, they will be discussed in the correlation analysis performed in section 5.1.

3.2 Data sources

For this research two data sources are consulted. The first data source is a Dutch research report conducted by I & O Research (2011 & 2016) called 'Koopstromenonderzoek', in short KSO. Through analysing flows of consumer spending, this data source contains specific information regarding retail activity in the western part of the Netherlands. The other data source used in this research is a database provided by Statistics Netherlands.

3.2.1 KSO

KSO is an initiative of the three provinces: Noord-Holland, Utrecht and Zuid-Holland which are part of the Randstad, in collaboration with the regions and municipalities located within these provinces. The goal of the KSO is to gain insight into the actual developments on the retail real

estate market. To achieve this, the KSO uses over 100.000 surveys to map the developments of consumer spending in the three provinces. From this information, conclusions can be drawn about the economic functioning of a total of 122 municipalities. This research has thus far been conducted three times; in the years 2004, 2011 and 2016. Each edition of the KSO contains more comprehensive information than the preceding edition of the KSO.

3.2.2 Statistics Netherlands

Every year Statistics Netherlands publishes a spreadsheet containing key figures about municipalities, districts and neighbourhoods. The data incorporated in this document is retrieved from the organisation's own 'StatLine' database. This database contains predominantly sociodemographic information.

3.3 Justification of modelling choices

In order to be able to realise the research objective defined in section 1.3 of this research, a number of modelling choices are made. Each of them is discussed briefly in this section.

The first modelling choice is to use a research sample consisting of municipalities as the unit of analysis. The reasons for using municipalities is that the KSO only publishes data concerning online shopping on the municipal level of aggregation.

Secondly, as already mentioned in section 1.5, the choice is made to not only incorporated municipalities located in the province of Zuid-Holland, but to also incorporate municipalities located in the provinces of Noord-Holland and Utrecht. The reason behind this is to improve the statistical power of the multiple regression analysis. Combined the three provinces contain a total of 122 municipalities.

Finally, due to the limited accessibility of data, the factors 'economies of scale', 'magnet stores' and 'perceived attractiveness' are not incorporated in the regression analysis.

3.4 Operationalisation

In this section the factors introduced earlier in this research are operationalised into measurable variables. This is done through matching the factors of the conceptual model with the available data in the databases of the KSO and Statistics Netherlands. Table 2 gives an overview of the variables that represent the different factors incorporated in this research.

Table 2: Operationalisation of factors

Variable label	Unit of measurement	Data source
dependent		
Demand for retail real estate		
Amount of occupied square meters of retail floor space (daily)	[[m^2]/1000]	KSO and Statistics Netherlands
Amount of occupied square meters of retail floor space (non-daily)	[[m^2]/1000]	KSO and Statistics Netherlands
Amount of occupied square meters of retail floor space (total)	[[m^2]/1000]	KSO and Statistics Netherlands
Number of occupied retail stores (daily)	[Number of retail stores]	KSO and Statistics Netherlands
Number of occupied retail stores (non-daily)	[Number of retail stores]	KSO and Statistics Netherlands
Number of occupied retail stores (total)	[Number of retail stores]	KSO and Statistics Netherlands
independent		
Online shopping		
Online expenditures (daily)	[Million euros]	KSO
Online expenditures (non-daily)	[Million euros]	KSO
Online expenditures (total)	[Million euros]	KSO
Retail revenue generated in municipalities		
Retail revenue (daily)	[Million euros]	KSO
Retail revenue (non-daily)	[Million euros]	KSO
Retail revenue (total)	[Million euros]	KSO
Composition of the population		
Average household size	[Inhabitants/household]	Statistics Netherlands
Percentage elderly citizens	[Inhabitants older than 65 years/total inhabitants] * 100	Statistics Netherlands
Economic cycle		
Average income of inhabitants	[Euro/inhabitant]	Statistics Netherlands
Degree of urbanisation		
Number of inhabitants	[Inhabitants]	Statistics Netherlands

Most factors are operationalised fairly straightforward. An exception to this is the factor the degree of urbanisation. Instead of being operationalised as the proportion of built surface area of the total surface area, this factor is operationalised as the number of inhabitants. The reason for this is that specific data on the degree of urbanisation is not accessible. We believe that the number of inhabitants is a good alternative for operationalising the degree of urbanisation, because in general the more inhabitants live in a municipality the more urbanised the municipality becomes.

3.5 Conclusion

In this chapter an effort is made to conceptualise and operationalise the factors that potentially have an effect on the demand for retail real estate. These efforts result in a final conceptual model, presented in figure 12. This conceptual model provides the reader with insights into the relevant relationships between the different variables that are entered into the multiple regression analysis later on in this research.

Figure 12 shows that in total six variables are incorporated in this research. The main interest of this research lies with empirically examining the effects of growing online expenditures on the demand for retail real estate. Moreover, we want to examine whether the other five variables influence the demand for retail real estate.

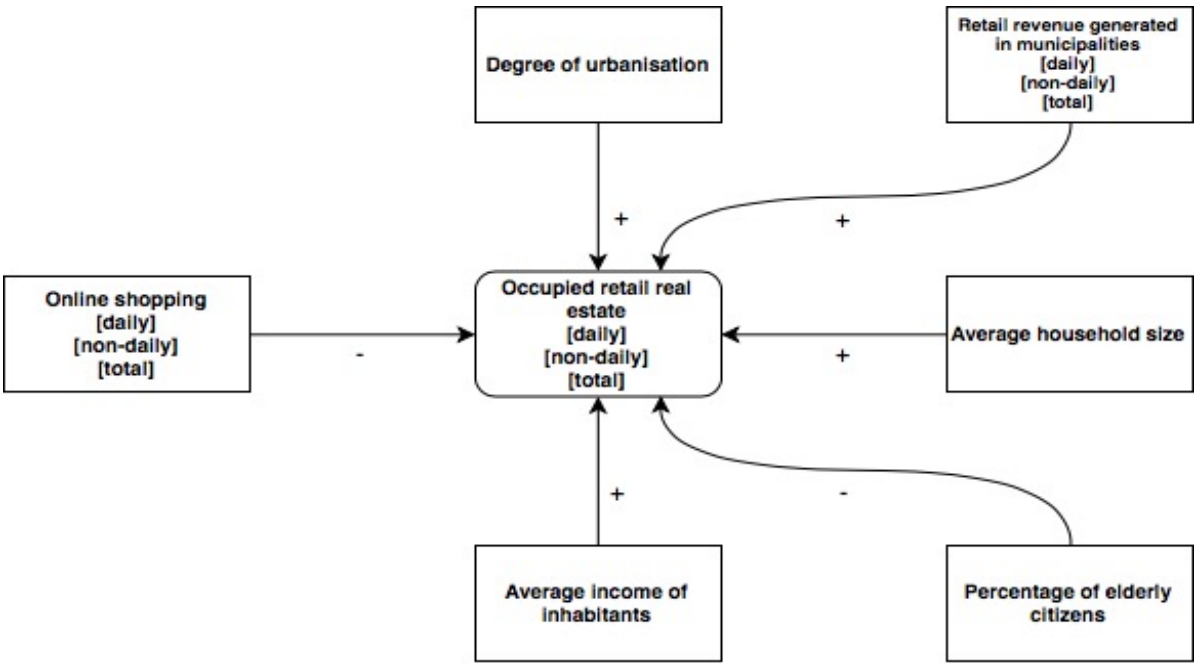

Figure 12: Conceptual model with operationalised variables

Both data sources used in this research contain a high level of data specificity, which allows for the estimation of a number of different multiple regression models. In the KSO a distinction is made between data related to stores selling daily products, stores selling non-daily products and stores selling daily and non-daily products combined. Furthermore, in the KSO the data regarding the amount of occupied retail real estate is measured in both square meters of floor space as well as in the actual number of stores. This allows for the estimation of a total of six different multiple regression models. An overview of these models is presented in table 3.

Table 3: Overview of the six different models

Model number	Focus area	Unit of measurement dependent variable
1	Demand for retail real estate (daily + non-daily products)	Occupied m^2 (daily + non-daily)
2	Demand for retail real estate (daily + non-daily products)	Occupied number of objects (daily + non-daily)
3	Demand for retail real estate (non-daily products)	Occupied m^2 (non-daily)
4	Demand for retail real estate (non-daily products)	Occupied number of objects (non-daily)
5	Demand for retail real estate (daily products)	Occupied m^2 (daily)
6	Demand for retail real estate (daily products)	Occupied number of objects (daily)

4. Descriptive statistic

In chapter 3 the conceptual factors have been operationalised into measurable variables. In this chapter a general introduction to these variables and the corresponding data is presented. The objective of this chapter is to introduce the data to the reader in order to give them a feeling for the data that is used in this research. This will help the reader to understand what is actually being examined in the analysis phase of this research.

In section one a closer look is taken at the distribution of the different types of municipalities that are incorporated in this research. In section two the development of the trends on the retail real estate market and the trends of the variables that are expected to affect the demand for retail real estate are described. In this section the numeric values of the dependent variables and all the independent variables are presented separately for the years 2011 and 2016. The differences in the trends of the data concerning rural municipalities and urban municipalities are displayed in section three. This section provides an indication whether the trends behave differently in rural municipalities compared to urban municipalities. In section four the characteristics of the province of Zuid-Holland are compared with the characteristics of the provinces of Noord-Holland and Utrecht combined. In this section the similarities and differences between the provinces are highlighted. In section four we will more specifically explore the characteristics of the data as it is actually used in the analysis phase. The input data represents the change in numeric value between the years 2011 and 2016. Therefore, this data is not as easily interpretable as the data presented in the first three sections of this chapter.

4.1 Sample characteristics

In this research one single research sample is used for estimating a total of six multiple regression models. This sample consists of a total of 122 municipalities located in the provinces Noord-Holland, Utrecht and Zuid-Holland. The characteristics of these 122 municipalities differ significantly. Moreover, the shopping function that these municipalities perform within the whole network of municipalities varies considerably. Part of the interest of this research lies with examining how the demand for retail real estate is affected in municipalities with varying degrees of urbanisation. For this reason, the research sample is divided into two approximately equal-sized groups. One group consists of municipalities with a generally rural character. The second group consists of municipalities with mainly an urban character. The mark of 35.000 inhabitants is used to differentiate between these two groups. In which municipalities with less than 35.000 inhabitants are considered as rural and municipalities with more than 35.000 inhabitants are considered as urban. The mark of 35.000 is also used by I & O Research (2016) to categorise different types of municipalities into different groups.

Table 4 shows that in both years the distribution between rural and urban municipalities is exactly equal. Furthermore, from table 4 it can be observed that there are

twelve missing values. The missing values belong to the following municipalities: Alblasserdam, Albrandswaard, Cromstrijnen, Giessenland, Hardinxveld-Giessendam, Hendrik-Ido-Ambacht, Korendijk, Leerdam, Molenwaard, Sliedrecht, Strijnen and Zederik. This means that these twelve municipalities cannot be used in the analysis phase of this research. This reduces the research sample to 110 municipalities.

Furthermore, between the years 2011 and 2016 national policy was introduced aimed at making municipalities more efficient. The government tried to achieve this through merging small adjacent municipalities into a single larger municipality (Provincie Zuid-Holland [A], 2014). An example of this is the merging of the municipalities of Bussem, Naarden en Muidem into one municipality called Gooise Meren in the year 2016. In order to be able to incorporate these cases, minor mutations to the data are made. The way the data has been mutated to incorporate these cases is explained in Appendix A: Data Modification.

Table 4: Municipalities entire research sample categorised according to number of inhabitants

Degree of urbanisation	Frequency (2011)	Percent (2011)	Frequency (2016)	Percent (2016)
Rural municipalities (inhabitants < 35.000)	55	45,1	55	45,1
Urban municipalities (inhabitants > 35.000)	55	45,1	55	45,1
Missing values	12	9,8	12	9,8
Total	122	100,0	122	100

Table 5 shows that 60 municipalities are located in the province of Zuid-Holland. Moreover, from the table it follows that all twelve municipalities of which no data is accessible are located in the province of Zuid-Holland. Consequently, 48 municipalities located in Zuid-Holland are incorporated in the total research sample of 110 municipalities. In both the years 2011 and 2016 the group of municipalities with a rural character consists of 23 municipalities, while the group of municipalities with an urban character contains 25 municipalities. This means that proportionally Zuid-Holland contains slightly more urban municipalities than the provinces of Noord-Holland and Utrecht. However, the difference is minimal, which means that the distribution of rural and urban municipalities in Zuid-Holland is pretty similar to the distribution of rural and urban municipalities in the provinces of Noord-Holland and Utrecht.

Table 5: Municipalities in Zuid-Holland categorised according to number of inhabitants

Degree of urbanisation	Frequency (2011)	Percent (2011)	Frequency (2016)	Percent (2016)
Rural municipalities (inhabitants < 35.000)	23	38,3	23	38,3
Urban municipalities (inhabitants > 35.000)	25	41,7	25	41,7
Missing values	12	20	12	20
Total	60	100,0	60	100,0

4.2 General trends

In this section the trends on the demand side of the retail real estate market are explored. The average values per municipality are presented for both the years 2011 and 2016. In the first sub-section the trends concerning the demand for retail real estate, measured in both square meters of retail floor space and number of retail stores, are displayed. In the second sub-section the trends of the various independent variables used in this research are presented.

4.2.1 Trends of demand for retail real estate

Figure 13 shows the trends of the average amount of occupied square meters of retail floor space per municipality for stores selling daily products, stores selling non-daily products and for stores selling daily and non-daily products combined. Figure 14 shows the trends of the average number of occupied retail stores per municipality for stores selling daily products, for stores selling non-daily products and for stores selling daily and non-daily products all together.

Both figures paint a similar picture regarding the trends of the average demand for retail real estate per municipality. Both the average amount of occupied square meters of retail floor space per municipality and the average number of occupied retail stores per municipality of stores selling daily products show a slight increase between the years 2011 and 2016. For stores selling non-daily products both the average amount of occupied square meters of retail floor space per municipality and the average number of occupied retail stores per municipality decreased between 2011 and 2016. The decrease in the average amount of occupied non-daily occupied retail real estate per municipality is stronger than the increase in the average amount of daily occupied retail real estate per municipality. This results in the fact that both the average amount of occupied square meters of retail floor space per municipality and the number of occupied retail stores per municipality show a slight decrease between 2011 and 2016.

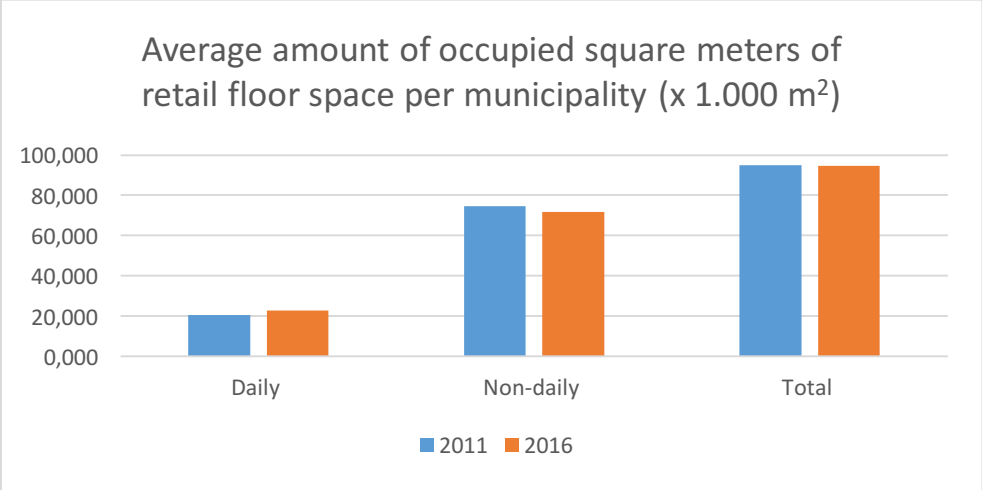

Figure 13: Demand for square meters of retail floor space

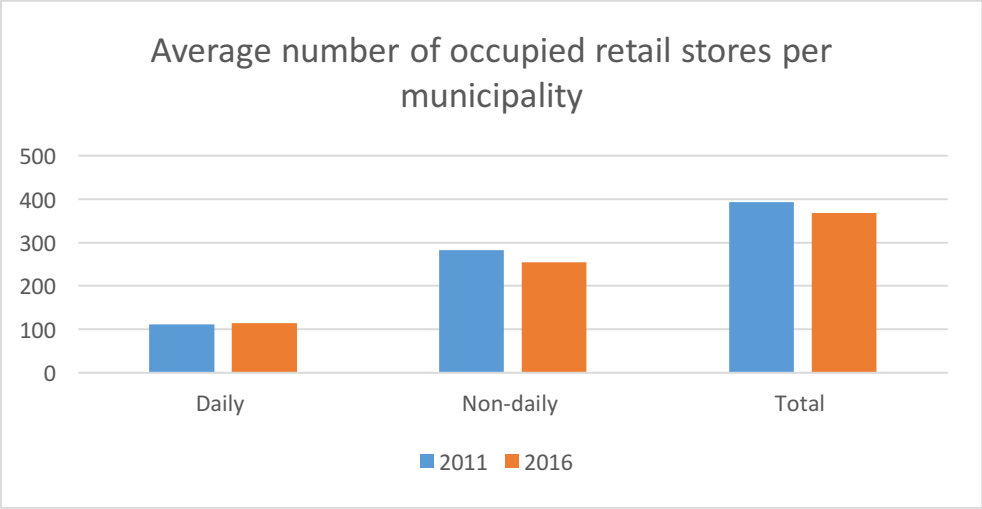

Figure 14: Demand for retail stores

4.2.2 Trends of the independent variables

The average amount of online expenditures per municipality in the three provinces more than doubled between the years 2011 and 2016, as shown in figure 15. The average non-daily online expenditures per municipality increased from around 18 million euros in 2011 to close to 41 million euros in 2016. The average daily online expenditures per municipality increased form 1,5 million euros in 2011 to 2,9 million euros in 2016. Resulting in a total increase in average online expenditures per municipality from close to 20 million euros in 2011 to more than 43 million euros in 2016.

These figures show that the inhabitants of the provinces of Noord-Holland, Utrecht and Zuid-Holland have significantly increased their online expenditures between 2011 and 2016. Although the percentage increase in both daily as well as non-daily online expenditures between the years 2011 and 2016 is very high, the large increase in real values of the average total online expenditures per municipality is caused by the increase in non-daily online expenditures.

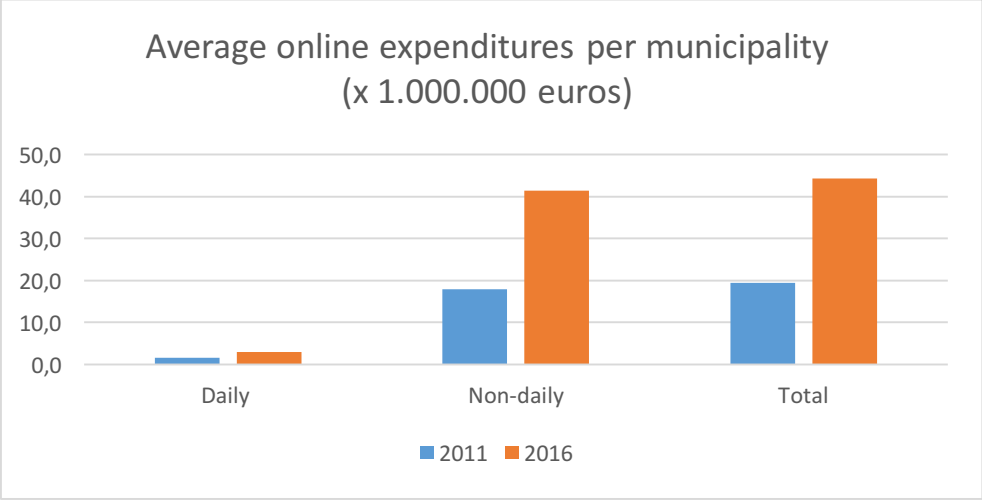

Figure 15: Online expenditure

The trends concerning the average retail revenue generated in municipalities are shown in figure 16. The increase in the average retail revenue generated in municipalities of stores selling daily products is rather similar to the increase in the average retail revenue generated in municipalities of stores selling non-daily products between the years 2011 and 2016. Collectively this adds ups to a considerable increase in the average total retail revenue generated in municipalities between 2011 and 2016.

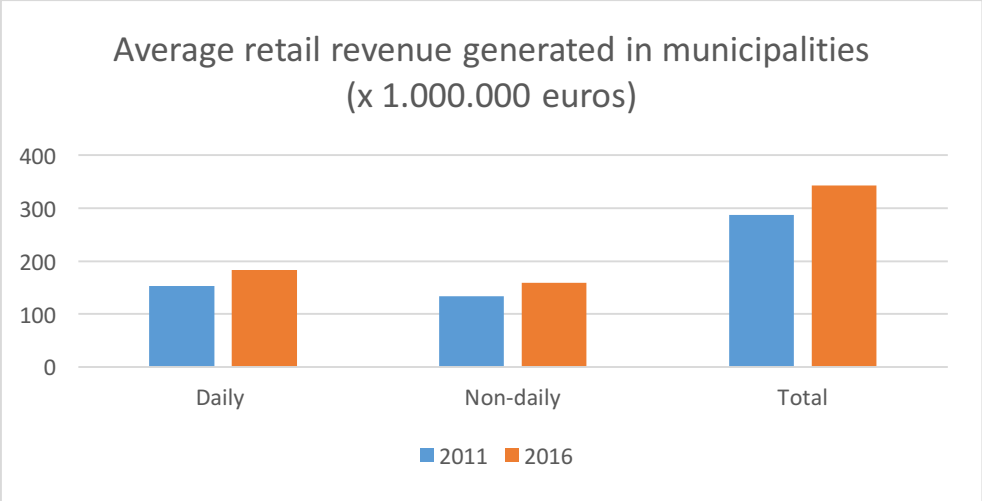

Figure 16: Retail revenue generated in municipalities

In figures 17 and 18 the trends about the composition of the population are presented. Figure 17 shows the trend of the average household size per municipality, which decreased slightly from 2,3 persons per household in 2011 to 2,26 persons per households in 2016.

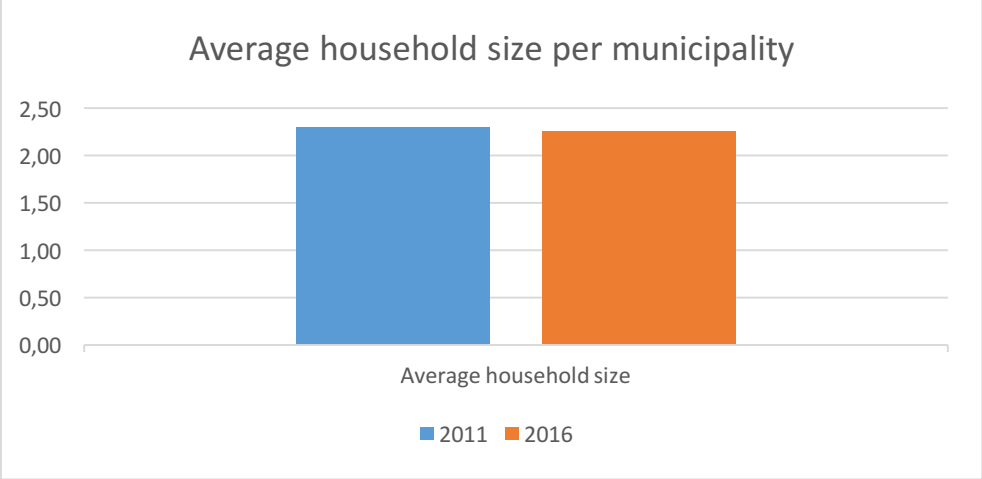

Figure 17: Household size

Figure 18 shows the trends regarding the average percentage of elderly citizens per municipality between 2011 and 2016. In the municipalities located in the provinces of Noord-Holland, Utrecht and Zuid-Holland the average percentage of elderly citizens per municipality has increased from approximately sixteen percent in 2011 to over nineteen percent in 2016.

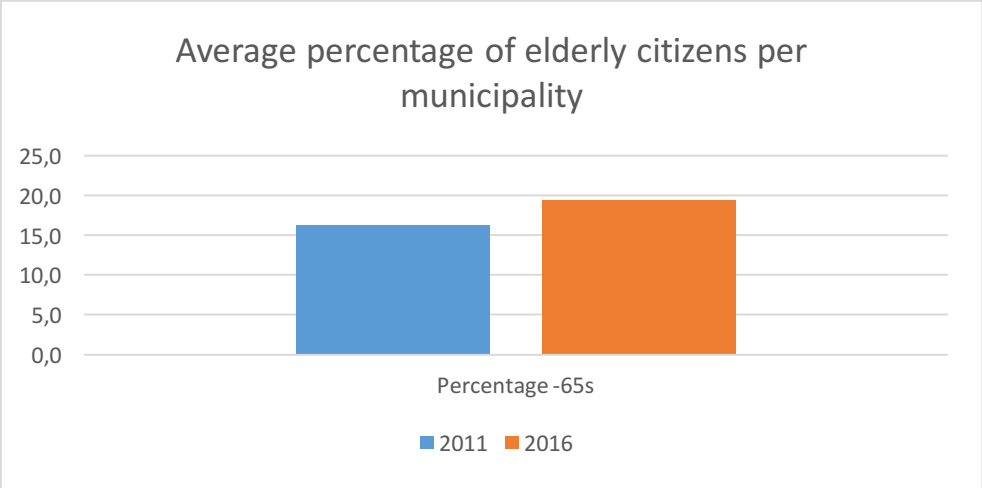

Figure 18: Percentage of elderly citizens

Figure 19 exhibits that in the period between 2011 and 2016 the average income of inhabitant per municipality has increased by 1800 euros. This increase is mainly due to the increase in the number of people who are employed. Their occupation gives them a higher income; this has a positive effect on the average income of inhabitants living in municipalities located in the three provinces (Troost, 2017).

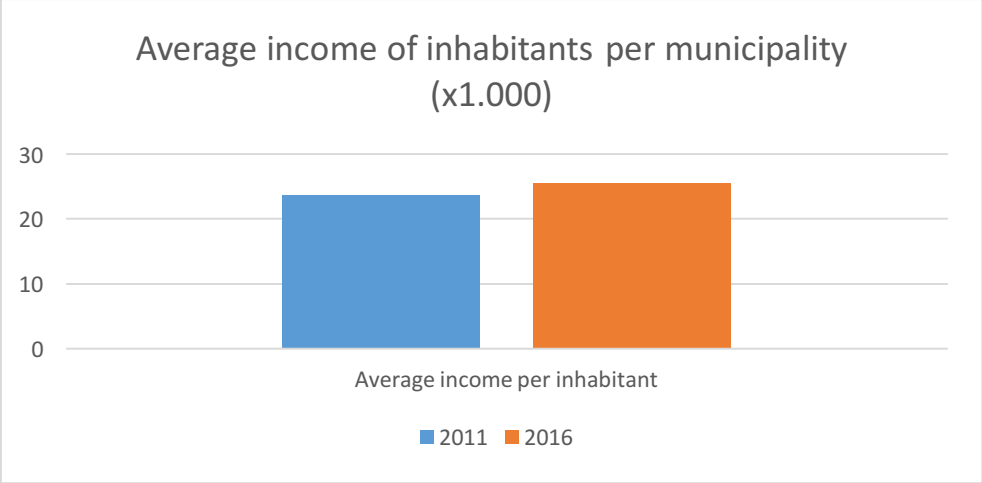

Figure 19: Income level

Figure 20 displays the average number of inhabitants in municipalities located in the provinces of Noord-Holland, Utrecht and Zuid-Holland. The figure shows that on average the number of inhabitants in municipalities increased by approximately 2.000 inhabitants.

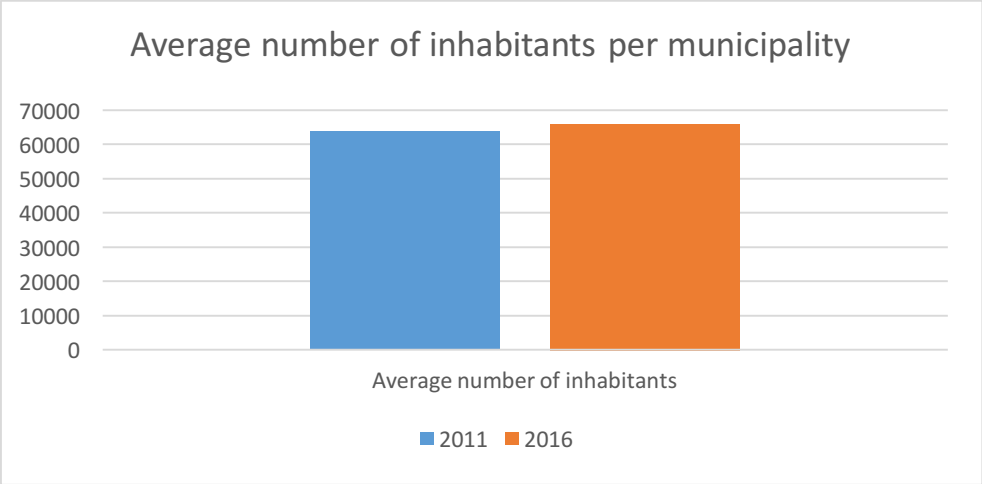

Figure 20: Number of inhabitants

In this section the general trends in the data have been presented. Both the average amount of occupied square meters of retail floor space and the average number of occupied retail stores concerning daily products per municipality increased between 2011 and 2016. On the other hand, the average amount of occupied square meter of retail floor space and the average number of occupied retail stores regarding non-daily products per municipality decreased between 2011 and 2016. Secondly, on average the online expenditures within municipalities increased considerably between 2011 and 2016. Moreover, the average amount of revenue generated in municipalities also increased between 2011 and 2016. Thirdly, the average household size per municipality decreased slightly, while the average percentage of elderly citizens per municipality increased significantly between 2011 and 2016. Finally, the average income of inhabitants per municipality and the average number of inhabitants per municipality increased slightly between 2011 and 2016.

4.3 Differences between rural and urban municipalities

In this section a closer look is taken at the differences in the data between rural municipalities and urban municipalities, between the years 2011 and 2016. In this research rural municipalities are operationalised as municipalities containing fewer than 35.000 inhabitants, while urban municipalities are operationalised as municipalities with more than 35.000 inhabitants. In order to be able to compare these two groups of municipalities with each other we look at the average numeric value per inhabitant or per household living within a municipality, instead of looking at the average numeric values of the entire municipalities. A complete overview of the numeric values of the different variables in both rural municipalities as well as urban municipalities in the years 2011 and 2016 is presented in Appendix B: Characteristics of rural and urban municipalities.

Figure 21 displays the trends in the demand for square meters of retail floor space per inhabitant for both rural and urban municipalities. The figure shows that the trends in both groups of municipalities behave rather similar. The amount of occupied square meters of retail floor space for stores selling daily products per inhabitant increased slightly between 2011 and 2016. On the other hand, the amount of occupied square meters of retail floor space for

stores selling non-daily products per inhabitant decreased slightly. The overall amount of occupied square meters of retail floor space per inhabitant also decreased slightly between 2011 and 2016. A slight difference is that on average in urban municipalities there are more square meters of non-daily retail floor space per inhabitant compared to rural municipalities.

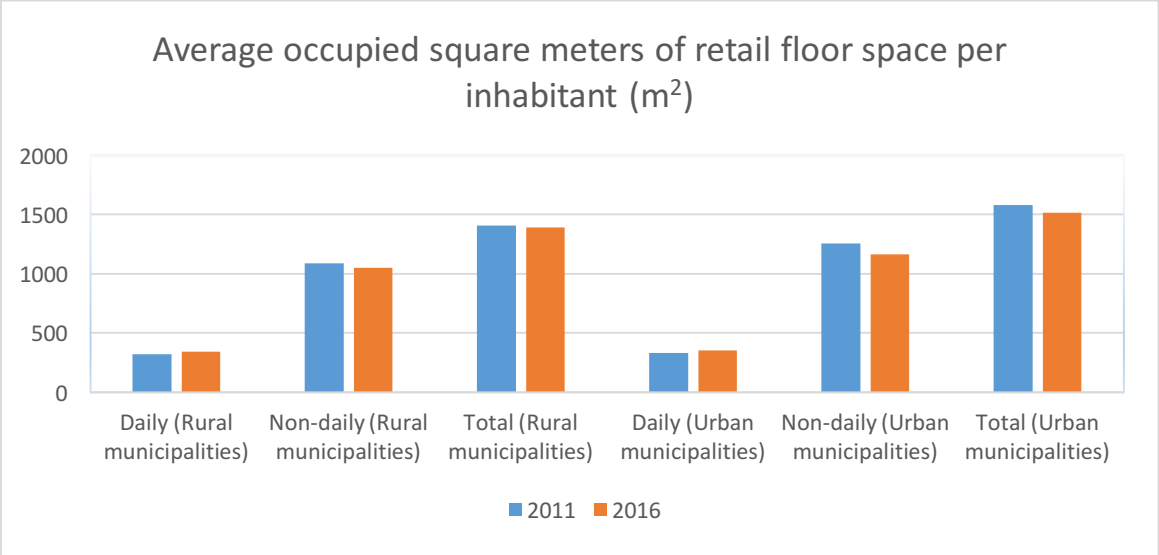

Figure 21: Demand for square meters of retail floor space per inhabitant

Figure 22 shows the trends in the demand for retail stores per inhabitant in both rural and urban municipalities. The number of occupied retail stores selling daily products per inhabitant showed a very slight decrease between. The number of occupied retail stores selling non-daily products per inhabitant decreased considerably. The total number of occupied retail stores per inhabitant also decreased considerably, between 2011 and 2016.

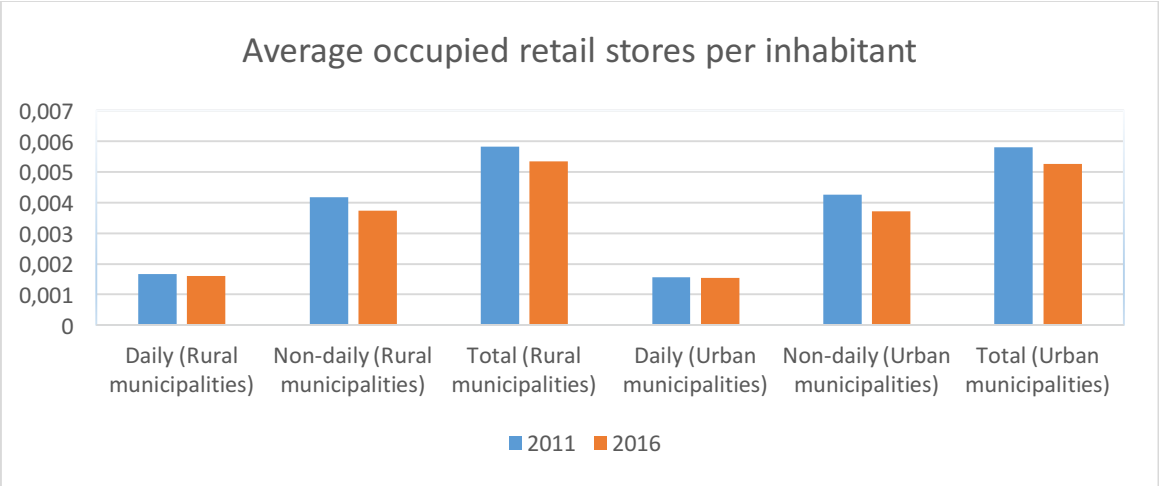

Figure 22: Demand for retail stores per inhabitant

Figure 23 presents the average online expenditures per inhabitant for both rural and urban municipalities. The trends in both types of municipalities behave rather similar. The average daily online expenditures per inhabitant increased very little, while the average non-daily online expenditures per inhabitant increased significantly. This also leads to a significant overall increase in online expenditures per inhabitant, between 2011 and 2016.

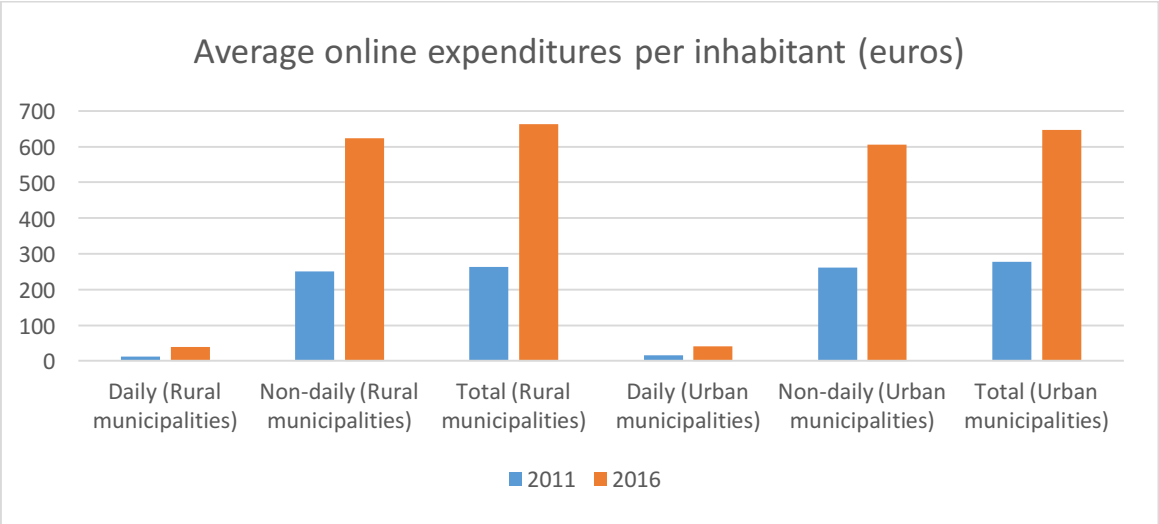

Figure 23: Online expenditures per inhabitant

Figure 24 displays the average retail revenue generated per inhabitant in both rural and urban municipalities. In both rural and urban municipalities, the average increase in retail revenue generated per inhabitant relating to both daily and non-daily products is of a relatively similar magnitude. Combined this results in a relatively strong increase in the average overall retail revenue generated per inhabitant in both rural as well as urban municipalities. A slight difference is that urban municipalities on average generated more revenue per inhabitant relating to non-daily products than rural municipalities. This is also translated in the total revenue generated per inhabitant.

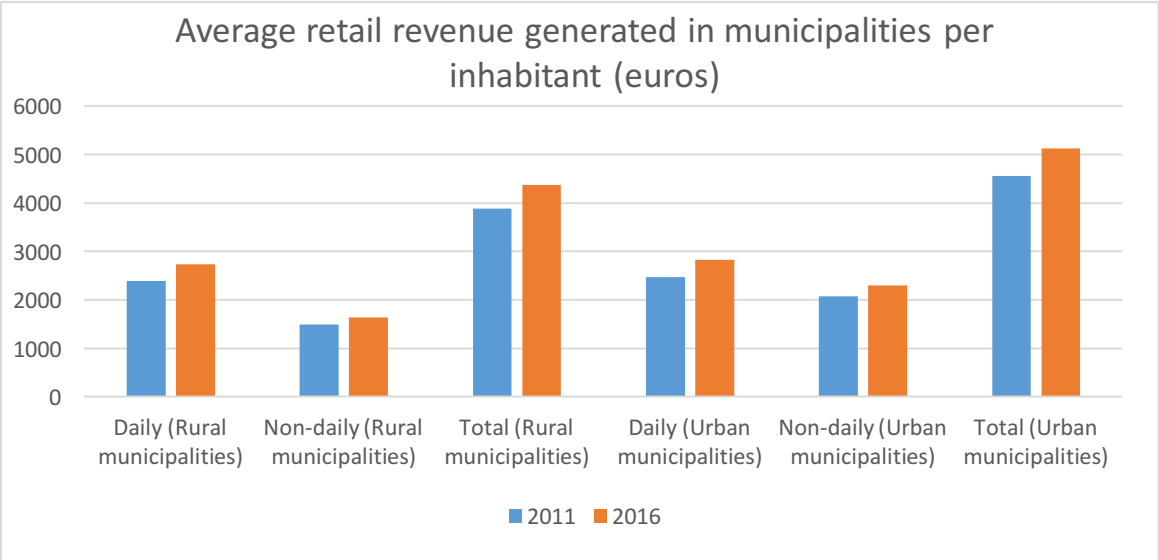

Figure 24: Retail revenue generated in municipalities per inhabitant

Figure 25 shows the average household size in both rural and urban municipalities. The figure makes clear that the average household size decreased very little in both rural and urban municipalities, between 2011 and 2016.

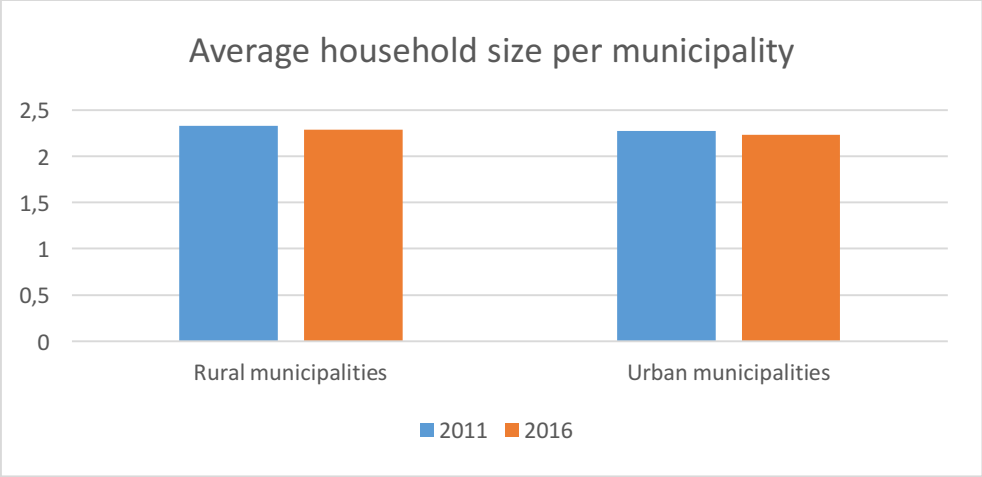

Figure 25: Average household size per municipality

Figure 26 shows that there is a slight difference in the behaviour of the average percentage of elderly citizens in rural and urban municipalities. In urban municipalities this percentage increased more than in rural municipalities, between the years 2011 and 2016. This has resulted in the fact that in 2016 the percentage of elderly citizens is approximately 20 percent in both rural as well as urban municipalities.

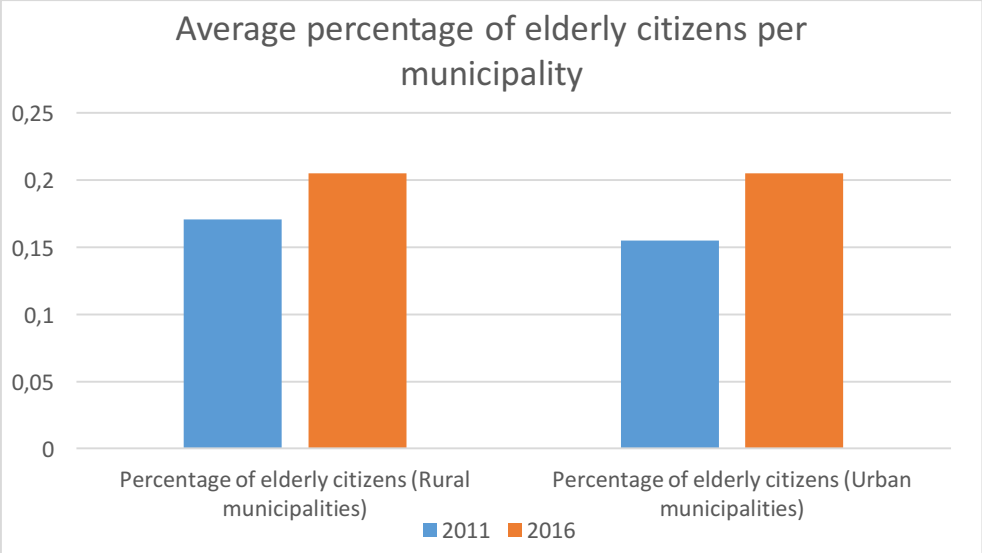

Figure 26: Percentage of elderly citizens per municipality

Figure 27 shows that the average income of inhabitants in rural municipalities is slightly higher than the average income of inhabitants in urban municipalities. However, the difference is small and lies around a couple of hundred euros.

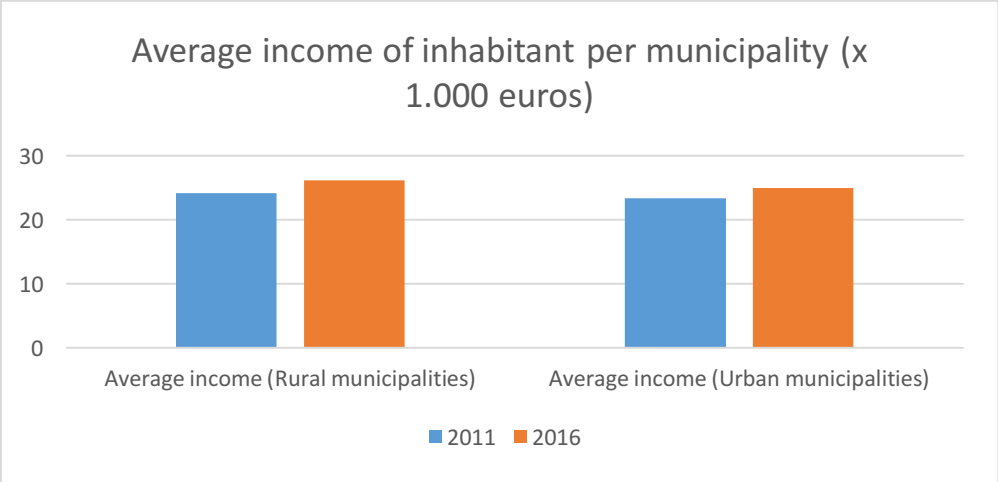

Figure 27: Average income of inhabitants per municipality

Figure 28 displays that the average number of inhabitants in rural municipalities decreased slightly between 2011 and 2016. On the other hand, the average number of inhabitants in urban municipalities increased slightly between 2011 and 2016.

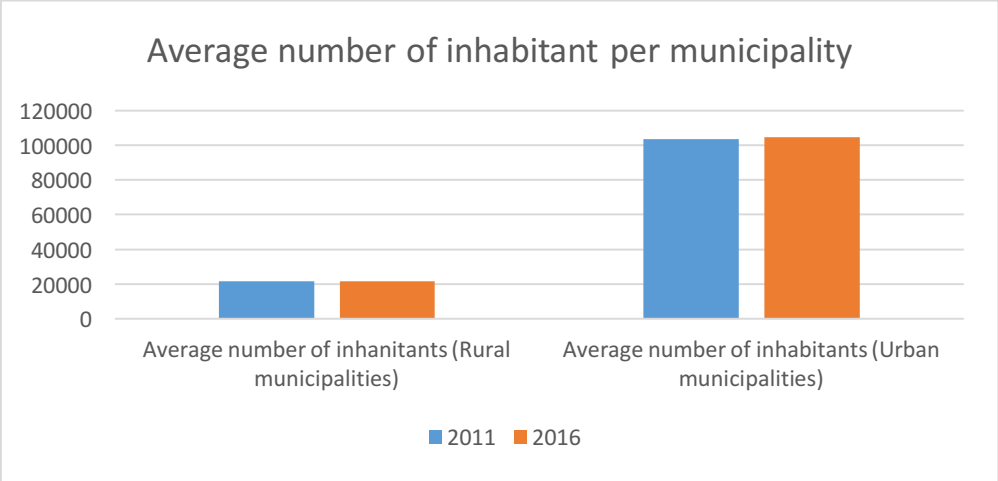

Figure 28: Number of inhabitants

In this section the differences between rural municipalities and urban municipalities have been presented. Overall the figures show that the trends in the two different groups of municipalities behave rather similar. Inhabitants in both rural and urban municipalities have approximately the same number of stores at their disposal, spent equal amounts of money online and have almost the same income. Moreover, the percentage of elderly citizens and the average household size are almost similar in both rural and urban municipalities. On the other hand, there are three slight differences between rural and urban municipalities. Firstly, on average in rural municipalities inhabitants have less retail floor space at their disposal compared to inhabitants of urban municipalities. Secondly, on average the amount of retail revenue generated per inhabitant in rural municipalities is lower than in urban municipalities. And finally, the average number of inhabitants in rural municipalities has decreased between

2011 and 2016, while the average number of inhabitants in urban municipalities has increased between 2011 and 2016.

4.4 Differences between provinces

In this section we will compare the data regarding the, for this research, important trends in the province of Zuid-Holland with the data about these same trends in the provinces of Noord-Holland and Utrecht combined, between 2011 and 2016. The provinces differ considerably in size and the number of inhabitants. Therefore, comparing the data as the sum of all municipalities located within the provinces is not useful. Consequently, the data is compared as the average value of the municipalities located within their associated provinces. A complete overview of the numeric values of the different variables in the three provinces in the years 2011 and 2016 is presented in Appendix C: Characteristics of the three provinces.

Figure 29 presents the differences in the average amount of occupied square meters of retail floor space per municipality, between municipalities located in Zuid-Holland and municipalities located in the other two provinces. In Zuid-Holland and the other two provinces the average amount of occupied square meters of retail floor space per municipality for stores selling daily products increased between 2011 and 2016, while the average amount of occupied square meters of retail floor space per municipalities for stores selling non-daily products decreased between 2011 and 2016. In Zuid-Holland the average total amount of occupied square meters of retail floor space per municipality slightly decreased between 2011 and 2016, while in the provinces of Noord-Holland and Utrecht the average total amount of occupied square meters of retail floor space increased slightly between 2011 and 2016.

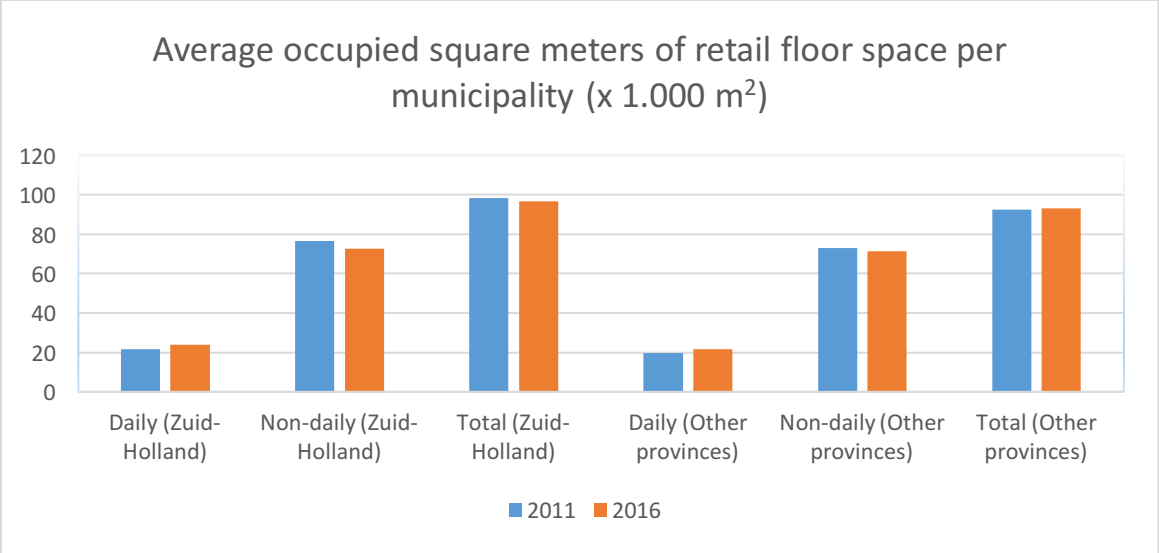

Figure 29: Demand for square meters of retail floor space per municipality

Figure 30 shows that the average number of occupied retail stores per municipality for municipalities located in Zuid-Holland and the other two provinces are almost identical. The average number of occupied retail stores selling daily products per municipality increased in all provinces. On the other hand, both the average number of occupied retail stores selling non-daily products per municipality and the average total number of occupied retail per municipality decreased between 2011 and 2016.

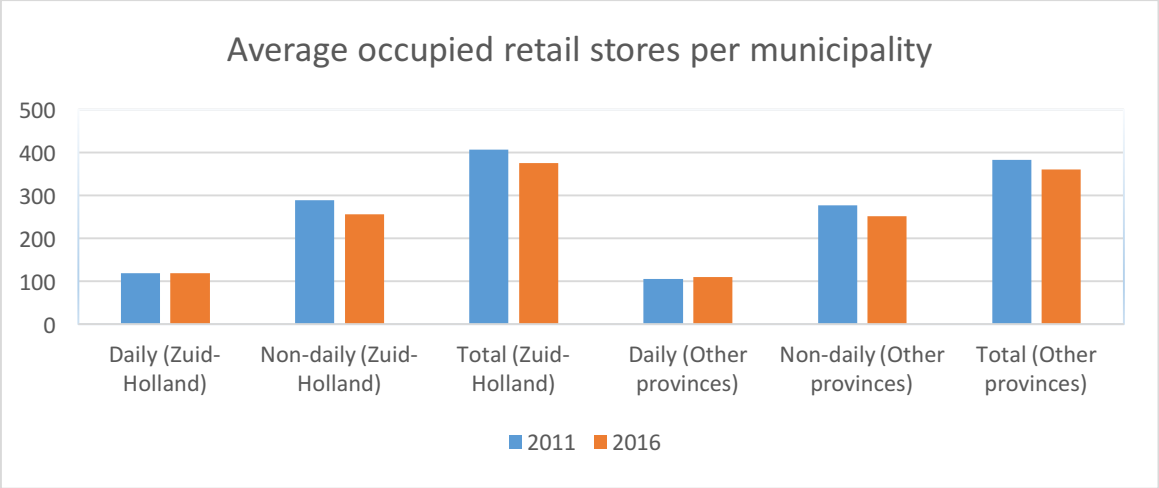

Figure 30: Demand for retail stores per municipality

Figure 31 compares the average online expenditures per municipality located in Zuid-Holland with the average online expenditures per municipality located in the provinces of Noord-Holland and Utrecht combined. The figure shows that the average online expenditures per municipality in Zuid-Holland are slightly higher than in municipalities located in Noord-Holland and Utrecht. Moreover, the figure also clearly shows that across all three provinces the average online expenditures per municipality increased significantly between 2011 and 2016.

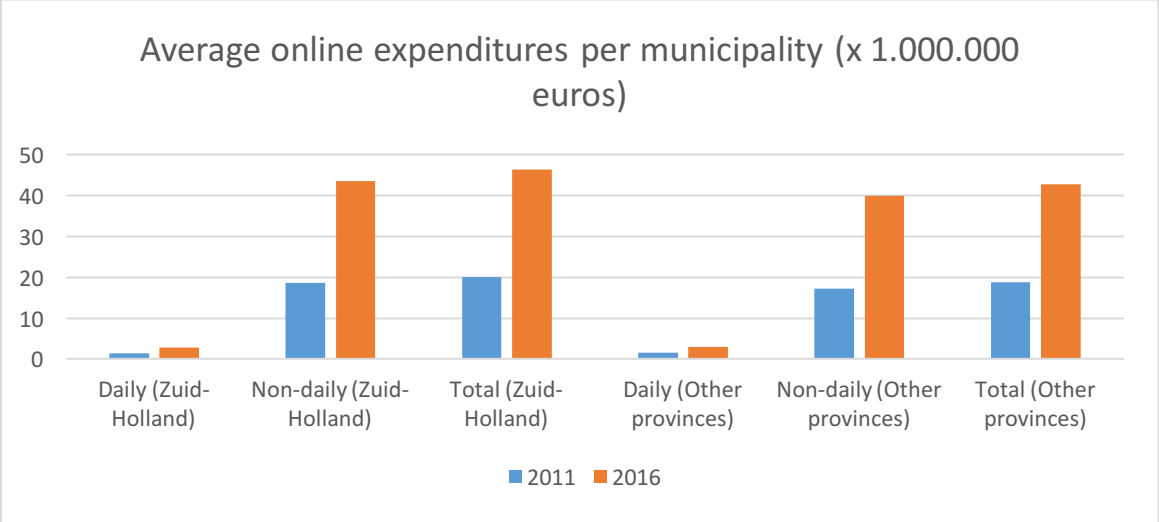

Figure 31: Online expenditures per municipality

Figure 32 portrays a picture of the average retail revenue generated per municipality in the province of Zuid-Holland as well as in the other two provinces combined. It can be witnessed that in both 2011 and 2016 the retail revenue generated per municipality is slightly higher in Zuid-Holland than the retail revenue generated per municipality in Noord-Holland and Utrecht. It can also be observed that the retail revenue generated in municipalities behaves pretty similar across the provinces between 2011 and 2016.

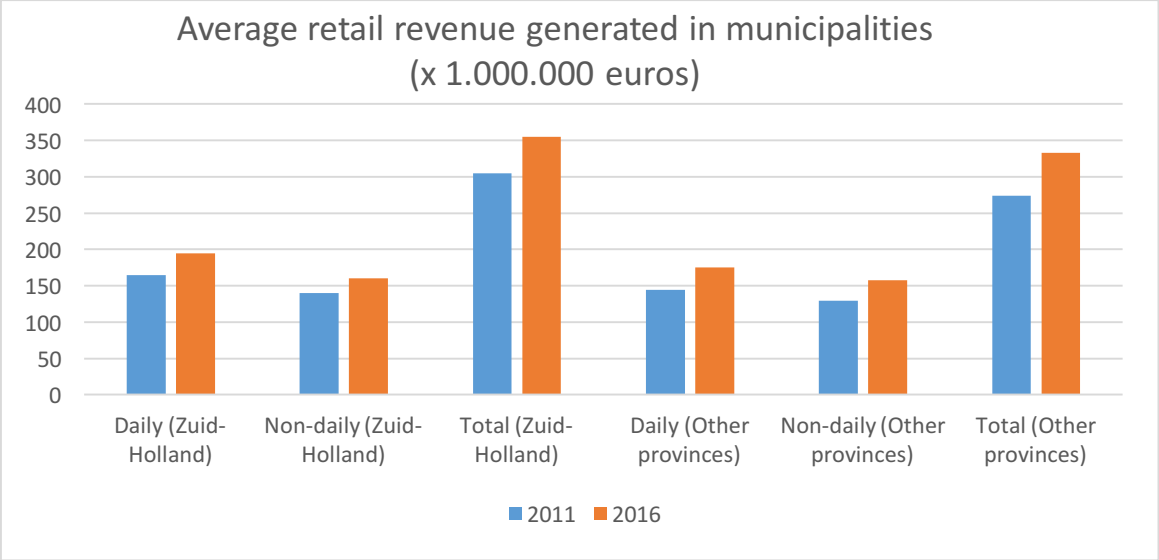

Figure 32: Retail revenue generated in municipalities

Figure 33 shows the average household sizes per municipality in Zuid-Holland and in the provinces of Noord-Holland and Utrecht combined. In both 2011 and 2016 the average household size of municipalities located in Zuid-Holland is slightly smaller than of municipalities located the provinces of Noord-Holland and Utrecht. On the other hand, the decrease in the average household size per municipality is pretty similar across the municipalities located in all three provinces.

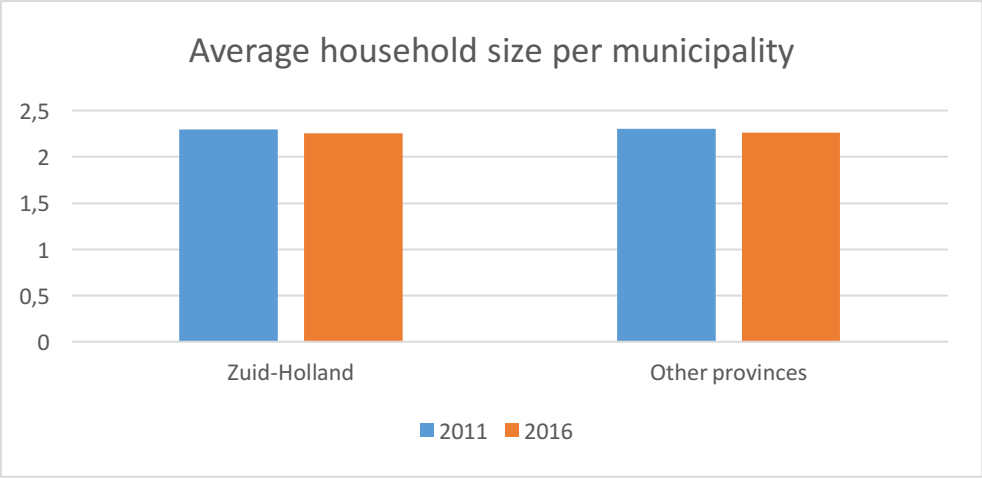

Figure 33: Average household size per municipality

The difference in the average percentage of elderly citizens between municipalities located in the province of Zuid-Holland and municipalities located in the other two provinces is presented in figure 34. In both 2011 and 2016 the average percentage of elderly citizens per municipality in Zuid-Holland is almost identical to the average percentage of elderly citizens per municipality in the other two provinces.

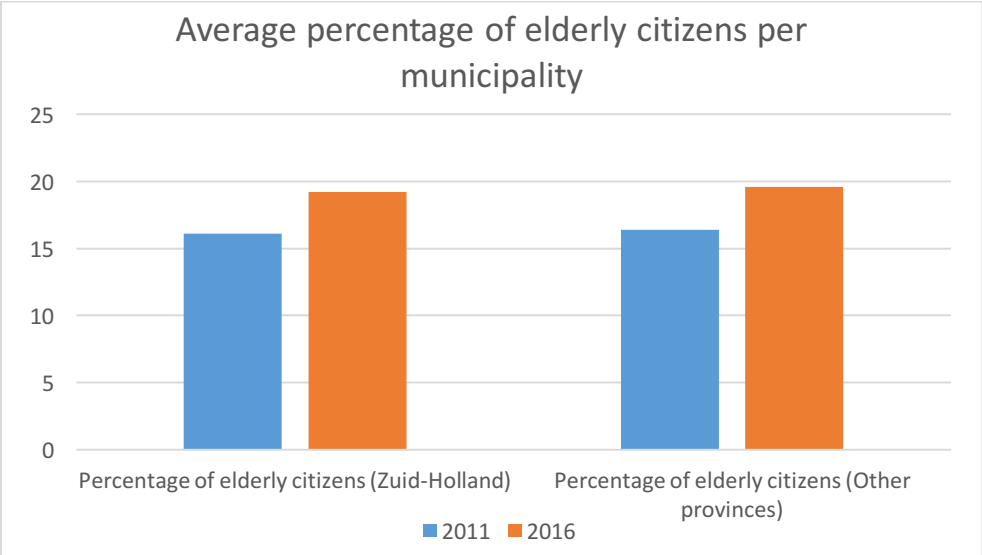

Figure 34: Percentage of elderly citizens per municipality

In figure 35 the average income of inhabitants per municipality in Zuid-Holland and the average income of inhabitants per municipality in Noord-Holland and Utrecht are compared. The figure displays that in both 2011 and 2016 the average income of inhabitants per municipality located in Zuid-Holland is a couple of hundred euros lower than the average income of inhabitants per municipality in Noord-Holland and Utrecht. What can also be observed is that the average income of inhabitant per municipality in all three provinces has risen with more than 1.500 euros in five years.

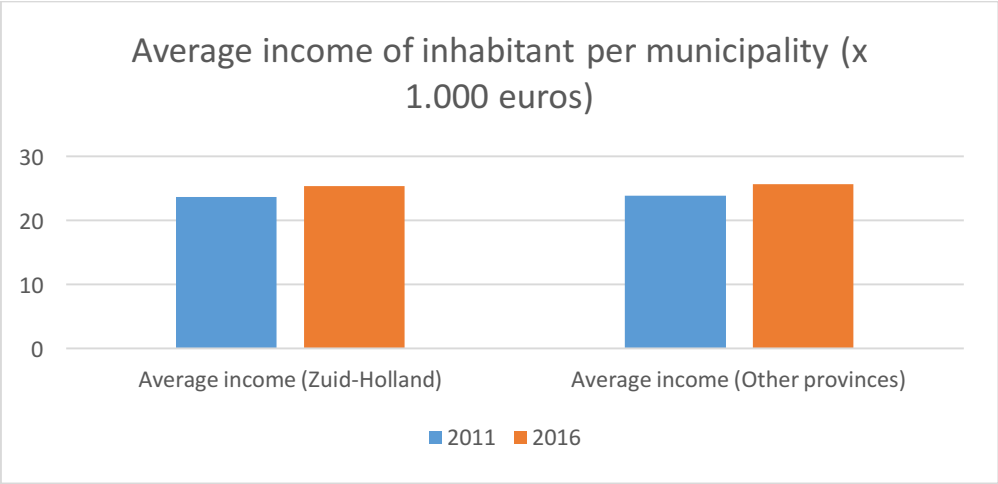

Figure 35: Average income of inhabitants per municipality

Figure 36 shows the average number of inhabitants per municipality in the province of Zuid-Holland and the provinces of Noord-Holland and Utrecht combined. From the figure it becomes clear that the municipalities located in Zuid-Holland have on average approximately 8.000 more inhabitants than municipalities located in the other two provinces. In both Zuid-Holland and in the other two provinces the average number of inhabitants per municipality have increased slightly.

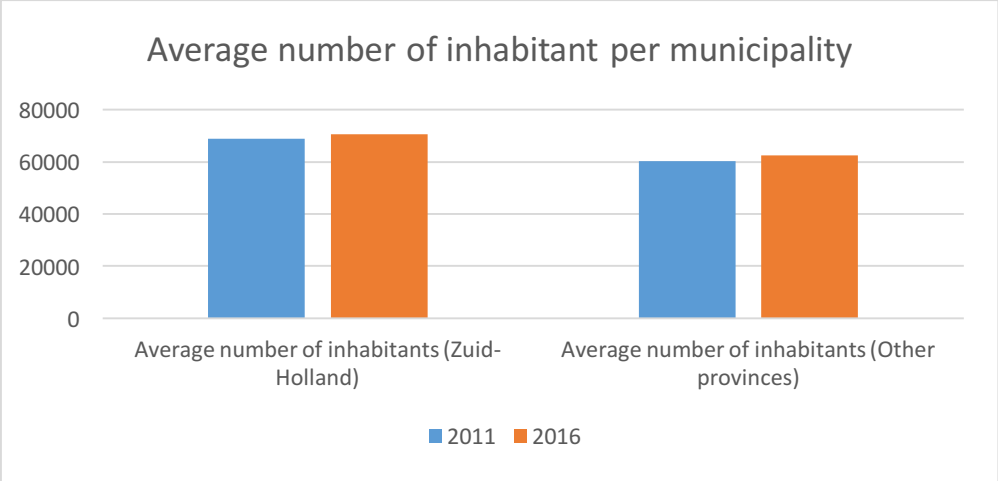

Figure 36: Number of inhabitants

In this section we compared the trends in the province of Zuid-Holland with the trends in the provinces of Noord-Holland and Utrecht combined. The overall picture across the different figures is that most trends behave rather similar. However, there are also a number of small differences between the province of Zuid-Holland and the other two provinces. Firstly, on average municipalities located in Zuid-Holland experienced a slight decrease in the total amount of occupied square meters of retail floor space, while the other two provinces combined experienced a slight increase. Secondly, the average online expenditures are higher in municipalities located in Zuid-Holland compared to municipalities located in Noord-Holland and Utrecht. The other trends between the municipalities located in the different provinces behave very similar.

4.5 Description of data used in the analysis phase

This section describes the actual input variables used in the analysis phase of this research, conducted in chapter 5: Results. In section 4.2, section 4.3 and section 4.4 the numeric values of the variables are displayed separately for the years 2011 and 2016, this is done in order to paint an easy interpretable picture of the trends of the relevant variables incorporated in this research. However, in order to examine the effects of the trends in the data of the different variables on the demand for retail real estate, a choice is made to examine the data over a period of time rather than at one static moment in time. The only years of which the KSO and CBS both published data are the years 2004, 2011 and 2016. The KSO of the year 2004 does not contain information regarding online expenditures. Consequently, in this research the

effects of online shopping and the other factors incorporated in this research on the demand for retail real estate are empirically examined over the period between 2011 and 2016.

The objective of this section is to give the reader a more detailed introduction to the characteristics of the input variables that are actually used in both the correlation analysis and the multiple regression analysis.

Table 6 gives a description of the minimum value, maximum value, average value and standard deviation for the variables used in this research measured as the numeric difference between the years 2011 and 2016. The most interesting insights from this table are elaborated on in more detail.

Table 6: Overview of variables (Δ 2016-2011)

Variable label	N	Minimum (Δ 2016-2011)	Maximum (Δ 2016-2011)	Mean (Δ 2016-2011)	Std. Deviation (Δ 2016-2011)
Dependent					
Demand for retail real estate					
Amount of occupied square meters of retail floor space (daily) (x 1.000)	110	-0,825	42,796	2,097	5,026
Amount of occupied square meters of retail floor space (non-daily) (x 1.000)	110	-39,793	32,066	-2,558	8,683
Amount of occupied square meters of retail floor space (total) (x 1.000)	110	-25,724	59,007	-0,461	10,005
Number of occupied retail stores (daily)	110	-16	105	2,25	13,567
Number of occupied retail stores (non-daily)	110	-259	19	-27,87	44,057
Number of occupied retail stores (total)	110	-204	41	-25,71	36,527
independent					
Online shopping					
Online expenditures (daily) (x 1.000.000 euros)	110	-15,2	19,9	1,377	3,0642
Online expenditures (non-daily) (x 1.000.000 euros)	110	1,8	313,7	23,639	40,804
Online expenditures (total) (x 1.000.000 euros)	110	2,0	298,5	25,016	41,353
Retail revenue generated in municipalities					
Retail revenue (daily) (x 1.000.000 euros)	110	-2,6	634,7	29,897	70,342
Retail revenue (non-daily) (x 1.000.000 euros)	110	-25,4	824,4	25,145	87,057
Retail revenue (total) (x 1.000.000 euros)	110	-15,0	1.459,1	55,043	155,993
Composition of the population					
Average household size	110	-0,1	0,1	-0,041	0,054
Percentage of elderly citizens	110	0,00	0,06	0,031	0,0108
Economic cycle					
Average income of inhabitant (x 1.000 euros)	110	1,0	5,8	1,802	0,659
Degree of urbanisation					
Number of inhabitants	110	-1.106	53.814	2026,84	6455,889

Table 6 shows a number of interesting things. Firstly, as also established in the previous sections, the amount of occupied non-daily floor space decreased on average, while the amount of occupied daily floor space increased on average in the 110 municipalities between 2011 and 2016. Secondly, the minimum numeric value of the following variables: online expenditures non-daily, online expenditures total, percentage of elderly citizens and average income of inhabitant are all equal to or larger than zero. This means that in all 110 municipalities the numeric values of these four variables increased between 2011 and 2016. The third interesting aspect is that many variables have a minimum value or maximum value

that is more than four times larger than their corresponding standard deviation, this is an indication that there potentially are cases that have a large influence on the model outcomes, meaning they possibly have to be considered as outliers and have to be removed from the research sample. The actual removal of outliers, is presented in the Appendix E: Output Regression Analysis.

4.6 Conclusion

This chapter gives a general description of the data that is used in this research. A number of interesting things are discovered. Firstly, for twelve of the 122 municipalities located in the three provinces the accessible data is insufficient. Therefore, the research sample that is used in this research is reduced to a total of 110 municipalities, of which 48 municipalities are located in the province of Zuid-Holland. In this research around half of these municipalities are considered as rural municipalities and the other half of the municipalities are considered as urban municipalities.

Secondly, what stands out from inspecting the trends in the data is that the demand for retail real estate of stores selling daily products grew between 2011 and 2016, while the demand for retail real estate of stores selling non-daily products shrunk between 2011 and 2016. Stores selling non-daily products make up a larger proportion of the total demand for retail real estate, resulting in a decrease in the total demand for retail real between 2011 and 2016. Moreover, the average non-daily online expenditures per municipality increased from around 18 million euros in 2011 to close to 41 million euros in 2016. The average daily online expenditures per municipality increased form 1,5 million euros in 2011 to 2,9 million euros in 2016. This shows that the online expenditures on both daily and non-daily products on average increased in municipalities.

Thirdly, it becomes clear that the trends in the data behave relatively similar for both rural municipalities as well as for urban municipalities. The only differences are that on average in urban municipalities there are more square meters of non-daily retail floor space per inhabitant and that on average in urban municipalities more non-daily retail revenue is generated per inhabitant. The fact that the trends in the data behave pretty similar gives a first indications that the demand for retail real estate in rural municipalities is not affected differently than the demand for retail real estate in urban municipalities. This will be further examined with the use of a dummy variable in the multiple regression analysis.

Another aspect that is addressed in this chapter is the difference between the trends in the data of municipalities located in Zuid-Holland and the trends in the other municipalities incorporated in this research sample between 2011 and 2016. The trends in the data behave very similar between Zuid-Holland and the other two provinces. A small difference is that on average municipalities located in Zuid-Holland contain more square meters of floor space and more stores than municipalities located in Noord-Holland and Utrecht. Furthermore, the retail revenue generated in municipalities and the online expenditures are on average also a bit higher for municipalities located in the province of Zuid-Holland than for municipalities located in the province of Noord-Holland and Utrecht.

Moreover, the sociodemographic trends of municipalities located in Zuid-Holland are also pretty similar to the sociodemographic trends of municipalities located in the provinces of Noord-Holland and Utrecht combined. A small difference is that the incomes of inhabitants of municipalities located in Zuid-Holland are on average lower than those of inhabitants living in municipalities located in Noord-Holland and Utrecht. On the other hand, the percentage of elderly citizens and the average household size are almost identical across the three provinces. Additionally, the distribution of municipalities with a rural character and municipalities with an urban character in the province of Zuid-Holland is pretty similar to the distribution of these same types of municipalities in the provinces of Noord-Holland and Utrecht combined.

In short, the data of municipalities located in the province of Zuid-Holland and municipalities located in the provinces of Noord-Holland and Utrecht are almost identical. This justifies the interpolation of the results of this research, which regard municipalities located in all three provinces, to the municipalities located in the province of Zuid-Holland only. Therefore, in the design chapter of this research the results will be used to optimise the retail policy of the province of Zuid-Holland.

5. Results

In this chapter the results of the statistical analyses are presented and discussed. The main objective of this chapter is to gain more insight into the effects of the increasing popularity of online shopping on the change in the demand for retail real estate. Secondary, in this chapter we examine whether the change in the demand for retail real estate is affected by other factors, such as: the change in the retail revenue generated in municipalities, demographic changes and the economic cycle. In total six models are used to shed light on the factors that are expected to explain part of the changing demand for retail real estate, between 2011 and 2016. Moreover, in all six models dummy variables are incorporated in order to examine whether the effects on the change in the demand for retail real estate vary for municipalities with a different degree of urbanisation. In this way this chapter provides answers to the following sub-questions:

- *Does online shopping have a substitution, complementarity, neutrality or modification effect on traditional in-store shopping?*
- *What are the differences between the effects of online shopping on retail real estate used for the sale of daily products and retail real estate used for the sale of non-daily products?*
- *What is the effect of different degrees of urbanisation in municipalities on the retail real estate market?*

In the first section we start off with discussing the results of the correlation analysis. In this section the one-on-one relations between the variables incorporated in this research are examined individually. This gives an idea about the strength of the association and the direction of the mutual relations between variables. In section two these relationships are examined with the use of a multiple regression analysis. Through this analysis the relations between the change in each of independent variables and the change in the demand for retail real estate are examined, while controlling for the other independent variables incorporated in this research. In section three the model validation is discussed. In this section the six multiple regression models are checked on validity and correctness, using different statistical criteria. This chapter is concluded in section four, in which the literature and the results from the statistical analysis are combined to establish which of the incorporated factors actually have an effect on the change in the demand for retail real estate.

5.1 Results correlation analysis

A correlation analysis is used to examine the mutual relationships between the variables introduced in the previous chapters. With the use of the Pearson correlation coefficient the strength and the direction of the relationships between the numeric change of one variable and the numeric change of another variable, between 2011 and 2016, are examined. The Pearson correlation coefficient can only be used in case the relationships comply with both the linearity and the outlier assumption. Whether this is the case is examined in more detail with the use of scatterplots in Appendix D: Output Correlation Analysis. These scatterplots indicate that there are a number of outliers, which have to be removed from the research sample. Moreover, the scatterplots display a point cloud shape or a linear shape, which indicates that the linearity assumption is met and and that the relationships are indeed linear in nature. Linear relationships with a Pearson correlation coefficient between 0,0 and 0,3 are regarded as weak, linear relations with a Pearson correlation coefficient between 0,3 and 0,7 are considered as moderate and linear relations with a Pearson correlation coefficient between 0,7 an 1,0 are considered as strong. Furthermore, the signs of the correlation coefficients tell something about the directions of the relationships (Baarda & De Goede, 2011).

Part of the interest of this research lies with determining whether the demand for retail real estate is affected differently in rural municipalities compared to urban municipalities. To get a first impression whether this is the case, the correlations between the change in the demand for retail real estate and the number of inhabitants of rural municipalities are analysed separately from the correlations between the change in the demand for retail real estate and the number of inhabitants of urban municipalities.

This section is divided into four sub-sections. In sub-section 5.1.1 we discuss the correlations between the variables regarding daily and non-daily products combined. In sub-section 5.1.2 we discuss the correlations between the variables concerning non-daily products only. In the section 5.1.3 we discuss the correlations between the variables that are limited to data about daily products. In the final sub-section, the similarities and the differences between the results of the correlation analysis will be discussed. For reasons of clarity we only show the correlations between the dependent variables and the associated independent variable that are used in the multiple regression analysis. Other important correlations between independent variables are discussed textual. A complete overview of the correlations between the different variables used in the various multiple regression models is displayed in Appendix H: Correlation Analysis.

5.1.1 Correlations variables daily and non-daily products combined

In this sub-section we discuss the results of the correlation analysis concerning the variables that represent the total demand for retail real estate. The total demand includes both the demand for stores selling daily products and stores selling non-daily products. Table 7 stipulates that an increase in the total online expenditures, between 2011 and 2016, is associated with a decrease in the total demand for retail stores. The strength of this

relationship is regarded as moderate. On the other hand, the results indicate that there is no linear relationship between the change in the total online expenditures, between 2011 and 2016, and the change in the total demand for square meters of retail floor space.

Moreover, the other consumer behavioural and sociodemographic variables also show some significant correlations with the change in the total demand for retail real estate, between 2011 and 2016. Firstly, the Pearson correlation coefficient indicates the existence of a weak negative relationship between the change in the total retail revenue generated in municipalities, between 2011 and 2016, and the change in the total demand for retail stores. Secondly, the composition of the population is represented by both the change in the average household size, between 2011 and 2016, which relates negatively and moderate with the change in the demand for retail real estate, as well as the change in the percentage of elderly citizens, between 2011 and 2016, which is moderately positively related to the change in the demand for retail real estate. Thirdly, the negative correlation coefficient concerning the number of inhabitants living in municipalities indicates that the change in the demand for retail stores, between 2011 and 2016, is moderately related to the number of inhabitants in municipalities with more than 35.000 inhabitants. For municipalities with fewer than 35.000 inhabitants this relationship does not exist.

The mutual correlations between the independent variables are shown in Appendix H: Correlation Analysis. Most independent variables correlate weak or moderate with one another.

Table 7: Correlations of variables regarding both daily and non-daily products

		Online expenditures total	Retail revenue total	Average household size	Percentage of -65s	Average income of inhabitants	Number of inhabitants (municipalities < 35.000 inhabitants)	Number of inhabitants (municipalities > 35.000 inhabitants)
Total amount of occupied square meters of retail floor space	Pearson Correlation	-0,133	0,194	-.355	0,377	0,077	-0,059	0,070
	Sig. (2-tailed)	0,179	0,050	0,000	0,000	0,437	0,680	0,620
Total number of occupied retail stores	Pearson Correlation	-0,608	-0,283	-.289	0,400	0,154	-0,243	-.500
	Sig. (2-tailed)	0,000	0,004	0,003	0,000	0,119	0,086	0,000

5.1.2 Correlations variables non-daily products

In this sub-section we explore the results of the correlation analysis regarding the variables which represent that part of the retail real estate market concerned with the sale of non-daily products.

Table 8 shows that the change in non-daily online expenditures and the change in the demand for retail real estate, between 2011 and 2016, are significantly negatively correlated. The results indicate the existence of a weak negative relationship between the change in online expenditures and the change in the demand for square meters of retail floor space, between 2011 and 2016. Moreover, the Pearson correlation coefficient indicates a moderate

negative linear association between the change in online expenditures and the change in the demand for retail stores, between 2011 and 2016.

Furthermore, the table shows that a weak positive significant association exists between the change in the retail revenue generated in municipalities spent on non-daily retail products, between 2011 and 2016, and the change in the demand for square meters of retail floor space. Secondly, the Pearson correlation coefficient points to the existence of a moderate negative linear relationship between the change in the average household size and the change in the demand for square meters of retail floor, between 2011 and 2016. Thirdly, the change in the percentage of elderly citizens, between 2011 and 2016, is significantly positively related to the change in the demand for retail real estate. The strength of this relation is regarded as moderate. Fourthly, the change in the demand for retail stores, between 2011 and 2016, is negatively related to the number of inhabitants in both municipalities with fewer than 35.000 inhabitants and municipalities with more than 35.000 inhabitants.

The mutual correlations between the independent variables are shown in Appendix H: Correlation Analysis. The Pearson correlation coefficients of these independent variables indicate the existence of weak and moderate linear relationships.

Table 8: Correlations of variables regarding non-daily products

		Online expenditures non-daily	Retail revenue non-daily	Average household size	Percentage of elderly citizens	Average income of inhabitants	Number of inhabitants (municipalities < 35.000 inhabitants)	Number of inhabitants (municipalities > 35.000 inhabitants)
Amount of occupied non-daily square meters of retail floor space	Pearson Correlation	-0,232	0,252	-.345	0,409	0,134	-0,152	0,013
	Sig. (2-tailed)	0,018	0,010	0,000	0,000	0,176	0,288	0,927
Number of occupied non-daily retail stores	Pearson Correlation	-0,625	-0,115	-.276	0,395	0,174	-.299	-.434
	Sig. (2-tailed)	0,000	0,241	0,004	0,000	0,076	0,033	0,001

5.1.3 Correlations variables daily products

In this sub-section we discuss the results of the correlation analysis, concerning the variables which represent that part of the retail real estate market focussed on the sale of daily products.

Table 9 shows that there is no significant linear relationship between the change in the online expenditures spent on daily products, between 2011 and 2016, and the change in the demand for retail real estate. This indicates that there is no cohesion between the change in online expenditures in daily products and the change in the demand for retail real estate.

Furthermore, the table points to the existence of a positive moderate relation between the change in the amount of retail revenue generated in municipalities by stores selling daily products, between 2011 and 2016, and the change in the demand for square meters of retail floor space. Secondly, the Pearson correlation coefficient points to the existence of a negative weak relationship between the change in the percentage of elderly citizens, between 2011 and 2016, and the change in the demand for square meters of retail floor space. Thirdly, the

table points to the existence of a positive correlation coefficient concerning the change in the demand for retail floor space, between 2011 and 2016, and the number of inhabitants in both municipalities with fewer than 35.000 inhabitants and municipalities with more than 35.000 inhabitants.

The mutual correlations between the independent variables are shown in Appendix H: Correlation Analysis. The correlations between these independent variables are predominantly considered to be weak or moderate.

Table 9: Correlations of variables regarding daily products

		Online expenditures daily	Retail revenue daily	Average household size	Percentage of elderly citizens	Average income of inhabitants	Number of inhabitants (municipalities < 35.000 inhabitants)	Number of inhabitants (municipalities > 35.000 inhabitants)
Amount of occupied daily square meters of retail floor space	Pearson Correlation	0,145	0,567	-0,009	-0,156	-0,237	.279	.379
	Sig. (2-tailed)	0,139	0,000	0,926	0,112	0,015	0,048	0,005
Number of occupied daily retail stores	Pearson Correlation	0,013	0,138	-0,125	0,102	-0,055	0,098	-0,031
	Sig. (2-tailed)	0,897	0,161	0,205	0,303	0,579	0,496	0,823

5.1.4 Discussion results correlation analyses

Above the results of the correlation analysis are presented. In the first sub-section the results regarding the entire market for retail real estate are displayed, in sub-section two the results about that part of the retail real estate market concerned with the sale of non-daily products are shown and in sub-section three a closer look is taken at the results of that part of the retail real estate market focussed on the sale of daily products.

First of all, from the correlation analysis it becomes evident that an increase in the popularity of online shopping, between 2011 and 2016, is significantly related to a decrease in the demand for retail real estate. The increase in the online expenditures on non-daily products, between 2011 and 2016, is moderately related to a decrease in the demand for retail real estate. On the other hand, the results show that the change in online expenditures for daily products, between 2011 and 2016, and the change in the demand for retail real estate are not related to each other.

Next, the Pearson correlation coefficient points to the existence of a weak negative relationship between the change in the total retail revenue generated in municipalities and the change in the demand for retail stores, between 2011 and 2016. On the other hand, the results point to the existence of a positive moderate association between the change in retail revenue generated in municipalities by stores selling non-daily products and the change in the demand for square meters of retail floor space, between 2011 and 2016. This same relationship is observed for that part of the retail real estate market focussed on selling daily products.

Thirdly, the results indicate that a decrease in the average household size, between 2011 and 2016, is significantly related to an increase in the total demand for retail real estate. The results indicate that this same association exists for that part of the retail real estate market focussed on the sale non-daily products. Contrary, the results of the correlation

analysis point out that there is no relation between the change in the average household size and the change in the demand for retail stores selling daily products.

Fourthly, the results indicate that an increase in the percentage of elderly citizens, between 2011 and 2016, is significantly positively related to an increase in the total demand for retail real estate. Moreover, this same positive relationship is observed between the change in the percentage of elderly citizens, between 2011 and 2016, and the change in the demand for retail real estate focussed on the sale of non-daily products.

Fifthly, the results of the correlation analysis stipulate that the increase in the average income on inhabitants, between 2011 and 2016, and the change in the demand for retail real estate are not related to each other.

Finally, the correlation analysis shows that the change in the total demand for retail stores, between 2011 and 2016, is negatively related to the number of inhabitants in municipalities with more than 35.000 inhabitants, but is not related to the number of inhabitants in municipalities with fewer than 35.000 inhabitants. The results also show that the change in the demand for retail stores selling non-daily products, between 2011 and 2016, is negatively related to the number of inhabitants in both municipalities with fewer than 35.000 inhabitants and municipalities with more than 35.000 inhabitants. Moreover, the results of the correlation analysis show that the change in the demand for retail stores selling daily products, between 2011 and 2016, is positively related to the number of inhabitants in both municipalities with fewer than 35.000 inhabitants and municipalities with more than 35.000 inhabitants.

5.2 Results multiple regression analysis

In this section the relationships discovered in the previous section are examined further with the use of a multiple regression analysis. This analysis allows for investigating the strength and direction of the relationships between the various independent variables and the changing demand for retail real estate, between 2011 and 2016, while holding the effects of other independent factors constant.

Thus far in this research the factor the degree of urbanisation has been analysed using the actual number of inhabitants living in a municipality. However, in the multiple regression analysis the municipalities are split into two groups. Municipalities with less than 35.000 inhabitants are classified as rural municipalities and municipalities with more than 35.000 inhabitants are classified as urban municipalities, as was discussed in chapter 4. The use of this dummy variable allows for examining whether the change in the demand for retail real estate is affected differently in rural municipalities in relation to urban municipalities.

The structure of this section is as follows: in the first sub-section the result of the two multiple regression models which are estimated with the use of data regarding both daily and non-daily products are discussed. In the second sub-section the results of the two multiple regression models are demonstrated, which are estimated using merely data about non-daily products. In the third sub-section the results of the two multiple regression models are presented, which are estimated with solely data about daily products. All the models

presented throughout this section contain six independent variables which are expected to have a certain association with the change in the demand for retail real estate. After running a stepwise regression analysis, SPSS differentiates between the statistically significant variables and statistically non-significant variables. Throughout this section the statistically significant variables are presented in tables and the non-significant variables are discussed throughout the text. In the final sub-section, the similarities and differences between the multiple regression models presented in sub-sections 5.2.1 till 5.2.3 will be discussed.

5.2.1 Regression models daily and non-daily products combined

The results of multiple regression models 1 and 2 are shown in table 10. Both models estimate the strength of the relations between the numeric change in the various independent variables, on the one side, and the changing demand for retail real estate for municipalities in Noord-Holland, Utrecht and Zuid-Holland, between 2011 and 2016, on the other side. Model 1 estimates the associations between the numeric change in the independent variables and the change in the total demand for square meters of retail floor space, between 2011 and 2016. Model 2 estimates the relationships between the numeric changes in the various independent variables on the change in the total demand for retail stores, between 2011 and 2016.

Model 1 (R^2 = 0,300 and N = 103) explains 30,0 percent of the variance of the numeric change in the total demand for square meters of retail floor space, between 2011 and 2016. After checking specific model assumptions, the total number of cases that are used to estimate this model is 103. The cases that are excluded are: Amersfoort, Amsterdam, 's-Gravenhage, Haarlem, Rotterdam, Utrecht and Zaanstad. These cases are considered to be too influential on the model outcomes and therefore removed from the research sample, based on the following statistical criteria: Leverage values, Cook's distances and standardised residuals. More information on this process of removing individual cases is presented in Appendix E: Output Regression Analysis.

Model 2 (R^2 = 0,468 & N = 103) explains 46,8 percent of the variance of the numeric change in the demand for retail stores between 2011 and 2016. This model explains a larger percentage of the variance of its corresponding dependent variable than model 1. This means that the total demand for retail stores better explains the changes on the demand for retail real estate than the total demand for square meters of retail floor space. Appendix E: Output Regression Analysis shows that the same seven cases are removed as in model 1. This supports the statements that these seven cases possess certain characteristics that make them stand out from the rest of the research sample, which results in the exclusion of these cases.

Table 10: Results multiple regression models concerning both daily and non-daily products

Variable (Δ 2016- 2011)	Model 1 (total demand for square meters of retail floor space Δ 2016-2011)	Model 2 (total demand for retail stores Δ 2016- 2011)
Online shopping		
Online expenditures total	-0,575 (0,000)	-1,006 (0,000)
Retail revenue generated in municipalities		
Retail revenue total	0,669 (0,000)	0,506 (0,007)
Composition of the population		
Percentage of elderly citizens	0,247 (0,009)	
Number of cases	103	103
R	0,547	0,684
R square	0,300	0,468

p-value between brackets

Table 10 indicates that the change in the total online expenditures, between 2011 and 2016, is significantly negatively related to the change in the total demand for retail real estate, when measured in both square meters and the number of retail stores. The relation between the change in the total online expenditures, between 2011 and 2016, and the change in the total demand for retail stores can be considered as strong.

Secondly, the results of the regression analysis stipulate that an increase in the overall retail revenue generated in municipalities, between 2011 and 2016, is related to a growing demand for retail real estate. At the same time, a decrease in the overall retail revenue generated in municipalities, between 2011 and 2016, is related to a shrinkage of the demand for retail real estate.

Next, the results suggest that the increase in the percentage of elderly citizens, between 2011 and 2016, is associated with an increase in the total demand for square meters of retail floor space, while not being related to an increase in the total demand for retail stores.

Finally, the following variables incorporated in this research: 'change in the average household size', 'change in the average income of inhabitants', and the 'degree of urbanisation' are not significantly related to the change in the demand for retail real estate. This means that these variables do not explain any additional variance of both the two dependent variables.

5.2.2 Regression models non-daily products

Table 11 gives an overview of the results of the multiple regression models 3 and 4. Both models represent that part of the retail real estate market focussed on the sale of non-daily products. Model 3 estimates the relationships between the various independent variables and the changing demand for square meters of retail floor space of stores selling non-daily products, between 2011 and 2016. Model 4 estimates the associations between the various independent variables and the change in the demand for retail stores selling non-daily products, between 2011 and 2016.

Model 3 (R^2 = 0,345 and N = 103) explains 33,3 percent of the variance of the numeric change in the demand for square meters of retail floor space of stores selling non-daily products, between 2011 and 2016. Model 4 (R^2 = 0,556 & N = 105) explains 55,6 percent of the variance of the numeric change in the demand for retail stores selling non-daily products, between 2011 and 2016. This means that when purely looking at the retail real estate related to the sale of non-daily products, the change in the demand for retail stores better explains the changes on the retail real estate market than the change in the demand for square meters of retail floor space of stores selling non-daily products. In model 3 the same seven cases are removed, as in models 1 and 2. In model 4 only five cases are removed. These are the four largest cases of the research sample: Amsterdam, s'-Gravenhage, Rotterdam and Utrecht. The fifth case that is considered to be too influential is Haarlem. Also for these regression models the process of removing the individual cases is presented in Appendix E: Output Regression Analysis.

Table 11: Results multiple regression models regarding non-daily products

Variable (Δ 2016- 2011)	Model 3 (non-daily demand for square meters of retail floor space Δ 2016- 2011)	Model 4 (non-daily demand for retail stores Δ 2016- 2011)
Online shopping		
Online expenditures non-daily	-0,498 (0,000)	-0,990 (0,000)
Retail revenue generated in municipalities		
Retail revenue non-daily	0,552 (0,000)	0,546 (0,000)
Composition of the population		
Percentage of elderly citizens	0,220 (0,018)	
Number of cases	103	105
R	0,577	0,746
R square	0,345	0,556

p-value between brackets

Both models displayed in table 11 indicate that the growth of non-daily online expenditures, between 2011 and 2016, is significantly related to the reduction in the demand for retail real estate. To add to this, in both models the changes in the non-daily expenditures, between 2011 and 2016, are related the strongest to the change in the demand for retail real estate.

Moreover, the results of the regression analysis stipulate that an increase in the amount of retail revenue generated in municipalities by stores selling non-daily products, between 2011 and 2016, goes hand in hand with a growing demand for retail real estate. At the same time, a decrease in the amount of retail revenue generated in municipalities by stores selling non-daily products, between 2011 and 2016, is related to a decline in the demand for retail real estate.

Thirdly, the change in the percentage of elderly citizens, between 2011 and 2016, is significantly positively associated with the changing demand for retail real estate.

Furthermore, the change in the percentage of elderly citizens, between 2011 and 2016, is only positively related to the change in the demand for square meters of retail floor space, and not to the changing demand for retail stores.

Additionally, the other sociodemographic variables and the degree of urbanisation in municipalities, do not explain any additional unique portion of the variance in both the two dependent variables.

5.2.3 Regression models daily products

An overview of the results of the multiple regression models 5 and 6 is presented in table 12. These models represent that part of the retail real estate market concerned with the sale of daily products. Model 5 estimates the relations between the various independent variables and the changing demand for square meters of retail floor space of stores selling daily products, between 2011 and 2016. Model 6 estimates the associations between the various independent variables and the changing demand for retail stores selling daily products, between 2011 and 2016.

Model 5 (R^2 = 0,321 and N = 105) explains 32,1 percent of the variance of numeric change in the demand for square meters of retail floor space of stores selling daily products, between 2011 and 2016. Model 6 (R^2 = 0,000 and N = 104) consists of no significant variables. Consequently, this model explains 0,0 percent of the variance of the numeric change in the demand for retail stores selling daily products, between 2011 and 2016. This means that model 5 better explains the changes taking place on the demand side of the retail real estate market concerned with the sale of daily products than model 6 does. Five cases are removed in model 5. Besides removing the four largest cases, also the case of Amersfoort is removed. One of the reasons of the large influence of Amersfoort on the model outcomes could be that a large online delivery company of daily products called 'Picnic' originates from Amersfoort. Consequently, online shopping for daily products is considerably more popular in Amersfoort than in any of the other municipalities, in which the delivery services of Picnic are less established (I&O Research, 2016).

Table 12: Results multiple regression models concerning daily products

Variable (Δ 2016- 2011)	Model 5 (daily demand for square meters of retail floor space Δ 2016- 2011)	Model 6 (daily demand for retail stores Δ 2016- 2011)
Online shopping		
Online expenditures daily		
Retail revenue generated in municipalities		
Retail revenue daily	0,567	
	(0,000)	
Composition of the population		
Percentage of elderly citizens		
Number of cases	105	104
R	0,567	0
R square	0,321	0

p-value between brackets

The results in table 12 only show a significant relation between the change in retail revenue generated in municipalities by stores selling daily products, between 2011 and 2016, and the changing demand for square meters of retail floor space. Stipulating that the change in the demand for retail real estate concerned with the sale of daily products, between 2011 and 2016, is only related to the change in the amount of generated retail revenue. The other variables incorporated in this model do not explain any additional variance of the change in the demand for square meters of retail floor space concerned with selling daily products.

5.2.4 Discussion multiple regression analysis

Thus far in section 5.2 we discussed the results of a total of six multiple regression models. In this sub-section the most important findings are presented. Furthermore, interesting similarities and discrepancies between the different multiple regression models are discussed.

First of all, the results make clear that the increasing total online expenditures, between 2011 and 2016, are significantly negatively associated with the changes in the total demand for retail real estate concerned with both daily and non-daily products. Looking at daily and non-daily online expenditures individually the results indicate that the increase in non-daily online expenditures, between 2011 and 2016, is significantly related to the decrease in the demand for retail real estate. While, the results show that the increase in daily online expenditures, between 2011 and 2016, is non-significantly related to the changing demand for retail real estate. Additionally, the results show that the reduction in the demand for retail real estate is stronger when measured in the number of occupied retail stores than when measured in the amount of occupied square meters of retail floor space.

Secondly, the results signify that the change in the total retail revenue generated in municipalities, between 2011 and 2016, is significantly positively associated with the changes in the total demand for retail real estate. This implies that an increase in the total retail revenue generated in municipalities, between 2011 and 2016, is accompanied by a growing demand for retail real estate. On the other hand, it also means that a decrease in the total retail revenue generated in municipalities, between 2011 and 2016, is connected to a decrease in the demand for retail real estate. These same positive significant relationships are discovered between the change in the amount of retail revenue generated in municipalities by stores selling non-daily products, between 2011 and 2016, and the demand for retail real estate. The change in the amount of retail revenue generated in municipalities by stores selling daily products, between 2011 and 2016, is only related to the changing demand for retail real estate when measured in square meters. When the changing demand is measured in the number of stores this relationship is not significant.

Thirdly, the results indicate that the change in the percentage of elderly citizens, between 2011 and 2016, is significantly positively related to the change in the total demand for square meters of retail floor space. This indicates that an increase in the percentage of elderly citizens, between 2011 and 2016, is accompanied by an increase in the total demand for square meters of retail floor space. To add to this, the same relationship is observed when examining that part of the retail real estate market concerned with the sale of non-daily

products. Contrary, the change in the percentage of elderly citizens, between 2011 and 2016, is non-significantly related to that part of the retail real estate market focussed on the sale of daily products.

Additionally, the absence of relationships between the change in the demand for retail real estate, between 2011 and 2016, and the numeric change in other sociodemographic and consumer behavioural variables points out that these variables do not explain any additional portion of the variance of their associated dependent variables. Moreover, the results of the multiple regression analysis also suggest that the 'degree of urbanisation' does not explain any additional portion of the variance of any of the dependent variables.

5.3 Model Validation

Before drawing the final conclusions of the quantitative analysis phase, this section is used to validate the results of the six multiple regression models. This is done with the use of three statistical criteria. In order to check the first two criteria, six additional models are estimated. Each of these models uses a random selection of approximately 75 percent of the cases included in the original models. Through comparing each random sampling model with its corresponding original model we are able to check whether these criteria are met. The first criterion is that in both the original models and the random sampling models the same variables are statistically significant. The second criterion is that the difference between the R square values of the original models and the random sampling models must be smaller than five percent. The third criterion is that the number of influential, and thus removed, cases has to be as small as possible. The results of this validation process are displayed briefly in table 13.

Table 13: Overview of comparison with random sampling model

	Number of similar significant variables in random sampling model	Number of different significant variables in random sampling model	Difference in R square value between random sampling model (percent)	Number of removed cases
Model 1	3	0	2,1	7
Model 2	2	0	5,5	7
Model 3	3	0	0,4	7
Model 4	2	0	6,5	5
Model 5	1	0	1,4	5
Model 6	0	0	0,0	6

From table 13 it becomes clear that models 1, 3, 5 and 6 comply with the first two criteria used for the model validation. At the same time, the table shows that models 2 and 4 do not comply with one of these two criteria. Although both the original models 2 and 4 contain the same significant variables as their corresponding random sampling models, the difference between the R square values of these original models and random sampling models exceeds the 5 percent mark.

Although the differences in the R square values between the original models 2 and 4 and their associated random sampling models are slightly exceeding the predefined limit, the other two criteria do not indicate that these models are invalid. To add to this, in all six models

the number of removed cases is pretty similar and relatively small. Consequently, the results of the validation process lead us to conclude that none of the six models differentiate extremely from the validation criteria. Therefore, all six models are considered to be valid. A more detailed overview of the comparison between the original models and the random sampling models is presented in Appendix G: Validation regression models.

5.3.1 Exclusion of variables

Part of validation process is also to check whether the independent variables incorporated in the multiple regression models correlate too strongly among each other. Strong correlations are an indication for multicollinearity, which can seriously harm the outcomes of the regression models. Checking for multicollinearity takes place by both the stepwise regression method incorporated in the software package SPSS and by manual checks performed by the researcher. In none of the six models variables had to be manually excluded from the analysis, due to multicollinearity.

Moreover, in Appendix E: Output Regression Analysis we checked the standardised residuals of the regression models for the normality assumption. This is an important assumption, because non-normally distributed standardised residuals could form a problem for the calculation of p-values for significance testing. Which could result in incorrect conclusion regarding the incorporation or exclusion of variables in the models. The violation of the normality assumption has led to two situations in which the interpretation of the multiple regression results could form a problem. Firstly, in both model 1 and model 3 the p-values of the variable 'the change in the percentage of elderly citizens' lies relatively close to the limit of 0,05. Secondly, the violation of the normality assumption in model 4 is relatively strong compared to the violations of the normality assumption in the other models. This means that the results regarding the statistical significance of variables in this model are not as robust as the results regarding the other models. This requires additional attention regarding the interpretation of these specific variables. However, the margin between the p-values of both the significant variables and the excluded variables in this model is considerably large, which means that the interpretation of the results of this model is not a problem.

5.3.2 Exclusion of cases

As mentioned throughout section 5.2 in each of the six multiple regression models a number of individual municipalities are removed. Among the excluded municipalities are the four municipalities: Amsterdam, 's-Gravenhage, Rotterdam and Utrecht. Additionally, across the six models the municipalities of Amersfoort, Haarlem and Zaanstad are occasionally removed. All these cases are removed because they are considered to be too influential on the model outcomes. The level of influence of an individual case on the overall model outcomes is determined by its associated Leverage value, Cook's distance and standardised residual. The highly influential cases are most likely caused by the fact that all of these cases are among the larger municipalities incorporated in the research sample. This indicates that they are removed from the research sample, because they are larger in size in relation to the other

municipalities, and not because they perform significantly different than the other municipalities in the research sample. Consequently, the largest municipalities are not included in the quantitative analysis phase and the design phase of this research

5.4 Conclusion

Using both a correlation analysis and a multiple regression analysis we set out to, first of all empirically examine the effects of the increasing popularity of online shopping, between the years 2011 and 2016, on the market for retail real estate. Secondary, we investigated whether there are other factors which have also contributed to the changes on the market for retail real estate, between 2011 and 2016. In the third place, we inspected whether the changes on the retail real estate market are differently related to municipalities with a rural character compared to municipalities with an urban character. Our findings are based on data regarding a total of 110 municipalities located in the provinces of Noord-Holland, Utrecht and Zuid-Holland.

Most importantly, the results of this research reveal that the increase in online expenditures, between 2011 and 2016, is strongly related to the changing demand for retail real estate. On average the online expenditures in municipalities located in Zuid-Holland more than doubled from 20 million euro in 2011 to more than 46 million euro in 2016. The results of this research indicate that this increase in online expenditures is the main cause of the reduction in the demand for retail real estate. This is consistent with claims from researchers who state that online shopping is a substitute for traditional in-store shopping (Buursink, 1996; Tonn & Hemrick, 2004; Farag, et al., 2007; Weltevreden, 2007). These findings provide an answer to the following sub-question: *Does online shopping have a substitution, complementarity, neutrality or modification effect on traditional in-store shopping?*

In more detail, our findings show that especially the strong growth of online expenditures on non-daily products, between 2011 and 2016, is a major contributor to the reduction in the demand for retail real estate. On the other hand, our findings do not provide evidence that the slight increase in the online expenditures on daily products, between 2011 and 2016, has an effect on the change in the demand for retail real estate. In this way our findings support the statements made by Farag et al. (2007) that certain types of products are more easily purchased through the internet than others. These findings answer the following sub-question: *What are the differences between the effects of online shopping on retail real estate used for the sale of daily products and retail real estate used for the sale of non-daily products?*

The second interesting finding of this research is related to the retail revenue generated in municipalities. The correlation analysis shows a weak negative relationship between the change in the total retail revenue generated in municipalities, between 2011 and 2016, and the change in the demand for retail stores. This is a striking result, as generally an increase in retail revenue generated in municipalities is expected to be associated with a growing demand for retail real estate (Weltevreden and Van Rietbergen, 2007). The other Pearson correlation coefficients indicate the existence of positive moderate correlations

between the change in retail revenue generated in municipalities, between 2011 and 2016, and the change in the demand for retail real estate. These relations are consistent with previous findings (Woodruffe-Burton et al., 2002; Weltevreden & Van Rietbergen, 2007).

The results of the multivariate regression analysis, which controls for other independent variables, indicate that the change in the retail revenue generated in municipalities, between 2011 and 2016, is significantly positively associated with the changing demand for retail real estate. These findings are consistent with findings of previous researches (Weltevreden & Van Rietbergen, 2007; Cosmin, 2008). These findings indicate that an increase in retail revenue generated in municipalities, between 2011 and 2016, results in the growth of the demand for retail real estate. Similarly, a decrease in retail revenue generated in municipalities, between 2011 and 2016, results in a decreasing demand for retail real estate.

Moreover, both the correlation analysis and the multiple regression analysis show striking results regarding the percentage of elderly citizens. The correlation analysis shows the existence of moderate positive relations between the change in the percentage of elderly citizens and the change in the demand for retail real estate, between 2011 and 2016. This is confirmed by the results generated with the use of the multiple regression analysis, in which we control for other independent variables. Contrary, in the literature and in research reports elderly citizens are generally associated with spending considerably less money on retail products than citizens of younger generations (Bureau Stedelijke Planning, 2012; DTNP, 2013; Van Dam & Daalhuizen, 2013; Platform 31, 2014; Ministerie van Economische Zaken, 2015; ING Bank, 2017).

To add to this, the violation of the normality assumption is also connected to this variable, because the p-values related to the change in the percentage of elderly citizens are relatively close to the limit of 0.05. The fact that the statistical confidence for the existence of this relationship is not as high as with some of the other relationships, in combination with the fact that the literature provides no basis for the existence of a positive relation between the change in the percentage of elderly citizens and the change in the demand for retail real estate, leads us to seriously question the findings regarding the variable the change in the percentage of elderly citizens.

Moreover, in this research no evidence is found that the change in the average household and the change in the average income of inhabitants explain any unique portion of variance in one of the six dependent variables used in either one of the different multiple regeression models. This means that the results of this research are unable to confirm the statements made in the literature that the change in the demand for retail real estate, between 2011 and 2016, is related to the change in the average household size (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2014; Groenemeijer et al, 2016) or the change in the average income of inhabitants (Teale, 2012; Evers et al., 2014).

Moreover, the findings of this research do not confirm that the change the demand for retail real estate, between 2011 and 2016, is associated significantly different to rural municipalities compared to urban municipalities, as is argued by Weltevreden and Van

Rietbergen (2009) and Dynamis (2017). Thereby, providing an answer to the following sub-question: *What is the effect of different degrees of urbanisation in municipalities on the retail real estate market?*

The results also indicate that there are some differences between the multivariate regression models that use the amount of square meters as the unit of measurement for the demand for retail real estate and the models that use the number of retail stores as the unit of measurement for the demand for retail real estate. Firstly, the effects of online shopping, between 2011 and 2016, are stronger on the change in the demand for retail stores than on the change in the demand for square meters of retail floor space. A possible explanation for this according to DTNP (2013) could be that small retail stores are affected stronger by the growing popularity of online shopping than large retail stores. Another explanation for this could be the increase in the average store size. In the latter case, the effects of the increase in online expenditures on the change in the demand for square meters of retail floor space are partly cancelled out by the continuous tendency of retailers to scale up the surface areas of their retail stores (Evers et al., 2014). In this research, data regarding economies of scale is not incorporated. Therefore, statements about the exact reason for this difference cannot be made based on the results of this research.

Secondly, the results of this research indicate that the change in retail revenue generated in municipalities, between 2011 and 2016, is differently associated with the demand for retail stores compared to the demand for square meters of retail floor space. A positive relationship is observed between the change in the amount of retail revenue generated in municipalities by selling daily products, between 2011 and 2016, and the changing demand for square meters of retail floor space. On the other hand, this relation is not observed when the demand for retail real estate is measured in the number of retail stores. According to I & O Research (2016) there is a plausible explanation for this. They report that the desire of consumers to purchase daily products more locally has led to the expansion of existing supermarkets. Consequently, the increase in retail revenue generated in municipalities of stores selling daily products, between 2011 and 2016, is positively related to the increase in the demand for square meters of retail floor space for stores focussed on the sale of daily products. On the other hand, according to I & O Research (2016) the growing desire to purchase more daily products in close proximity to home, does not necessarily result in the establishment of additional retail stores.

In short, our findings indicate that there are two factors that have an effect on the changing demand for retail real estate. Firstly, the growing popularity of online shopping, between 2011 and 2016, has a strong negative effect on the change in the demand for retail real estate. Secondly, the change in the retail revenue generated in municipalities, between 2011 and 2016, has a positive effect on the change in the demand for retail real estate. The downward retail vacancy spiral, which was presented in the introduction of this research, illustrates how additional retail vacancy originates. Figure 37 shows how the factors online shopping and the municipal retail revenue interact with this downward retail vacancy spiral.

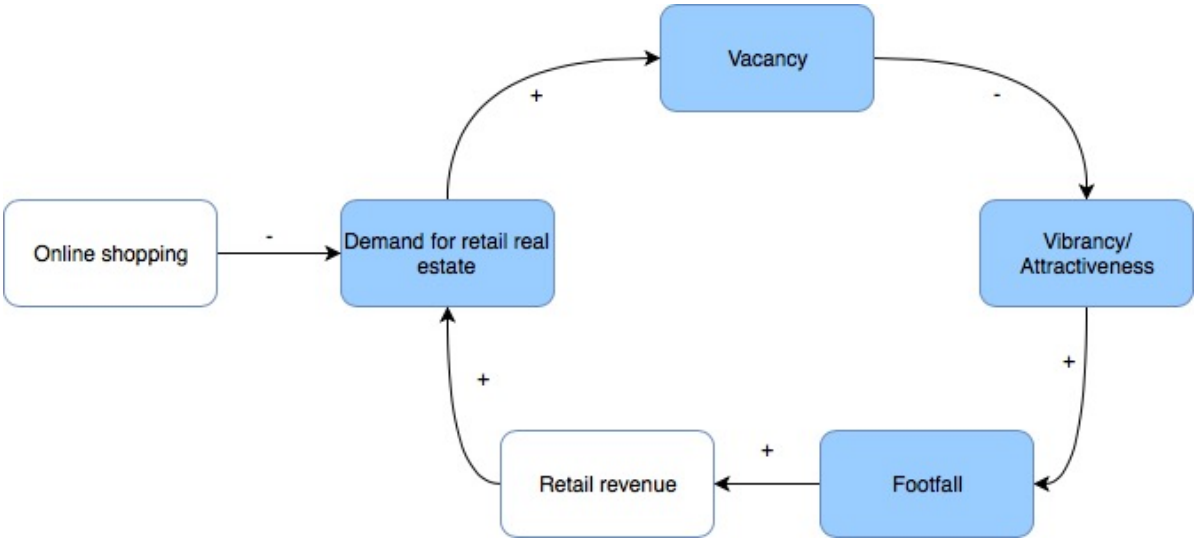

Figure 37: Overview of the effects on the retail real estate market

6. Design synthesis

In this chapter the insights gathered throughout this research are used to arrive at a policy design, which is helpful in addressing the problems regarding the retail real estate market in the province of Zuid-Holland. The objective of this design is to, based on the results of this research, optimise the current provincial retail policy. In the first section the current retail policy of the province of Zuid-Holland is introduced. In the second section this provincial retail policy is related to the effects on the demand for retail real estate discovered in this research. From which we conclude that a change in the mind-set of policy makers is required. In section three, we state that a secondary policy tracks needs to be added to the existing retail policy in order to effectively reduce the stock of retail real estate. The implementation of this secondary policy track alongside the existing retail policy, results in the recommendation to establish a two-track policy. In section four we introduce additional retail policy that provides governments with the necessary means to be able to enforce the reduction of vacant retail real estate. Moreover, the consequences that this policy has on the transformation task and on the market parties will be discussed in this section. In section five, we conclude that in order to provide governments with the necessary means to enforce the reduction of superfluous retail real estate, the meter for a meter plus policy should be implemented to complement the secondary policy track.

- *What should be the focus of future retail policy to address the effects of online shopping on the retail real estate market?*

6.1 Effects on the current retail policy

The objective of the province of Zuid-Holland is to be a leading province in which people enjoy to reside, work and leisure. A proper functioning retail real estate market is vital in achieving this goal, because attractive and inviting shopping areas are important to the living and business climate of municipalities. In recent years the retail vacancy rates have increased significantly in Zuid-Holland. The negative externalities associated with retail vacancy are threatening the liveability of municipalities and thereby the ambitions of the province of Zuid-Holland.

In order to address the issues of retail vacancy the province of Zuid-Holland initiated retail policy aimed at maintaining attractive and vibrant shopping areas, through the concentration and funnelling of retail activities in the centres of municipalities, cities, villages and neighbourhoods. Promising aspects of the retail market are being reinforced, while the fine-grained structure of smaller shopping areas is being preserved (Provincie Zuid-Holland, 2017).

Part of the provincial retail policy is to divide the shopping centres located in Zuid-Holland into three groups. The first group contains eleven shopping centres which have a supra-regional retail function. Expansion of the retail real estate market is permitted in these

shopping centres. The second group contains 35 shopping centres which have a supra-local retail function. In these types of shopping centres, the province strives for qualitative improvements rather than for the expansion of the retail real estate market. The remaining shopping centres make up the third group. These shopping centres generally have a local retail function and are of importance to consumers living in close proximity. For these shopping centres the province opts for a customised approach that matches the economic performance of a specific shopping centre. These approaches include expansion, transformation, merging, restructuring or re-profiling of retail real estate in shopping centres.

The current retail policy approach is predominantly focussed on restoring the demand for retail real estate in shopping centres. The aim of this approach is to maintain and improve the attractiveness of shopping centres, through which the province tries to attract additional retailers to reoccupy vacant retail real estate objects. This policy approach focusses primarily on the improvement of the demand side of the market for retail real estate. Therefore, in this research we refer to this approach as the growth-oriented policy approach.

In light of the current levels of retail vacancy, one could ask the question whether this growth-oriented policy approach deals adequately with the issues on the market for retail real estate.

6.2 Does a growth-oriented policy approach suffice?

This research reveals that there are two major factors that influenced the market for retail real estate between 2011 and 2016. Convincing empirical evidence is provided that online shopping, and in particular online shopping for non-daily products, is a substitute for traditional in-store shopping. To add to this, the market for online shopping is most likely going to expand in the future. In 2016 inhabitants of the Netherlands purchased on average approximately 12,5 percent of their non-daily products through online channels (I&O Research, 2016). Forecasts predict that this percentage is likely to increase to 25 percent in the year 2025 (ING Bank, 2017) or even 30 percent in 2030 (Comarch, 2017).

Moreover, the results make clear that the change in retail revenue generated in municipalities, between 2011 and 2016, has a significant positive effect on the change in the demand for retail real estate. This means that an increase in retail revenue generated in municipalities, between 2011 and 2016, strengthened the demand for retail real estate. Similarly, in municipalities where the amount of generated retail revenue decreased, between 2011 and 2016, the demand for retail real estate weakened. The amount of retail revenue that is generated in municipalities and thereby the demand for retail real estate fluctuates over time. The growth of the amount of retail revenue that is generated in municipalities in one year does not necessarily mean that this growth continues in the following years. Therefore, the effect is considered to be temporary in nature.

In short, the results of this research show that the growing popularity of online shopping, between 2011 and 2016, has resulted in a decrease in the demand for retail real estate. Moreover, forecasts show that the increasing popularity of online shopping is likely to expand in the future, which indicates that the change in consumer behaviour, from traditional

in-store shopping towards online shopping, is of a structural nature. This entails that the original levels of demand for retail real estate are unlikely to be restored.

To add to this, our results indicate that economically good performing municipalities experience an increase in the demand for retail real estate, while municipalities which perform economically poorly are experiencing a decrease in the demand for retail real estate. Improving the demand side of the retail market through investments in the attractiveness of shopping areas could potentially boost the demand for retail real estate in specific municipalities. However, the amount of money that people are capable and willing to spend is restricted by their income. Consequently, attracting retail revenue to a specific shopping area is likely to result in a reduction in the amount of retail revenue generated in other shopping areas. This, so called 'waterbed effect', entails that the strengthening of particular shopping areas comes at the expense of other nearby located shopping areas. From this we conclude that investments in the attractiveness of the retail real estate market most likely result in stronger competition amongst shopping areas, rather than resulting in an integrally strengthened retail real estate market.

The results of this research lead us to conclude that the growth-oriented policy approach, which the province of Zuid-Holland has in place does not adequately deal with the problems on the market for retail real estate. The reason for this is that the current retail policy, predominantly focused on preserving and improving the attractiveness of existing shopping areas, is unable to restore the previous levels of demand. Therefore, the implementation of additional retail policy, focused on the reduction of the total stock of retail real estate, is required. Through this the current high levels of retail vacancy and its associated negative externalities could be reduced.

Retail policy focused on the shrinkage of the stock of retail real estate market is something which policy makers are not very familiar with. In previous decades, due to the growing prosperity, the growth of the population and trends regarding economies of scale the market for retail real estate grew almost uninterrupted (PBL, 2011). During this period, policy makers were primarily focussed on facilitating the expansion of the retail real estate market. The reduction of the retail real estate market was never positioned high on the policy agenda. Consequently, calls for additional policy require a shift in the mind-set of policy makers.

6.3 Two-track policy

In order to solve the issues on the retail real estate market the shift in the mind-set of policy makers should contribute to the implementation of additional retail policy. Besides the growth-oriented policy approach, policy makers can opt to implement an approach focussed primarily on reducing the stock of retail real estate. In this research this approach is referred to as the reduction-oriented policy approach. This approach focusses directly on the reduction of the excess of retail real estate by means of transformation and redevelopment or by putting restrictions on the development of new retail real estate. The reduction of vacant retail real estate decreases the negative externalities that are associated with retail vacancy. On top of that, the redevelopment and transformation of former retail real estate objects into other

functional types of real estate provides opportunities to add additional positive externalities. In this way strengthening the liveability of municipalities.

Through the implementation of this additional policy approach the province of Zuid-Holland can opt for a two-track policy. This allows for combining aspects of both approaches into a more effective new retail policy. On the one hand, the reduction-oriented policy approach aims to reduce the excess of retail real estate. Through this approach the province can restore the balance between the demand and supply on the retail real estate market in the middle-to-long term. On the other hand, the focus of the growth-oriented policy approach lies with the providing continuity to shopping areas. Through this approach the province can minimise the further deflation of the demand for retail real estate and maintain a stable stock of retail real estate. The implementation of the two-track policy entails that the current retail policy is still important. No longer as a means to reduce retail vacancy through primarily focussing on the attraction of additional retailers, but rather as a means to stop the increase in retail vacancy through the protection of existing shopping areas.

As discussed above the two policy tracks interact differently with the market for retail real estate. In figure 38 an overview is presented of the interaction of the two-track policy with the downward retail vacancy spiral.

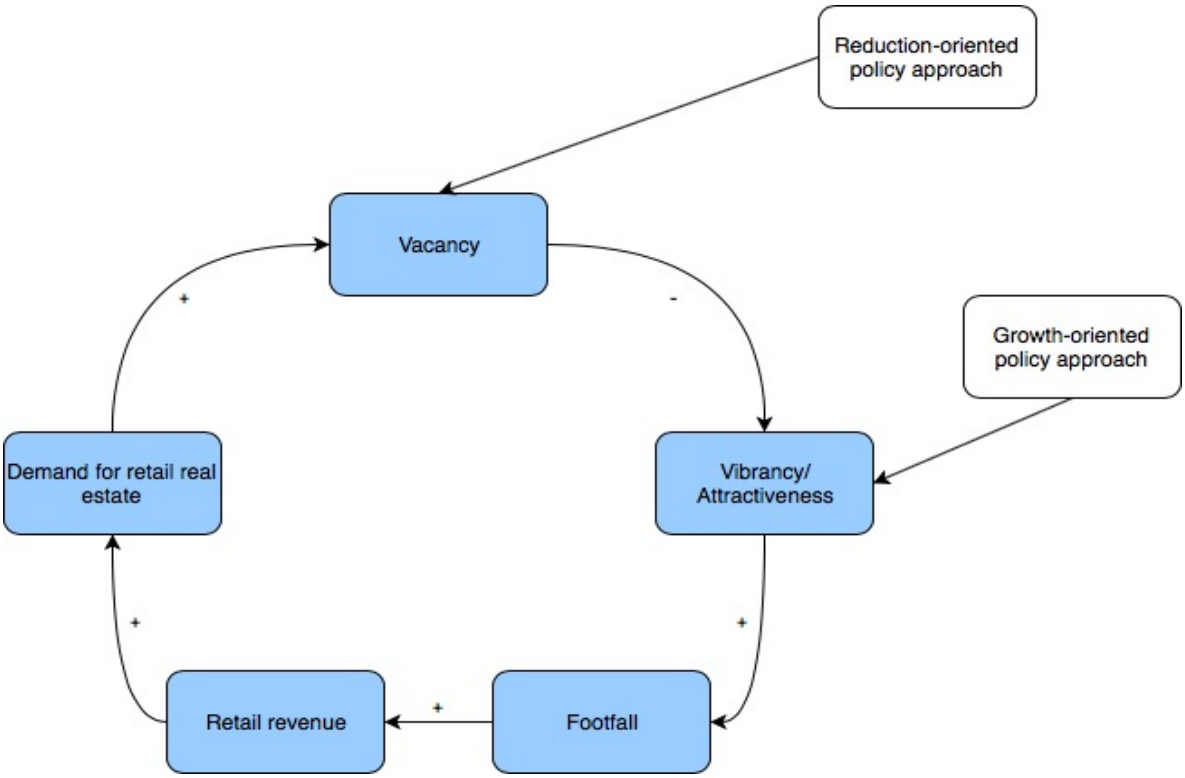

Figure 38: Interaction with the downward retail vacancy spiral

Currently, an active policy approach, focussed on the supply side of the market for retail real estate, does not exist in Zuid-Holland. Platform 31 (2014) introduced a large number of instruments which can be utilised to strengthen the market for retail real estate. In table 14 an overview of the instruments that are focussed on the reduction of vacant retail real estate is presented. The purpose and the expected effect of each individual instrument is discussed briefly in Appendix F: Policy instruments. Although the province of Zuid-Holland accompanied by its municipalities is responsible for the implementation of the reduction-oriented policy approach, for the execution the governments are also relying on other actors. These include: retailers, retail real estate investors, retail real estate agents, project developers and the national government. The overview of instruments presented in table 14 is used as a basis to determine what the potential roles of the different actors are; in case a reduction-oriented policy approach is introduced.

Table 14: Instruments aimed at the reduction of the amount of retail real estate

Province of Zuid-Holland	Municipalities	Retailers	Retail real estate investors	Retail real estate agents	Project developers	National government
-Provincial spatial development strategy	-Municipal spatial development strategy		-Organisation and mutual coordination	-Advise with transformation and redevelopment	-Creation of added value through craftsmanship	-Tax policy
-Provincial retail vision	-Municipal retail vision		-Functional transformation			-Legislature
-Provincial process based instruments	-Centrum vision		-Separating living and shopping			-Ladder of sustainable development
-Provincial spatial regulation	-Regional coordination retail policy		-Merging of retail objects			
-Inter-governmental supervision	-Knowledge of and consultation with real estate owners					
-Provincial financial instruments	-Zoning plan					
	-Environmental permit					

The province of Zuid-Holland contains a number of instruments that can play a role in facilitating the successful reduction of the stock of retail real estate. The province has the ability to document new retail visions and objectives in their spatial retail vision in order to create a foundation for the reduction-oriented policy approach. Moreover, the province of Zuid-Holland possesses process instruments which enable the province to keep a dialogue with other actors, bring them together and steer them in the desired direction.

Individual municipalities are very important parties for cooperating with the province. The reason for this is that the municipalities have to translate the retail vision drafted by the province of Zuid-Holland into their own municipal retail visions. In this way the province together with the individual municipalities are responsible for drafting a spatial retail vision in

which the development of new retail real estate is restricted and the reduction of existing retail real estate is stimulated. An important instrument for actively enforcing these spatial retail visions is the zoning plan. In order to stimulate the transformation and redevelopment of retail real estate, municipalities have to be flexible in handling earlier drafted zoning plans. This means that municipalities should be able to nullify or revise existing zoning plans, because without a flexible and cooperating attitude of municipalities, well willing market parties are unable to realise their transformation projects. Municipalities also have the possibility to be strict on incorporating the retail function in newly drafted zoning plans. Municipalities also possess instruments that allow for the spatial enforcement of their municipal retail policies, such as the expropriation of land or retail real estate. These instruments are however very drastic, costly and timely to use (PBL, 2010). Moreover, municipalities can apply different process instruments, which allow municipalities to cooperate and exchange knowledge with other actors.

The market parties are a broad group of actors consisting of retailers, retail real estate investors, retail real estate agents and project developers. Both retailers themselves and retail real estate agents possess little instruments to reduce the stock of retail real estate. From the group of market actors, the retail real estate investors and the project developers actually have the capabilities of reducing the excess of retail real estate through investments in or the execution of transformation and redevelopment projects. According to the Compendium for the Living Environment (2017) market parties have been able to transform and redevelop part of the stock of retail real estate in the past couple of years. This reduction of retail real estate is mainly driven by the reoccupation of retail real estate objects formerly occupied by V&D, but the reduction in retail vacancy is also the result of the successful transformation of smaller retail stores into lunch rooms, restaurants and other types of real estate (Dynamis, 2017).

In order to maintain attractive shopping areas in the future, it is important that a dominant shopping function is retained. Transformation and redevelopment projects which turn former retail real estate objects into real estate objects with other functional uses could be beneficial for shopping areas in general. However, shopping areas can also lose part of their attractiveness in case too many retail real estate objects stores are transformed or redeveloped into other functional types of real estate. It is important that the right balance between shopping functions and other functional uses such as restaurants and lunch rooms is obtained. Otherwise the street scene could potentially become too uniform, in which case the shopping area could lose part of its attractiveness.

Moreover, the national government possesses few instruments to stimulate the reduction of retail real estate. They initiated the ladder of sustainable development, which is to be carried out by local governments. This is a mean to ensure that parties who are looking to develop real estate, choose the most sustainable option. Through this instrument the reoccupation of existing locations is stimulated. Other than that, the national government has the jurisdiction to initiate new tax policies or legislation to stimulate the transformation or redevelopment of vacant retail real estate. Both instruments are political sensitive and the implementation consists of lengthy procedures.

In short, the role of the governments is limited to a facilitating role. The province is responsible for creating a retail vision in which they can limit the development of new retail real estate and stimulate the reduction of vacant retail real estate. Individual municipalities have to adopt this vision into their own municipal visions and facilitate the reduction of vacant retail real estate through the accompanied zoning plans. They also have to be strict on incorporating the retail function in new zoning plans. The ladder of sustainability gives the province and the municipalities the power to stimulate actors to reoccupy existing retail real estate, before simply developing new retail real estate. Overall we concluded that for the actual reduction of existing retail real estate, the province of Zuid-Holland is currently very dependent on initiatives from market parties. Moreover, the province of Zuid-Holland and the municipalities located within Zuid-Holland also possess very little instruments to incentivise or enforce market parties to contribute the reduction of the stock of retail real estate. Consequently, for the successful implementation of the reduction-oriented policy approach, additional instruments are required.

6.4 Meter for a meter plus policy

One way of reducing the excess of retail real estate is to introduce retail policy that puts a hold on, or limits the development of new retail real estate. In this way, through the natural aging and the associated demolition of retail real estate, the amount of vacant retail real estate could be reduced. There are two main reasons why this type of retail policy is considered as undesirable. Firstly, real estate in general has a long life span. The reduction of retail vacancy rates would take a considerable amount of time. During this period the retail vacancy rates remain high, which means that the negative effects on the liveability of municipalities are kept in place for a certain period of time. Secondly, restricting the development of new retail real estate limits the opportunities for retailers to move to better suiting retail objects. In case the developments surrounding the retail market demand other types of retail real estate objects, the restriction on the development of new retail real estate prohibits retailers to relocate to more efficient retail real estate objects.

Another, more promising option for providing the province of Zuid-Holland and the associated municipalities with additional means is to implement policy previously used by the province of Zuid-Holland in the greenhouse farming sector. In the past this so called ‘meter for a meter’ policy was successfully implemented to restrict the construction of new greenhouse farms. The policy only permitted the construction of new greenhouse farms in case existing greenhouse farms were demolished (Provincie Zuid-Holland [B], 2014). The aim of this instrument was to put a hold on the expansion of greenhouse farms. This meter for a meter policy contains valuable aspects that could be utilised in addition to the current reduction-oriented policy approach.

The objective of the reduction-oriented policy approach is to actually reduce the amount of vacant retail real estate. This means that implementing a meter for a meter policy, in which the ratio between the construction of square meters and the transformation or redevelopment of square meters is one to one, will only contribute to keeping the stock for

retail real estate at the current level. This means that this policy in its current form will not contribute to the actual reduction of the excess of retail real estate. Therefore, in this design it is put forward to sharpen the meter for a meter policy to a meter for a meter plus policy. With this policy the ratio between the construction of square meters of new retail real estate and the transformation or redevelopment of square meters of existing retail real estate becomes 1 to more than 1. The introduction of the meter for a meter plus policy would actually provide the province of Zuid-Holland and its accompanied municipalities an instrument which enables the enforcement of reducing the stock of retail real estate.

The implementation of the meter for a meter plus policy would require developers who want to develop retail real estate to simultaneously transform or redevelop more vacant retail real estate than they are planning to develop. The implementation of this instrument is feasible from a legal standpoint. In the allotment of municipal land, under civil law, municipalities are allowed to capture the meter for a meter plus clause in a contract (PBL, 2010). Also in case a developer wants to develop real estate on his own land, but for which the zoning plan does not yet allow the retail function, municipalities are allowed to contractually include the meter for a meter plus clause during the process of altering the zoning plan. The only legal restriction is that governments have to follow the European public procurement law in case they enter into a deal with market parties (PBL, 2010). Therefore, it can be concluded that in case the European public procurement law is followed, legal feasibility in many cases does not form a constraint. Only in case a developer wants to develop retail real estate on a location where the zoning plan already permits the retail function, the municipality possess very little instruments to enforce the reduction of retail real estate.

One aspect of the meter for a meter plus policy that could potentially form an issue is the coordination between the different municipalities. Ideally for an effective use of this instrument the location of the development of new retail real estate and the transformation or redevelopment of existing retail real estate would not matter. This means that a developer should be able to develop units of retail real estate in one municipality and transform or redevelop units of retail real estate in another municipality. This requires a strong coordinative role for the province of Zuid-Holland. The reason for this is that municipalities are most likely not willing to participate in the transfer of retailers to other nearby located municipalities. Therefore, the province must ensure that, in locations where retail real estate is being transformed or redeveloped, other functional types of real estate are developed. In this way the province ensures that the liveability of the municipalities in question is sufficiently compensated through the return of other functional types of real estate.

The second aspect of the meter for a meter plus policy that could form an issue is the ability to actually incentivise market parties. For the successful implementation of this instrument it is important that there is an actual gain for market parties. Otherwise market parties are not going to participate in the transformation or redevelopment of retail real estate. This entails that the revenue generated from developing units of retail real estate must outweigh the cost of transforming or redeveloping units of retail real estate and provide a sufficient profit margin. Consequently, a competitive ratio at which the construction versus

the transformation or redevelopment of retail real estate must take place should be established. Additionally, municipalities also have the possibility to incentivise market parties through other means. One of these means is giving out options on other land parcels on which the developer can realise other developments as part of the deal for the transformation or redevelopment of retail real estate. In this case developers are able to recover the losses they make on the transformation or redevelopment of existing retail real estate by developing profitable types of real estate elsewhere. Again, in order for this instrument to be legally feasible it is important that municipalities follow the laws of public procurement (PBL, 2010).

The introduction of the meter for a meter plus policy has a number of consequences for the transformation task of retail real estate and for the actors that are active on this market. First of all, currently transformation projects are already initiated by market parties. Which is illustrated by the fact that the national retail vacancy rate reached its peak in 2016 after which the retail vacancy declined steadily (Compendium for the Living Environment, 2017). This means that in case the meter for a meter plus policy works effectively, it has the potential to further contribute to the return of the retail vacancy rates to the desired pre-crisis level. Once the desired retail vacancy rate is reached policy makers need to reconsider the use of the meter for a meter plus policy. They could either loosen or abandon the meter for a meter plus policy, in this way handing part of the freedom or all of the freedom of developing retail real estate back to the market.

Secondly, the meter for a meter plus policy has a number of consequences for the market parties who are active on the retail real estate market. As mentioned before, in order for this policy to be successful from the perspective of the market parties, opportunities for realising certain profit margin will have to be present. If this is not het case project developers are unlikely to participate in transformation and redevelopment projects, leading to a potential standstill of transformation and redevelopment projects on the retail real estate market. According to Ossokina, Svitak and Teulings (2017) transformation and redevelopment projects become financially more attractive when they are executed on a large scale. This suggests that market parties are most likely to initiate transformation and redevelopment projects in areas where vacant retail real estate is clustered, because in these areas economies of scale are easiest to utilise. Consequently, this means that in areas where vacant retail real estate is more scattered the transformation and redevelopment projects are financially less attractive, and therefore less likely to be undertaken.

To add to this, the statement made by Ossokina et al. (2017) that transformation and redevelopment projects become financially more attractive when they are executed on a large scale, means that large project development companies have an advantage over smaller companies. The reason for this is that large companies possess the resources to undertake large scale projects. Smaller companies do not have these same resources. In case these smaller companies want to undertake transformation and redevelopment projects they are more frequently forced to collaborate with other market parties in a joint venture or other legal entity.

6.5 Conclusion: additional policy required

In short, the province of Zuid-Holland is a very ambitious province. Its objective is to be a leading province in which people enjoy to reside, work and leisure. Proper functioning retail markets are crucial in achieving this ambition. However, the current high levels of retail vacancy and its associated negative externalities are threatening the liveability of municipalities and thereby the objectives of the province of Zuid-Holland.

Based on the findings of this research we conclude that the current provincial retail policy does not adequately deal with the problems on the market for retail real estate. The reason for this is that the current policy approach is predominantly growth-oriented. The reduction of the excess of retail real estate is very much underexposed in the current policy approach. Consequently, a shift in the mind-set of policy makers, from an attitude focussed on the growth of the retail real estate market to an attitude focussed on the reduction of the retail real estate, is required.

The change in the mind-set of policy makers should result in the implementation of a reduction-oriented policy approach. The currently available instruments that could make up this policy approach are unlikely to yield the desired results. The reason for this is that the currently available instruments only allow for a facilitating role for the province of Zuid-Holland and its associated municipalities. Therefore, these governments are relying too strongly on the initiatives from market parties, without being able to directly enforce or incentivise them. Consequently, additional means should be made available to the governments in the province of Zuid-Holland.

In this design chapter a suggestion is made to implement the meter for a meter plus policy. This policy requires developers who want to develop one unit of retail real estate to simultaneously transform or redevelop more than one unit of retail real estate elsewhere. We argue that the implementation of the meter for a meter plus policy, under strong provincial coordination, would provide governments the necessary means to successfully enforce the reduction of the stock of retail real estate. In this way contributing to restoring the attractiveness and vibrancy of shopping areas, which stimulate the liveability in municipalities in Zuid-Holland.

7. Conclusion and recommendations

In this research the effects of the increasing popularity of online shopping, between 2011 and 2016, on the market for retail real estate are empirically examined. Moreover, in this research other potential effects on the changing retail real estate market are examined. The results of this analysis are used to optimise the current provincial retail policy. In this chapter the main findings of this research are combined in order to answer the main research question:

> *What are the effects of online shopping on the retail real estate market, and how should retail policy address these effects?*

7.1 The effects on the retail real estate market

In the post crisis years, the retail vacancy rates in the Netherlands steadily increased from around six percent to more than ten percent (Evers et al., 2014), before dropping back below ten percent in 2016 (PBL, 2016). In the literature many different explanation for this increase in retail vacancy are presented, including: online shopping (Kumar & Kumari, 2014), retail revenue generated in municipalities (Woodruffe-Burton et al., 2002; Weltevreden & Van Rietbergen, 2007), composition of the population (Zhang et al., 2016; CBS [B], 2017; CBS [C], 2017), economic cycle (Zhang et al., 2016; Teale, 2012; Burt, 2010; Evers et al., 2014), economies of scale (PBL, 2011; DTNP, 2017; Still & Simmonds, 2000; PBL, 2013) and perceived attractiveness (Weltevreden & Van Rietbergen, 2007; Zhang et al., 2016; Berwyn, 2013).

In this research, statistical analysis is used to determine whether the problems on the retail real estate market are caused by the increasing popularity of online shopping, or whether these issues are caused by other factors. The analysis is conducted using data of a total of 110 municipalities located in the western part of the Netherlands.

The main finding of this research is that the increase in online expenditures, between 2011 and 2016, is the main cause of the reduction in the total demand for retail real estate. This reduction in the demand for retail real estate is for a large part contributed to the strong increase in the online expenditures on non-daily products. Our results do not provide evidence that the slight increase in the online expenditures on daily products, between 2011 and 2016, contributed to the reduction in the demand for retail real estate.

In this way our research provides strong empirical evidence that supports the claims of those scholars who state that online shopping is a substitute for traditional in-store shopping (Baen, 2000: Winograd, et al., 2000; Weltevreden & Van Rietbergen, 2007). To elaborate on this, especially online shopping for non-daily products forms a strong substitute for traditional in-store shopping. Our results indicate that online shopping for daily products does not form a direct substitute for traditional in-store shopping. Furthermore, our findings directly contradict the claims of those scholars who argue that the effects of online shopping on traditional in-store shopping should be regarded as complementary or modifying (Salomon, 1986; Andersen & Rosen, 2000; Winograd et al., 2000; Mokhtarian, 2002; Ferrel, 2005; Weltevreden & Van Rietbergen, 2007). The evidence provided for the existence of a

substitution effect entails that online shopping has captured part of the market share of traditional in-store shopping. Thereby, contributing to the extent of retail vacancy and threatening the liveability of municipalities.

Another interesting finding of this research regards the positive effect of the change in retail revenue generated in municipalities, between 2011 and 2016, on the changing demand for retail real estate. From this finding we conclude that the economic performance of municipalities also plays an important role in the functioning of the retail real estate market. Increasing retail revenues generated in municipalities, between 2011 and 2016, contributed to the increase in the demand for retail real estate in municipalities. Similarly, a decrease in retail revenue generated in municipalities, between 2011 and 2016, weakened the demand for retail real estate in municipalities.

Moreover, the results of this research do not provide evidence that supports the believes that other sociodemographic and consumer behavioural factors have an effect on the change in the demand for retail real estate, between 2011 and 2016. These factors include: change in the composition of the population and the economic cycle. Additionally, no evidence is found that the demand for retail real estate is affected differently in rural municipalities compared to urban municipalities.

In short, the results stipulate that there are two factors that directly affect the changing demand for retail real estate. Besides the effect of the structural change in the behaviour of consumers, which has partly shifted the consumer spending from traditional in-store shopping channels to online shopping channels, the change in the retail revenue generated in municipalities also has an effect on the demand for retail real estate. Contrary, to the structural change in shopping behaviour, the retail revenue generated in municipalities is sensitive to constant economic fluctuations. This means that the amount of retail revenue generated in municipalities is susceptible to change. Figure 39 displays on a conceptual level how these two factors affect the change in the demand for retail real estate and how they ultimately contribute to the problems regarding retail vacancy.

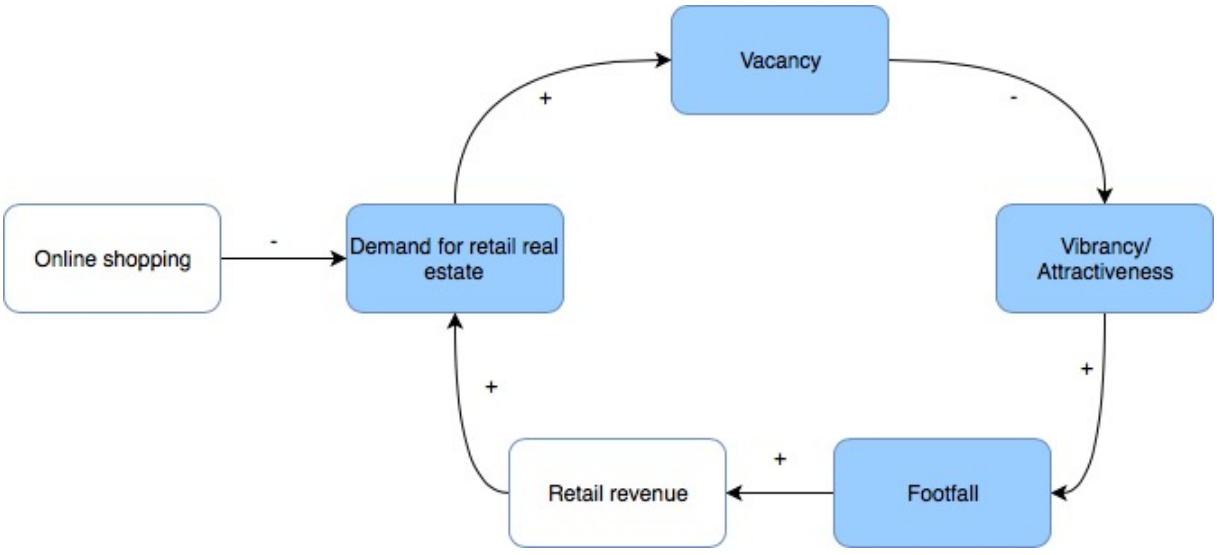

Figure 39: Effects on the demand for retail real estate

7.2 Consequences for provincial retail policy

The province of Zuid-Holland has the ambition to be a leading province in which people enjoy to reside, work and leisure. Vibrant and attractive shopping areas are vital in realising this ambition. The high levels of retail vacancy are threatening part of the liveability of municipalities and thereby the objective of the province of Zuid-Holland.

In order to deal with the problems of retail vacancy the province has implemented retail policy which aims at strengthening the strong aspects of the traditional in-store retail market and preserving the fine-grained structure of small shopping areas. Central themes in this retail policy are reinforcement and preservation. The shrinkage of the market for retail real estate through transformation, redevelopment or merging is only occasionally utilised in this retail policy.

From the results of this research it is concluded that the current retail policy does not adequately deal with the problems on the retail real estate market. The main reason for this is that the current retail policy is primarily focussed on restoring the demand for retail real estate, while the results of this research show that part of the decrease in the demand for retail real estate is of a structural nature. This entails that it is very unlikely that the demand for retail real estate will match its previous levels in the future. Consequently, the only way to restore the attractiveness and vibrancy of shopping areas is to reduce the stock of retail real estate through the transformation and redevelopment of superfluous retail real estate.

In previous decades, due to the growing prosperity, the growth of the population and trends regarding economies of scale the market for retail real estate grew almost exclusively. During these times policy makers were mainly focussed on facilitating the growth of the retail real estate market, without focussing on the reduction of vacant retail real estate on a large scale. Consequently, the need for new retail policy focussed on the reduction of the stock of retail real estate requires a shift in the mind-set of policy makers.

7.3 Policy recommendations for reducing retail vacancy

First of all, it is recommended to implement a so called two-track retail policy. With this policy approach the province can utilise the strong aspects of the current retail policy as well as adopting additional retail policy. In this way additional retail policy, referred to as the reduction-oriented policy approach, can be used to restore the balance between the demand and supply of retail real estate in the middle-to-long term. On the other hand, the current retail policy, referred to as the growth-oriented policy approach, can be used to maintain this balance on the market for retail real estate in the long-term. In this way the two-track policy aims to restore the attractiveness and vibrancy of shopping areas and keep them attractive and vibrant. Figure 40 illustrates how the factors discovered in this research affect the market for retail real estate. Moreover, the figure shows how the two policy approaches interact with the retail real estate market.

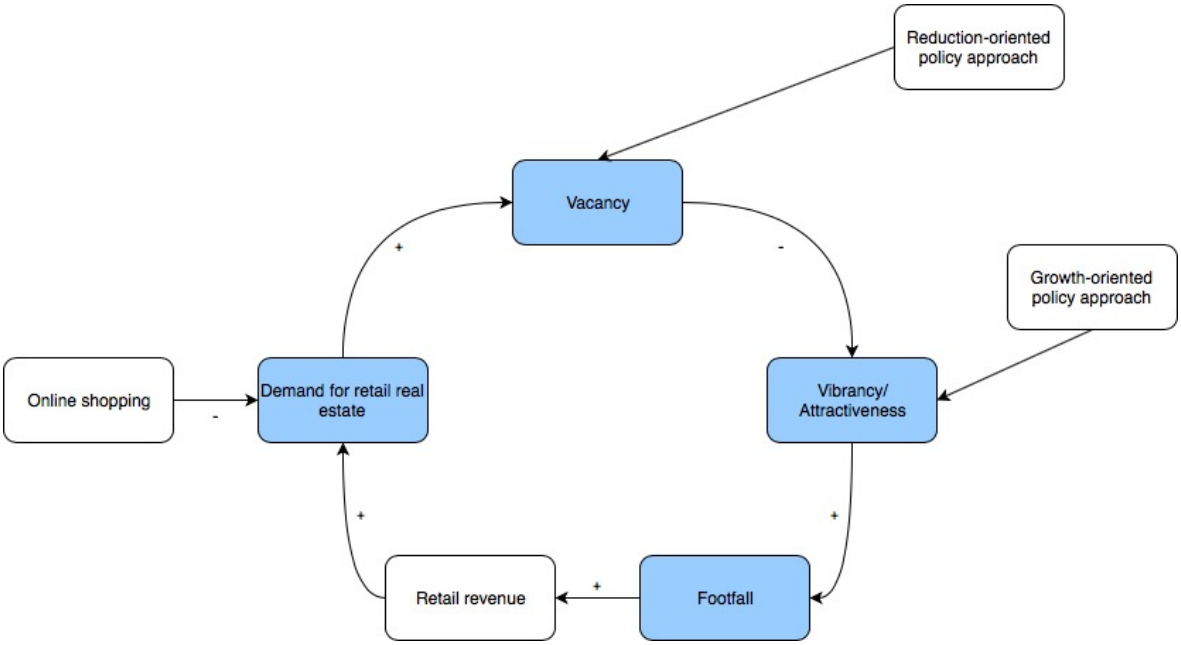

Figure 40: Interaction between the retail real estate market and the two policy tracks

The second recommendation is to provide the governments with additional means to ensure that the retail vacancy rates are reduced. One promising instrument is the meter for a meter policy. This policy proved to be successful in the greenhouse farming sector in Zuid-Holland, where it was used to restrict the number of greenhouse farms. In order for this instrument to be successful in the retail sector its use will have to be rearranged slightly. It is recommended to implement this policy in such a way that the construction of one unit of retail space is accompanied by the transformation or redevelopment of more than one unit of retail space. Through tightening this policy into a meter for a meter plus policy, municipalities can actually enforce the reduction of the excess of retail real estate.

In short, the growing popularity of online shopping, between 2011 and 2016, has captured part of the market share of traditional in-store shopping. To add to this, the market share of online shopping currently lies at approximately 12,5 percent, predictions indicate that the market for online shopping is continuing to grow to a possible 30 percent market share in 2030. In order to deal adequately with the current and expected effects of the growing online shopping market on the market for retail real estate, the mind-set of policy makers needs to partially shift towards a reduction-oriented policy approach. This change in the mind-set of policy makers should result in the introduction of a two-track policy, through which governments can steer both the reduction of the excess of retail real estate as well as the preservation of the existing shopping areas. Currently the available instruments only allow governments in Zuid-Holland to take on a facilitating role. In order to provided governments with additional means to enforce or incentivise market parties to participate more in the reduction of the excess of retail real estate, it is recommended to implement the meter for a meter plus policy. This policy ensures that the construction of an additional unit of retail real estate is accompanied with the transformation or redevelopment of more than one unit of retail real estate.

8 Discussion

In this chapter the outcomes of the executed master thesis are discussed. The objective of this research is to design a policy approach that improves the way the province of Zuid-Holland deals with the effects of the growing popularity of online shopping on the retail real estate market. The results of the statistical analyses show that the market for online shopping has substituted part of the market for traditional in-store shopping. The introduction of the two-track policy complemented by the meter for a meter plus policy is required in order to deal adequately with the problems surrounding vacancy on the retail real estate market. This discussion points out the implications of this research from a scientific and a societal perspective in section one and section two respectively. Next, the limitations of this research concerning aspects such as important modelling choices and data constraints are discussed. This chapter finishes with recommendations for future research in section four.

8.1 Scientific implications

The scientific implication of this research is twofold. Firstly, the impact of online shopping on traditional in-store shopping has not yet been analysed with use of multiple regression analysis. The added value of multivariate analysis methods, which go beyond simple descriptive analysis and bivariate analysis, to this field of research was previously indicated by Weltevreden (2007). Consequently, the results derived from this analysis are of important scientific relevance.

Through this research we are able to contribute to the ongoing scientific debate regarding the effects of online shopping on traditional in-store shopping. The results provide strong empirical evidence that online shopping is a substitute for traditional in-store shopping. In this way we are able to confirm what others have argued before us (Baen, 2000: Winograd, et al., 2000; Mokhtarian, 2002; Weltevreden & Van Rietbergen, 2007; Zhang et al., 2016). The level of specificity in our data allows us to elaborate on this effect in more detail. In this research evidence is provided that the substitution effect of online shopping on traditional in-store shopping is completely appertaining to the online purchase of non-daily products. On the other hand, no evidence is provided that traditional in-store shopping is affected by the online purchase of daily products. Moreover, this research does not indicate that online shopping strengthens traditional in-store shopping. In this way this research does not support the claims of those authors who state that online shopping has a complementarity effect on traditional in-store shopping (Salomon, 1986; Andersen & Rosen, 2000; Mokhtarian, 2002; Farag et al., 2007; Weltevreden & Van Rietbergen, 2007).

Secondly, the fact that online shopping forms a substitute for traditional in-store shopping also has consequences for the spatial retail structure. Ever since people first started retailing, a spatial retail structure began to emerge. In the 20th century many authors have tried to capture this spatial retail structure in locational theories. One of the most common theories is Christaller's (1933) Central Place Theory. In this theory the existence of a

hierarchical network of retail agglomerations is explained through the number of physical interactions that take place within shopping areas. Another influential theory is Alonso's (1954) Bid-rent theory. In this theory the hierarchical structure within shopping centres is explained based on the retailer's ability and willingness to pay rent for accessible retail locations. Next, the Law of retail Gravitation introduced by Reilly (1932) argues the importance of the distance to and the size of a municipality for the locational choices of retailers. The theories of cumulative attraction (Nelson, 1958) and cumulative causation (Myrdal, 1956) explain the importance of clustering of retail activities from the perspective of the consumer and the retailer respectively.

The results of this research indicate that some of the basic principles underlying the locational theories are losing their relevance. The growing popularity of online shopping leads to a change in the locations where consumers and retailers interact. In the past all of these interactions took place in the physical domain, our results show that a portion of these interaction have shifted to the internet. This means that the physical interactions described by Christaller (1933) are becoming of less importance to retailers. Also, the importance of accessibility as argued by Alonso (1954) is subject to change. With the introduction of the online shopping market, part of the physical accessibility has moved towards online accessibility. Moreover, Reilly (1932) introduced the concepts of distance to and size of a municipality as important factors for successful retailing. Especially the concept of distance loses its relevance as the internet takes away the distance between the online consumer and online retailer. Finally, Nelson (1958) and Myrdal (1956) both stress the importance of the clustering of retail activities. With the introduction of the internet the entire online shopping market is basically clustered on the devices of consumers, which indicates that part of the importance of physical clustering has vanished. In short, the introduction of the internet leads to the partial diminishing of some of the basic principles underlying the existing locational theories. Summarising, this research indicates that the growth of the online shopping market has partly evaporated the concepts underlying the spatial retail structure.

8.2 Societal implications

The insights derived from this research are also of societal relevance, mainly through the implications for retail policy. First of all, the results point out that in order to keep the market for retail real estate attractive to retailers and consumers a shift in the mind-set of policy makers is required. This change in mind-set embodied by the recommendations for the reduction-oriented policy approach is not only useful for the future of shopping areas, but also for the liveability of municipalities as a whole.

Secondly, this research is useful to society by pointing out that in order to restore the balance between demand and supply of the retail real estate market, additional means should be made available to governments. A recommendation is made to bring back the meter for a meter policy, which previously proved its success in the greenhouse farming sector. In order to help retain an attractive retail sector a recommendation is made to tighten this policy from a meter for a meter policy to a meter for a meter plus policy. In this way municipalities are

finally provided the means to actually enforce the reduction of the superfluous retail real estate. The successful implementation of this meter for a meter plus policy requires municipalities to follow public procurement laws. Additionally, it requires a strong coordinative role for the province of Zuid-Holland in order to assure the cooperation between municipalities and it requires sufficient incentives for market parties to participate in this meter for a meter plus policy.

8.3 Limitations of research

This section contains a reflection on this research. The implications of the important choices made in this research and the data constraints are addressed.

Firstly, in this research the chosen unit of analysis is the municipality. The reason for this is that data concerning online expenditures is only available at the municipal level of aggregation. Ideally, one would conduct an analysis on the shopping centre level of aggregation, because shopping centres are autonomous entities that operate independently of each other. This entails that the economic performance of individual shopping centres located in the same municipalities could differ significantly. In this research this remains unnoticed as the data of all shopping centres located in a single municipality is analysed collectively. Consequently, in this research we are unable to draw conclusions on the performance of different types of shopping centres, while this could be very relevant from the perspective of the spatial retail structure. With the use of municipalities as the unit of analyses we are limited to making broad statements about the effects of online shopping, without actually being able to identify the way specific types of shopping centres are affected by the growing popularity of online shopping.

Besides being unable to draw conclusions on different types of shopping centres, we are also unable to pinpoint precisely the geographical locations within the province of Zuid-Holland in which the problems are most severe. Consequently, in this research we are unable to customise retail policy for different municipalities located in varying geographical locations.

Thereafter, a number of municipalities is considered to be too influential on the model outcomes. Therefore, they have been removed from the analysis. The municipalities located in the province of Zuid-Holland that were removed from the analysis are s-Gravenhage and Rotterdam. This means that the two largest municipalities located in the province of Zuid-Holland are not incorporated in the analysis conducted in this research.

Thirdly, our results indicate that the change in the percentage of elderly citizens, between 2011 and 2016, is positively related to the change in the demand for retail real estate. Contrary, in the literature it is expected that elderly citizens spend less money on retail products than citizens of younger generations (Platform 31, 2014; Ministerie van Economische Zaken, 2015). Moreover, the violation of the normality assumption proved to be most critical in those models in which the variable the change in the percentage of elderly citizens is statistically significant. For these two reasons the results regarding the percentage of elderly citizens are questionable and regarded as invalid. This means that the effect of the change in the percentage of elderly citizens is not incorporated in the design chapter of this research.

Finally, this research is limited to investigating the factors on the demand side of the retail real estate market. The reason for this is that the consulted data sources do not contain data on the supply side of the retail real estate market. Accordingly, the conclusions that are drawn about the effects on the market for retail real estate are purely based on data concerning the demand side of the retail real estate market, not taking into account the data on the supply side of the market. Although the nature of the supply side of the retail real estate market is not as dynamic as the nature of the demand side of the retail real estate market, and therefore less likely to contributed to the significant increase in retail vacancy in a short period of time, the inclusion of the data regarding the supply side of the market would have presented a more complete picture of the causes of retail vacancy.

8.4 Recommendations for future research

This research provides further evidence for the substitution of traditional in-store shopping by the growth of online shopping. Moreover, the need for additional retail policy is explained. However, we also touched upon a number of aspects that provide interesting topics for future research.

First of all, it is recommended to focus future research on the effects of online shopping on individual shopping centres. This type of research could provide additional insights into the effects of the growth of the online shopping market on specific types of shopping centres. The results of such a research could especially be interesting from the perspective of spatial planning. With these insights one would be able to analyse the implications on the locational retail theories in more detail. In this research we were only able to broadly review the underlying concepts of these theories. Additional research could focus on examining the choices of retailers and consumers in the age of the internet. Possibly providing new explanations for the spatial component of the retail structure.

Moreover, an analysis on a lower level of aggregation contains more detailed information on the consequences for the retail real estate market. This additional information would allow local municipalities to apply a more customised retail policy. In this way future research could also be interesting from a policy perspective.

Next, additional research into the shopping behaviour of elderly citizens could provide more insight into the actual effect this group of citizens has on the demand for retail real estate. Especially in the coming years this group of citizens is growing significantly and could therefore play a considerable role on the market for retail real estate (Ministerie van Binnenlandse Zaken, 2015). Besides focussing on the total expenditures of this group of citizens, future research could also focus on the retail spending on specific types of products.

Furthermore, currently a debate is going on whether the development of new housing should take place within the already existing structure of municipalities, or whether this development should take place near the edges of municipalities (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2016; Hekwolter, Nijskens & Heeringa, 2017). From a retail real estate market perspective, the development of outer city housing also means that additional retail facilities have to be developed. With smart use of retail functions, they could be

implemented successfully in these new outer city housing areas. However, this research and other reports show that overall there already is an excess of retail real estate. (Weltevreden en Rietbergen, 2007; DNTP, 2013; Evers et al., 2015; Ministerie van Economische Zaken, 2015; Dyanmis, 2007). Developing additional concentrations of housing could potentially attract retailers from existing shopping areas, thereby worsening the situation in the already existing shopping areas.

Another possibility for dealing with the shortage of housing is to concentrate the development of additional housing within the existing structure of municipalities. In this scenario, the currently struggling retail real estate market could potentially benefit from these new developments. Therefore, future research should focus on the question whether the transformation or redevelopment of part of the vacant retail real estate into additional housing, has the potential to revive the currently struggling retail real estate market in the province of Zuid-Holland? The answer to this question could provide an additional argument for the concentration of new development of housing within the existing structure of municipalities.

Finally, additional case studies could provide the necessary information regarding the municipalities of s-Gravenhage and Rotterdam, which is missing in this research. Through these studies one should be able to determine whether the effects that are observed in this research are also observed within the municipalities of s-Gravenhage and Rotterdam. Consequently, one should be able to determine whether the two-track policy would also be useful in these two municipalities, or whether a different policy approach is required in these municipalities.

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Appendix A: Data Modification

Across the Netherlands a number of municipalities have merged between the years 2011 and 2016, including municipalities that are located in the research sample used in this research. In order to incorporated these cases, the data had to be modified slightly. One example of the merging of municipalities is illustrated below in table 15, the data of other merged municipalities is handled in similar fashion. This particular example involves the merging of the three municipalities of Bussum, Muiden and Naarden into the new municipality called Gooise Meren. Table 15 presents the data at the year 2011, in this year the municipalities were not yet merged. In order to be able to compare the data of these municipalities with the data of 2016, in which the municipalities are merged, the data of the individual municipalities had to be combined. The process of combining the data is done in the row called 'Proxy Gooise Meren' in table 15. This proxy can now be compared with the already existing data of the Gooise Meren in 2016, displayed in table 16. This process is repeated for every municipality that has merged between the years 2011 and 2016.

Table 15: Example of the incorporation of merged municipalities year 2011

Name municipality	Year	Number of inhabitants	Number of inhabitants older than 65 years	Number of households	Average household size	Number of income receivers	Average income of income receiver	Average disposable income	Average distance to large supermarket	Surface area
Bussum	2011	32410	6157,90	14770	2,2	22200	41,3	29	0,5	815
Muiden	2011	6500	1170,00	2780	2,3	4600	39,5	28,1	2,1	3649
Naarden	2011	17185	3437,00	7260	2,3	11400	47	31,8	0,6	3290
Proxy Gooise Meren	2011	56095	10765	24810	2,3	38200	42,60	29,63	0,7	7754

Table 16: Example of the incorporation of merged municipalities year 2016

Name municipality	Year	Number of inhabitants	Number of inhabitants older than 65 years	Number of households	Average household size	Number of income receivers	Average income of income receiver	Average disposable income	Average distance to large supermarket	Surface area
Gooise Meren	2016	56696	11824	25338	2,2	41200	44	33	0,7	7522

Appendix B: Characteristics of rural and urban municipalities

Table 17: Differences between rural municipalities and urban municipalities

Variable label	2011 Rural municipalities (<35.000 inhabitants)	2011 Urban municipalities (>35.000 inhabitants)	2016 Rural municipalities (<35.000 inhabitants)	2016 Urban municipalities (>35.000 inhabitants)
dependent				
Demand for retail real estate				
Average amount of occupied square meters of retail floor space per inhabitant (daily)	322,369	329,286	340,921	352,668
Average amount of occupied square meters of retail floor space per inhabitant (non-daily)	1087,464	1253,959	1051,726	1163,032
Average amount of occupied square meters of retail floor space per inhabitant (total)	1409,834	1583,245	1392,647	1515,700
Number of occupied retail stores per inhabitant (daily)	0,002	0,002	0,002	0,002
Number of occupied retail stores per inhabitant (non-daily)	0,004	0,004	0,004	0,004
Number of occupied retail stores per inhabitant (total)	0,006	0,006	0,005	0,005
Independent				
Online shopping				
Average online expenditures per inhabitant (daily)	12,055	15,775	39,557	40,244
Average online expenditures per inhabitant (non-daily)	251,384	262,055	624,245	606,556
Average online expenditures per inhabitant (total)	263,439	277,830	663,802	646,800
Retail revenue generated in municipalities				
Average retail revenue per inhabitant (daily)	2387,901	2471,707	2734,087	2825,048
Average retail revenue per inhabitant (non-daily)	1490,937	2077,528	1636,263	2299,450
Average retail revenue per inhabitant (total)	3878,838	4549,235	4370,350	5124,498
Composition of the population				
Average household size per municipality	2,330	2,270	2,283	2,230
Average percentage of elderly citizens per municipality	0,171	0,155	0,205	0,184
Economic cycle				
Average income of inhabitants per municipality	24,178	23,339	26,131	24,995

Appendix C: Characteristics of the three provinces

Table 18: Differences between provinces

Variable label	2011 Noord-Holland	Utrecht	Zuid-Holland	2016 Noord-Holland	Utrecht	Zuid-Holland
dependent						
Demand for retail real estate						
Average amount of occupied square meters of retail floor space per municipality (daily) (x 1.000)	21,780	16,222	21,564	23,810	18,364	23,716
Average amount of occupied square meters of retail floor space per municipality (non-daily) (x 1.000)	76,409	64,397	77,610	72,776	64,591	74,826
Average amount of occupied square meters of retail floor space per municipality (total) (x 1.000)	98,188	80,619	99,173	96,587	82,955	98,541
Number of occupied retail stores (daily)	119	82	119	120	86	122
Number of occupied retail stores (non-daily)	288	218	309	256	198	282
Number of occupied retail stores (total)	407	299	429	376	284	404
Independent						
Online shopping						
Average online expenditures per municipality (daily) (x 1.000.000)	1,44	0,91	1,98	2,90	3,06	2,84
Average online expenditures per municipality (non-daily) (x 1.000.000)	18,64	14,14	18,90	43,48	34,35	42,99
Average online expenditures per municipality (total) (x 1.000.000)	20,08	15,05	20,88	46,37	37,41	45,82
Retail revenue generated in municipalities						
Average retail revenue per municipality (daily) (x 1.000.000)	164,96	130,86	152,53	194,45	160,31	354,76
Average retail revenue per municipality (non-daily) (x 1.000.000)	140,00	121,91	133,05	154,42	137,71	292,14
Average retail revenue per municipality (total) (x 1.000.000)	304,96	252,77	285,58	186,40	169,13	355,53
Composition of the population						
Average household size per municipality	2,294	2,368	2,269	2,252	2,323	2,269
Average percentage of elderly citizens per municipality	0,161	0,155	0,169	0,192	0,185	0,202
Economic cycle						
Average income of inhabitants per municipality	23,624	24,05	23,74	25,363	25,882	25,600

Appendix D: Output Correlation Analysis

In this appendix the relationships between the dependent variables on the one side, and the independent variables on the other side, are analysed. This is done in order to establish whether the relationships between the different variables comply with both the linearity as well as the outlier assumptions. Checking these two assumptions is required in order to determine whether the relationships are linear in nature. If this is the case the Pearson correlation coefficient can be used to determine the direction and the strength of linear relationships.

In the continuation of this appendix scatterplots are used to take a first look at the pattern in the data points. After which, the z-scores, which represent the number of standard deviations a data point is located away from the mean, of both the dependent variables and independent variables are plotted against each other to check for potential outliers. In this research the plots which have z-scores close to the absolute value of 3 for both the dependent variable as well as the associated independent variables, are regarded as potential outliers. In case of the presence of an outlier, this case is removed from the research sample and the process of identifying outliers starts over. Once all outliers have been removed from the research sample, additional scatterplots are used to determine whether linear relationships exist between the variables used in this research. Table 19 shows the initial scatterplots which include all the cases of the research sample. Table 20 shows a number of scatterplots after the identified outliers are removed from the research sample.

In this appendix only the scatterplots concerned with the total demand for retail real estate are examined. This means that the scatterplots concerned with that part of the market focused specifically on the sale of daily products and the sale of non-daily products are not displayed. The reason for this is that these scatterplots exhibit the same patterns as the scatterplots concerned with the total demand for retail real estate. Consequently, the conclusions drawn from this appendix also apply to the data concerning these two specific sectors of the market for retail real estate.

Table 19: Initial scatterplots containing all the cases incorporated in the research sample

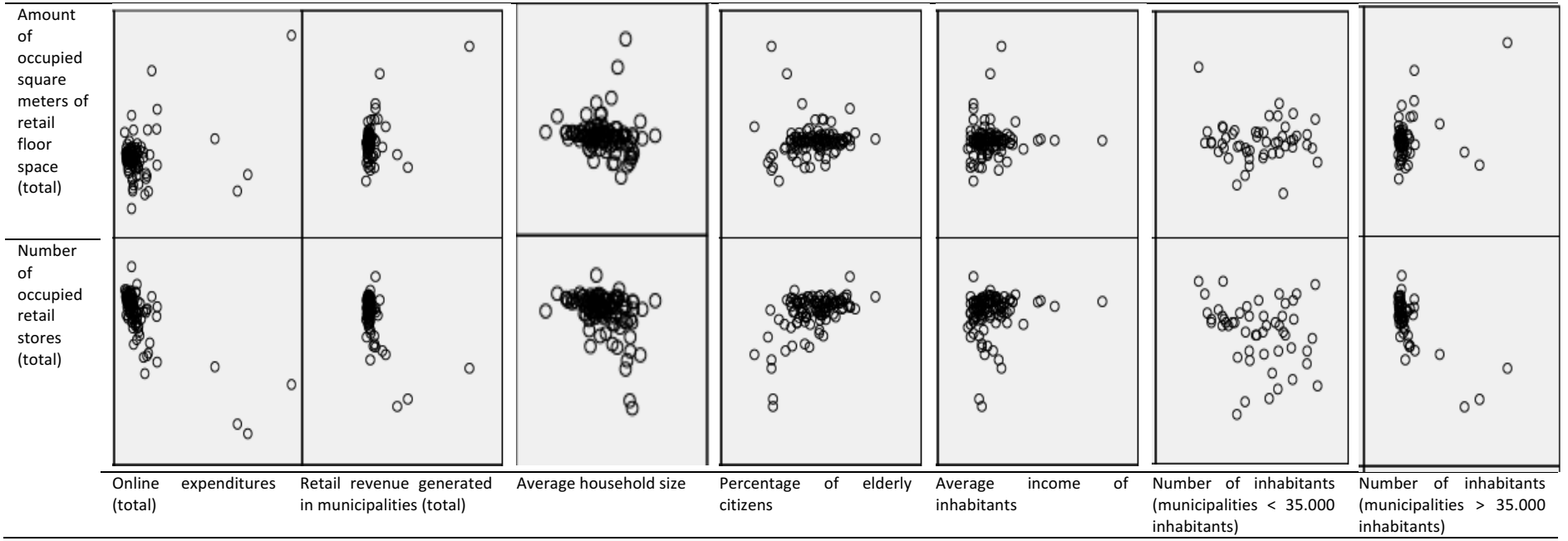


Table 19 seems to suggest that there are possible outliers present in the research sample. After examining the plots of z-scores of both the independent variables and dependent variables, it becomes clear that the following municipalities have to be considered as outliers: Amersfoort, Amsterdam, 's-Gravenhage, Haarlem, Rotterdam, Utrecht and Zaanstad. These cases have too much influence on the correlation analysis. Therefore, they are removed from the research sample.

Table 20: Additional scatterplots after the removal of outliers

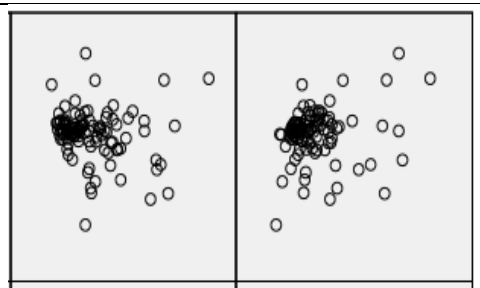
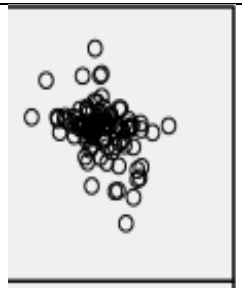
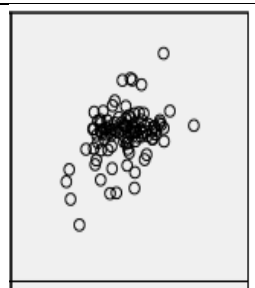
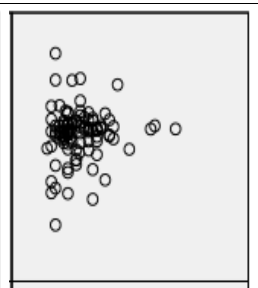
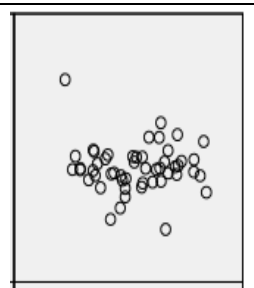
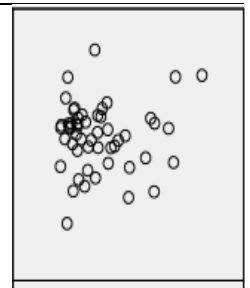
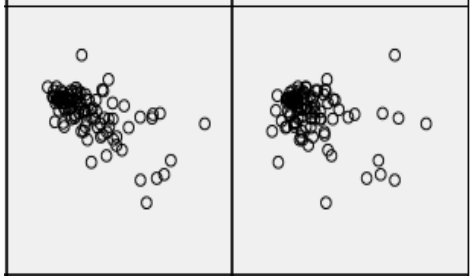
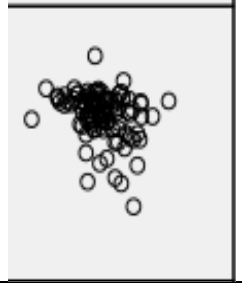
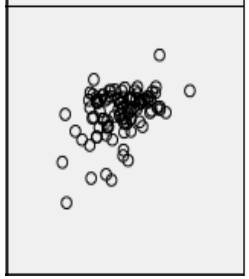
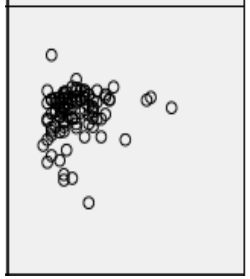
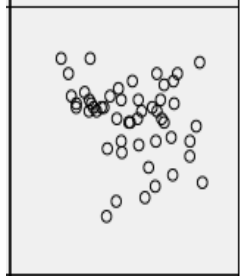
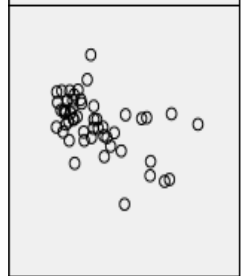
Amount of occupied square meters of retail floor space (total)							
Number of occupied retail stores (total)							
	Online expenditures (total)	Retail revenue generated in municipalities (total)	Average household size	Percentage of elderly citizens	Average income of inhabitants	Number of inhabitants (municipalities < 35.000 inhabitants)	Number of inhabitants (municipalities > 35.000 inhabitants)

Table 20 shows the scatterplots after the outliers are removed from the research sample. The patterns of the different scatterplots show relatively similar images. The patterns generally take the form of a point cloud with a certain line shape. This is an indication that the associations between the dependent variables and the independent variables are linear in nature, which allows for the use of the Pearson correlation analysis to examine the strength and the direction of these relationships.

Appendix E: Output Regression Analysis

Throughout this appendix the six multiple regression models are tested on the important multiple linear regression assumptions. These assumption tests help to assure that the results of the models are actually applicable and interpretable in practice. Additionally, the variables entered in a multiple regression model have to be of either an interval scale or a ratio scale. Moreover, in a multiple regression model the ratio between the number of cases and the number of independent variables has to be equal to or larger than 5 to 1.

In all six models the dependent as well as the independent variables are measured at a ratio scale. The dummy variables that are incorporated in the regression models are labelled as 'dichotomous' variables. Dummy variables take on the values 0 or 1. This means that the average value of dummy variables represents the proportion of the two categories making up the dummy variable. Interval and ratio variables, opposed to nominal and ordinal variables, have a meaningful average, this means that dummy variables are actually ratio variables as well. Examples of other ratio variables are the percentage of elderly citizens and the revenue generated by stores selling daily products measured in respectively percentages and euros.

Furthermore, in each of the six multiple regression models used in this research the number of cases is more than 100, while the number of independent variables in each multiple regression model is exactly six. This means that the ratio between the number of cases and the number of independent variables is around 16,7 to 1, this exceeds the minimum required ratio of 5 to 1.

Table 21: Overview of the different models

Model Number	Level of scale	Unit of measurement dependent variable	Method	Number of cases (N)	Number of independent variables	R square	Statically significant variables
1.	Municipality	Demand for square meters of retail floor space (total)	Stepwise	103	6	0,300	• Online expenditures total • Retail revenue total • Percentage of elderly citizens
2.	Municipality	Demand for retail stores (total)	Stepwise	103	6	0,468	• Online expenditures total • Retail revenue total
3.	Municipality	Demand for square meters of retail floor space (non-daily)	Stepwise	103	6	0,333	• Online expenditures non-daily • Retail revenue non-daily • Percentage of elderly citizens
4.	Municipality	Demand for retail stores (non-daily)	Stepwise	105	6	0,556	• Online expenditures non-daily • Retail revenue non-daily
5.	Municipality	Demand for square meters of retail floor space (daily)	Stepwise	105	6	0,321	• Retail revenue daily
6.	Municipality	Demand for retail stores (daily)	Stepwise	104	6	0,000	

In order to be able to generalise from the sample to the population, a multiple regression analysis needs to meet a total of five assumptions. These assumptions are tested according to the model results. In the continuation of this appendix the six multiple regression models are tested one by one according to the corresponding assumptions. Firstly, the assumptions will be introduced and summarised in table 22. After which the actual testing of the multiple regression models will take place.

The first assumption is called the linearity assumption. Because a multiple linear regression model is used, it should be checked whether the relations between the dependent variable and all the independent variables are actually linear. This is done by plotting a scatterplot of the standardised residuals on the y-axis and the standardised predicted values on the x-axis. Residuals represent the difference between the actual observed values and the predicted values of the dependent variable. When standardised the residuals can be compared with each other. In case the scatterplot displays a randomly spread of cases around the x-axis the linearity assumption is met (Hair et al., 2006).

Secondly, the independence of the error term assumption is checked. This assumption checks for any dependency between the residual of one case to the residual of the next case. This dependency is often present in time series data. The pattern in the residuals occurs when there are change in the basic regression model conditions which are not represented by the independent variables included in the regression model. Serial correlated error terms affect the correct estimation of several model parameters. In order to check for this assumption, the same scatterplot, as used for checking the first assumption, is used. This scatterplot should be checked for serial correlation. If the scatterplot is not conclusive the Durban-Watson test should be performed. The Durban-Watson statistic can take on values between 0 and 4. A value near 2 is a good indication that auto-correlation is not an issue in this model and that the independence of the error term assumption is met (Hair et al., 2006).

The third assumption is the homoscedasticity assumption. This assumption assures that the regression model is reliable for all values of X, this means that the residuals are as large for small values of X as for large values of X. When the residuals are not the same for all values of X, this is referred to as heteroscedasticity. In order to meet the homoscedasticity assumption for every value of X, the variance of Y has to be equal. Moreover, the observed values of Y should be symmetrically spread around the regression line, meaning that approximately the same number of cases are found beneath and above the regression line (Hair et al., 2006). In order to check this assumption, the standardised residuals versus the standardised predicted values should be checked for constant variance around the x-axis. If this is the case the homoscedasticity assumption is met. A slight deviation from this pattern is not immediately worrying as multiple linear regression is rather robust to the violation of this assumption (Keith, 2014).

The fourth check that is performed is the check for multicollinearity. Collinearity refers to the mutual correlation between two independent variables. Large collinearity between two independent variables means that the portion unique variance of the dependent variable that is explained by both independent variables is small. If more than two variables in the

regression model have strong correlations amongst each other, this is referred to as multicollinearity. In order to test for multicollinearity the correlation matrix is checked for correlations larger than 0,9 or smaller than -0,9. In case independent variables are strongly correlated one of them should be excluded from the regression model. A second test that can be performed is looking at the Tolerance values of the independent variables. Tolerance values below 0,1 indicate that multicollinearity is present and that particular variables should be excluded from the model, after which the regression analysis should be repeated (Hair et al., 2006).

The final assumption for which has to be checked, is the normality assumption. Multiple regression requires the residuals to be normally distributed, because non-normally distributed standardised residuals could form a problem for the calculation of p-values for significance testing. This means that the p-values could be either too small or too large, and thereby creating a change of wrongfully including variables in the model or excluding variables from the model (Hair et al., 2006).

With the use of histograms and P-P plots it is easily detectable whether the normality assumption is met. In case the shape of the histograms and the P-P plots indicate a deviation from the normal distribution, the Skewness value and the Kurtosis value are used to determine the extent of the deviation from the normal distribution. Skewness is a measure for the extent of asymmetry present in the distribution of standardised residuals, while Kurtosis is a measure for the weight of the tails in relation to the other cases that make up the distribution (McNeese, 2016). In table 22 the above mentioned assumptions are summarised.

Table 22: The assumptions of multiple linear regression

Number	Assumption	Manner of testing
1.	Linearity	1. Plotting a scatterplot diagram with standardised residuals on the y-axis and the standardised predicted values on the x-axis. 2. Inspecting the scatterplot for patterns deviating from a random or linear pattern. 3. Scanning and removing obvious outliers (cases with standardised values exceeding 3,5) ("Regression methods", n.d., § 11.1) 4. Testing leverage values. Cases with a leverage greater than 2(k+1)/n are potentially influential. We will further investigate their position on the y-axis to see if these cases are actually influential. Cases are considered to be highly influential, when the Leverage value approaches 1.0 and they determine the regression line on their own (Hair et al., 2006). 5. Testing influential data points with Cook's Distance. Cases with a Cook's Distance greater than 4/(n-k-1) should be investigated. Cases with a Cook's Distance close to 1.0 are quite likely to be influential and should potentially be removed (Hair et al., 2006). 6. Furthermore for determining whether a data point is influential, the standardised residual, Leverage value and Cook's Distance of this data point should not deviate too much from the nearest data point ("Regression methods", n.d., § 11.5).
2.	Independence of the error term	1. Inspecting the scatterplot for any type of sequence in the data. 2. Checking the Durban-Watson statistic, the value of this statistic needs to be between 1,5 and 2,5 (Hair et al., 2006).
3.	Homoscedasticity	1. Checking whether the variation around the predicted values is constant regardless of whether the predicted values are large or small (Hair et al., 2006).
4.	Multicollinearity	1. Checking the correlation matrix. Independent variables should not correlate strongly ($r < -0,9$ or $r > 0,9$) with each other ("Regression methods", n.d., § 7,3). 2. Tolerance value should exceed 0,1 (Hair et al., 2006).
5.	Normality	1. Checking for a normal distribution by plotting a histogram and a normal P-P plot of the distribution of the residuals of the dependent variable (Hair et al., 2006). 2. A possible deviation from the normal distribution is expressed by the Skewness value and the Kurtosis value (Frieman, Saucier & Miller, 2017). Skewness is present in case the absolute Skewness value the 1,0 mark. A negative value indicates that the left-hand tail is longer than the right-hand tail, while a positive value indicates the opposite. Kurtosis is present in case the absolute Kurtosis value approaches the 3,0 mark. A negative value is an indication for a light-tailed dataset, while a positive value is an indication for a heavy-tailed dataset (McNeese, 2016).

k = number of independent variables

n = number of cases

Model 1 – checking assumptions

1. The initial standardised residual versus the standardised predicted value plot, figure41a, does not show an equal distribution of scatters. A number of cases seem to deviate from the random pattern. To check whether these cases actually do have a large influence on the model outcomes, we observe the standardised residuals, Cook's Distances and the Leverage values. These values determine whether certain cases should be excluded from the research sample. A more random pattern of scatters, shown in figure 41b, is established after seven iterations in which influential cases have been removed.

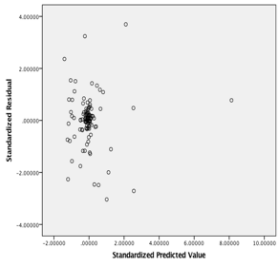


Figure 41a: Model 1 scatterplot including all original cases

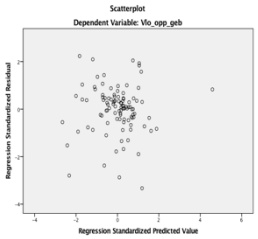


Figure 41b: Model 1 without influential cases

In order to arrive at a reliable model, influential cases have to be removed. To check for influential cases, two different plots are used. The first one is a plot of Cook's Distance versus Leverage Value and the second one is a plot of the dependent variable versus the unstandardised predicted value. Furthermore, we take a look at the standardised residuals. For each case, that is removed from the research sample during one of the iterations, the above mentioned values are summarised in table 23. Figures 42a & 42b show two charts which are used determine whether influential cases have been removed successfully.

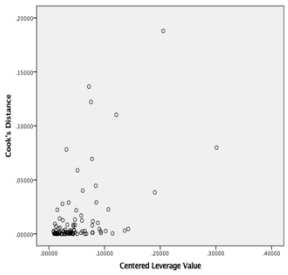


Figure 42a: Model 1 Cook Distance vs. Leverage value after all iterations

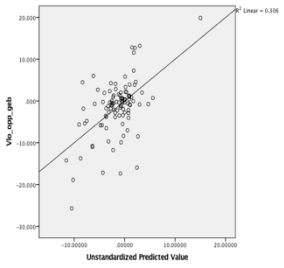


Figure 42b: Model 1 Dependent variable vs. Unstandardised predicted value after all iteration

Table 23: Model 1 influential case

Iteration	Case number	Municipality	Standardised residual	Leverage value	Cook's Distance
1.	85	Amsterdam	0,774	0,941	45,583
2.	61	Amersfoort	4,139	0,168	1,121
3.	122	Zaanstad	3,834	0,090	0,452
4.	93	Haarlem	-1,605	0,308	0,438
5.	76	Utrecht	2,384	0,115	0,230
6.	45	Rotterdam	-1,983	0,073	0,096
7.	16	's-Gravenhage	-0,779	0,805	0,017

2. The independent error term assumption tests for autocorrelation among the residuals. This often occurs when the data is observed in a time sequence. Our data is observed as the numeric differences between the years 2011 and 2016, which means that autocorrelation does not form a problem. To test this, we can again look at figure 41b for a particular pattern in the scatters, we have already established that this is not the case. The Durban-Watson statistic, shown in table 24, also indicates that there is no autocorrelation in this model, as the value of this statistic is 1,397 which lies within the range of the 2,0 mark. Therefore, the independent error term assumption is met.

Table 24: Model 1 model summary

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
3	.547[c]	0,300	0,278	5,641112	1,397

c. Predictors: (Constant), Per_65, Koopkracht_Totaal, Totale_online

d. Dependent Variable: Vlo_opp_geb

3. Figure 41b does not show an obvious pattern in the scatterplot, however the residuals don't seem to be constant around all the values of the predicted values, as there is a slight cluster in the middle. However according to Keith (2014) multiple regression analysis is a pretty robust tool to violation of this assumption, therefore we are not taking any steps at this stage.

4. Table 45 (Appendix H: Correlation Analysis) shows that most independent variables correlate moderately amongst each other. This indicates that multicollinearity is not a problem. After SPSS runs a stepwise regression analysis, any of the remaining strongly correlated variables are excluded from the model. To test the remaining variables for multicollinearity we use the Tolerance-value, these are shown in table 25. From this table it can be concluded that there are no variables with low Tolerance-values. This indicates that the remaining variables are not strongly correlated amongst each other and the multicollinearity assumption is met.

Table 25: Model 1 coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
3	(Constant)	-5,161	2,667		-1,935	0,056		
	Per_65	166,106	62,743	0,247	2,647	0,009	0,810	1,235
	Koopkracht_Totaal	0,144	0,031	0,669	4,714	0,000	0,351	2,849
	Totale_online	-0,346	0,090	-0,575	-3,827	0,000	0,313	3,190

a. Dependent Variable: Vlo_opp_geb

5. The normal P-P plot displayed in figure 43b indicates that the standardised residuals approximately follow a straight line. From inspecting the histogram in figure 43a it can be observed that the standardised residuals between 0 and 0,5 are overrepresented in the model and that the medium-sized standardised residuals between -1 and -2 and 1 and 2 are underrepresented. This can also be observed in figure 41b, in which the standardised residuals cluster slightly between 0 and 0,5.

From inspecting the linearity assumption in step 1, we already concluded that the deviation from the normal distribution is not caused by outliers. Instead the deviation from the normal distribution it is caused by an overrepresentation of cases with small standardised residuals. This is confirmed by the positive Kurtosis value of 1.799. However, the Kurtosis value does not approach the 3.0 mark, which means that the deviation from the normal distribution is only moderate (McNeese, 2016). Consequently, we do not immediately expect problems with the interpretation of the results in this model (Williams, Grajales & Kurkiewicz, 2013).

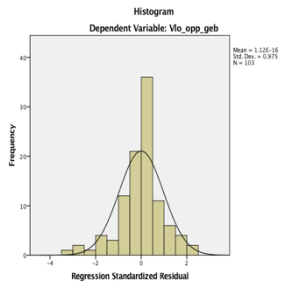


Figure 43a: Model 1 standardised residual histogram

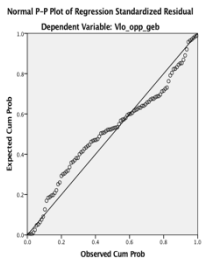


Figure 43b: Model 1 standardised residual normal P-P Plot

Table 26: Model 1 Skewness and Kurtosis values

Descriptives			
		Statistic	Std. Error
Skewness		-0,703	0,238
Kurtosis		1,799	0,472

Model 2 – checking assumptions

1. The scatterplot in figure 44a, showing the standardised residuals versus the standardised predicted values, indicates that the spread of scatters is not entirely random. The influential cases are removed to try and create a more random distribution. The order in which these cases are excluded is shown in table 27. After the exclusion of the influential cases the pattern of scatters is more randomly distributed as can be seen from figure 44b. Figures 45a & 45b show two charts which are used to determine whether influential cases are removed or not.

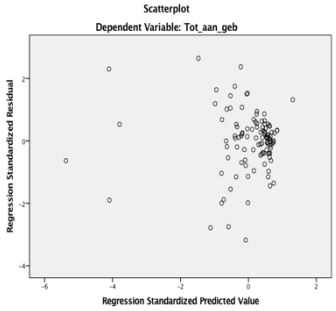


Figure 44a: Model 2 scatterplot including all original cases

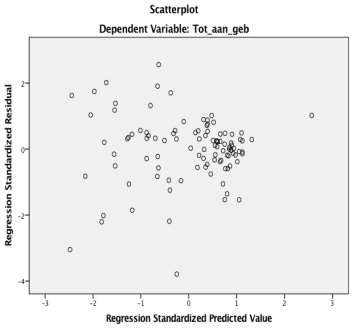


Figure 44b: Model 2 scatterplot without influential cases

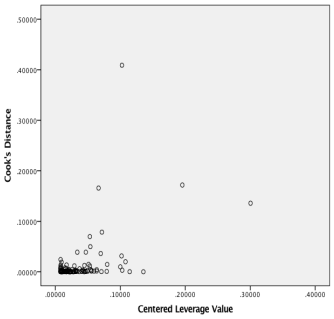


Figure 45a: Model 2 Cook Distance vs. Leverage value after all iterations

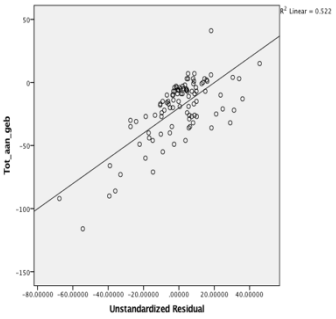


Figure 45b: Model 2 Dependent variable vs. Unstandardised predicted after all iterations

Table 27: Model 2 influential cases

Iteration	Case number	Municipality	Standardised residual	Leverage value	Cook's Distance
1.	85	Amsterdam	0,529	0,941	17,816
2.	93	Haarlem	-2,825	0,249	0,747
3.	76	Utrecht	1,376	0,439	0,558
4.	45	Rotterdam	-0,145	0,885	0,283
5.	16	's-Gravenhage	-0,040	0,972	0,909
6.	61	Amersfoort	0,852	0,210	0,052
7.	122	Zaanstad	2,734	0,147	0,331

2. Table 28 below shows the Durban-Watson statistic, which has a value of 1,890. This value lies close to the 2,0 mark. Furthermore, the scatterplot in figure 44b doesn't show any kind of sequence in the data. Both these indicators led us to conclude that the independence of the error term assumption is met.

Table 28: Model 2 model summary

Model Summary[c]					
Model	R	R Square	Adjusted R Square	the Estimate	Durbin-Watson
2	.684 [b]	0,468	0,457	17,833	1,890

b. Predictors: (Constant), Totale_online, Koopkracht_Totaal

c. Dependent Variable: Tot_aan_geb

3. For the third assumption we again take a look at figure 44b. There is no obvious pattern visible in the scatterplot, the residuals are pretty much similar for all values of the standardised predicted values. Therefore, we can conclude that the homoscedasticity assumption is met.

4. In order to test for the multicollinearity assumption we used the correlation matrix, displayed in table 46 (Appendix H: Correlation Analysis), and the coefficients tables displayed in table 29. The correlation matrix gives an indication that the independent variables correlate either moderately or weakly amongst each other. Table 29 confirms that multicollinearity is not a problem.

Table 29: Model 2 coefficients with all variables

Coefficients[a]								
		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
2	(Constant)	5,406	3,277		1,650	0,102		
	Totale_online	-2,209	0,259	-1,006	-8,538	0,000	0,383	2,609
	Koopkracht_Totaal	0,398	0,093	0,506	4,299	0,000	0,383	2,609

a. Dependent Variable: Tot_aan_geb

5. Both the Histogram and the normal P-P Plot, shown in figure 46a & 46b, indicate that the standardised residuals deviate slightly from the normal distribution. This is the results of an overrepresentation of standardised residuals with a value between 0 and 0,5, which leads to a distribution with a moderate positive Kurtosis value (Frieman et al., 2017), which is displayed in table 30.

The deviation is not the result of extreme outliers, but rather the result of the clustering of cases with small standardised residuals. Moreover, figure 46b shows that the standardised residuals still approximately follow the straight line of the normal distribution. Finally, the p-values of the variables are not near the 0,05 limit, therefore we conclude that the moderate violation of the normality assumption in this model does not cause problems for the interpretation of the results.

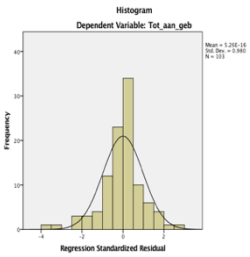


Figure 46a: Model 2 standardised residual histogram

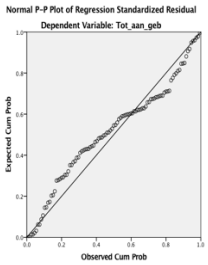


Figure 46b: Model 2 standardised residual normal P-P Plot

Table 20: Model 2 Skewness and Kurtosis values

Descriptives			
		Statistic	Std. Error
Skewness		-0,788	0,238
Kurtosis		2,241	0,472

Model 3 – checking assumptions

1. Figure 47a shows a scatterplot of the standardised residuals versus the standardised predicted values with all cases included. Cases that are considered to be too influential are removed in order to establish a more random distribution of scatters. These cases and the order in which they have been excluded is shown in table 31. After the exclusion of the influential cases the pattern of scatters is more randomly distributed as can be seen in figure 47b. Figures 48a & 48b display two charts that are used to determine whether all the influential cases have been removed.

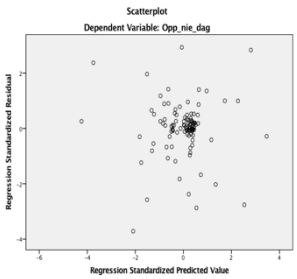


Figure 47a: Model 3 scatterplot including all original cases

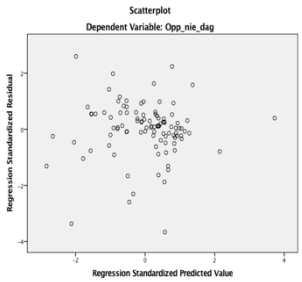


Figure 47b: Model 3 plot without influential cases

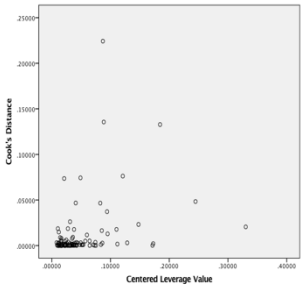


Figure 48a: Model 3 Cook Distance vs. Leverage value after all iterations

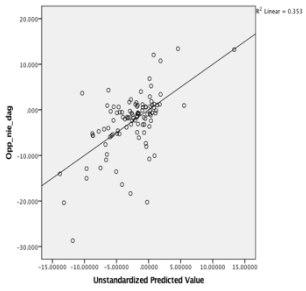


Figure 48b: Model 3 Dependent variable vs. Unstandardised predicted after all iterations

Table 31: Model 3 influential cases

Iteration	Case number	Municipality	Standardised residual	Leverage value	Cook's Distance
1.	85	Amsterdam	0,530	0,941	17,816
2.	93	Haarlem	-2,825	0,249	0,747
3.	45	Rotterdam	0,017	0,876	0,004
4.	16	's-Gravenhage	-0,955	0,745	1,894
5.	76	Utrecht	-0,025	0,971	0,264
6.	122	Zaanstad	2,648	0,139	0,286
7.	61	Amersfoort	1,152	0,218	0,102

2. Figure 47b shows a slightly decreasing pattern in the scatters, which could be an indication for autocorrelation. However, the Durban-Watson statistic displayed in table 32, lies close to the 2,0 mark. That is the reason we can conclude that the independence of error terms assumption is met.

Table 32: Model 3 model summary

Model Summary[d]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
3	.587[c]	0,345	0,325	5,401603	1,561
c. Predictors: (Constant), Per_65, Koopkracht_Niet-dag, Afv_onl_nie_dag					
d. Dependent Variable: Opp_nie_dag					

3. Figure 47b shows that the variation around the predicted values is not constant for all predicted values, because the scatters on the right are located closer to each other than the scatters on the left side of the scatterplot. However multiple regression is rather robust towards homoscedasticity (Keith, 2014). Therefore, we are not taking any further action at this stage and the homoscedasticity assumption is met.

4. Table 47 (Appendix H: Correlation Analysis) shows the correlation matrix, which includes the dependent variable and all independent variables. After the stepwise regression performed by SPSS only the variables with low correlations amongst each other are retained. The tolerance-values, displayed in table 33, are considerably higher than the critical value of 0,100. Therefore, the multicollinearity assumption is met.

Table 33: Model 3 coefficients

Coefficients[a]								
		Unstandardized Coefficients		d Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
3	(Constant)	-4,482	2,601		-1,723	0,088		
	Per_65	146,475	60,942	0,220	2,404	0,018	0,787	1,270
	Koopkracht_Niet-dag	0,187	0,037	0,552	5,039	0,000	0,551	1,815
	Afv_onl_nie_dag	-0,316	0,074	-0,498	-4,276	0,000	0,487	2,052
a. Dependent Variable: Opp_nie_dag								

5. Both the Histogram and the normal P-P Plot, displayed in figures 49a and 49b, indicate that the residuals deviate from the normal distribution. First of all, the left side of the histogram is slightly heavy-tailed, also referred to as negative Skewness. The large Skewness value displayed in table 34 points indeed to the existence of negative Skewness. The slight heavy-tailed left side of the histogram is created by one case, which is the case of Heerhugowaard. This municipality has a relatively large number of stores located within their administrative borders. However, as mentioned before, tests performed earlier did not indicate that this case should be considered as a case that has too much influence on the model outcomes.

Secondly, the histogram shows that the standardised residuals are slightly clustered around 0 and 0,5, which indicates the existence of a distribution with positive kurtosis. From table 34 it follows that the Kurtosis value exceed the 3.0 mark, which means it is considered as large. Combined these 2 aspects indicate that the standardised residuals are non-normally distributed. This could provide problems with the interpretation of the results. The p-value of the variable 'change in the percentage of elderly citizens' lies relatively close to the limit of 0,05. This means that we have to take some caution with the interpretation of this specific variable. The p-values of the other variables are considerably distant from the 0,05 value, which means that problems with the interpretation of the remaining variables

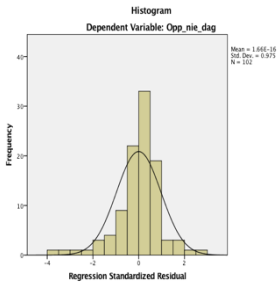


Figure 49a: Model 3 standardised residual histogram

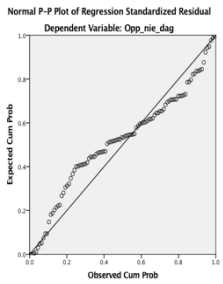


Figure 49b: Model 3 standardised residual normal P-P Plot

Table 34: Model 3 Skewness and Kurtosis values

Descriptives			
		Statistic	Std. Error
Skewness		-1,090	0,238
Kurtosis		3,259	0,472

Model 4 – checking assumptions

1. Figures 50a and 50b show scatterplots of the standardised residuals versus the standardised predicted values before and after outliers are removed from the research sample respectively. The scatterplot without the extremely influential cases, displayed in figure 50b shows a cluster of scatters around the middle but there is no obvious pattern visible other than a linear pattern. Therefore, we can conclude that the linearity assumption is met. Figures 51a & 51b display two charts which are used to determine whether all the influential cases are removed. The order in which the cases have been removed is presented in table 35.

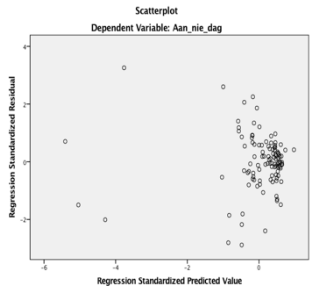


Figure 50a: Model 4 scatterplot including all original cases

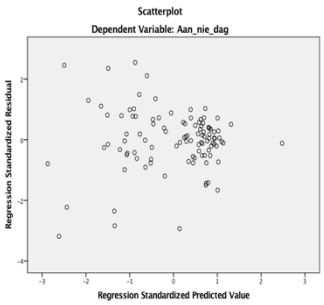


Figure 50b: Model 4 scatterplot without influential cases

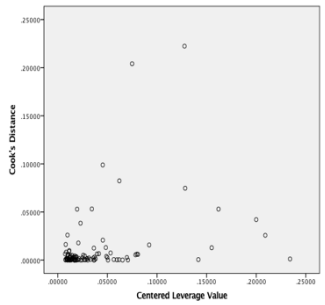


Figure 51a: Model 4 Cook Distance vs. Leverage value after all iterations

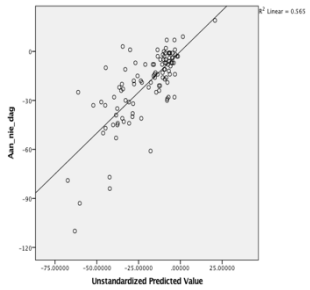


Figure 51b: Model 4 Dependent variable vs. Unstandardised predicted after all iterations

Table 35: Model 4 Influential cases

Iteration	Case number	Municipality	Standardised residual	Leverage value	Cook's Distance
1.	85	Amsterdam	0,704	0,933	27,656
2.	45	Rotterdam	0,387	0,877	2,043
3.	16	's-Gravenhage	-1,190	0,811	5,962
4.	76	Utrecht	-0,047	0,969	0,761
5.	93	Haarlem	-3,091	0,224	0,756

2. Figure 50b doesn't show any sign of a sequence in the data which points to any form of autocorrelation. To be sure of this we observe the Durbin-Watson statistic in table 36, the value of this statistic is 1,765 which also suggests that autocorrelation is not an issue in this model. For that reason, we conclude that the independence of the error term assumption is met.

Table 36: Model 4 model summary

Model Summary[c]					
Model	R	R Square	Adjusted R Square	the Estimate	Durbin-Watson
2	.746 [b]	0,556	0,547	14,731	1,765

b. Predictors: (Constant), Afv_onl_nie_dag, Koopkracht_Niet-dag

c. Dependent Variable: Aan_nie_dag

3. Figure 50b shows us that the variation around the predicted values is pretty consistent for all predicted values, because the scatters are quite evenly spread for all values of the standardised predicted values. Consequently, we can conclude that the homoscedasticity assumption is met for now.

4. Table 48 (Appendix H: Correlation Analysis) shows the correlation matrix including all variables. The independent variables correlate moderately and weakly amongst each other. The tolerance-values, displayed in table 37, are considerably higher than the critical value of 0,100. Therefore, the multicollinearity assumption is met.

Table 37: Model 4 coefficients

Coefficients[a]								
		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
2	(Constant)	4,667	2,655		1,758	0,082		
	Afv_onl_nie_dag	-1,937	0,173	-0,990	-11,167	0,000	0,554	1,806
	Koopkracht_Niet-dag	0,534	0,087	0,546	6,158	0,000	0,554	1,806

a. Dependent Variable: Aan_nie_dag

5. Both the Histogram and the normal P-P Plot, shown in figures 52a and 52b, indicate that the residuals deviate from the bell-shape of the normal distribution. Firstly, the peak of the histogram slightly exceeds the normal distribution, which points to a distribution with a slight positive kurtosis. Moreover, the standardised residuals around the values of -2 and 2 are underrepresented, which leads to a slight deviation from the normal distribution. Table 38 indicates that both negative Skewness and positive Kurtosis play a role in this model. The p-values of both the included as well as the excluded variables are considerably different from the 0,05 value. This means that the deviation from the normal distribution does not result in problems with the interpretation of the results.

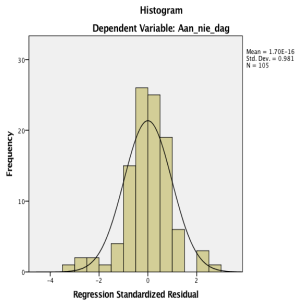


Figure 52a: Model 4 standardised residual histogram

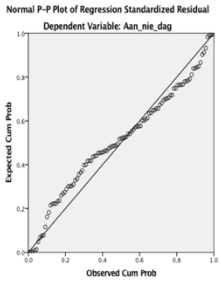


Figure 52a: Model 4 standardised residual Normal P-P Plot

Table 38: Model 4 Skewness and Kurtosis values

Descriptives			
		Statistic	Std. Error
Skewness		-1,327	0,236
Kurtosis		3,714	0,467

Appendix H: Correlation Analysis

Model 5 – checking assumptions

1. Figures 53a and 53b show scatterplots of the standardised residuals versus the standardised predicted values before and after outliers are removed from the research sample respectively. The scatterplot without the extremely influential cases, displayed in figure 53b shows a cluster of scatters around the middle but there is no obvious pattern visible other than a linear pattern. Therefore, we can conclude that the linearity assumption is met. Figures 54a & 54b display two charts which are used as criteria to determine that all the influential cases have been removed. The order in which the cases have been removed is presented in table 39.

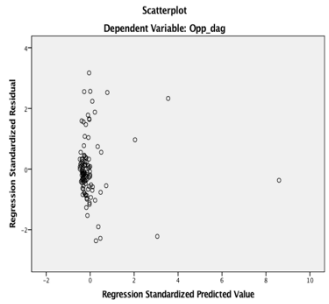


Figure 53a: Model 5 scatterplot including all original cases

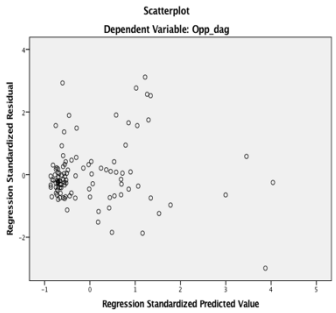


Figure 53b: Model 5 scatterplot without influential cases

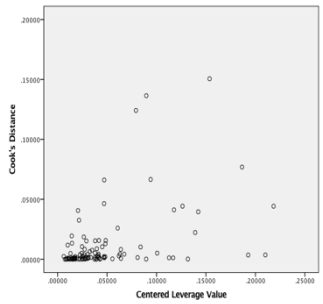


Figure 54a: Model 5 Cook Distance vs. Leverage value after all iterations

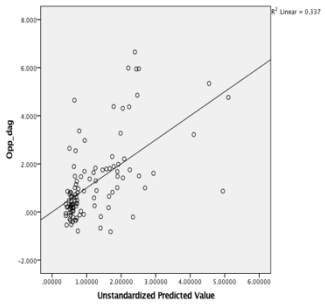


Figure 54b: Model 5 Dependent variable vs. Unstandardised predicted after all iterations

Table 39: Model 5 Influential cases

Iteration	Case number	Municipality	Standardised residual	Leverage value	Cook's Distance
1.	85	Amsterdam	-0,369	0,703	0,293
2.	45	Rotterdam	1,931	0,453	1,486
3.	16	's-Gravenhage	-1,143	0,644	1,778
4.	76	Utrecht	0,282	0,919	3,629
5.	61	Amersfoort	2,761	0,381	2,003

2. Figure 53b doesn't show any sign of a sequence in the data which points to any form of autocorrelation. To be sure of this we observe the Durbin-Watson statistic in table 40, the value of this statistic is 2,039 which also suggests that autocorrelation is not an issue in this model. For that reason, we can conclude that the independence of the error term assumption is met.

Table 40: Model 5 model summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.567[a]	0,321	0,315	1,368270	2,039

a. Predictors: (Constant), Koopkracht_dag

b. Dependent Variable: Opp_dag

3. Figure 53b shows us that the variation around the predicted values is pretty consistent for all predicted values, because the scatters are quite evenly spread for all values of the standardised predicted values. Consequently, we can conclude that the homoscedasticity assumption is met for now.

4. Table 49 (Appendix H: Correlation Analysis) shows the correlation matrix including all variables. After the stepwise regression, performed by SPSS, only the variables remain with low correlations amongst each other. The tolerance-value, displayed in table 41, is considerably higher than the critical value of 0,100. Therefore, the multicollinearity assumption is met.

Table 41: Model 5 coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	0,191	0,200		0,958	0,340		
	Koopkracht_dag	0,058	0,008	0,567	6,986	0,000	1,000	1,000

a. Dependent Variable: Opp_dag

5. The histogram in figure 55a shows a moderate extent of positive skewness. This means that the right-hand tail is longer than the left-hand tail and that the mass of the distribution lies on the left side of the histogram. Table 42 confirms the existence of positive skewness. The skewness is not caused by extreme outliers, instead it is caused by a concentration of standardised residuals with a value between -0,5 and -1,0. Therefore, both figures 55a and 55b deviate slightly from the normal distribution. Moreover, the peak also suggests that the distribution of the standardised residuals also shows signs of moderate positive kurtosis. This is also confirmed by table 42, but the kurtosis value does not exceed the critical value of 3,0. The moderate violation of the normal distribution, indicates that the results of model 5 have to interpreted with a certain degree of caution. This regards both the included variables as well as the independent variables.

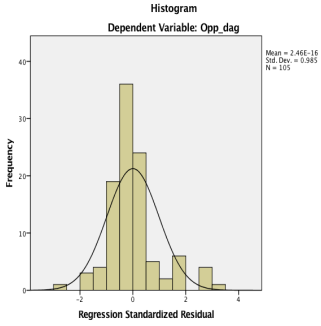


Figure 55a: Model 5 standardised residual histogram

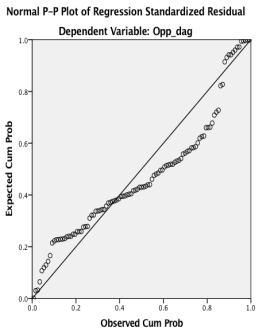


Figure 55a: Model 5 standardised residual Normal P-P Plot

Table 42: Model 5 Skewness and Kurtosis values

Descriptives

		Statistic	Std. Error
Skewness		1,066	0,236
Kurtosis		2,176	0,467

Model 6 – checking assumptions

1. Figures 56a and 56b show scatterplots of the standardised residuals versus the standardised predicted values before and after outliers were removed from the research sample respectively. The scatterplot without the extremely influential cases, displayed in figure 56b shows a cluster of scatters around the middle but there is no obvious pattern visible other than a linear pattern. Therefore, we can conclude that the linearity assumption is met. Figures 57a & 57b display two charts which are used as criteria to determine that all the influential cases have been removed. The order in which the cases have been removed is presented in table 43.

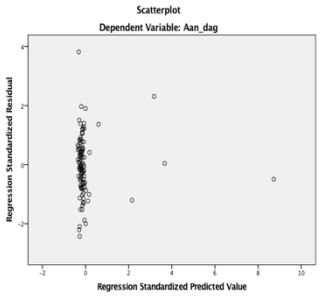


Figure 56a: Model 6 scatterplot including all original cases

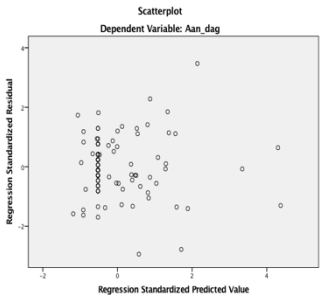


Figure 56b: Model 6 scatterplot without influential cases

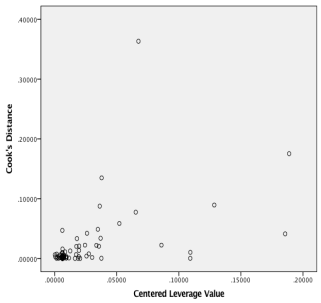


Figure 57a: Model 6 Cook Distance vs. Leverage value after all iterations

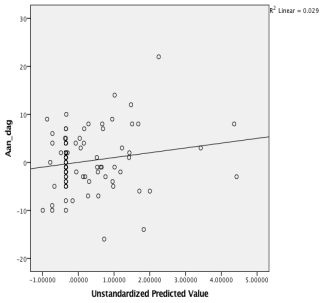


Figure 57b: Model 6 Dependent variable vs. Unstandardised predicted after all iterations

Table 43: Model 6 Influential cases

Iteration	Case number	Municipality	Standardised residual	Leverage value	Cook's Distance
1.	85	Amsterdam	-0,491	0,703	0,518
2.	16	's-Gravenhage	1,262	0,636	1,356
3.	45	Rotterdam	0,686	0,703	1,013
4.	76	Utrecht	0,209	0,904	1,320
5.	61	Amersfoort	1,566	0,368	0,597
6..	11	Dordrecht	-2,528	0,262	1,093

2. Figure 56b doesn't show any sign of a sequence in the data which points to any form of autocorrelation.

3. Figure 56b shows us that the variation around the predicted values is pretty consistent for all predicted values, because the scatters are quite evenly spread for all values of the standardised predicted values. Consequently, we can conclude that the homoscedasticity assumption is met.

4. Table 50 (Appendix H: Correlation Analysis) shows the correlation matrix including all variables, which do not point to multicollinearity. However, with the use of the stepwise regression no statistical significant model was estimated. Therefore, further tests for multicollinearity are both impossible to perform and not required.

5. No statistical significant regression model was estimated. Therefore, checking for normality is not required and not possible.

Appendix F: Policy instruments

Province

Provincial spatial development strategy
Policy document in which the province displays the spatial ambitions of the coming years.

Provincial retail vision
This is an optional elaboration on the general provincial spatial development strategy. This document focusses especially on the ambitions regarding retail.

Provincial process-based instruments
Regional cooperation is becoming more and more important. Therefore, provinces stimulate this by initiating expert teams and regional advisory commissions.

Provincial spatial regulation
This is a legal instrument which gives the province jurisdiction over the zoning plans of the municipalities. Municipalities have to fit their zoning plans within the provincial spatial regulations.

Inter-governmental supervision
Legal instrument that carries even more weight than the provincial spatial regulation. Is used when municipalities violate the certain rules and laws.

Provincial financial instruments
Provinces have a number of financial instruments. Often used for pilot projects or for the redevelopment of shopping centres located in economic weaker areas.

Municipality

Municipal spatial development strategy
A policy document in which the municipality presents their views on the spatial developments.

Municipal retail vision
This is an elaboration of that part of the general municipal spatial development strategy aimed at retail.

Centrum vision
A special retail vision for that part of a municipality designated as ‘centrum’. In this document the boundaries of and the different functions within the centrum are laid down.

Regional coordination retail policy
Because consumers are not bounded by municipal borders, shopping is often a regional activity. Therefore, municipalities have the option to cooperate in one regional retail retail vision, which takes over the jurisdictions of the individual municipal retail visions.

Knowledge of and consultation with real estate owners
This is a process instrument which municipalities use to establish a dialogue with real estate owners. The dialogue can take on many different forms.

Zoning plan
Instrument that determines which functional uses are permitted at specific locations.

Environment permit
A document that is required in order to be able to intervene with the living and working environment.

Management regulation
In situations where conservation is the primary concern, a management regulation can be used instead of a zoning plan. A management regulation determines basically the same as a zoning plan, only allows for little changes to the current situation.

Vacancy regulation
This gives owners of retail real estate that has been vacant longer than 6 months a notification obligation. This creates a dialogue between the municipality and the real estate owners of vacant retail stores. Municipalities could also oppose penalties if the real estate owner does not notify his vacant property.

Land policy
This is a broad instrument that contains other instruments such as the first right to purchase a parcel that is offered for sale and the right of deprivation.

Municipal subsidy
Subsidy can be provided to establish certain desired developments within shopping areas.

Municipal land purchase
Municipalities can purchase certain plots to either stop undesirable development or to facilitate desirable developments.

Municipal taxation
The municipal has a variety of different taxes which it can levy.

Shaping and managing public space
De municipality is obliged to keep the public space safe and useable. In shopping centre shopping centres often maintain higher standards regarding the public space, because it improves the attractiveness of these areas.

Accessibility and parking

Municipalities are within their administrative borders primarily responsible for the infrastructure. This includes roads and public transport axis which improve the accessibility of shopping centres. Moreover, they are also responsible for parking space.

Retailer

Trade association

Consists of retailers located in the same shopping centre or in nearby located locations. The retailers of this association are spread across different trade categories. They participate in lobbying, promotion, organisation of events and sometimes even the collective purchase of goods.

Aligning of shopping times and shopping Sundays

For the purpose of clarity, it is important for a shopping centre to align the shopping times and the number of shopping Sundays. This creates a uniform centre and adds to the attractiveness of a shopping centre.

Association of undertakings

This is an association that consist of retailers who are active in the same category of trade. This association looks after the collective interest of the retailers.

Enterprise fund

This is a fund established by entrepreneurs located within a specific shopping centre. They raise money which is spend on certain collective functions within a shopping centre. Examples of these expenses are extra investments in the public space or efforts to increase the sense of safety.

Retail real estate investor

Rent incentives

A discount on the rent with the purpose of improve the dynamic, reduce the vacancy or to establish an attractive mixture of retailers in a shopping centre. This instrument is often regarded as a risk by real estate investors.

Rent decrease

A reduction of rent is often applied to long-term vacant retail stores. The risk of this instrument is that the rent cannot be increased as quickly in times of economic high conjuncture or in the case the popularity of an area increases considerably. Secondly this instrument often leads to a decrease in the asset value of the retail store. This leads to refinancing issues for the real estate owner.

Active acquisition
For the attractiveness of shopping centres it is important that the right mix of stores is created. With this instrument real estate owners can target specific retailers to occupy their real estate in order to contribute to a diverse supply of stores.

Organisation and mutual cooperation
The cooperation between public and private actors can be improved when structural meetings are planned. This instrument promotes these structural moments for collaboration. Also the mutual collaboration between real estate owners can be improved through this instrument, which creates possibilities to operate as one uniform group.

Creation of temporary quality
This instrument is aimed at finding temporary solutions to vacant objects. Real estate owners can opt for example to allow pop-up stores or cultural activities to take place in their objects. Although this doesn't create value on the long-term, in the short-term the quality of the shopping centre is maintained.

Optimise appearance retail stores
The appearance of a retail store determines a large part of its attractiveness. Improvements to the façades of retail stores can boost the appearance of entire shopping centres.

Functional transformation
The change from an object with a retail function to another functional use such as residential or hospitality. Often requires a long-term vision from both the real estate owner as well as the corresponding governmental bodies, which are responsible for the change in zoning plan and the required permits.

Separation living and shopping
The development of apartments on top of the ground floor in vacant retail stores vacant creates additional liveability, more social control and security in an area. In these cases, the ground floor remains available for retail purposes.

Merging of retail stores
Often the floor space of retail stores has become too small for optimal retail performances. Real estate owners could opt to merge neighbouring retail stores in order to create a single retail store which is more attractive to retailers.

Retail real estate agent

Acquisition activities

They handle the acquisition of the real estate objects that belong to their portfolio. They try to establish the right mix of tenants across this portfolio, in order to create an attractive retailing climate within the shopping centre.

Advise with transformation and redevelopment

Real estate agents are often consulted to advise on the redevelopment or transformation opportunities.

Efficient management of real estate

A real estate agent can be appointed to manage the owner's real estate. In this way he becomes responsible for the management of the property, renovations and the exploitation.

Advise with correct rental and sale prices and contracts

Real estate agents advise parties on both the supply and demand side of the retail real estate market with accurate rental and sale prices and the signing of contracts.

Taxations

Real estate owners perform taxations. This is of importance to real estate owners who base their actions on these taxations.

Project developer

Creation of added value through craftsmanship

Now the focus for a large part has focussed from new development projects to redevelopment projects, the project developer has to rely on his craftsmanship to create added value.

Realisation of building and area quality

Project developers have a lot of influence on the quality of the building and the areas that they develop. These developments determine for a large part the attractiveness of shopping centres as a whole.

National government

National economic policy

Through the Ministry of Economic Affairs, the Dutch government conducts economic policies. This policy is mainly focussed on IT, top sectors and tourism. Moreover, the Ministry also hands out subsidies and low rent loans for innovative projects.

National spatial planning policy

The national government has had a very strict national spatial planning policies for 30 years. In which retail was only allowed in designated concentrated shopping centres. Since 2004 they abandoned this strict national spatial policy, however in practice it is now continued by provinces and municipalities. Which means the national government has decentralised its control over the spatial planning

Tax policy

The main tax policies that effect the retail market are the increases of the value added tax. A few years ago the standard tariff increased from 19 percent to 21 percent. The new government is going to increase the lower tariff from 6 percent to 9 percent. Retailers expect an increase in bankruptcies and loss of jobs, because of these tax increases.

Knowledge creation and sharing

The national government plays a big part in the creation and sharing of knowledge. This is done through the organisation of meetings, monitoring of market trends and the financing of research and knowledge events.

Legislature

The national government is the only governmental body that is authorised to issue legislation. A lot of this legislation is relevant for the actors on the retail market.

Ladder of sustainable development

This is an instrument aimed at sustainable development. It contains three consecutive stages which have to be taken in case new retail location are being developed. This ladder ensures that the most sustainable option is chosen. This often leads to the reoccupation of already existing locations.

Appendix G: Validation regression models

Table 44: Comparison results original models and random sampling models

Variable (Δ 2016- 2011)	Results original model	Results random sampling model (approximately 75 % of the cases)
Model 1		
Online expenditures total	-0,575	-0,514
	(0,000)	(0,000)
Retail revenue total	0,669	0,613
	(0,000)	(0,000)
Percentage of elderly citizens	0,247	0,272
	(0,009)	(0,012)
Number of cases	103	77
R square	0,300	0,380
Model 2		
Online expenditures total	-1,006	-1,017
	(0,000)	(0,000)
Retail revenue total	0,506	0,470
	(0,007)	(0,000)
Percentage of elderly citizens	-	-
Number of cases	103	89
R square	0,468	0,523
Model 3		
Online expenditures total	-0,498	-0,486
	(0,000)	(0,000)
Retail revenue total	0,552	0,490
	(0,000)	(0,000)
Percentage of elderly citizens	0,220	0,231
	(0,018)	(0,024)
Number of cases	103	89
R square	0,345	0,341
Model 4		
Online expenditures total	-0,990	-1,047
	(0,000)	(0,000)
Retail revenue total	0,546	0,519
	(0,000)	(0,000)
Percentage of elderly citizens	-	-
Number of cases	105	76
R square	0,556	0,621
Model 5		
Online expenditures total	-	-
Retail revenue total	0,567	0,554
	(0,000)	(0,000)
Percentage of elderly citizens	-	-
Number of cases	105	87
R square	0,321	0,307
Model 6		
Online expenditures total	-	-
Retail revenue total	-	-
Percentage of elderly citizens	-	-
Number of cases	104	79
R square	0,000	0,000

Appendix H: Correlation Analysis

Model 1 correlations variables total products (Δ 2016- 2011)

Table 45: Correlations of variables incorporated in model 1

		Total amount of occupied square meters of retail floor space	Online expenditures total	Retail revenue total	Average household size	Percentage of -65s	Average income of inhabitants	Number of inhabitants (municipalities < 35.000 inhabitants)	Number of inhabitants (municipalities > 35.000 inhabitants)
Total amount of occupied square meters of retail floor space	Pearson Correlation	1,000	-0,133	0,194	-.355	0,377	0,077	-0,059	0,070
	Sig. (2-tailed)		0,179	0,050	0,000	0,000	0,437	0,680	0,620
Online expenditures total	Pearson Correlation	-0,133	1,000	0,785	0,177	-0,340	-0,148	.798	.920
	Sig. (2-tailed)	0,179		0,000	0,073	0,000	0,135	0,000	0,000
Retail revenue total	Pearson Correlation	0,194	0,785	1,000	0,007	-0,098	-0,115	.279	.780
	Sig. (2-tailed)	0,050	0,000		0,947	0,326	0,246	0,047	0,000
Average household size	Pearson Correlation	-0,230	0,230	0,098	1	-0,295	0,057	0,052	-0,035
	Sig. (2-tailed)	0,020	0,020	0,323		0,003	0,570	0,720	0,807
Percentage of -65s	Pearson Correlation	0,377	-0,340	-0,098	-.350**	1,000	-0,075	0,221	-0,217
	Sig. (2-tailed)	0,000	0,000	0,326	0,000		0,454	0,120	0,122
Average income of inhabitants	Pearson Correlation	0,077	-0,148	-0,115	.250*	-0,075	1,000	-0,160	-0,129
	Sig. (2-tailed)	0,437	0,135	0,246	0,011	0,454		0,261	0,360
Number of inhabitants (municipalities < 35.000 inhabitants)	Pearson Correlation	-0,059	.798	.279*	0,052	0,221	-0,160	1	
	Sig. (2-tailed)	0,680	0,000	0,047	0,720	0,120	0,261		
Number of inhabitants (municipalities > 35.000 inhabitants)		0,070	.920	.780	-0,035	-0,217	-0,129		1
		0,620	0,000	0,000	0,807	0,122	0,360		

Model 2 correlations variables total products (Δ 2016- 2011)

Table 46: Correlations of variables incorporated in model 2

		Total number of occupied retail stores	Online expenditures total	Retail revenue total	Average household size	Percentage of -65s	Average income of inhabitants	Number of inhabitants (municipalities < 35.000 inhabitants)	Number of inhabitants (municipalities > 35.000 inhabitants)
Total number of occupied retail stores	Pearson Correlation	1	-0,608	-0,283	-.289	0,400	0,154	-0,243	-.500
	Sig. (2-tailed)		0,000	0,004	0,003	0,000	0,119	0,086	0,000
Online expenditures total	Pearson Correlation	-0,608	1	0,785	0,177	-0,340	-0,148	.798	.920
	Sig. (2-tailed)	0,000		0,000	0,073	0,000	0,135	0,000	0,000
Retail revenue total	Pearson Correlation	-0,283	0,785	1	0,007	-0,098	-0,115	.279	.780
	Sig. (2-tailed)	0,004	0,000		0,947	0,326	0,246	0,047	0,000
Average household size	Pearson Correlation	-0,128	0,230	0,098	1	-0,295	0,057	0,052	-0,035
	Sig. (2-tailed)	0,198	0,020	0,323		0,003	0,570	0,720	0,807
Percentage of -65s	Pearson Correlation	0,400	-0,340	-0,098	-.350**	1	-0,075	0,221	-0,217
	Sig. (2-tailed)	0,000	0,000	0,326	0,000		0,454	0,120	0,122
Average income of inhabitants	Pearson Correlation	0,154	-0,148	-0,115	.250*	-0,075	1	-0,160	-0,129
	Sig. (2-tailed)	0,119	0,135	0,246	0,011	0,454		0,261	0,360
Number of inhabitants (municipalities < 35.000 inhabitants)	Pearson Correlation	-0,243	.798	.279*	0,052	0,221	-0,160	1	
	Sig. (2-tailed)	0,086	0,000	0,047	0,720	0,120	0,261		
Number of inhabitants (municipalities > 35.000 inhabitants)		-.500	.920	.780	-0,035	-0,217	-0,129		1
		0,000	0,000	0,000	0,807	0,122	0,360		

Model 3 correlations variables non-daily products (Δ 2016-2011)

Table 47: Correlations of variables incorporated in model 3

		Amount of occupied non-daily square meters of retail floor space	Online expenditures total	Retail revenue total	Average household size	Percentage of -65s	Average income of inhabitants	Number of inhabitants (municipalities < 35.000 inhabitants)	Number of inhabitants (municipalities > 35.000 inhabitants)
Amount of occupied non-daily square meters of retail floor space	Pearson Correlation	1	-0,232	0,252	-.345	0,409	0,134	-0,152	0,013
	Sig. (2-tailed)		0,018	0,010	0,000	0,000	0,176	0,288	0,927
Online expenditures total	Pearson Correlation	-0,232	1	0,618	0,173	-0,341	-0,152	.799	.928
	Sig. (2-tailed)	0,018		0,000	0,081	0,000	0,124	0,000	0,000
Retail revenue total	Pearson Correlation	0,252	0,618	1	-0,040	0,033	-0,064	0,173	.627
	Sig. (2-tailed)	0,010	0,000		0,685	0,737	0,523	0,225	0,000
Average household size	Pearson Correlation	-0,238	0,221	0,116	1	-0,295	0,057	0,052	-0,035
	Sig. (2-tailed)	0,015	0,025	0,244		0,003	0,570	0,720	0,807
Percentage of -65s	Pearson Correlation	0,409	-0,341	0,033	-.350**	1	-0,075	0,221	-0,217
	Sig. (2-tailed)	0,000	0,000	0,737	0,000		0,454	0,120	0,122
Average income of inhabitants	Pearson Correlation	0,134	-0,152	-0,064	.250*	-0,075	1	-0,160	-0,129
	Sig. (2-tailed)	0,176	0,124	0,523	0,011	0,454		0,261	0,360
Number of inhabitants (municipalities < 35.000 inhabitants)	Pearson Correlation	-0,152	.799	0,173	0,052	0,221	-0,160	1	
	Sig. (2-tailed)	0,288	0,000	0,225	0,720	0,120	0,261		
Number of inhabitants (municipalities > 35.000 inhabitants)	Pearson Correlation	0,013	.928	.627	-0,035	-0,217	-0,129		1
	Sig. (2-tailed)	0,927	0,000	0,000	0,807	0,122	0,360		

Model 4 correlations variables non-daily products (Δ 2016-2011)

Table 48: Correlations of variables incorporated in model 4

		Number of occupied non-daily retail stores	Online expenditures non-daily	Retail revenue non-daily	Average household size	Percentage of elderly citizens	Average income of inhabitants	Number of inhabitants (municipalities < 35.000 inhabitants)	Number of inhabitants (municipalities > 35.000 inhabitants)
Number of occupied non-daily retail stores	Pearson Correlation	1	-0,625	-0,115	-.276	0,395	0,174	-.299	-.434
	Sig. (2-tailed)		0,000	0,241	0,004	0,000	0,076	0,033	0,001
Online expenditures non-daily	Pearson Correlation	-0,625	1	0,668	.194	-0,364	-0,170	.799	.930
	Sig. (2-tailed)	0,000		0,000	0,048	0,000	0,084	0,000	0,000
Retail revenue non-daily	Pearson Correlation	-0,115	0,668	1	0,017	-0,055	-0,078	0,173	.720
	Sig. (2-tailed)	0,241	0,000		0,862	0,579	0,427	0,225	0,000
Average household size	Pearson Correlation	-0,126	0,247	0,157	1	-0,307	0,049	0,052	0,031
	Sig. (2-tailed)	0,200	0,011	0,111		0,001	0,622	0,720	0,825
Percentage of elderly citizens	Pearson Correlation	0,395	-0,364	-0,055	-.360**	1	-0,067	0,221	-0,268
	Sig. (2-tailed)	0,000	0,000	0,579	0,000		0,499	0,120	0,050
Average income of inhabitants	Pearson Correlation	0,174	-0,170	-0,078	.243*	-0,067	1	-0,160	-0,143
	Sig. (2-tailed)	0,076	0,084	0,427	0,012	0,499		0,261	0,301
Number of inhabitants (municipalities < 35.000 inhabitants)	Pearson Correlation	-.299*	.799	0,173	0,052	0,221	-0,160	1	
	Sig. (2-tailed)	0,033	0,000	0,225	0,720	0,120	0,261		
Number of inhabitants (municipalities > 35.000 inhabitants)	Pearson Correlation	-.434	.930	.720	0,031	-0,268	-0,143		1
	Sig. (2-tailed)	0,001	0,000	0,000	0,825	0,050	0,301		

Model 5 correlations variables daily products (Δ 2016- 2011)

Table 49: Correlations of variables incorporated in model 5

		Amount of occupied daily square meters of retail floor space	Online expenditures daily	Retail revenue daily	Average household size	Percentage of elderly citizens	Average income of inhabitants	Number of inhabitants (municipalities < 35.000 inhabitants)	Number of inhabitants (municipalities > 35.000 inhabitants)
Amount of occupied daily square meters of retail floor space	Pearson Correlation	1	0,145	0,567	-0,009	-0,156	-0,237	.279	.379
	Sig. (2-tailed)		0,139	0,000	0,926	0,112	0,015	0,048	0,005
Online expenditures daily	Pearson Correlation	0,145	1	0,387	0,176	-0,221	-0,076	0,194	.467
	Sig. (2-tailed)	0,139		0,000	0,073	0,023	0,439	0,173	0,000
Retail revenue daily	Pearson Correlation	0,567	0,387	1	0,131	-0,296	-0,151	.312	.826
	Sig. (2-tailed)	0,000	0,000		0,182	0,002	0,124	0,026	0,000
Average household size	Pearson Correlation	0,059	0,241	0,095	1	-0,307	0,050	0,052	0,071
	Sig. (2-tailed)	0,548	0,013	0,333		0,001	0,614	0,720	0,609
Percentage of elderly citizens	Pearson Correlation	-0,156	-0,221	-0,296	-.368**	1	-0,069	0,221	-.273
	Sig. (2-tailed)	0,112	0,023	0,002	0,000		0,485	0,120	0,046
Average income of inhabitants	Pearson Correlation	-0,237	-0,076	-0,151	.243*	-0,069	1	-0,160	-0,128
	Sig. (2-tailed)	0,015	0,439	0,124	0,012	0,485		0,261	0,357
Number of inhabitants (municipalities < 35.000 inhabitants)	Pearson Correlation	.279	0,194	.312	0,052	0,221	-0,160	1	
	Sig. (2-tailed)	0,048	0,173	0,026	0,720	0,120	0,261		
Number of inhabitants (municipalities > 35.000 inhabitants)	Pearson Correlation	.379	.467	.826	0,071	-.273	-0,128		1
	Sig. (2-tailed)	0,005	0,000	0,000	0,609	0,046	0,357		

Model 6 correlations variables daily products (Δ 2016- 2011)

Table 50: Correlations of variables incorporated in model 6

		Number of daily retail stores	Online expenditures daily	Retail revenue daily	Average household size	Percentage of elderly citizens	Average income of inhabitants	Number of inhabitants (municipalities < 35.000 inhabitants)	Number of inhabitants (municipalities > 35.000 inhabitants)
Number of daily retail stores	Pearson Correlation	1	0,013	0,138	-0,125	0,102	-0,055	0,098	-0,031
	Sig. (2-tailed)		0,897	0,161	0,205	0,303	0,579	0,496	0,823
Online expenditures daily	Pearson Correlation	0,013	1	0,490	0,176	-0,233	-0,087	0,194	.467
	Sig. (2-tailed)	0,897		0,000	0,073	0,017	0,380	0,173	0,000
Retail revenue daily	Pearson Correlation	0,138	0,490	1	0,131	-0,301	-0,145	.312	.826
	Sig. (2-tailed)	0,161	0,000		0,182	0,002	0,143	0,026	0,000
Average household size	Pearson Correlation	-0,065	0,227	0,139	1	-0,312	0,045	0,052	0,071
	Sig. (2-tailed)	0,511	0,021	0,160		0,001	0,647	0,720	0,609
Percentage of elderly citizens	Pearson Correlation	0,102	-0,233	-0,301	-.368**	1	-0,071	0,221	-.273
	Sig. (2-tailed)	0,303	0,017	0,002	0,000		0,476	0,120	0,046
Average income of inhabitants	Pearson Correlation	-0,055	-0,087	-0,145	.243*	-0,071	1	-0,160	-0,128
	Sig. (2-tailed)	0,579	0,380	0,143	0,012	0,476		0,261	0,357
Number of inhabitants (municipalities < 35.000 inhabitants)	Pearson Correlation	0,098	0,194	.312	0,052	0,221	-0,160	1	
	Sig. (2-tailed)	0,496	0,173	0,026	0,720	0,120	0,261		
Number of inhabitants (municipalities > 35.000 inhabitants)	Pearson Correlation	-0,031	.467	.826	0,071	-.273	-0,128		1
	Sig. (2-tailed)	0,823	0,000	0,000	0,609	0,046	0,357		

Appendix I: Scientific Article

The effects of online shopping on the market for retail real estate

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Abstract
In the period following the start of the economic crisis retail vacancy has steadily increased in many countries around the world. A frequently mentioned cause of the increase in retail vacancy is the growing popularity of online shopping. In various scientific publications, scholars have addressed the possible future implications of online shopping. In this research an attempt is made to empirically examine the effects of online shopping on the demand for retail real estate. This is done, using a correlation analysis and a multiple regression analysis. The results show that the increase in online expenditures, between 2011 and 2016, is significantly associated with the decrease in the demand for retail real estate. Therefore, online shopping should be considered as a substitute for traditional in-store shopping. These insights are used to determine the broad implications for retail policy.

Keywords: retail vacancy, online shopping, demand for retail real estate, substitution

1. Introduction

In the years following the start of the economic crisis, in 2007, various countries experienced an increase in retail vacancy (Evers, Tennekes & Dongen, 2014; Zhang, Zhu & Ye, 2016, Colliers International, 2018; JLL Research Report, 2018). For example, in The Netherlands the retail vacancy rates increased from around five percent before the start of the crisis to more than ten percent in 2016 (PBL, 2016).

Increasing retail vacancy rates are regarded as undesirable, because the negative externalities associated with retail

vacancy have the potential to seriously harm the attractiveness of shopping areas (Detailhandel Nederland, 2017). According to Berwyn (2013) these negative externalities include a sense of unsafety, reduced vibrancy, decreased visual attractiveness, reduced ability to attract customers and investors, increased risk of blight and decline, reduced revenue generated by property owners and reduced tax-income for governments. These negative externalities indicate that the factors, affecting the market for retail real estate, should be addressed in order to keep shopping centres, the beating heart of many municipalities attractive and vibrant.

The ideas of how to address retail vacancy vary among different scholars (Van der Krabben, 2009; Burt, 2010; PBL, 2010; Evers et al., 2014; PBL, 2016). In general, two different policy approaches can be distinguished. The first policy approach is growth-oriented. This approach focusses on bringing balance to the demand and the supply of retail real estate, through attracting additional retailers to reoccupy part of the vacant retail real estate. The second policy approach is reduction-oriented. This approach focusses on bringing balance to the demand and supply of retail real estate, through reducing the stock of retail real estate. The nature of the increase in retail vacancy ultimately determines which type of policy approach is most effective in keeping shopping areas attractive in the long-term.

Initially the increasing retail vacancy rates were contributed to the nature of the market for retail real estate, in which high retail vacancy rates are no exception (Huizinga & Ossokina, 2014). Retail vacancy was considered to be related to the inability of the retail real estate market to adjust to the economic crisis (Locatus, 2012; Evers et al., 2014). Soon after, other causes for the increase in retail vacancy started to emerge. One of these causes is the growing popularity of online shopping (Tonn & Hemrick, 2004; Farag, Schwanen, Dijst, & Faber, 2007; Zhang et al., 2016).

The effects of online shopping on the market for retail real estate are the topic of many studies in the scientific literature. The majority of these studies focus on the future developments and implications of online shopping (Mokhtarian, 2002: Tonn & Hemrick, 2004; Farag et al., 2007). At the same time, except for Weltevreden (2007) and Weltevreden and Van Rietbergen (2009), little empirical research concerning the effects of online shopping on the market for retail real estate is conducted. In this research we will try to fill part of this gap, through examining the effects of the increasing popularity of online shopping on the changing demand for retail real estate in 122 municipalities located in the western part of The Netherlands, while we control for sociodemographic and other consumer behavioural factors. Our hypothesis is that the increase in online shopping results in a decreasing demand for retail real estate. The results of this research are used to determine the broad implications for the two main policy approaches, in restoring the balance between the demand and the supply of retail real estate.

The structure of this paper is as follows. The different effects of online

shopping on the market for retail real estate are discussed in section two. Section three is used to introduce the independent and dependent variables. Additionally, in this section the factors are operationalised and the characteristics of the research sample are described. The results of both the correlation analysis and the multiple regression analysis are presented in section four. The results show the strong relationship between the increase in online expenditures and the change in the demand for retail real estate. The importance of our research, its relation to the existing literature and its implications on future retail policy are discussed in section five. This paper is rounded off with a conclusion in section six

2. Background: the effects of online shopping

The introduction of the internet led to the creation of the online shopping market parallel to the traditional in-store shopping market. The precise effects of online shopping, also referred to as 'e-commerce', on the market for retail real estate are the topic of an ongoing scientific debate. In the literature two dominant perspectives regarding the effects of online shopping on the retail real estate market can be observed; substation and complementarity (Salomon, 1982; Gillespie, Marvin & Green, 2001; Mokhtarian, 2002; Boschma and Weltevreden, 2005). Two other, less frequently mentioned, perspectives are neutrality and modification (Mokhtarian, 2002; Ferrel, 2005).

2.1 Substitution

One speaks of substitution in case online shopping decreases the demand for retail real estate. A large number of scholars believes that the stock of retail real estate is (partly) reduced by the increasing popularity of online shopping (Weltevreden & Van Rietbergen, 2007). According to Baen (2000) the increase in the extent of online shopping results in a diminishing demand for retail real estate through a reduction in footfall, lower impulse purchases, greater competition and lower profit margins. Winograd, Conner, Liang and Whitaker (2000) add to this that traditional in-store retailers are losing their competitive edge, because they no longer possess locational advantages and they no longer sell unique products. Moreover, Luley, Bitzer and Lenz (2002) studied the impact of online shopping on shopping related travel trips. In all three scenarios they examined, the number of shopping trips reduced significantly.

2.2 Complementarity

Other scholars argue that online shopping complements the demand for retail real estate (Salomon, 1986; Mokhtarian, 2003; Weltevreden & Van Rietbergen, 2007). The complementarity effect encompasses that the increase in the volume of online expenditures leads to an expansion of the stock of retail real estate. This is the case when online advertisements or online incentives strengthen traditional in-store retailing. Andersen and Rosen (2000) argue that online shopping has the potential to increase the demand for retail real estate. According to them retailers could use online shopping as an expansion of their

business case. Winograd et al. (2000) argue that the adaptive qualities of retailers will lead them to direct their in-store activities towards niche-markets, which only suite traditional in-store retailing. On top of that, these retailers could offer their more basic products on the traditional in-store shopping market. In this way creating win-win situations that could result in a rising demand for retail real estate. To add to this, Farag et al. (2007) concluded in their research that the likelihood of Dutch consumers making in-store shopping trips increases in case they perform more online searches.

2.3 Neutrality and Modification

In the literature the neutrality and modification effect of online shopping on the market for retail real estate are also mentioned. Neutrality entails that the introduction of the online shopping market has no effect on the stock of retail real estate (Weltevreden & Rietbergen, 2007). According to Mokhtarian (2002) the effects of online shopping on the demand for retail real estate vary for different types of products. She argues that the characteristics of certain products make that they are hardly purchased on the internet, and are therefore considered to have a neutral effect on the stock of retail real estate. Additionally, Ward (2001) concludes that online shopping is to a larger extent a substitute for catalogue shopping than for traditional in-store shopping.

Additionally, one speaks of a modification effect when the use of the internet alters the way consumers make traditional in-store purchases, but does not result in the alteration of the demand for retail real estate (Ferrel, 2005). This is the case when for example the internet is used to conduct research on products, without online purchases being made.

2.4 Summary

In short, the ideas regarding the effects of online shopping on the demand for retail real estate differ vastly among scholars. Studies conducted in various geographical locations and different time periods with the use of different variables and various methodologies provide different views on the effects of online shopping on the demand for retail real estate.

3. Data and Methodology

In order to gain more insight into the actual effects of the growing online shopping market on the market for retail real estate, correlation analysis and multiple regression analysis are conducted. With the use of multiple regression analysis, we are able to control for other factors expected to influence the demand for retail real estate. These analyses are used to empirically examine the effects of the growing online expenditures, between 2011 and 2016, on the change in the demand for retail real estate. Other focus points of these analyses are examining the effects of sociodemographic and other consumer behavioural trends, between 2011 and 2016, on the change in the demand for retail real estate. Finally, we also examine whether the demand for retail real estate is affected differently in municipalities with a rural character compared to municipalities with an urban character.

This research is based on data retrieved from, on the one hand a comprehensive Dutch research report, called the KSO (I & O Research; 2011; I & O Research, 2016), and on the other hand on the database from Statistics Netherlands (CBS [C], 2017). The KSO bundles data retrieved from a consumer survey, conducted among more than 100.000 consumers, with data acquired by Locatus, a Dutch retail research company. The KSO contains information regarding the market for retail real estate, the online shopping market and the economic performance of municipalities. The data concerning the years 2011 and 2016 forms the basis of our research as it contains the most detailed information about the online shopping behaviour of consumers.

The database from Statistic Netherlands contains annual data about a wide variety of characteristics of municipalities and their corresponding inhabitants. For this research the interest lies with the data regarding sociodemographic factors.

3.1 Independent variables

Besides the effects of the growing popularity of online shopping on the demand for retail real estate as discussed in chapter 2, more factors are mentioned in the literature that are expected to affect the demand for retail real estate. These factors are: retail revenue generated in municipalities (Brown, 1993; Weltevreden & Van Rietbergen, 2007), composition of the population (Zhang et al., 2016; CBS [A], 2017; CBS [B], 2017), the economic cycle (Burt, 2010; Teale, 2012; Evers et al., 2014; Zhang et al., 2016) and degree of urbanisation (Weltevreden & Van Rietbergen, 2009; DTNP, 2013; Dynamis; 2017).

The retail revenue generated in municipalities captures how well municipalities and their associated shopping areas perform economically (Brown, 1993). This is determined by a large variety of other aspect, such as: number of visitors, proportion of income spent on retail products, perceived attractiveness and accessibility (Jókövi & Lübke, 2004; Weltevreden & Van Rietbergen, 2007; Teale, 2012; Berwyn, 2013).

Another factor incorporated in this research is the changing composition of the population. According to Locatus (2012) it is not the growing online shopping market that causes problems on the retail real estate market, instead the demographic changes are the primary cause of these issues. The composition of the population is a wide ranging concept containing many different aspects. In general, it is expected that areas which experience demographic growth see the number of potential customers increase, which in its turn is expected to have a positive effect on the demand for retail real estate. The opposite holds for areas that experience demographic decline (Bureau Stedelijke Planning, 2012; Platform 31, 2014).

The fourth factor incorporated in this research is the economic cycle. In times of high conjuncture people generally earn more money and are inclined to spend a larger proportion of their money, which is expected to positively affect the demand for retail real estate (Evers et al., 2014). In times of low conjuncture people earn less money or are more inclined to save, which is expected to negatively affect the demand for retail real estate (Teale, 2012; Zhang et al., 2016).

Finally, the factor the degree of urbanisation is incorporated in this research. Different research reports DTNP (2013) and I & O Research (2016) indicate that stores selling non-daily products are affected the most by the changing consumer behaviour. These non-daily products are sold predominantly in municipalities with a more urban character (Weltevreden & Van Rietbergen, 2009; CPB; 2016, Dynamis; 2017). Therefore, part of the interest of this research lies with examining whether the demand for retail real estate is affected differently in rural municipalities compared to urban municipalities.

3.2 Dependent variables

In this research the dependent variables represent the change in the demand for retail real estate, between 2011 and 2016. Figure 58 shows a conceptual model in which all the factors that have been discussed above are displayed graphically. The demand for retail real estate is positioned in the centre, surrounded by the factors that are expected to affect the demand for retail real estate.

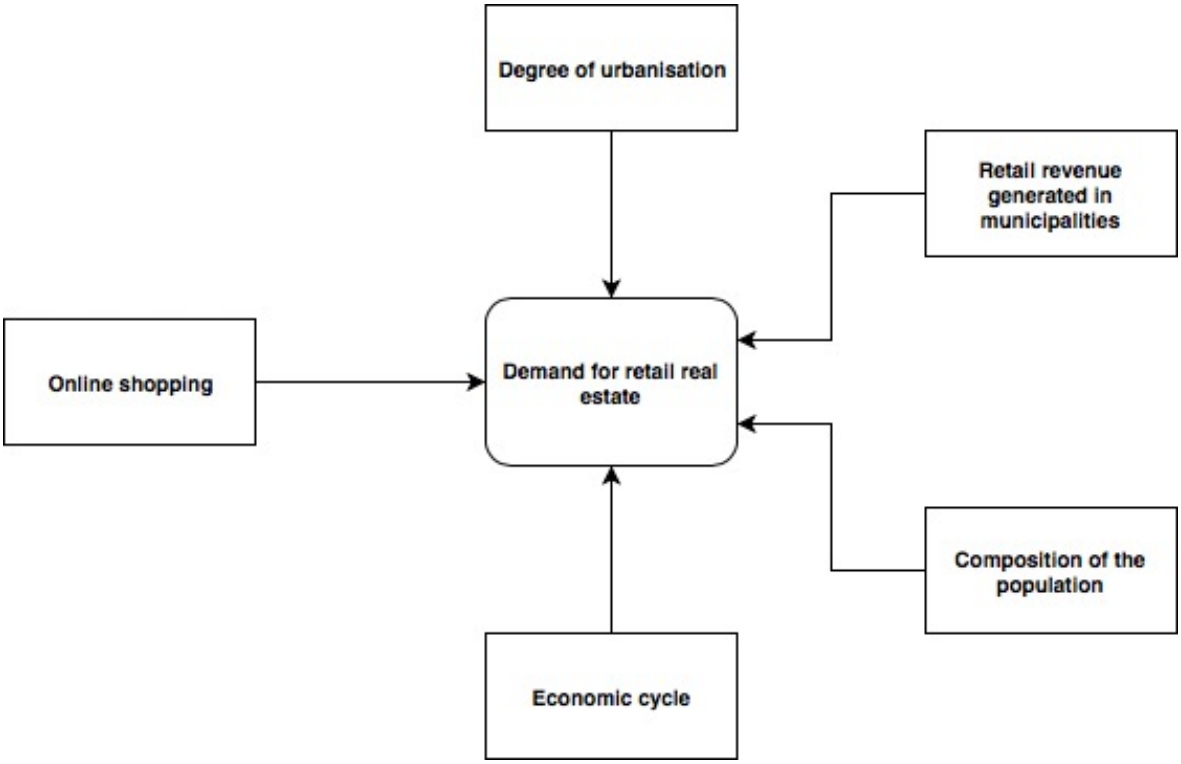

Figure 58: Overview of factors affecting the demand for retail real estate (Δ 2016- 2011)

3.3 Operationalisation

Table 1 shows that in this research the change in the demand for retail real estate is operationalised as both the change in the demand for occupied square meters of retail floor space as well as the change in the demand for retail stores. Moreover, the data sources contain data regarding the daily retail activity, the non-daily retail activity and the total retail activity. The level of specificity in the data allows for the use of a total of six different dependent

variables. All of which contain their own unique piece of information.

On the other hand, most independent variables are operationalised fairly straightforward. There are two exceptions. The first one regards the change in the average income of inhabitants. This variable is measured between the years 2011 and 2015, because the data of 2016 is not accessible. Using data from the year 2015, is justified by the fact that no major economic shocks occurred between 2015 and 2016 (CBS [D], 2017).

The dummy variable forms the second exception. This variable is used to incorporate the degree of urbanisation in municipalities at a particular moment in time, rather than the change in the municipality's degree of urbanisation between 2011 and 2016. The dummy variable divides the research sample into two groups. One group containing rural municipalities operationalised as municipalities with less than 35.000 inhabitants, and the other group containing urban municipalities operationalised as municipalities with more than 35.000 inhabitants. According to I & O research (2016) in general the mark for determining whether municipalities have a rural or an urban character, lies somewhere around 35.000 inhabitants.

3.4 Sample characteristics

This section outlines both the characteristics of the demand for retail real estate as well as the consumer behavioural and sociodemographic characteristics, of the municipalities used in the research sample. Of the 122 municipalities located in the geographical research area, data is available of a total of 110 municipalities. Table 51 gives an overview of the minimum values, maximum values, means and standard deviations, all measured as the numeric change between the years 2011 and 2016. Moreover, the dummy variable is not displayed in this table, because their numeric values do not contain relevant information.

Table 51: Sample characteristics

Variable label (Δ 2016-2011)	N	Minimum (Δ 2016-2011)	Maximum (Δ 2016-2011)	Mean (Δ 2016-2011)	Std. Deviation (Δ 2016-2011)
Dependent					
Demand for retail real estate					
Amount of occupied square meters of floor space (daily)	110	-0,825	42,796	2,097	5,026
Amount of occupied square meters of floor space (non-daily)	110	-39,793	32,066	-2,558	8,683
Amount of occupied square meters of floor space (total)	110	-25,724	59,007	-0,461	10,005
Number of occupied objects (daily)	110	-16	105	2,25	13,567
Number of occupied objects (non-daily)	110	-259	19	-27,87	44,057
Number of occupied objects (total)	110	-204	41	-25,71	36,527
independent					
Online shopping					
Online expenditures (daily) (x 1.000.000 euros)	110	-15,2	19,9	1,377	3,0642
Online expenditures (non-daily) (x 1.000.000 euros)	110	1,8	313,7	23,639	40,804
Online expenditures (total) (x 1.000.000 euros)	110	2,0	298,5	25,016	41,353
Retail revenue generated in municipalities					
Retail revenue generated in municipalities daily (x 1.000.000 euros)	110	-2,6	634,7	29,897	70,342
Retail revenue generated in municipalities non-daily (x 1.000.000 euros)	110	-25,4	824,4	25,145	87,057
Retail revenue generated in municipalities total (x 1.000.000 euros)	110	-15,0	1459,1	55,043	155,993
Composition of the population					
Average household size	110	-0,1	0,1	-0,041	0,054
Percentage of elderly citizens (percentage)	110	0,00	0,06	0,031	0,0108
Economic cycle					
Average income per inhabitant (x 1.000 euros)	110	1,0	5,8	1,802	0,659
Degree of urbanisation					
Number of inhabitants	110	-1.106	53.814	2026,84	6455,889

In this research sample the average total amount of retail real estate actually being occupied, has decreased between 2011 and 2016. This decrease is the result of the strong shrinkage of the average amount of retail real estate being occupied by stores selling non-daily products, which decreased on average by 2558 square meters of retail floor space per municipality and close to 28 stores per municipality. On the other hand, the average amount of retail real estate being occupied by stores selling daily products grew on average by 2097 square meters of retail floor space per municipality and close to 2 stores per municipality.

Furthermore, the increase in non-daily online expenditures, between 2011 and 2016, stands out from this research sample. The average increase in non-daily online expenditures is more than ten times larger than the average increase in the daily online expenditures. The total increase in online expenditures is on average approximately 25 million euros per municipality. Additionally, on average the amount of retail revenue generated in municipalities by stores selling both daily and non-daily products increased between 2011 and 2016, by 55 million euros per municipality.

Moreover, between 2011 and 2016, on average in the municipalities is this research sample the average household size has decreased with 0,04 persons, the percentage of elderly citizens has increased with 3 percent, the average income of inhabitants has increased with 1800 euros and the number of inhabitants increased by more than 2000 per municipality.

3.5 Future of online shopping

According to I & O Research (2016) currently 12,5 percent of the products are purchased through online channels. ING Bank (2017) predicts that this percentage is likely to increase to 25 percent in the year 2025. Comarch (2017) predicts that the percentage of online purchases is likely to exceed the 30 percent mark around the year 2030.

4. Results

In this section, using statistical analysis, we explore the relationship between the increase in the online expenditures, between 2011 and 2016, and the change in the demand for retail real estate. Firstly, the Pearson correlation coefficient is used to analyse the strength and the direction of the relationship between the change in the online expenditures, between 2011 and 2016, and the change in the demand for retail real estate. After which, multivariate regression analysis is used to examine the relationship between the change in online expenditures, between 2011 and 2016, and the change in the demand for retail real estate, while accounting for sociodemographic and other consumer behavioural variables.

4.1 Correlation analysis

In table 2 the results of the correlation analysis are presented. The results point to the existence of a moderate negative relationship between the change in the total demand for retail stores, between 2011 and 2016, and the total online expenditures. Moreover, when considering that part of the retail market concerned with selling non-daily products, the Pearson correlation coefficient points to the existence of a significant negative relationship between the change in the demand for retail real estate, between 2011 and 2016, and the change in the online expenditures. This negative association is weak when the change in the demand is measured in square meters, and moderate when the change in the demand is measured in the actual number of stores. On the other hand, the results do not indicate that there is an association between the change in the demand for retail real estate related to the sale of daily products, between 2011 and 2016, and the change in online expenditures.

Table 52: Results correlation analysis

		Total (non-daily + daily)		Non-daily		Daily	
Variable (Δ 2016- 2011)		**Demand for square meters of retail floor space**	**Demand for retail stores**	**Demand for square meters of retail floor space**	**Demand for retail stores**	**Demand for square meters of retail floor space**	**Demand for retail stores**
Online expenditures total	Pearson Correlation	-0,133	-0,608				
	Sig. (2-tailed)	(0,179)	(0,000)				
Online expenditures non-daily	Pearson Correlation			-0,232	-0,625		
	Sig. (2-tailed)			(0,018)	(0,000)		
Online expenditures daily	Pearson Correlation					0,145	0,013
	Sig. (2-tailed)					(0,139)	(0,897)

4.2 Multivariate regression analysis

Table 3 gives an overview of the results of the six multiple regression models. Apart from the results regarding online shopping, the table also shows the other variables that are significantly related to the change in the demand for retail real estate, between 2011 and 2016. From the table it becomes evident that an increase in the total online expenditures, between 2011 and 2016, is significantly related to a decrease in the total demand for retail real estate. This negative association is primarily the result of the strong negative relation between the increase in online expenditures on non-daily products, between 2011 and 2016, and the change in demand for retail real estate. Additionally, do not indicate that the change in the online expenditures on daily products, between 2011 and 2016, is related to the change in the demand for retail real estate.

Furthermore, what stands out is that the effect of the growing popularity of online shopping, between 2011 and 2016, is stronger on the change in the demand for retail stores than on the change in the demand for square meters of retail floor space. This could mean that the increase in online expenditures is stronger related to the decrease in small-sized stores compared to the decrease in large-sized stores. However, this difference could also be explained by the increase in the average store size. In the latter case, the association between the increase in online expenditures, between 2011 and 2016, and the change in the demand for square meters of retail floor space is partly cancelled out by the continuous tendency of retailers to scale up the surface areas of their stores (Evers et al., 2014). In this research data regarding economies of scale is not incorporated. Therefore, we are unable to elaborate further on what causes the difference between these effects.

Table 3 also shows that the change in the demand for retail real estate, between 2011 and 2016, is significantly positively related to the change in the total retail revenue generated in municipalities. This indicates that an increase in the total amount of retail revenue generated in municipalities is accompanied by the growth of both the demand for square meters of retail floor space as well as the demand for retail stores. Similarly, a decrease in retail revenue, between 2011 and 2016, corresponds with a decline in the demand for retail real estate. These same

positive relationships are observed between the change in the amount of retail revenue generated by stores selling non-daily products, between 2011 and 2016, and the demand for retail real estate concerned with selling non-daily products. Furthermore, the change in retail revenue generated by daily stores, between 2011 and 2016, is only positively related to the change in the demand for retail real estate when measured in square meters of retail floor space, but not when measured in the number of retail stores. I & O Research (2016) provides a plausible explanation. In their report they state that the desire of consumers to purchase daily products more locally has led to the expansion of already existing supermarkets, but not necessarily to the establishment of additional stores. This partly explains why the change in the demand for square meters of retail floor space is affected differently than the change in the demand for retail stores.

Moreover, the change in the percentage of elderly citizens, between 2011 and 2016, is positively related to the change in the demand for square meters of retail real estate, while it is not associated with the change in the demand for retail stores. This is contradicting with previously published research reports (Bureau Stedelijke Planning, 2012; Platform 31; 2014). An explanation for this deviation from the expectations is simply not found in this research. Without being able to find a plausible explanation for this result, we regard it is inconclusive.

Several other sociodemographic and consumer behavioural factors that were also incorporated in this research are not significantly related to the change in the demand for retail real estate, between 2011 and 2016. These results indicate that the average household size, the change in the average income of inhabitants and the level of urbanisation in municipalities do not explain any additional proportion of the variance of the various dependent variables representing the change in the demand for retail real estate, between 2011 and 2016.

Table 53: Results multiple regression analysis

	Total (non-daily + daily)		Non-daily		Daily	
Variable (Δ 2016- 2011)	**Model 1 (occupied floor space Δ 2016- 2011)**	**Model 2 (occupied stores Δ 2016- 2011)**	**Model 3 (occupied floor space Δ 2016- 2011)**	**Model 4 (occupied stores Δ 2016- 2011)**	**Model 5 (occupied floor space Δ 2016- 2011)**	**Model 6 (occupied stores Δ 2016- 2011)**
Online shopping						
Online expenditures total	-0,575 (0,000)	-1,006 (0,000)	-0,500 (0,000)	-0,990 (0,000)	-	-
Municipal retail revenue						
Retail revenue total	0,669 (0,000)	0,506 (0,007)	0,416 (0,000)	0,546 (0,000)	0,567 (0,000)	-
Composition of the population						
Percentage of elderly citizens	0,247 (0,009)	-	0,216 (0,022)	-	-	-
Number of cases	103	103	103	105	105	104
R	0,547	0,684	0,577	0,746	0,567	0
R square	0,300	0,468	0,333	0,556	0,321	0

4.3 Model justification

The four municipalities with the most inhabitants of the research sample: Amsterdam, Rotterdam, 's-Gravenhage and Utrecht are removed from all six regression models. Based on the following statistical criteria: Leverage values, Cook's distances and standardised residuals, these municipalities are regarded as too influential on the model outcomes. Throughout the six different models the municipalities of Amersfoort, Haarlem and Zaanstad are also occasionally considered to be too influential on the model outcomes. They are removed from the specific models in which their influence on the model outcomes is considered too large. To elaborate on this, these municipalities are most likely considered to be too influential, because they are part of the larger municipalities incorporated in the research sample. Consequently, they are not removed from the models because they perform significantly different than the other municipalities in the research sample.

5. Discussion

The results presented in the previous chapter reveal that the change in the overall demand for retail real estate, between 2011 and 2016, is significantly negatively related to the change in the online expenditures. More specifically, the findings of this research make clear that an increase in the online expenditures on non-daily products, between 2011 and 2016, is strongly associated with the decrease in demand for retail real estate. Contrary, according to our findings the change in the online expenditures on daily products, between 2011 and 2016, is not significantly related to the change in the demand for retail real estate.

In this way our research provides strong empirical evidence that supports the claims of those scholars who state that online shopping, and especially online shopping for non-daily products, substitutes part of the demand for retail real estate (Baen, 2000: Winograd, et al., 2000; Weltevreden & Van Rietbergen, 2007). Moreover, the results point to the

absence of a relation between online shopping for daily products and the demand for retail real estate. Also, our findings provide proof that contradicts the claims of those scholars who argue that the effects of online shopping on the demand for retail real estate should be regarded as complementary or modifying (Salomon, 1986; Andersen & Rosen, 2000; Winograd et al., 2000; Mokhtarian, 2003; Ferrel, 2005; Weltevreden & Van Rietbergen, 2007).

Besides the effect of online shopping, our findings also indicate that municipalities of which the retail sector performed well, between 2011 and 2016, are likely to have experienced an increase in the demand for retail real estate, whereas municipalities of which the retail sector performed poorly, between 2011 and 2016, most likely saw the demand for retail real estate diminish. These findings are harmonious with previous findings (Weltevreden and Van Rietbergen, 2007; Cosmin, 2008).

Moreover, our findings do not support the statements made in previous studies that the sociodemographic and other consumer behavioural factors incorporated in this research did play a role in the changing demand for retail real estate, between 2011 and 2016 (Burt, 2010; Teale, 2012; DTNP; 2013; Evers et al., 2014; Zhang et al., 2016; CBS [A], 2017). To add to this, our findings are unable to confirm statements made by Weltevreden and Van Rietbergen (2009) and Dynamis (2017) that the demand for retail real estate is affected differently in municipalities with a rural character compared to municipalities with an urban character.

As mentioned in the introduction of this research, the nature of the increase in retail vacancy ultimately determines the type of policy approach that is most effective in keeping shopping areas attractive in the long-term. Therefore, our findings also have implications on retail policy. The confirmation of the existence of a substitution effect, suggests that a large portion of the vacant retail real estate that originated between 2011 and 2016, is the direct result of the increasing popularity of online shopping. To add to this, forecasts indicate that this substitution effect is structural in nature and most likely going to expand in the future (Comarch, 2017; ING Bank, 2017). Consequently, the previous levels of demand for retail real estate are unlikely to be restored.

This entails that in areas where this subsitution effect forms the basis for the mismatch between the demand and the supply of retail real estate, policy approaches need to be primarily reduction-oriented. Through the reduction of the stock for retail real estate policy makers are able to reduce the amount of retail vacancy and minimise the associated negative externalities. Thereby, keeping municipalities liveable for its inhabitants and attractive to its visitors. Furthermore, the purpose of the growth-oriented policy approach needs to change partially. Instead of directing its focus on the expansion of the market for retail real estate, this policy policy approach needs to be used to stop the deflation of the market for retail real estate. Combining these two policy approaches gives policy makers the

means to deal with the structural reduction in the demand for retail real estate, caused primarily by the growing popularity of online shopping.

In short, through providing empirical evidence that online shopping has substituted part of the demand for retail real estate, we were able to fill part of the gap in the existing scientific literature. More specifically, we were able to determine that the reduction in the demand for retail real estate, between 2011 and 2016, is mainly caused by the increase in online expenditures on non-daily products. Simultaneously, we were able to contradict that the increase in online expenditures, between 2011 and 2016, has a complementary effect on the demand for retail real estate.

Despite the strong aspects of this research, there are also a number of limitations attributed to our research. Firstly, due to data constraints, this research is limited to performing an analysis on the municipal level, which is a relatively high level of aggregation. Performing an analysis on a lower level of aggregation would allow us to more specifically pinpoint the effects of online shopping on the demand for retail real estate. To add to this, differentiating between the degree of urbanisation in municipalities did not result in significant differences between various types of municipalities. This either suggests that there are no differences between municipalities and the effects of online shopping are uniformly spread across the research sample, that the differentiation made in this research is irrelevant or that the municipal level of aggregation is not the right level to make these differentiations.

Next, the supply side of the retail real estate market is not incorporated in this research, which entails that this research is limited to investigating the factors on the demand side of the market only. Accordingly, statements about retail vacancy rates are made under the assumption that the supply of retail real estate is fixed.

6. Conclusion

In this research we studied the effects of the growing online expenditures, between 2011 and 2016, on the changes in the demand for retail real estate, while controlling for a number of sociodemographic and other behavioural factors. The hypothesis of this research is that the increase in online shopping results in a decreasing demand for retail real estate. Using both a correlation analysis and a multiple regression analysis on data regarding a total of 110 municipalities located in the western part of The Netherlands, we were able to establish that the increase in online expenditures, between 2011 and 2016, is related to a decrease in the demand for retail real estate. These findings are consistent with our hypothesis.

Our research contributes to the scientific debate regarding the effects of online shopping, by providing empirical evidence that online shopping substitutes part of the demand for retail real estate. From these findings it is concluded that, in order to restore the balance between the demand and the supply of retail real estate, reduction-oriented policy approaches are

required. Moreover, we conclude that the growth-oriented policy approach should be used as a means to stop the deflation of the market for retail real estate, rather than as a means to expand the retail real estate market.

Looking beyond the boundaries of this research, our findings could also have consequences for the theories on retail locations, which explain the spatial component of the market for retail real estate as we currently know it. The substitution effect of online shopping on the demand for retail real estate, suggests that certain underlying concepts of these locational theories might be susceptible to change in the future.

To be able to examine in more detail the influences of the growing popularity of online shopping on the underlying concepts of the retail location theories, we recommend additional research to focus on the relation between online shopping and the market for retail real estate at the shopping centre level of aggregation. Most retail locational theories, focus on retail activities in shopping centres. Consequently, additional information on the shopping centre level of aggregation provides better grounds for investigating the retail locational theories.

Closing off, we recommend future research to, besides the demand side, also examine the factors on the supply side of the retail real estate market. In this way the effects of online shopping on the market for retail real estate are also controlled for by factors on the supply side of the market. This paints a more complete picture of the factors contributing to the problems on the market for retail real estate.

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