The impact of retail diversity on Dutch inner cities

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Abstract

In the past 20 years the number of stores is decreasing within Dutch inner cities. This is potentially harmful for local economies. A lack of a retail diversity could have contributed to this decline. Implementing policies that stimulate retail diversity could therefore be a viable method to stimulate the economies of inner cities. Quantitively research on the subject is however lacking. The aim of this thesis is to quantify how retail diversity has influenced the change in number of stores within Dutch inner cities between 2000 and 2016. In order to do this a literature review has been written and a regression analysis has been constructed.

The results of the literature review conclude that most retail is still located within Dutch inner cities. This is partially due to the benefits of urban planning and clustering that provide the possibility to comparative- and multipurpose shop. The stores within these inner cities focus on clothing- shoe stores and other forms of 'fun' shopping which results in low retail diversity. The advent of online shopping is the primary cause for the decline of stores and contributed to the homogenizing of retail.

To test how retail diversity has influenced the changing number of stores a regression analysis was constructed. The analysis tested wherever 100m x 100m grid cells with a high diversity would perform better and see an increase in stores. To account for spatial differences and other influences, multiple variables where included in the regression. The results showed that a low retail variety resulted in a decrease in stores. In relation to the other influences, retail diversity had the highest influence on the number of stores between 2000 and 2008 and between 2008 and 2016.

Increasing the retail diversity is therefore presumed to be a good measure to increase the number of stores within inner cities. Further research could improve the quality of the results by using more accurate variables. The scope of the study could also be adjusted as some influences extend further from the used cells.

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1. Introduction

1.1. Problem statement

The Dutch retail landscape is changing rapidly: the variety of stores as well as the number of shoppers is decreasing according to PBL (2020) and Locatus (2018). With the current COVID-19 epidemic projections are that the number stores will decrease even more, up to 40% of all retail spaces as mentioned in PBL (2020). Retail locations in The Netherlands are, due to strict urban planning, primarily located within inner cities as described in Evers et al. (2014) and Van Der Krabben (2009). These inner cities have important economic influence on local economies according to Wal et al. (2016). With the declining number of stores this economic influence will dwindle. Buitelaar et al. (2013) cites that a decrease in stores will stagnate economic growth and deteriorate the attractiveness of the inner cities. In order to maintain an attractive shopping area, policy briefs like Evers et al. (2014), Clarke et al. (2012), Hospers (2016) and Tool (2018) emphasize the importance of retail diversity. A diverse set of retail establishments would contribute to a wider range of consumers.

Contrary to the suggested importance by researchers, retail diversity is very low within inner cities as was concluded by Evers et al. (2014). Most stores are targeted towards 'fun-shopping' (e.g. Clothing and shoe stores). Findings on the relation between retail diversity and the number of stores would contribute to the discourse on policies to improve inner cities. This thesis therefore tries to quantify the relation between retail diversity and the number of stores within inner cities.

1.2. Goal and research questions

The concept of Diversity is central within theories about agglomeration and economic growth. Glaeser et al. (1992) describes that (urban) variety will encourage growth in industries. Diversity of retail will also contribute to the perception of inner cities. Clarke et al. (2012) and Hospers (2016) describe that variety in retail will attract more and a wider range of consumers due to a more positive perception of the city. A diverse set of retail functions will, according to these researchers, contribute to local economic growth.

Research therefor indicates that retail diversity is an important factor to maintain the economic growth and relevance of Dutch (inner) cities. The influence of high retail diversity within inner cities is however a scarcely researched subject. If a higher diversity of stores would increase the number of stores within a city, than it would be substantiate claims of policymakers to enforce a diverse set of stores. This sheds new light on the impact of retail diversity as it will try to quantify the impact of retail diversity whereas most research on retail diversity is qualitatively based.

The main research question for this thesis is:

How has retail diversity influenced the number of stores within Dutch inner cities from 2000 to 2016?

In order to quantify the effect of retail diversity on Dutch inner cities, the retail structure of Dutch inner cities is conceptualized with a literature review. First presenting economic theories that influence the location choices of retailers. Subsequently the Dutch retail structure is conceptualized and described how the retail location theories have influenced the structure. The causes for the decline in stores of the past 20 years are described thereafter. Finally, a set of influence are conceptualized that influence the number of stores within the inner cities. From the conclusions of the literature review two models are constructed that quantify the effect of retail diversity on the number of stores. The first model quantifying the effect between 2000 and 2008, the second between 2008 and 2016.

The following sub questions have been formulated:

- *How do retailers choose the location for their establishment and which theories support these retail location choices?*
- *How is the current Dutch retail geography structured and which policies and economic theories have influenced this structure?*
- *Which developments in the retail market are inciting a decline in the number of stores within Dutch inner cities?*
- *Which influences have shaped the Dutch retail market and how do these influences change the number of stores?*

Literature review

In the upcoming chapters an overview of the theories on retailer location choices (retail location theories) is given. The second chapter describes the current Dutch retail structure and composition in inner cities and the policies that influenced this realization. The third chapter discusses the threats to this retail structure with emphasis on the impact of online shopping. Finally, a set of influences is presented that shape the Dutch retail market.

2. Retail location theories

Retail location theories consist a multitude of economic theories that aim to model location choices of retailers. Including all relevant theories in this review is deemed to be an impossible task. Therefore, the aim of this section is to give an overview of the basic economic theories that drive retail location choices. Dawson (1980), Brown (1993) and Hirschman (1981), state that the main theories of retail location choices are: central place theory and bid rent theory. Other theories that are mentioned by Brown (1993) are: spatial interaction theory and the principle of minimum differentiation. All mentioned theories will be discussed in the upcoming section.

2.1. Central place theory

The central place theory was first formulated by Christaller (1933) and Losch (1944). Brown (1993) summarizes the theory as the size, number, functional composition and distance between service centres (stores), assuming that the population is distributed uniformly, is equally affluent and fully informed. In addition, this theory assumes that the population acts in a rational, perfectly competitive, profit-maximizing manner. Products are bought from the service centres that sell their products free on board, have equivalent costs and enjoy free entry to the market. The theory assumes that supply and demand are held in equilibrium through the price mechanism and additionally introduces travel costs. These travel costs are uniformly priced and inner cities are equally accessible. Consumers prefer the nearest centre if it provides the products they seek and for every item that is bought, an individual trip is made (single purpose shopping). The theory models that if distance to a store increases, demand will decrease until the point is reached where travel costs make the product so expensive that there is no demand for it. With this framework the central place theory introduces two concepts that are important to location choices: thresholds and range. Lesger & Delaney (2011) summarize the concept of range as: 'the range of a product is the maximum distance that a consumer is prepared to travel in order to buy that specific product'. The range can otherwise be referred to as the market area of a product. The concept of threshold is summarized as: 'the minimum consumption demand that is required in order to keep a business [..] running'. If demand would fall below the threshold, it would not be economically viable for the shop to exist in that location. Central place theory predicts that products that are more expensive and infrequently purchased have a larger market area (or range) than inexpensive products. Furthermore, it predicts that there will be many stores with a small market area and relatively few stores with a large market area. In addition, if there are identical sellers, free entry and every customer is served, the service centres who sell the same products will be evenly spaced in a triangular arrangement with equally sized market areas. Figure 1 illustrates the relation of the range, threshold and market distance.
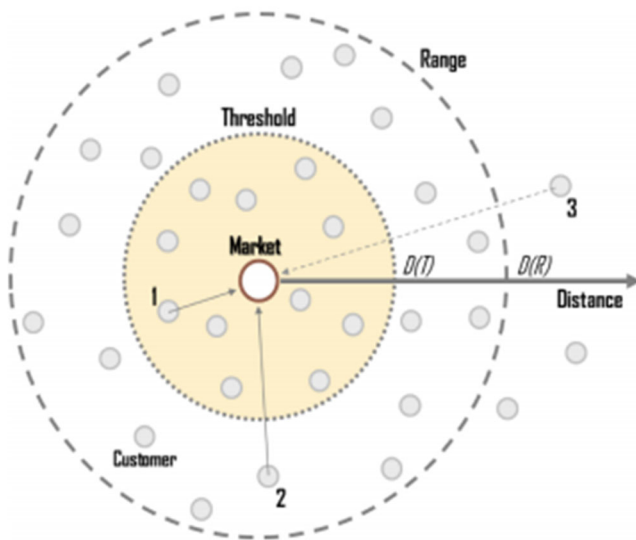
Figure 1: The relation between range, threshold, customers and markets.

The assumptions made in central place theory are far from realistic and after its first publication, other researchers worked on improving the theory. The assumption that population is uniformly distributed and equally affluent was tested by Berry & Garrison (1958)a and Berry & Garrison (1958)b. They conclude that if there is a low population density and purchasing power, market areas will expand and centres will be more dispersed. Centres are located more closely and more compact when population density and purchasing power are high. Centres in peripheral regions are therefore more dispersed, while in the Randstad area they are closer together. The assumption that consumers prefer the nearest centre was tested by Huff (1962). Huff concluded that this is not the case: shoppers do not inevitably prefer the nearest centre; choices are made in relation to the utility and distance of centres. Finally the assumption that consumers only shop with a single purpose was tested by Kondo & Kitamura (1987) and Thill & Thomas (1987). Contrary to the assumption they find that most of the time shoppers buy several products in a single trip, therefore shopping is more multi-purpose instead of single purpose.

2.2. Bid rent theory

It is stated by Brown (1993) that bid rent theory is primarily based on Haig (1927) who studied the land use of New York City in his time. The theory states that in a uniform landscape, where travel accessibility is even in all directions, the centre of the plane is the most accessible and thus the lowest (travel) cost location. He cited that 'all economic activities covet the accessibility to sources of labour and customers that centrality [has]'. The desire for centrality is however dependent on how effective the economic activity is in the centre. Therefore, different land uses result in a different willingness to pay for centrality and thereby rank themselves from highest paying rent, in the centre, to the lowest on the fringes. Brown (1993) summarizes this by stating that: 'competition for an inelastic supply of land ensures that, in the long run, all urban sites are occupied by the activity capable of paying the highest rents and land is thereby put to its 'highest and best' use'. Alonso (1960 & 1964) modelled this willingness to pay for land use and constructed bid rent curves (figure 2) for each land use function, with the angle of the curves indicating how much the land use prioritized accessibility. Because retailers would enjoy the biggest influx of customers in the centre of the landscape, since it is the most accessible, they would prefer centrality the most. However, differences between retailers are still

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prevalent and cause the spatial organization to be different. Chudzynska (1981) shows, for instance, that retailers with a lower bid rent curve, like grocery stores, will locate near the urban fringes.
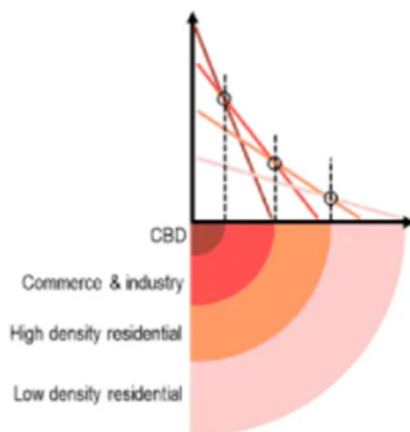

Figure 2: Bid-rent curves

Just as the central place theory, bid rent theory has assumptions that hinder its ability to model real world phenomena. One of the most glaring issues the theory has is the fact that the modern inner city is not as accessible as it once was. Peiser (1987) and others reported for instance the rent increases when distance from the inner cities increases. Finally, Garner (1966) and others note that rent prices increase along busy intersections or roads and are therefore not uniformly distributed in regions.

2.3. Spatial interaction theory

Whereas the central place theory assumes that consumers will prefer the nearest shopping location, spatial interaction theory bases its finding on the theory that people will, despite larger distances, prefer certain shopping locations over the others. If, for instance, a shop has a wider variety of products, consumers might prefer that shop over others despite the distance from the shop. Conversely, consumers might prefer the nearer shop with a limited variety of products. Reilly (1931) formulated this theory as his 'Law of Retail Gravitation' in which trade from a smaller city was drawn by two (big) cities in proportion to the populations of the two cities and the square of the distance between the smaller city and bigger city. The theory, in its original form, is somewhat hard to implement in real-world scenarios. According to Huff (1962) this is due to the fact that the variables, population and road distance, and the parameters do not lend itself particularly well in real-world scenarios. Brown (1993) summarized that different variables, for instance retail floorspace, where used and parameters where adjusted. The parameters could indicate now that larger cities had a far greater range of shopping facilities than smaller cities and that the effect of distance was different between consumers and goods. Huff (1962) states that 'each shopping area [..] had a probability of being patronized which is directly related to its size, inversely related to its distance from the consumer and inversely related to the utility of competing shopping areas'.

The theory is useful to model attractiveness of retail locations in relation to its distance to the consumer. There are, however, some conceptual and technical difficulties with the theory which are mentioned by Brown (1993). Firstly, the study area is perceived to have a uniformly distributed population which isn't the case in almost every situation. Moreover, the size of the study area will influence the results. If, for example, a larger city is left out of the analysis, results could be overestimated. Conceptually the model assumes that shopping trips are single purpose. However, as mentioned in the chapter about central place theory, this is not true in many cases. Finally, the lack of

dynamism is stated as problematic. Shopping opportunities and personal mobility are ever-changing variables and therefore only short- or medium-term conclusions can be made.

2.4. Principle of minimum differentiation

The principle of minimum differentiation was conceptualized in Hotelling (1929). Hotelling (1929) formulizes his model with two profit-maximizing firms, selling identical products from fixed locations in a linear market with constant transport costs. Demand for the products of the firms is completely inelastic and identical and consumers are utility-maximizing and evenly distributed. Hotelling (1929) concluded that if the firms would sell identical products for the same prices, customers would not differentiate by product but by location, therefore preferring the firm that would be nearer to them. For example, if two competing firms offer the same products on the same street, the social optimum locations would be on the first and third quartile of the street. The firms would each provide for half the market and the average distance to the store is the lowest. However, in equilibrium both firms will locate to the centre of the street since independently locating to the quartile would enable the competing firm to capture more than half the market. A real-world example for this is competing hardware stores on the same street. Clustering of firms can also be the cause of complementary products. For example, Bromley & Thomas (1989) note that 66% of shoppers that shopped at the local shoe store also visited the nearby clothing store. In this example, the clustering of stores results in positive externalities for both stores.

However, most assumptions that were made are very unlikely to be true real-world scenarios. Moreover, if most of these assumptions are relaxed, they indicate dispersal rather than clustering. When demand, for instance, decreases with distance to the store as described by Devletoglou (1965), dispersion between firms is predicted. Transport costs also have an impact on the degree of clustering. As described in Brown (1993) 'when freight rates are high or are met by the seller, a dispersed pattern of outlets results. [..]'. Contrary, low freight rates will result in clustering. Finally, Brown (1993) summarizes that 'the retailing of differentiated products, which are not in direct competition, [will result in clustering]'.

3. Dutch retail structure

3.1. Changes in size and composition of retail

The theories that have been discussed in the previous chapter all have had an impact on the Dutch retail structure. The bid rent theory predicts that accessibility (and in turn centrality) is a desirable property for the location choice of retailers. Therefore, high streets and inner cities have been the centre of retail establishments in most European towns or cities for the last decades. According to Birkin et al. (2002) European inner cities will 'undoubtedly remain a major retail landscape in the future'. They state that three quarters of all shopping was still being done on these high streets in 1997. The predictions of Birkin et al. (2002) came true for the most part in the Netherlands in 2020, when most in-store shopping was still being done in inner city and especially in big cities as stated by Locatus (2018). The difference in number of stores can primarily be contributed to the central place theory: if there is a bigger market area more stores can be realized. The medium-sized cities, with populations around 100.000 people, are struggling however according to for instance Wal et al. (2016) and Hospers (2016). Vacant retail establishments are increasing in these locations which has, according to Wal et al. (2016), a self-reinforcing effect on the vacancy rate. More vacant establishments will, according to central place theory and the spatial interaction theory, cause the inner city to be less appealing and attract less customers resulting in more vacant establishments. The causes for the initial vacant establishments and threats to inner cities will be discussed in chapter 4.

Not only the number of stores in inner cities has changed over the last 20 years. The composition of these high streets has also changed in the last decades. During the 1960's the high streets were dominated by: clothing, footwear, jewellery, furniture and electronic goods. Grocery products like food were also present but less commonly available. Due to increasing rents (see bid rent theory) stores that were less profitable were driven away to the urban fringes and now the urban centres are predominantly dominated by clothing and shoe stores. The principle of minimum differentiation also contributes to the clustering of clothing and shoe stores since it is beneficial for them to locate next to each other. The expulsion of some of these stores (electronic and furniture) can also be linked to Dutch urban planning which will be discussed in section 2.2. Burger et al. (2013), who discuss regional structures and retail amenities in the Netherlands, state that retailers will profit most if consumers can both multipurpose- and comparison shop. The modern structure, with a low variety of stores, makes that comparison shopping is very well achievable. However, multipurpose shopping is more difficult and could cause utility losses for consumers and profit losses for retailers if the variability becomes too low.

3.2. The Influence of spatial patterns

In Burger et al. (2013) it is stated that in more modern forms of central place theory the difference is made between poly- and monocentric structures of cities (figure 3). Where a polycentric structure is the situation where cities are relatively the same size. In dispersed structures, a large part of the population is not living in inner cities but spread out in a non-concentrated pattern. It is mentioned that, in contrast to the expected agglomeration, in recent decades the process of decentralization and dispersion in the Randstad (to a more polycentric structure) has accelerated. Incentives for this development are mixed. Lambregts (2009) notes that in the Randstad area scale economies drive the region to a more polycentric structure but also states that clustering of business services primarily occurs in the four bigger cities. Urban planning also has had an impact on the location choices of retail establishments, these will be discussed in the next section (3.2).

Burger et al. (2013) argue that 'the different spatial structures [..] vary in the extent to which they support retail'. Monocentric and centralized structures support the idea of efficient shopping

behaviour (e.g. multipurpose shopping). However, Wensley & Stabler (1998) point out that in peripheral regions (lower population regions) transportation costs are higher and therefore demand thresholds, in these areas are lower for some stores. They state that: 'the inclusion of [..] distance [..] indicates that the required population (threshold) decreases the more isolated the community is'. This is of course dependent on the kind of store that is considered. Grocery stores have, for instance, a lower establishment multiplication rate than clothing stores. The initial demand threshold may be higher for clothing stores but less people are needed to establish a second or third clothing store relative to grocery stores. Moreover, Mushinski & Weiler (2002) state that there is less competition between retailers in sparsely populated areas, resulting in more retail establishments.
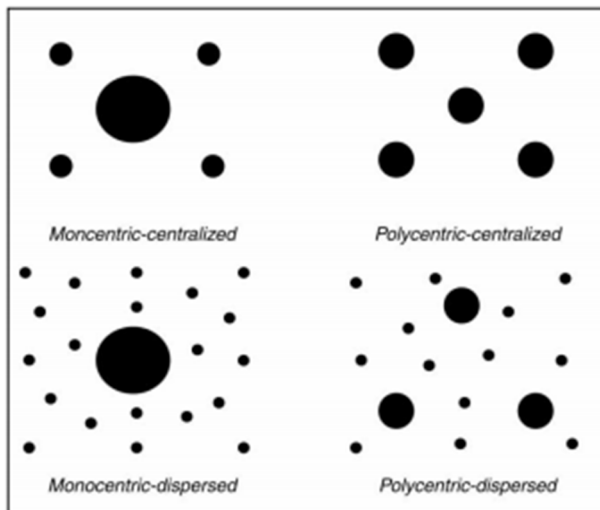

Figure 3: different forms of city structures.

In a polycentric (peripheral) structure it is more likely that some specialized stores do not meet the demand threshold. In cities these stores would be established since the threshold is being met, but also because people can multipurpose and comparison shop, further reinforcing their existence. This indicates that, although shopping options are present in more rural regions, the variety of products is limited. The limited range of travel, due to high transport costs, further enforces that people living in these regions will shop locally and have a limited number of options.

3.3. Urban planning

An important influence on the Dutch retail geography is urban planning. Evers (2002) shows that national Dutch urban planning has had a big influence on the retail structure. For over five decades it didn't allow to decentralize the retail market from the inner city to the urban fringe in order to protect the inner city. The necessity of protection is summarized by Hospers (2016) by stating that inner cities have a major influence on the local economies and communities. Wal et al. (2016) further elaborate on the importance of inner cities. They state that, in addition to the self-reinforcing effect of vacancy (section 3.1), even just a few vacant retail establishments have a negative effect on the safety and image of the city.

However, the necessity of these policies is debatable, and many other European countries have had much more lenient restricting policies. Evers (2002) states that the policies where already outdated when they were first implemented. The initial restricting policies were introduced after the Second World War. Cities were destroyed and the population was booming, which resulted in the expansion of cities. The policies that were implemented followed Christaller's central place theory: a hierarchy of retail functions with exclusive items sold in inner cities and everyday goods in neighbourhood centres. Retail establishments outside of these centres could only be realized when they were complementary

but not competing with existing centres. For smaller retailers the restrictions were very useful since it provided them a competitive edge: competitors were free to settle in the same centre but not elsewhere.

Evers (2002) concludes however that this was already an outdated form of urban planning since: "[t]he advent of the multi-purpose trip, leisure shopping, female participation in the labour market, price comparative shopping, modernization of retail formats and, most importantly, the sharp rise in car ownership all undermined [it's] validity". The growth of large-scale retailers was limited to the size of the centre while in for instance Germany, hypermarkets were constructed outside of the cities. The incentive to build retail establishments outside of the cities is caused by low land prices, the availability of space and the increased mobility due to car ownership. The spatial interaction theory stimulates these out-of-town hypermarkets since the variety of products is much greater due to the availability of space and further distances can be travelled when people own a car. Large-scale retailers have therefore argued that the restrictions deny market entry and are consumer unfriendly: if consumers would want to shop in inner cities, they would still be able to.

Due to increasing criticism on the restricting policies, the government abolished the restrictions on a national level in 2004. However, the main restrictions were largely reinstated by provinces on a regional level. According to Van Der Krabben (2009), the provinces were forced to reinstate some restrictions since the floor productivity of inner city stores would decrease too much. The result of these policies is that Dutch inner cities are still the top retail locations within a city. The typology of inner city shops has shifted, however. Evers (2014) states that Dutch inner cities are now dominated by recreational shopping facilities since they tend to cluster and locate primarily in the central pedestrian streets with the most footfall. According to him, this trend does not seem to be steepening, the share of recreational shopping grows everywhere but twice as fast in inner cities. Maintenance shopping is decreasing in inner cities but increasing anywhere else. According to Evers (2014), this is due to large shopping facilities like home improvement and furniture strips and malls which can now be realized due to more lenient retail planning.

3.4. Vitality of Dutch inner cities

Section 3.1, 3.2 and 3.3 indicate that the composition and size of retail in inner cities are widely different to each other and are influenced by a multitude of factors. The sections primarily focus on the influence of the size of the city population, as well as the spatial pattern the population is distributed in. However, population is not a perfect substitute for the number of consumers, which indicates how large the market area is according to the central place theory. Demographics and socioeconomic background are for instance important factors in determining the number of consumers. These factors are different between cities. Inhabitants of the inner city of Groningen consist primarily of young adults while the inner city of Emmen primarily consists of elderly people. This would result in a different composition of stores in both cities. Evers et al. (2015) used cluster analysis of inner cities with more than 200 stores in their inner city to account for their socioeconomic and spatial differences. The cities were categorized in the following groups:

- Flourishing in a strong region (A)
- Stable and regionally providing (B)
- Pinched in a strong region (C)
- Vulnerable and locally providing (D)
- Weak and peripheral (E)

The results of the analysis are visualized in figure 4. The figure indicates that there are certain geographical patterns. Profile A and C are predominantly found in the Randstad region while B and E are mostly found in the peripheral regions. Profile D is primarily found in Zeeland and Limburg. The least performing profiles of D and E are predominantly found in provinces with a declining population. Finally, the results confirm the perception that medium-sized cities outside of the Randstad region are struggling the most to keep their inner cities healthy.

Bron: PBL

Figure 4: profiles of inner cities

In conclusion, the Dutch retail landscape for shopping is primarily structured around inner cities. This is due to decades of policies protecting these inner city and agglomeration benefits of clustered shops: multipurpose- and comparative shopping. In recent years inner city have been developing into fun focused shopping while other forms of shopping have been moving to neighbourhood centres or outside of cities. In more peripheral regions the retail space is more scattered since transportation costs are greater in these less populated regions. This results in 'weaker' inner cities compared to cities in the Randstad area.

4. Threats to the retail function of inner cities

According to Evers (2014) certain trends are threatening the retail functions in the inner cities of the Netherlands. He mentions the following trends:

1. The advent of online shopping. This has caused retailers to not only compete with stores in their area but also with stores online.
2. Less shoppers in inner cities. The decline of these shoppers can be linked to the increased usage of online shopping.
3. Uncertain succession of store ownership. Traditonally, owners of privately owned stores were succeeded by their sons or daughters when the retirement age was reached. In recent years this tradition is less certain especially if the store is not financially healthy.
4. Decreasing floor productivity. The growth of retail floorspace is disproportionate to the growth of revenue. To maintain the desired revenue retailers choose to expand their stores even in inner cities which results in fewer but bigger stores.

Uncertain succession and the decreasing floor productivity cause the retail sector in inner cities to become less diverse and be dominated by 'fun shopping' and big retail chains. According to Clarke et al. (2012), attraction to inner cities increases when shops diversify because the supply of products is greater. Elaboration on the impact of this homogenization will be discussed in the section on consumer behaviour.

The trends that are mentioned are related to the advent of online shopping. Consumers might prefer online shopping over in-store shopping, resulting in less shoppers in inner cities and less revenue for the existing stores which decreases the floor productivity. Succession of stores will also be less appealing when a smaller retailer must compete with a large-scale retailer. Online shopping can therefore be identified as the primary threat to inner city shopping. In the next segment the impact of online shopping on the retail geographical structure will therefore be analysed.

4.1. Adaptation of online shopping in the Netherlands

The development of online shopping in the early 2000's is one of the most important advancements in the field of the retail market. The European Commission (2001) laid out four microeconomic aspects which have changed the market structures with the introduction of online shopping:

- Increased competition, resulting from lower barriers and the creation of new channels for delivery of products and services;
- New ways of buying and selling, with a further customization of products and services.

Statistics from Eurostat confirm that about 85% of Europeans use the internet and 53% of them used it for online shopping in 2019. The Netherlands is one of the countries that has adopted the internet and online shopping the most in the EU. Approximately 96% of the population uses the internet and over 80% of the population under the age of 65 uses the internet for online shopping. Although every demographic in the Netherlands uses the internet for online shopping, most online shopping is done by people under the age of 65. The impact of online shopping will therefore be less considerable in regions where there is a larger number of elderly people.

The Central Bureau of Statistics Netherlands (2020) states that most products that are bought online in the Netherlands are 'clothing and shoes' followed by 'furniture, home accessories and garden items' and 'sports equipment'. Other products like 'computers and tablets', 'cosmetics and beaty products' and 'printed books and magazines' are all bought in equal amounts. Further statistics about the usage of the internet and online shopping can be found in appendix 1 and 2.

4.2. Impact of online shopping on consumer behaviour

The conceptual benefits and disadvantages of online shopping are laid out by Mokhtarian (2004). The main benefits that online shopping has over in-store shopping are:

1. *Unlimited selection:* as mentioned in the previous paragraph, online stores can offer a wider variety of products than physical stores since they are not limited to a physical location. This makes it much easier for consumers to find the specific products they need and to buy them from the same (web)store.
2. *Information about products:* the internet is useful for finding information about the products and to compare different products with each other.
3. *Speed of differentiation:* it is much easier to compare different stores to each other. Consumers do not physically have to visit stores anymore but can compare store prices and inventory online.
4. *Convenience:* shopping and trip-chaining can now be done anywhere as long the consumer has access to the internet.
5. *Personalization of products:* due to the wide applications of ICT, products can be more easily customized to personal preferences. For example, people don't have to buy whole albums of music anymore but can buy individual songs.

Mokhtarian (2004) and Salomon & Koppelman (1988) summarize the advantages that in-store shopping has over online shopping as follows:

1. *Sensory information:* products can be felt, seen, smelled or tasted which is not possible with online shopping.
2. *Tangibility:* in physical stores, consumers can buy their products immediately and trust that the products are of acceptable quality, whereas online purchases can sometimes be less trustworthy.
3. *Immediate possession:* products do not need to be shipped to the consumer and can be used immediately after purchasing.

The function of the physical stores is not only to be a place where products are can be acquired. Physical stores also have different benefits to them that online shopping does not have and are summarized by Mokhtarian (2004):

1. *Social interaction:* in-store shopping includes many social aspects that are not included in online shopping. Spending time with friends or family or simply being seen by others are aspects that can be involved in physical shopping.
2. *Entertainment:* 'shopping is not purely a maintenance activity, but possesses recreational overtones, to varying degrees of different people and circumstances.'
3. *Movement:* shopping does not necessarily have to serve a purpose but to simply 'get out of the house' and travel is sometimes a desired activity in itself.

It is important to note that all these benefits have a microeconomic impact on the whole retail market. The European Commission (2001) states that these benefits could shift the market from a 'supply-push' to a 'demand-pull'. This means that consumers, who now can purchase every product anywhere an at any time, are not dependent on the inventory of a local store but can choose the products themselves. The retail location theories are all affected by the benefits and disadvantages of online shopping. In the next section these theories (with the exception of Hotelling's (1929) theory which is primarily focused on retailers) will be discussed, as well as how they are affected by online shopping from a consumer perspective. Distinctions are made between maintenance, run- and fun shopping:

maintenance shopping is for necessary purchases (for instance white or brown goods). Run shopping is for groceries and other everyday products. Fun shopping is intended as entertainment (most commonly clothing goods).

Within the central place theory, the consumer is rationally motivated and pursues the highest utility. The central place theory states that consumers will buy products at the nearest store if travel costs are acceptable. If the distance to a physical store is too large, purchases online will be more desired, even though shipping costs are involved. Moreover, it was concluded that in areas with a low population density shops are generally further apart from each other and travel costs are higher. When not taking the disadvantages of online shopping into account these factors would indicate that it is likely that people living in peripheral regions will buy more online than their metropolitan counterparts. This is confirmed in Farag et al. (2006) and Weltevreden (2007) who state that, from an efficiency perspective, people who live in rural areas tend to buy more online.

With his principles of the bid rent theory, Haig (1927) concluded that accessibility is important to the success of a store and some stores are willing to pay more to achieve this accessibility. Since stores are now accessible anywhere at any time, predictions are that maintenance shopping will shift more to online shopping. This is, however, still dependent on the product that is being sold and the household location of the consumer. Sensory information, immediate possession and shipping costs are still important factors when buying products. For instance, sensory information on high end jewellery and high shipping costs of fresh (and cold) grocery products have caused these products to be sold less frequently online than other products.

With the spatial interaction theory from Huff (1962), it was concluded that consumers do not always prefer the closest shopping centre but could prefer shopping centres with a higher utility. When consumers shop for maintenance, higher utility could be achieved when a product is bought that is perfectly allocated with the needs of the consumer or when pricing of the same product is better. Since online shopping has an unlimited selection of products and information and products can be personalized, maintenance shopping online would be preferable since the utility is higher. This is however still related to shipping costs since high costs could drive utility downward. For instance, if someone wants to order his favourite whisky, that must be shipped from Japan, high shipping costs would still prevent him from doing so. In the case of fun shopping, utility is still related to the variety of products or pricing but also to other factors. As mentioned in Abrudan et al. (2015), different factors contribute to customer satisfaction and loyalty. They state that the shopping centre ambiance, special events, promotional activities, 'service and attitude' of the personnel and catering facilities like restaurants in addition to price and assortment of products contribute to the satisfaction or utility of the customer. All these factors are linked to bigger and more affluent shopping centres which are more prominent in bigger cities and metropolitan areas. However, recent developments of decreasing variety in inner cities could cause people to be less attracted to inner cities. If consumers would like to engage in fun shopping but only clothing shops are available, they might tend to be less attracted.

The advent of online shopping has shown that consumers will choose online shopping over in-store shopping in many cases. The conveniences of unlimited selection, information about products and stores make online stores a big threat to inner city retail. The inconveniences of direct possession and shipping costs seem to diminish rapidly. Vollebrecht (2021) cites that some retailers are now delivering groceries within 10 minutes of ordering. These developments indicate that consumers rather substitute in-store shopping for online shopping. Nevertheless, in-store shopping does not seem to disappear from inner cities, especially in larger cities. Consumers still enjoy in-store shopping as a leisure activity. Consumers are more demanding however, since fun shopping is not only about buying clothes anymore. Other requirements need to be met in order to reach the utility that consumers

desire. Therefore, Millington et al. (2015) emphasize that inner cities are multi-functional centres that draw people in with a much wider 'bundle of benefits' than only shopping. These benefits include meeting other people but also visiting a restaurant or going to the movies. Hospers (2016) suggests that not only the amenities of inner cities should be improved but that the centre also should be more compact. A scattered pattern of stores with a few vacant establishments has a negative impact on the enjoyment of the inner city. Finally, Hospers (2016) suggests that cities should distinguish themselves with their cultural aspects in order to compete with the larger cities. The example of Gouda is mentioned where there are several events every year revolving around cheeses and several (special) cheese shops are present in the inner city.

4.3. Impact of online shopping on the retailer location choice

Burt & Sparks (2003) layout the impact of information technologies on the retail process mostly from the perspective of the retailer. Their work was made in the early 2000's when the internet was less widely used, let alone for online shopping. However, possible advantages of online shopping were already clear. They based their findings on Dawson (2001), who birthed the theory of 'new commerce' where companies have a surge of new technology that allows them to gain more information of customers, products and the retail chain itself. Burt & Sparks (2003) built upon this idea of new commerce and cite two components that have been developed with new information technologies:

1. Inventory, stockholding and merchandizing
2. Marketing effort including branding

Inventory in physical stores is always limited to the space of the store itself, the larger the store the wider the variety of products it can offer. Since online retailers are not limited by the size of the location, they can offer a wider variety of products than their competitors with physical stores. In addition, complementary products can be sold on the same website. *Wehkamp.nl* and *Zalando.nl* offer for instance a wide variety of clothing but also shoes. As mentioned by Bromley & Thomas (1989), most customers will visit complementing stores (e.g. clothing and shoes) when visiting a shopping centre. This clustering of products on one site can be extended further from complementary goods to a whole assortment of products. Online retailers like *Bol.com* or *Amazon.com* offer up to 28 million products on their website, ranging from electronics to clothing and beauty products. Physical clustering of stores could therefore be deemed less efficient than the clustering that occurs online. Weltevreden et al. (2005) state however that in the city of Utrecht clustering of stores in high footfall areas is still a prominent phenomenon. The accessibility of these stores is still high and therefore does not need the additional accessibility of online shopping. However, it is important to note that these companies need to pay a high price for their accessibility as mentioned by Hotelling (1929). Therefore, these locations are most likely reserved for the large-scale retail companies.

An important aspect to this new development is that previously inner city retailers did not have to compete with so many large-scale retailers. The restricting policies that are mentioned in section 3.2 made it impossible to directly compete with the inner city. With the advent of online retailers, inner city retailers now need to compete and have to offer their products online or distinguish themselves in other ways. For example, retail chains *Primark* and *De Bijenkorf* (which both also have an online presence) distinguish themselves by offering either very cheap- or expensive clothing. Consumers do not want to pay for shipping for cheap clothing and consumers want to see the expensive clothing before buying it and choose to visit the stores.

Burt & Sparks (2003) find that another advantage of online shopping lies with marketing effort. They state that e-commerce retailers have the advantage that their store is available 24 hours per day from anywhere in the world. As mentioned by Haig (1927) accessibility of a store is priced through the rent

of its location. In e-commerce, this principal still holds but the store's location is now online, with the first website in an online search engine (e.g. Google) as the most accessible location. Since there are very few prime locations, advertisement for these locations is expensive and reserved for the large-scale retailers (e.g. Amazon).

In conclusion, the advent of online shopping causes retailers to compete on street level as well as online. Previously this competition was negated due to restrictive retail location policies, but now inner city retailers must compete with large-scale online retailers. The benefit of having a large inventory causes online stores to offer a wider variety of products than their physical competitors. This could pose as a problem for physical stores since specific products, which are better allocated to the consumer needs, can easily be found online. Smaller retailers are especially vulnerable due to the high costs of a strong online presence. Large-scale retailers are present both on- and offline which accumulates in a higher budget for rent, further pressuring smaller retailers to the urban fringes and decreasing the diversity of stores within inner cities.

5. Influences that shape the Dutch retail market

In previous chapters the developments of the retail sector in Dutch inner cities of the last 20 years were conceptualized. From these developments a set of forces can be determined that shape the retail market:

- Urban planning
- Agglomeration benefits
- Technology
- Demographics
- Retail diversity and provision
- Location factors

It was concluded by Evers (2002) that due to economic advantages and urban planning, the retail market in the Netherlands is mainly cantered in inner cities. Moreover, the agglomeration benefits caused inner cities to be predominantly occupied by 'fun shopping' (e.g. clothing- and shoe stores). The advent of online shopping (technology) has caused people to shift from in-store- to online shopping. People can order products online and have a wider variety of products available to them which could incite a decline in brick and mortar stores. Evers et al. (2015) concluded that primarily medium to smaller sized cities and cities with a decline in population are susceptible to this decrease of stores. These cities offer a limited variety of stores in relation to larger cities (Retail diversity and provision). Moreover according to Wal et al. (2016) vacant or few stores will discourage new retailers possibly decreasing the number of stores even more. Due to population decline (demographics) the demand for new retail establishments will decrease as well. According to Hospers (2016), Dutch inner cities will therefore need to provide more than only fun shopping establishments. Cultural and hospitality amenities are needed in order to make inner cities more attractive, as well as providing a more diverse set of retail establishments.

The influences will differ in magnitude and form. For policymakers it would be useful to quantify these influences as it would substantiate claims to improve aspects of inner cities. As I. Clarke et al. (2012)a and Hospers (2016), noted inner cities with a high diversity of stores will theoretically improve the perception of an inner city. The study by Clarke et al. (2012) quantifies the relationship of the diversity brands with consumer satisfaction within the UK. The (direct) relationship with the number of stores is however not studied. Furthermore, the study focuses on the UK which has a different retail structure than the Netherlands as was noted in Evers (2002). Hospers (2016) studies the Dutch inner cities and how to improve their perception. This is however a qualitative study and only hypothetically implies that a diverse set of retail establishments will attract a wider range of consumers.

This study aims to contribute to this area of research to study whether a relation between retail diversity and the change in the number of stores can be observed. Since most retail is highly concentrated in inner cities the study will focus on local changes within these areas. As most changes are presumed to occur within the last 20 years the study will study the relationship between 2000 and 2016.

6. Methods and data

6.1. Case study area: Inner cities of The Netherlands

Evers et al. (2015) define inner cities as a neighbourhood within a municipality that has been indicated as 'centrum' or historic inner city. The boundaries of neighbourhoods (buurten) are defined by the Dutch Central Bureau of Statistics (2020). Most boundaries of neighbourhoods are determined by morphologic or historic indicators, for example, waterways or old city walls. In this study by Evers et al. (2015) all neighbourhoods in the Netherlands are divided into three categories: inner city, rest of the city and rest the Netherlands. In total, 219 neighbourhoods are indicated as inner city. Evers et al. (2015) and PBL (2010) selected inner cities which contain at least 200 individual stores. The 200 individual stores are a threshold to indicate larger shopping areas. In this study only the inner cities that are selected by Evers et al. (2015) are taken into consideration as smaller inner cities will have less influence on local economies. In total 53 inner cities where selected and have been visualized in Figure 5.

Figure 5: inner cities that were used in the analysis

6.2. Methods

The main objective of this study is to quantify the effect of retail diversity on the change in number of retail establishments within Dutch inner cities, in the period between 2000 and 2016. This decline in the number of stores is larger during the later years with more people adapting to online shopping. This can be concluded from the descriptive statistics in table 2. The mean difference between the number of stores between 2000 and 2008 is smaller than between 2008 and 2016. The period between 2000 and 2016 is therefore split into two periods. Period 1 is the period between 2000 and 2008 and period 2 between 2008 and 2016.

The previous chapter describes that the number of stores is influenced by a multitude of influences. When quantifying the effect of diversity on the number of stores within an inner city, these forces should also be taken into consideration. This is done to prevent introducing omitted variable bias, according to Clarke (2005). However, exceptions are made for the forces of urban planning and technology. Urban planning has caused the retail market to be primarily located within inner cities. Since only inner cities are considered and planning restrictions related to retail location are usually limited within these areas, this aspect is not deemed relevant. The effect of technology will also not be considered within the regression analysis. The effect is not spatially dependent as well as the influence will impact general trends but does not explain regional differences.

Equation 1 explains the number of stores within inner cities:

$$N = f(DIV, AB, D, LF)$$

Equation 1: The number of stores dependent on the different influences.

N represents the number of stores within an inner city in a specific year. Which is a function of: diversity of shops (DIV), agglomeration benefits (AB), demographics (D) and location factors (LF).

6.2.1. Quantifying the influences on the number of retail establishments

First the number of retailers within an inner city is determined. The total number of retailers within an inner city will mainly differ due to differences in size of neighbourhoods. The inner city of Amsterdam is, for example, much larger than the inner city of Goes. To accommodate for these differences the inner cities are divided into cells of 100m x 100m. Each cell indicates how many stores are present within them in a specific year. The number of stores within a cell in 2000 is subtracted from the number of stores within a cell in 2008 to determine the changing numbers in the first period. The same is done for the second period with the number of stores in 2008 and 2016 respectively. If there are no stores within a cell in either period, then the cell is dropped from the regression as we are only interested in explaining changes. Therefore, there is a difference in observations between the periods. In period 2 there are 3392 observations, in period 1 there are 3162 observations. The influences presented in equation 1 will be quantified within the cells of 100m x 100m, as described below.

6.2.1.1. Diversity

Retail diversity will be measured with the Shannon index. The index is used in similar studies, like Alexander (1997), Shun et al. (2020) and Straathof (2006), to measure the difference in types of stores. The concept of the index is measuring uncertainty: if there are many different categories of stores and they are proportionally abundant, it will be difficult to predict which category a randomly chosen store is. Shun et al. (2020) describe this from a consumer perspective: how likely is it that a consumer will encounter different types of stores. The Shannon index can therefore be used to quantify the perception of diversity by consumers. This is useful since in chapter 3.2 it was concluded that the retail market has shifted from a supply-push to a market-pull. If consumers are not satisfied with the local supply and diversity of goods, they will shift to online purchases causing a decrease in stores.

The diversity of retail locations was calculated through the Shannon index, which is formulated in equation 2.

$$H' = -\sum_{i=1}^{S} \frac{n_i}{N} * \ln\left(\frac{n_i}{N}\right)$$

Equation 2: Shannon index of diversity.

In equation 2, S is the number of categories of stores (fun-, purpose- and run stores). The categorization of stores is based on Evers et al. (2005) and will be specifically discussed in the data section of this chapter. N, is the total number of stores and n_i is the total number of stores of a certain category. The value range of H' will be [0 , ln(3)], the cells with values close to 0 will have a very low diversity of stores, while cells with value ln(3) (1.098), will have an evenly proportionate and diverse set of stores. Predictions are that a higher variety of stores, will result in an increase in the number of stores. Therefore, the Shannon index will have a positive effect on the dependent variable. If the Shannon index is high, there is more diversity which will result in more stores.

An issue with implementing the Shannon index is that there are only three categories of stores. If more categories were introduced, than a more specific result for store diversity would be found. Although this would represent the diversity in products better, it would not represent the diversity in the function of stores. Shoe or clothing stores would still serve the function of fun shopping, while they might be categorized different from each other. In chapters 1.1 and 3.2 it was concluded that consumers strive to multi-purpose shop since combining different forms of shopping is more time efficient. Categorizing stores by function is therefor still presumed a viable way of measuring the Shannon diversity.

6.2.1.2.   Agglomeration benefits

One of the benefits of (retail) agglomeration is comparative shopping as described by Hotelling (1929)b. New retail establishments are more likely to be located near stores that sell comparative products since it would allow for comparative shopping. Inner cities with many stores are therefore more likely to have an increase in stores. However, there is limited space within cells for new establishments. If there is no more space for new establishments due to a high number of stores, than it is more likely the number will decrease. Measuring agglomeration by the initial number of stores on a (local) cell level is therefore not intuitive. To measure the agglomeration benefits, the concentration of stores within the inner city was considered. The variables were estimated by dividing the total number of stores in an inner city in 1996 and 2004, by the total surface area of an inner city. The total surface area was calculated by determining the total area of every inner city in square meters. The cells that are located within the same inner city therefore all have the same value of stores per square kilometers. Since the values are not cell specific, causal interpretation of these variables is limited.

6.2.1.3.   Demographics

From the literature review it was concluded that population and demographics of an inner city will influence the number of stores. The effect is twofold: a large population will provide more consumers for retailers, but housing could decrease the available space for new retail establishments. The analysis therefore accounts for two variables: *the distance to 100.000 inhabitants* and the *number of houses within a cell.*

The distance to 100.000 inhabitants variable should account for differences in population. If the distance to 100.000 inhabitants is small, then the market for retailers should be higher. The variable

should therefore be negative, larger distances will result in a decline of stores. Preferably, the distance would be estimated in 2000 and 2008. The variable is however estimated in 2004. It is presumed that the distance to 100.000 inhabitants will be the same in the first period as in the second. An increase in population between 2000 and 2004 and between 2004 and 2008 will most likely to result in very different distances.

The *number of housing within a cell* accounts for the pressure of housing on new retail establishments. If many houses are present in a cell than it is less likely new retail establishments will be realized. The variable is therefore assumed to be negative. The variable is estimated by counting the number of residences within the cell in 2000 and 2008.

6.2.1.4. Location factors

Hospers (2016) and RCE (2012) concluded that retailers will benefit from different amenities and cultural historic values within an inner city. Therefore, the number of nearby amenities and the cultural historic protected status is also included in the analysis.

The number of amenities is split into two categories: hospitality and cultural amenities. Hospitality amenities constitute of the total number of restaurants and cafes within 1 kilometer of the cell. The number is calculated within 1 kilometer, because consumers are willing to travel for these amenities. If only the number of amenities was calculated within the cell, this might have a negative effect since it would decrease the available space for new establishments.

Cultural amenities consist of the total number of cinemas, libraries and theatres within 5 kilometers of the cell. The distance between these amenities is different since hospitality amenities are more common and people are less likely to travel longer for them. As cultural amenities are scarcer, people are likely willing to travel further to them. It is assumed that cells that have more amenities nearby will experience an increase in the number of stores. Variation in the number of amenities is presumed to remain small. It is costly and time consuming to transform locations into new functions.

A cultural historic protection status is an indication that is given to neighbourhoods with cultural history significance. The variable is a dummy variable indicating wherever the cell is located within one of these areas or not. Since this status contributes to the perception of the inner city, cells with this indication will influence the number of stores positively. The protection status of a neighbourhood is presumed to remain the same within the periods. New neighbourhoods are rarely added to the selection.

Table 1 displays the variables and their corresponding influences and sources that have been used in the regression analysis. Table 2 display the descriptive statistics of these variables in models 1 and 2 and table 3 the descriptive statistics of the variables from models 3 and 4.

Influence	Variable	Description	Unit	Source
Diversity	Diversity 2000	Shannon Diversity Index of stores in 2000	Index	LISA
	Diversity 2008	Shannon Diversity Index of stores in 2008	Index	LISA
Agglomeration Benefits	Concentration of stores 1996	The concentration of stores within inner cities in 1996	Stores/m^2	LISA & CBS
	Concentration of stores 2004	The concentration of stores within inner cities in 1996	Stores/m^2	LISA & CBS
Demographics	Residences 2000	The number of residences within the cell in 2000	Residences	CBS
	Residences 2008	The number of residences within the cell in 2008	Residences	CBS
	Distance to 100.000 in habitants	The difference in population between 1996 and 2000	Kilometers	Verburg et al. (2004)
Location Factors	Number of hospitality amenities	The number of hospitality amenities within 1km	Stores	CBS
	Number of cultural amenities	The number of cultural amenities within 5km	Stores	CBS
	Protected Status	Is the cell located within a cultural historic protected neighbourhood	Dummy	RCE

Table 1: Description of variables with their corresponding influences.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Difference in stores 2000-2008	3162	-0.24	3.11	-24	33
Shannon diversity 2000	3162	0.29	0.34	0	1.10
Concentration of stores 1996	3162	0.31	0.15	.073	1.20
Distance to 100.000 inhabitants	3162	3.24	2.37	0	16.02
Residences in 2000	3162	38	31	0	240
Number of hospitality amenities	3162	110	94	0	642
Number of cultural amenities	3162	13	16	0	92
Cultural historic protected status	3162	0.48	0.5	0	1

Table 2: Descriptive statistics of model 1 and 2.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Difference in stores 2008-2016	3329	-0.61	2.68	-31	45
Shannon diversity 2008	3329	0.27	0.34	0	1.10
Concentration of stores 2004	3329	0.28	0.15	.073	1.20
Distance to 100.000 inhabitants	3329	3.25	2.40	0	16.02
Residences in 2008	3329	43	33	0	290
Number of hospitality amenities	3329	109	94	0	643
Number of cultural amenities	3329	13	16	0	92
Cultural historic protected status	3329	0.48	0.5	0	1

Table 3: Descriptive statistics of model 3 and 4.

6.2.2. Regression analysis

To measure the effect of diversity a regression analysis has been formulized in equation 2.

$$Difference\ in\ stores_{p,i} = \beta * Diversity_{p,i} + \beta * Concentration\ of\ stores_{p,i} + \beta * Distance_{p,i} + \beta * Residences_{p,i} + \beta * Cultural\ Amenities_i + \beta * Hospitality\ Amentiies + D * Protected\ status + \mu$$

Equation 3: regression analysis.

The difference in stores is a function of the variables presented table 1. In the formula, i represents the cell which is taken into consideration and p the period, either being 2000 to 2008 or 2008 to 2016. The previous section describes the predicted effect of the variables. The Shannon diversity index indicates that there is high variety if the index is low. It is therefore assumed that the variable will be negative since a higher index score will result in a decrease in stores. The concentration of stores will be positive. If there is a high concentration of stores within an inner city, then it is attractive for new retailers to locate themselves there. The distance to 100.000 inhabitants will be negative. If there is a long distance between the stores and a large population than there will be less demand for more stores. The number of residences will be negative. If there are more residences within the cell, then there is less space for new retail establishments. The number of amenities and the presence of a protected neighbourhood will be positive. These factors contribute to an attractive inner city and will therefore incite more retail establishments.

6.3. Data

The dataset that provided data for the retail variables*: difference in stores, diversity* and *concentration of stores* is the National Information System of Workplaces (LISA). The dataset consists of data about all locations of workplaces. It contains x, y coordinates of retail locations, SBI-codes of the retail locations, the municipality name and the year the location was accounted for. The years the data is available in are: 1996, 2000, 2004, 2008, 2012, and 2016. The dataset is a combination of two datasets: the basic registration addresses and buildings (BAG) and data from the Dutch Chamber of Commerce (KVK). The basic registration addresses and buildings dataset consists of data about addresses. The data of the Dutch Chamber of Commerce about businesses. With these datasets the National Information System of Workplaces (LISA) registered which retail function the addresses fulfil.

The BAG dataset is constructed by the Dutch cadaster, an institution that records real estate and property of the Netherlands. They acquire their data from all Dutch municipalities who need to provide a set of aspects of all the buildings within their municipality. The KVK dataset consist of information about businesses, the data is primarily used for the classification of economic activities. This classification is done according to the classification of the Dutch Central Bureau of Statistics called the SBI index. The SBI index is categorized by economic activity, for the analysis only the indexes with retail function where used (starting with 47). For the variable's *concentration of stores* and *difference in stores* these specific locations were only needed. The concentration of stores was calculated by counting the number of stores within each inner city. The total area of the inner city was then divided by the total number of stores within the inner city. The total area was calculated in square meters. This resulted in the unit of the variable being number of stores per square meters. The difference of stores by year could be calculated by subtraction. Since the data is only available every four years, only the difference in stores between 2000 and 2008 and between 2008 and 2016 could be calculated.

For the variable *diversity,* the retail function of the stores was needed. The broad category of retail included 122 SBI codes which consisted of different retail functions. These specific functions where aggregated into three types of shopping: 'Fun', 'Purpose' and 'Run' shopping. The categorization of stores is based on Evers et al. (2005). With fun shopping the activity itself is more important than the purchasing of the products, relaxing and socializing are the primary goals of this form of shopping. The goal of run shopping (or grocery shopping) is purchasing food products or other frequently bought non-food items from for instance pharmacies. Finally, with purposeful shopping the products bought are less choice dependent. People search for the best price-quality ratio while purchasing for instance 'Do It Yourself' products. In appendix 3 the SBI codes with their corresponding form of shopping can be found.

A weakness in the dataset is the categorization of the SBI codes. Some forms of shopping are considered 'fun' for some consumers while for others it is more purposeful. Consumers could for instance consider clothing or furniture shopping to be a fun activity while others only perceive it as necessary task. Most consumers will however adhere to the traditional perception of 'fun' shopping in inner cities. This thesis therefore assumes that the categorization of Evers et al. (2005) coincides with the general opinion.

The variable distance to 100.000 inhabitants was constructed by Verburg et al. (2004). They constructed this variable to determine the factors that contribute toward land-use allocation. The data is raster layer where every cell is 100m x 100m. The average distance toward 100.000 inhabitants is calculated through data from the National Road Database of the Netherlands. From there they performed a network analysis to determine the distances within each cell in kilometers.

The dataset that provided data for the residences and amenities variable is the 'square statistics' dataset of the Dutch Bureau of Statistics (CBS). The dataset is a rasterized dataset that has divided The Netherlands into 100m x 100m cells. Each cell containing information about demographics, residences and distances to amenities. For the *residences in 2000 to 2008,* variable data about the number of residences within the cell was used.

The number of hospitality amenities was calculated through data about the number of restaurants and cafés within 1 kilometer of the cell. The sum of these amenities was calculated and represents the total number of hospitality amenities within 1 kilometer of the cells. The number of cultural amenities was calculated through the number of libraries, theatres and cinemas within 5 kilometers of the cell. The sum of these amenities was taken as well to calculate the total number of cultural amenities within 5 kilometers of the cells.

Data about the *cultural historic protection status* was acquired from the Dutch Office of National Heritage (RCE). The Dutch Office of National Heritage is a governmental institution which belongs to the Dutch ministry of education, culture and science and is tasked with implementing and regulating heritage policies. The data consists of Central Bureau of Statistics indicated neighbourhoods with a protected status due to their cultural historic importance. The neighbourhoods with this indication attract more tourists and visitors according to RCE (2012). This dataset was rasterized to cells, where each cell indicates if it is located within a protected neighbourhood.

7. Empirical results

The goal of this study is to find how retail diversity has influenced the number of stores within Dutch inner cities between 2000 and 2016. The results for the influence of diversity and other influences have been presented in table 4. Model 1 and 2 displays the how different variables influence the changes in the number of stores between 2000 and 2008 (the first period). Model 3 and 4 between the period between 2008 and 2018 (the second period). Some variables in model 1 and 3 are not significant. Models 2 (first period) and 4 (second period) therefore show how the results change when these variables are not included.

The constant in the models is significant in models 3 and 4 but do not have a causal interpretation. The change in number of stores would be -0.335 in model 3 if all other factors, including diversity, are 0. If diversity is 0, then there is a lot of diversity within the cell and will therefore influence the dependent variable. The constants of the models therefore give no indication on the change in number of stores. R-squared values of the models of period 1 are 0.052 and 0.051 respectively. The R-squared of the second period is higher with values of 0.095. These values are low as only 5% and 9.5% of the model fits the data.

7.1. Shannon diversity index

The *Shannon diversity index* in both models is significant at the 99% interval. The variable has a negative value, indicating that a higher Shannon index will result in a decrease of stores. This is an expected outcome for the models. A high Shannon index indicates low variety of stores which should decrease the number of stores within each period. The variable has the highest value within the models, indicating that diversity has the most effect on the change in number of retail establishments from 2000 to 2016. The models that analyse the first period, model 1 and 2 have lower values for diversity than the models in the second period, model 3 and 4. This indicates that diversity has a bigger influence on the change in number of stores in the second period.

7.2. The concentration of stores

The *concentration of stores* in the previous periods in the models is in the first period significant at the 90% interval. In the second period they are significant at the 95% interval. Since the variables do not specify values for cells but rather for entire inner cities, causal interpretation of these variables is limited. Both variables are positive indicating that if there is initially a higher concentration of stores, it is likely that the number of stores will increase. This is an expected outcome since it is attractive for new retailers to locate near many stores due to agglomeration benefits and multipurpose shopping.

7.3. The number of residences

Within the first period models 1 and 2 show that the number of residences within a cell has a negative effect on the change in the number of stores at a 95% confidence interval. The effect is, relative to the diversity and concentration of stores variables, small. The negative effect is an expected outcome. If there are many residences within the cell than it is less likely that new stores will establish themselves due to the lack of space. It is therefore unexpected that the results of the variable in the second period (in model 3 and 4) is positive at the 95% confidence interval. This would indicate that if there are many residences within the cell the number of stores would increase. The effect of the variable is also small in relation to the effect of diversity and concentration of stores.

7.4. Distance to 100.000 inhabitants

The distance to 100.000 inhabitants is in both models not significant and can therefore not be interpreted. This implies that the distance to a large population does not affect the number of stores within an inner city.

7.5. The number of cultural and hospitality amenities

The *number of cultural amenities* is in all models positive and significant at the 99% confidence interval. From Hospers (2016) it was concluded that more amenities will most likely increase the number of stores, which was confirmed in models. The effect of the variable is relatively small in relation to the effect of diversity and the concentration of stores. If there are 45 cultural amenities within 5 kilometers and all other variables are held constant, the number of stores would increase by 1 in models 1, 3 and 4. It can therefore be argued that increasing the number of amenities is not productive toward increasing the number of stores. Moreover, available space for new cultural amenities in inner cities could be scarce. If there are many amenities, then there will be less space for new stores.

The number of hospitality amenities in models 1 and 2 is insignificant and can therefore not be interpreted. The variable is significant in model 3 and 4 at the 95% and 99% confidence interval and has a negative value. The effect is also very small. If there are 500 hospitality amenities within 1 kilometers of a cell and all other variables are held constant, the number of stores would decrease by 1.

7.6. Protected neighbourhoods

In all models the protected neighbourhoods variable is not significant. The variable can therefore not be interpreted.

7.7. Robustness checks

Based on the tests Tool (2018) used, several tests were performed to check if the results of the regression analysis are robust. For the regression only using heteroskedastic-robust standard errors were used. According to Adkins & Hill (2011) there will be no heteroscedasticity if these errors are used. Therefore, there will be no heteroscedasticity within the models. The Ramsey RESET test was performed to test wherever there is an omitted variable bias. Results of the tests indicate that this is not the case and can be found in appendixes 4 through 7. To check for multicollinearity of the variables a Variance Inflation Factors (VIF) test was performed. The results of the test indicate that the variables have no values above 10 or under 0.1 indicating no multicollinearity between the variables. The results of this tests can be found in appendixes 8 through 11.

Period 2000-2008			Period 2008-2016		
Model	**(1)**	**(2)**	**Model**	**(3)**	**(4)**
VARIABLES	Difference in stores 2000	Difference In stores 2000	VARIABLES	Difference in stores 2008	Difference in stores 2008
Diversity 2000	-1.940***	-1.961***	*Diversity 2008*	-2.403***	-2.399***
	(0.181)	(0.181)		(0.138)	(0.137)
Concentration Of stores 1996	1.058*	0.994*	*Concentration Of stores 2004*	0.785**	0.786**
	(0.545)	(0.530)		(0.383)	(0.375)
Residences in 2000	-0.004**	-0.004**	*Residences in 2008*	0.003**	0.003**
	(0.002)	(0.002)		(0.001)	(0.001)
Distance to 100.000 people	0.012		*Distance to 100.000 people*	0.012	
	(0.024)			(0.022)	
Number of cultural amenities	0.022***	0.016***	*Number of cultural amenities*	0.022***	0.023***
	(0.007)	(0.004)		(0.006)	(0.006)
Number hospitality amenities	-0.001		*Number hospitality amenities*	-0.002**	-0.003***
	(0.001)			(0.001)	(0.001)
Protected status	0.008		*Protected status*	-0.071	
	(0.113)			(0.098)	
Constant	-0.066	-0.044	*Constant*	-0.335***	-0.300***
	(0.196)	(0.167)		(0.136)	(0.111)
Observations	3,162	3,162	*Observations*	3,329	3,329
R-squared	0.052	0.051	*R-squared*	0.095	0.095

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: results of the regression analysis.

8. Conclusion

The aim of this thesis is to quantify how retail diversity has influenced the change in number of stores within Dutch inner cities between 2000 and 2016. In order to do this a literature review has been written and a regression analysis has been constructed.

From the results of the literature review it is concluded that the primary theories that describe retail location choices are central place theory, bid rent theory, the spatial interaction theory and the principle of minimum differentiation. These theories have influenced the Dutch retail structure. Most retail is still located within Dutch inner cities. This is partially due to the benefits of clustering that provide comparative- and multipurpose shopping according to the spatial interaction theory. Another factor that contributed to retail primarily being located within inner cities is urban planning. Since most retail is located within inner cities locating on prime locations within these regions is costly. Stores who can afford these high rent prices (for instance clothing stores) can still locate in these locations. Less profitable stores or smaller retailers are locating near the fringes of inner cities as is described by the bid rent theory. The diversity of stores is also dependent on the population of a city, if there are less people then the threshold for a new store is more difficult to reach according to central place theory. This results in Dutch inner cities having a low diversity of stores dominated by fun shopping.

Research has indicated that middle sized cities are struggling to retain their economic significance. Especially cities outside of the Randstad area with a population decline. One of the factors that contribute to this decline is the decreasing number of stores. The primary cause for this decline is the advent of online shopping. Online shopping benefits from a very large variety of products that can be ordered without travel. Retailers now must compete on street level as well as online. Whereas large scale retailers are present both online and on street level, smaller retailers do not have the funds and name recognition to compete on both platforms. Further pressuring smaller retailers to the urban fringes and decreasing the diversity of stores within inner cities. With increasing delivery speed and adaptation to online shopping, expectations are that the number and diversity of stores within inner cities will decline even further.

Form the literature review a set of influences was constructed that impact the number of stores within inner cities. These forces are retail diversity, agglomeration benefits, demographics, location factors, technology and urban planning. Apart from the influences of urban planning and technology these influences were quantified. The results showed that, although causal interpretation is limited, agglomeration benefits has positively influenced the changing number of stores. The number of residences within the inner cities have negatively influenced the change in number of stores between 2000 and 2008 but positively between 2008 and 2016. A large distance to 100.000 inhabitants did not have effect on the changing number of stores. Having more libraries, cinemas or theatres within an inner city will contribute to an increased number of stores. While having more restaurants and cafes in an inner city resulted in a decrease of stores between 2008 and 2016. The cultural historic protected status of a neighbourhood had no influence on the changes in the number of stores. Finally, a low retail variety resulted in a decrease in stores. In relation to the other influences, retail diversity had the highest influence on the number of stores between 2000 and 2008 and between 2008 and 2016. Therefore, it can be concluded that retail diversity is an important influence on the changing number of stores within Dutch inner cities.

9. Discussion

For this thesis a literature review was constructed to conclude which influences shape the retail in Dutch inner cities between 2000 and 2016. To quantify the effect of retail diversity, a regression analysis was performed including different influences on the Dutch inner cities. From the results, it was concluded that retail diversity has the most influence on the change in number of stores between 2000 and 2016. Excluding several influences, that are not significant, the analysis showed that the influence of retail diversity, store concentration, number of residences and number of cultural amenities would remain significant. Multiple tests confirmed the robustness of the results. It can therefore be stated that reproducing this study will result in the same results and confirms the validity of this research.

Some of the results that were acquired are, however, not corresponding with hypotheses of the literature review. The negative value of the diversity index was hypothesized. However, the effect in period 2 is bigger than in period 1. A possible explanation could be that consumers have a higher preference for retail diversity in the second period. Therefore, cells with a low retail variety are more susceptible to a decline in stores. In the second period there is a higher decrease of stores which can be attributed to online shopping, but another factor is the economic recession. Fun shopping stores consist of many luxury stores which people in a recession cannot afford. Stores could have gone under due to less customers being able to buy products. This would indicate that cells with many fun shopping stores (and a low variety) were more susceptible a have a decrease in stores.

The number of residences in 2008 has a positive effect on the changing number of stores, which was not hypothesized. An explanation for the difference in signs can be contributed by transformations in the housing market. According to Swart et al. (2020) the number of buildings transformed into residences has been increasing during the past 20 years. Their research also indicates that especially cities have chosen to transform old office spaces into new residences due to the increased influx of inhabitants and limited space for new residences. This would imply that the total occupied space for non-retailers has remained the same but has been transformed to residences. The effect of the number of hospitality amenities have a negative effect on the changing number of stores which was also not hypothesized. The negative value of the variable can possibly be contributed to the restrictions of space within the inner city. If there are many hospitality amenities within 1 kilometer of the cell, then it is less likely there will be space for new stores. This is further reinforced by the fact that the effect is small, and many hospitality amenities are needed to increase the number of stores. An interesting sidenote on the variable is that Tool (2018), who studied the effects of retail diversity on vacant retail space, also concluded that the effects of hospitality amenities are not significant.

The variables for the distance to 100.000 inhabitants and the presence of a cultural historic neighbourhood are not significant. Studies about central place theory and spatial interaction theory imply that distance to inner cities does matter and consumers factor in distance in their discission making. The cause for the effect of the distance variable not being significant could be that the distances to 100.000 inhabitants within inner cities are not very long. The average distance to 100.000 inhabitants is 3.24 kilometers according to the descriptive statistics in table 2 and table 3. If most distances to cells are small than consumers do not have to travel far to nearby stores. The distance would therefore have less effect on the changing number of stores.

From Evers et al. (2015) Hospers (2016) and RCE (2012) it was concluded that a protected status will contribute to more stores, which was not confirmed by the models of this study. The cause for the identifying variable of protected neighbourhood not being significant can perhaps be the costly- and difficult process to establish new stores in these regions. Since they are protected adjustments to existing buildings is difficult as described by Fikse et al. (2008). Therefore, it is not likely new stores will

be realized. Furthermore, Tool (2018) concluded that there are less vacant stores within these neighbourhoods. Indicating that changes in the number of stores occur less often.

This thesis contributes to the discourse of Dutch inner cities. It was concluded that retail diversity has directly influences the number of stores within these inner cities during the period of 2000 to 2016. Moreover, retail diversity is estimated to influence the number of stores the most in relation to the other forces that impact the changing number of stores. These findings contribute to policy briefs of Evers et al. (2014), Evers et al. (2005) and Hospers (2016) which suggested that diverse retail will have a positive influence on Dutch inner cities. It quantifies this effect and can help substantiate claims for policymakers to enforce a higher diversity of stores.

Shortcomings of this research lie with the measurement of diversity and the number of relevant variables. Diversity is measured with only three categories but could be more precise of more categories are introduced. For instance, if diversity was measured by the different branches the results would be more precise. Including more relevant variables will also be helpful. Some variables are insignificant and result in some influences not being represented properly. For instance, the variable distance to 100.000 inhabitants could be replaced with a variable that measures the effect of demographics better. Including more suitable variables could therefore be helpful in further research. This would also help increasing the R-squared value which is low with the current models. Further research could also involve studying the effects on a different scope. The effects of retail diversity could be measured for an entire inner city as opposed to cells of 100m x 100m. This would allow more accurate measurements for agglomeration and population since these effects extend further then the cells.

10. References

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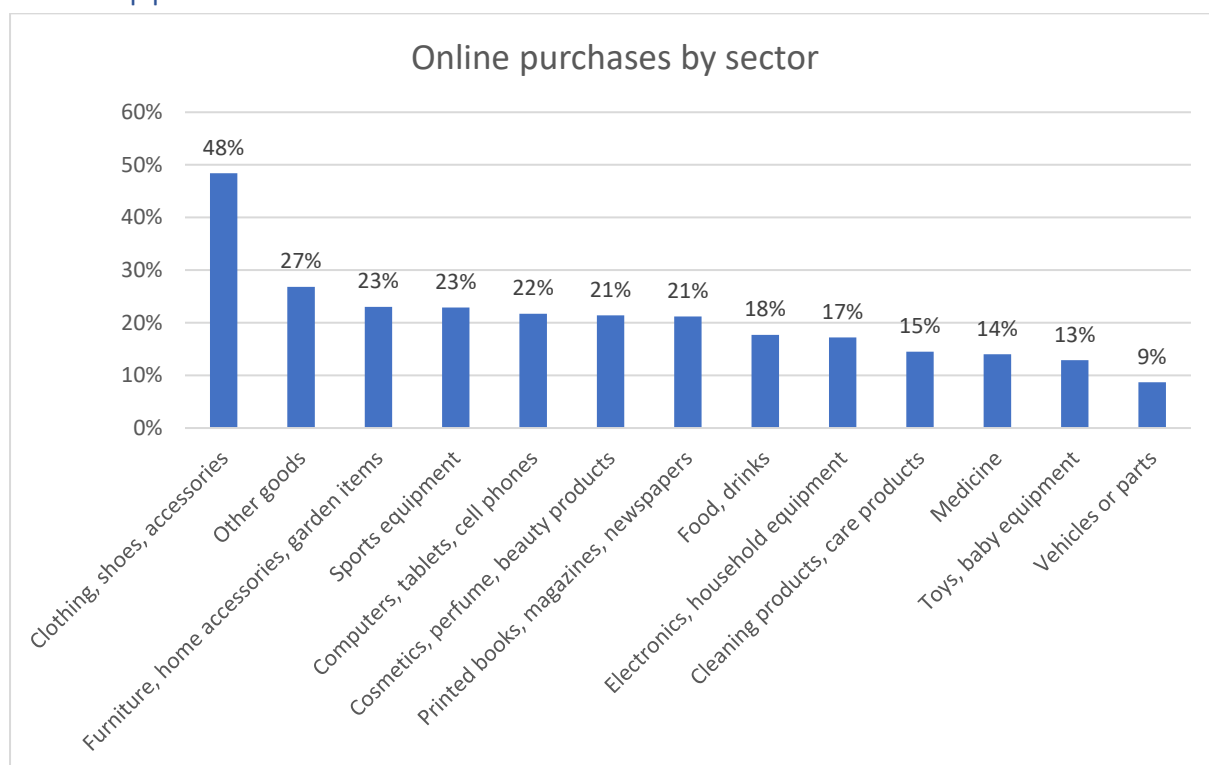
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11. Appendixes

Online purchases by sector

- Clothing, shoes, accessories: 48%
- Other goods: 27%
- Furniture, home accessories, garden items: 23%
- Sports equipment: 23%
- Computers, tablets, cell phones: 22%
- Cosmetics, perfume, beauty products: 21%
- Printed books, magazines, newspapers: 21%
- Food, drinks: 18%
- Electronics, household equipment: 17%
- Cleaning products, care products: 15%
- Medicine: 14%
- Toys, baby equipment: 13%
- Vehicles or parts: 9%

Appendix 1: online purchases by sector.

Total online purchases in 2018

- 12 to 25 year olds: 88%
- 25 to 35 year olds: 94%
- 35 to 45 year olds: 94%
- 45 to 55 year olds: 93%
- 55 to 65 year olds: 86%
- 65 to 75 year olds: 78%
- 75 years or older: 45%
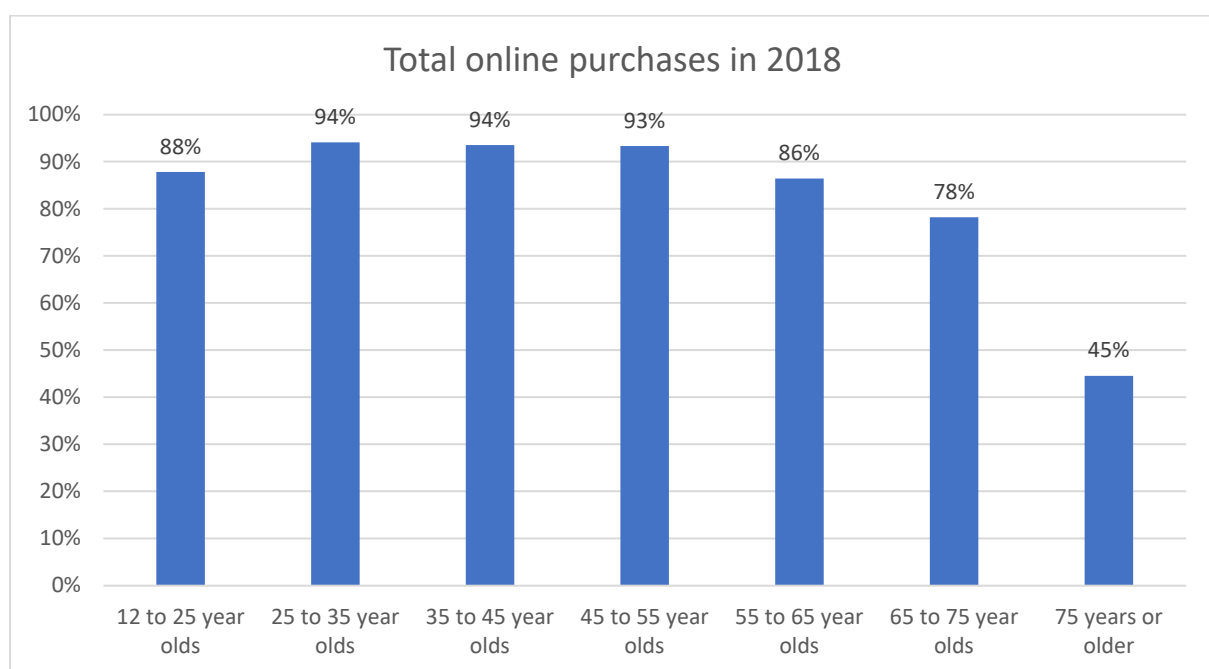
Appendix 2: total online purchases in 2018 by age group.

SBI CODE	Description	Category
47.1	Supermarkten, warenhuizen en dergelijke winkels met een algemeen assortiment	DOEL
47.11	Supermarkten en dergelijke winkels met een algemeen assortiment voedings- en genotmiddelen	RUN
47.19	Warenhuizen en dergelijke winkels met een algemeen assortiment non-food	DOEL
47.19.1	Warenhuizen	FUN
47.19.2	Winkels met een algemeen assortiment non-food (geen warenhuizen)	DOEL
47.2	Gespecialiseerde winkels in voedings- en genotmiddelen	RUN
47.21	Winkels in aardappelen, groenten en fruit	RUN
47.22	Winkels in vlees en vleeswaren, wild en gevogelte	RUN
47.22.1	Winkels in vlees en vleeswaren	RUN
47.22.2	Winkels in wild en gevogelte	RUN
47.23	Winkels in vis	RUN
47.24	Winkels in brood, banket, chocolade en suikerwerk	RUN
47.24.1	Winkels in brood en banket	RUN
47.24.2	Winkels in chocolade en suikerwerk	RUN
47.25	Winkels in dranken	RUN
47.26	Winkels in tabaksproducten	RUN
47.29	Gespecialiseerde winkels in overige voedings- en genotmiddelen	RUN
47.29.1	Winkels in kaas	RUN
47.29.2	Winkels in natuurvoeding en reformartikelen	RUN
47.29.3	Winkels in buitenlandse voedingsmiddelen	RUN
47.29.9	Gespecialiseerde winkels in overige voedings- en genotmiddelen (rest)	DOEL
47.3	Benzinestations	RUN
47.30	Benzinestations	RUN
47.4	Winkels in consumentenelektronica	DOEL
47.41	Winkels in computers, randapparatuur en software	DOEL
47.42	Winkels in telecommunicatieapparatuur	DOEL
47.43	Winkels in audio- en videoapparatuur of in een algemeen assortiment van wit- en bruingoed	DOEL
47.43.1	Winkels in audio- en videoapparatuur	DOEL
47.43.2	Winkels in een algemeen assortiment van wit- en bruingoed	DOEL
47.5	Winkels in overige huishoudelijke artikelen	DOEL
47.51	Winkels in kledingstoffen, huishoudtextiel en fournituren	DOEL
47.51.1	Winkels in kledingstoffen	DOEL
47.51.2	Winkels in huishoudtextiel	DOEL
47.51.3	Winkels in breiwol, handwerken en fournituren	DOEL
47.52	Winkels in doe-het-zelfartikelen	DOEL
47.52.1	Winkels in ijzerwaren en gereedschappen	DOEL
47.52.2	Winkels in verf, verfwaren en behang	DOEL
47.52.3	Winkels in houten bouw- en tuinmaterialen	DOEL
47.52.4	Winkels in tegels	DOEL

47.52.5	Winkels in keukens	DOEL
47.52.6	Winkels in parket-, laminaat- en kurkvloeren	DOEL
47.52.7	Winkels gespecialiseerd in overige doe-het-zelfartikelen	DOEL
47.52.8	Bouwmarkten en andere winkels in bouwmaterialen algemeen assortiment	DOEL
47.53	Winkels in vloerbedekking en gordijnen	DOEL
47.54	Winkels in elektrische huishoudelijke apparatuur en onderdelen daarvoor	DOEL
47.54.1	Winkels in witgoed	DOEL
47.54.2	Winkels in naai- en breimachines	DOEL
47.54.3	Winkels in overige elektrische huishoudelijke apparatuur	DOEL
47.54.4	Winkels in onderdelen voor elektrische huishoudelijke apparatuur	DOEL
47.59	Winkels in meubels, verlichting en overige huishoudelijke artikelen (rest)	DOEL
47.59.1	Winkels in meubels	DOEL
47.59.2	Winkels in verlichtingsartikelen	DOEL
47.59.3	Winkels in artikelen voor woninginrichting algemeen assortiment	FUN
47.59.4	Winkels in muziekinstrumenten	DOEL
47.59.5	Winkels in glas-, porselein- en aardewerk	DOEL
47.59.6	Winkels gespecialiseerd in overige huishoudelijke artikelen (rest)	DOEL
47.59.7	Winkels in huishoudelijke artikelen algemeen assortiment	DOEL
47.6	Winkels in lectuur, sport-, kampeer- en recreatieartikelen	DOEL
47.61	Winkels in boeken	FUN
47.62	Winkels in kranten, tijdschriften en kantoorbehoeften	DOEL
47.63	Winkels in audio- en video-opnamen	DOEL
47.64	Winkels in fietsen en bromfietsen, sport- en kampeerartikelen en boten	DOEL
47.64.1	Winkels in fietsen en bromfietsen	DOEL
47.64.2	Winkels in watersportartikelen	DOEL
47.64.3	Winkels in sportartikelen (geen watersport)	DOEL
47.64.4	Winkels in kampeerartikelen (geen caravans)	DOEL
47.65	Winkels in speelgoed	FUN
47.7	Winkels in overige artikelen	DOEL
47.71	Winkels in kleding en modeartikelen; textielsupermarkten	FUN
47.71.1	Winkels in herenkleding	FUN
47.71.2	Winkels in dameskleding	FUN
47.71.3	Winkels in bovenkleding en modeartikelen (algemeen assortiment)	FUN
47.71.4	Winkels in baby- en kinderkleding	FUN
47.71.5	Winkels in babyartikelen algemeen assortiment	FUN
47.71.6	Winkels in onderkleding, foundations e.d.	FUN
47.71.7	Winkels in modeartikelen	FUN
47.71.8	Textielsupermarkten	FUN
47.72	Winkels in schoenen en lederwaren	FUN
47.72.1	Winkels in schoenen	FUN
47.72.2	Winkels in lederwaren en reisartikelen	FUN
47.73	Apotheken	RUN

47.74	Winkels in drogisterij-, medische en orthopedische artikelen	RUN
47.74.1	Winkels in drogisterij-artikelen	RUN
47.74.2	Winkels in medische en orthopedische artikelen	RUN
47.75	Winkels in parfums en cosmetica	FUN
47.76	Winkels in bloemen, planten, zaden, tuinbenodigdheden, huisdieren en dierbenodigdheden	DOEL
47.76.1	Winkels in bloemen en planten, zaden en tuinbenodigdheden	DOEL
47.76.2	Tuincentra	DOEL
47.76.3	Winkels in dieren, dierbenodigdheden en hengelsportartikelen	DOEL
47.77	Winkels in juweliersartikelen en uurwerken	FUN
47.78	Winkels in overige artikelen (rest)	FUN
47.78.1	Winkels in fotografische artikelen	DOEL
47.78.2	Winkels in optische artikelen	DOEL
47.78.3	Winkels in schilderijen, lijsten, prenten, kunstvoorwerpen en religieuze artikelen	FUN
47.78.9	Winkels gespecialiseerd in overige artikelen (rest)	DOEL
47.79	Winkels in antiek en tweedehands goederen	FUN
47.79.1	Winkels in antiek	FUN
47.79.2	Winkels in tweedehands kleding	FUN
47.79.3	Winkels in tweedehands goederen (geen kleding)	DOEL
47.8	Markthandel	FUN
47.81	Markthandel in voedings- en genotmiddelen	RUN
47.81.1	Markthandel in aardappelen, groenten en fruit	RUN
47.81.9	Markthandel in overige voedings- en genotmiddelen	RUN
47.82	Markthandel in textiel, kleding en schoenen	FUN
47.89	Markthandel in non-food artikelen (geen textiel, kleding en schoenen)	FUN
47.89.1	Markthandel in bloemen, planten, zaden en tuinbenodigdheden	FUN
47.89.2	Markthandel in tweedehands goederen	FUN
47.89.9	Markthandel in overige goederen	FUN
47.9	Detailhandel niet via winkel of markt	DOEL
47.91	Detailhandel via internet	DOEL
47.91.1	Detailhandel via internet in voedingsmiddelen en drogisterijwaren	RUN
47.91.2	Detailhandel via internet in consumentenelektronica	DOEL
47.91.3	Detailhandel via internet in boeken, tijdschriften, cd's, dvd's	DOEL
47.91.4	Detailhandel via internet in kleding en mode-artikelen	FUN
47.91.5	Detailhandel via internet in huis- en tuinartikelen	DOEL
47.91.6	Detailhandel via internet in vrijetijdsartikelen	DOEL
47.91.8	Detailhandel via internet in overige non-food	DOEL
47.91.9	Detailhandel via internet in een algemeen assortiment non-food	DOEL
47.99	Colportage, straathandel en detailhandel via overige distributievormen	DOEL
47.99.1	Colportage	DOEL
47.99.2	Straathandel	DOEL
47.99.9	Detailhandel via overige distributievormen	FUN

Appendix 3: SBI codes with description and categorized group.

Ramsey RESET test using powers of the fitted values of Difference2000_2008
    Ho: model has no omitted variables
        F(3, 3151) =   8.88
         Prob > F =   0.0000
Appendix 4: Ramsey-Reset test model 1.

Ramsey RESET test using powers of the fitted values of Difference2000_2008
    Ho: model has no omitted variables
        F(3, 3154) =   9.77
         Prob > F =   0.0000
Appendix 5: Ramsey-Reset test model 2.

Ramsey RESET test using powers of the fitted values of Difference0816
    Ho: model has no omitted variables
        F(3, 3318) =   22.72
         Prob > F =   0.0000
Appendix 6: Ramsey-Reset test model 3.

. Ramsey RESET test using powers of the fitted values of Difference2008_2016
    Ho: model has no omitted variables
        F(3, 3320) =   23.26
         Prob > F =   0.0000
Appendix 7: Ramsey-Reset test model 4.

Variance inflation factor

	VIF	1/VIF
Hospitality Amenities	4.241	.236
Cultural amenities	3.559	.281
1.Protected status	1.238	.808
Concentration 2000	1.183	.845
Distance to 100000 inhabitants	1.138	.879
Number residences 2000	1.136	.88
Shannon 2000	1.044	.958
Mean VIF	1.934	.

Appendix 8: VIF- test model 1

Variance inflation factor

	VIF	1/VIF
Number Cultural Amenities	1.251	.8
Concentration 2008	1.135	.881
Number residences 2008	1.126	.888
Shannon index 20000	1.025	.976
Mean VIF	1.134	.

Appendix 9: VIF- test model 2

Variance inflation factor

	VIF	1/VIF
Shannon index 2008	1.051	.952
Concentration 008	1.308	.764
Distance to 100000 inhabitants	1.135	.881
Number residences2008	1.129	.886
Number hospitality	4.088	.245
Number cultural	3.443	.29
1.protected status	1.245	.803
Mean VIF	1.914	.

Appendix 10: VIF- test model 3

Variance inflation factor

	VIF	1/VIF
Number Hospitality Amenities	3.377	.296
Number Cultural Amenities	3.284	.304
Concentration 2008	1.283	.779
Number residences 2008	1.127	.887
Shannon 2008	1.049	.953
Mean VIF	2.024	.

Appendix 11: VIF- test model 4