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ONLINE GROCERY SHOPPING

Which products do consumer segments prefer to buy in an online supermarket?

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Abstract

The adoption of online grocery shopping is growing rapidly at the moment. Studies have shown that the adoption of online grocery shopping by consumers differs across categories. In this study, 167 participants were asked to indicate their preferences to buy 36 specific grocery products either in a brick-and-mortar or in an online supermarket. Besides, respondents were asked personal questions to describe different consumer segments. Findings show that consumers prefer to purchase packaged goods in an online supermarket. However, consumers prefer to buy perishable food products with a high need of touch in a brick-and-mortar supermarket. In addition, the products characteristics that determine the decision to buy either in a brick-and-mortar supermarket or in an online supermarket are perishability, need of touch, packaging and speciality. Although consumer segments are hard to describe, consumer segments can be distinguished based on age, whereby millennials are more willing to shop grocery online. This study contributes to the literature about differences in online adoption of grocery categories and provides practical implications for novice online grocery retailers.

Key words: online grocery shopping adoption, grocery categories, channel choice, consumer segments, online supermarket

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1. Introduction

The market of online business-to-consumer (B2C) sales in Europe is growing every year. According to the European E-commerce Report 2017, the turnover of online B2C sales in Europe has increased with 15% to €530 billion in 2016. Specifically for the Netherlands, there is a positive growth in sales of e-commerce annually (Statista, 2017). 96% of the Dutch population has access to internet. This possibly explains the e-commerce market is so popular in this country (Syndy, 2015).
According to IGD, the market of food retail in West-Europe will experience moderate growth of 2.2% annually, for the next five years (IGD, 2017). The share of online grocery in sales increases enormously, especially in West-European countries. Particularly, the Netherlands is labelled as the fastest growing online grocery market of the European Union. The Dutch market is very interesting for online grocery shopping, since 71% of the population shops online already. As mentioned, the Dutch online grocery market is developing fast. Despite this growth, it does not yet reach the level of the leading markets France and the UK (Syndy, 2015).

An explanation for this is that Dutch grocery retailers deal with difficulties to fulfil consumers' expectation in online grocery shopping. A lot of research on perceived advantages and disadvantages of online grocery shopping has been done. Studies of Raijas in 2002 and Rasmus and Asger Nielsen in 2005 show that "In the minds of consumers, internet grocery shopping is an advantage compared with conventional grocery shopping in terms of convenience, product range and price". "Disadvantages, which could act as mental barriers, are, for instance, the risk of receiving inferior quality groceries and the loss of the recreational aspect of grocery shopping" (Rasmus & Asger Nielsen, 2005).

Furthermore, the product category plays an important role in consumers' adoption of e-commerce. Some categories, like grocery, generally have lower acceptance among consumers (Grewal, Iyer & Levy, 2004). However, grocery contains various product categories such as fresh and canned grocery goods. All those product categories cannot be treated as one product category. Therefore, it is necessary to do more research about consumers' adoption of e-commerce for the specific grocery product categories. With this research, grocery retailers will have more insights which product categories are easier to adopt for consumers than others. Furthermore, it will help grocery retailers in decision-making whether to act online with a full assortment or with specific product categories.

Taking into account the above, the purpose of this study is to gain insights with a business perspective, into the willingness of consumers to buy specific product categories of grocery goods online. Determinants found in literature are used to find out why consumers buy online or in-store. Furthermore, this study aims to examine whether consumers are willing to buy a product category in an online supermarket or a brick-and-mortar supermarket. Furthermore, this study will investigate if consumer segments can be formed, based on their characteristics and preferences to buy products in an online supermarket or in a brick-and-mortar supermarket. On the basis of the above, the research questions are determined as follows:

<u>Research questions:</u>

- What perceived product characteristics determine consumers' intentions to buy grocery online?
- What grocery product categories are preferred to be bought in an online supermarket instead of a brick-and-mortar supermarket?
- Which consumer segments can be identified, based on their preferences to buy categories in an online supermarket or in a brick-and-mortar supermarket?

2. Theoretical Framework

The theoretical framework consists of an exposition of the available information regarding the subject to answer the research questions, starting with the information about online grocery shopping and its advantages and disadvantages. Secondly, this chapter presents information about differences in product characteristics that influences the preferences between shopping in an online supermarket or in a brick-and-mortar supermarket. Third, this chapter presents the different product categories with expectation to be bought online or in a brick-and-mortar supermarket. Finally, this chapter presents information regarding heterogeneity between consumers in the extent to which they buy different product categories in an online supermarket or in a brick-and-mortar supermarket. The purpose of this theoretical framework is to ensure the research questions of the empirical research are appropriate. In addition, the purpose is to gain insight about what information is already available and what should be investigated more intensively.

2.1 Online grocery shopping

To answer the research question, a literature research is conducted using the database Scopus. For conducting the search, possible synonyms of online grocery shopping are used to find important results in the existing literature. First, the synonyms of online grocery were investigated independently by reading many articles and indicating important terms. Later the search is done by combining all synonyms and determining the main findings in the literature. This has been done for all chapters in the same way.
Search (720 results): online grocery (362 individual results) OR online supermarket (261 individual results) OR egrocery (2 individual results) OR electronic grocery shopping (95 individual results)

At the beginning of this century, the future of online grocery shopping was forecasted as auspicious and potentially even the biggest online market (Killgren, 1999). Many studies examine the potential perceived advantages and disadvantages of online grocery shopping, which results are mentioned in the sub-chapters beneath (e.g. Verhoef & Langerak, 2001; Raijas, 2002). Later, studies with the purpose to understand the consumers and their behaviour towards online grocery shopping created insight in understanding consumers' limitations to adopt online grocery shopping (Rasmus & Asger Nielsen, 2005; Hansen, 2005).

2.1.1 (Dis)advantages online grocery shopping

As mentioned above, plenty of research has been done regarding perceived advantages and disadvantages. Those studies are important, since their results are also key in adoption of online grocery in the future. The distinction is made between perceived advantages and perceived disadvantages to gain a clear overview.

Advantages online grocery shopping

Search (603 results): online grocery (362 individual results) OR online supermarket (261 individual results) OR egrocery (2 individual results) OR electronic grocery shopping (95 individual results)
AND: advantages OR benefits OR satisfaction OR preference OR choice
The perceived advantages of shopping grocery online in comparison to shopping grocery in-store are:

Reduction of physical effort
As a result of ordering at home and getting your grocery delivered at home this is an enormous reduction of physical effort (Verhoef & Langerak, 2001). The relative impact of this advantage can be even bigger for some groups in particular, such as elderly consumers.

Saving of time
A logical consequence of ordering at home and delivering or picking-up grocery, is the saving of time. Specially for consumers with a busy life, this is a perceived advantage that is high valued (Verhoef & Langerak, 2001).

Time and place independence
The time and place independence of shopping grocery shopping online makes us able to order groceries without restrictions of the opening hours or demographic location of the supermarket (Raijas, 2002). However, this independence is not complete at the moment, since in most cases it requires the customer to come to a pick-up point or to be at home at the moment of delivery.

Greater variety of products and opportunity to find good deals
A greater variety of products can be perceived as a big advantage, for example for people with special preferences that cannot be fulfilled in the supermarkets in their neighbourhood (Raijas, 2002). Furthermore, shopping grocery online enables consumers to easily compare prices and find suitable deals, which is a financial benefit (Roberts et al., 2003).

Ability to avoid impulse buying
Consumers can reduce impulse buying, by shopping grocery online (Rasmus & Asger Nielsen, 2005; ING, 2015). This is an advantage, since consumers will stick to their budget easier and therefore experience financial benefits.

Avoiding negative aspects of shopping in a physical supermarket
Another advantage is the ability to avoid other negative aspects of shopping in a physical supermarket, like: tiring, necessity, too many people and shopping alone (Roberts et al., 2003). This advantage may be personal, since it depends on individual preferences.

Disadvantages online grocery shopping

Search (68 results): online grocery (362 individual results) OR online supermarket (261 individual results) OR egrocery (2 individual results) OR electronic grocery shopping (95 individual results)
AND: disadvantages OR dissatisfaction OR pitfalls OR drawback OR detriment OR hesitate

The perceived disadvantages of shopping grocery online in comparison to shopping grocery in-store are:

Quality concerns
The grocery sector partly consists of perishable products. A study found that consumers have trust concerns about the supermarket picking their groceries for them, without being able to examine the quality of perishable products themselves (Rasmus & Asger Nielsen, 2005). Although, some supermarkets promise excellent quality of their products. However, supermarkets are not automatically informed about individual preferences, for example whether receiving your avocado soft to consume immediately or hard to consume it in five days.

Delivery fees and delivery time reliability
The delivery fees and delivery time reliability are perceived as a major disadvantage (Punakivi & Saranen, 2001; Wilson-Jeanselme & Reynolds, 2006). Consumers especially judge low-costs orders as disproportionately expensive, due to the delivery fees (Rasmus & Asger Nielsen, 2005). Nevertheless, the willingness to pay a relatively high delivery fee seems to have a relation with the travel time consumers have to spend (Huang & Oppewal, 2006).

Missing enjoyment of shopping
Consumers tend to miss the enjoyment of shopping (Rasmus & Asger Nielsen, 2005). According to this study, some consumers experience fun by browsing around and attribute this feeling only to in-store shopping. In addition, consumers experience dissatisfaction in the desire for empowerment and experimentation (Clark & Wright, 2007).

Missing social aspect of shopping
Third, consumers miss the social aspects of shopping, for example to meet other people while being out of their home (Morganosky & Cude, 2013; Rasmus & Asger Nielsen, 2005).

2.2 Product characteristics

The characteristics of grocery products are various. The influence of those characteristics on the decision to buy online or in-store, is crucial to do research about preferences to buy grocery in an online supermarket or in a brick-and-mortar supermarket. Therefore, this part focuses on what product characteristics influence the choice whether to buy online or in-store.
Search (68 results): online grocery (362 individual results) OR online supermarket (261 individual results) OR egrocery (2 individual results) OR electronic grocery shopping (95 individual results)
AND: product characteristics OR product attributes OR product aspects OR product features

In 2003, researchers already mentioned that it will become important that future research should focus on product attributes to more fully explain the use of electronic commerce service (Henderson & Divett, 2003). A study found that consumers' willingness to purchase products online varies based on product category due to the inherent limitations of virtual shopping (Cho, 2011). This suggests that different product categories with different product characteristics are not treated the same by consumers. According to existing literature, the following variables are important in the decision to buy online or in-store:

Price
Price is undoubtedly one of the main determinants of consumer decision making. A key difference between shopping online and in-store is the ability of consumers to find more information about a product online. Moreover, consumers are able to compare prices easily, since it only takes a few clicks. In addition, it is known that consumers perceive the opportunity to find good deals as an advantage of online grocery shopping (Raijas, 2002; Roberts et al., 2003). Concluding, price will be an important variable to use in this study. The expectation is that the higher the price of a category, the more consumers prefer to buy online, for example, because the advantage of price benefit will be bigger.

Size
Size does matter. Bulky products are more likely to be bought online to take advantage of online convenience benefits (Campo & Breugelmans, 2015). Therefore, expected is: the greater the size, the more consumers prefer to buy online.

Weight
Heavy products are more likely to be bought online to take advantage of online convenience benefits (Campo & Breugelmans, 2015). Therefore, the expectation is that the higher the weight, the more consumers prefer to buy online.

Need of touch
Sensory products are more likely to be bought in-store, because of a higher perceived online purchase risk (Campo & Breugelmans, 2015). As mentioned above, a study found that consumers have trust issues in supermarkets picking their groceries for them, without being able to examine the quality (Rasmus & Asger Nielsen, 2005). This suggest a higher need to touch products before buying. Since online grocery stores cannot offer this, it is expected that categories with a higher need of touch will be less preferred to be bought online.

Perishability
Inherent for supermarkets is the great number of perishable products. As mentioned before, consumers do behave different towards perishable goods than towards non-perishable goods. Previous research even recommended not to focus on perishable goods for online grocery shopping, but to focus more on non-food and non-sensory products (Chu et al., 2010). However, since perishability is inherent for supermarkets, this variable is essential to take in account. Expected is that when a category is valued high at perishability, consumers will prefer to shop in a brick-and-mortar supermarket.

Enjoyment of shopping
Another factor that plays a part in grocery shopping is the enjoyment of shopping. This feeling of enjoyment varies across consumers (Rasmus & Asger Nielsen, 2005; ING, 2015), but is also likely to vary across different products categories. Consumers may experience more enjoyment shopping fresh baked bread than when shopping toilet paper. Therefore, enjoyment of shopping per category needs to be indicated by respondents. The expectation is that when consumers value enjoyment of shopping a certain category higher, they will less prefer to shop it online.

Frequency of buying
Frequency of buying has an influence on the intentions to buy a product online. Products that are bought frequently are more likely to be bought online (Phau & Meng Poon, 2000). To examine whether this variable is varying across categories, it will be indicated by the respondents. As mentioned, the expectation is that when consumers buy a category more frequent, they will prefer to buy it online.

Need for immediate receive
The independence of time and location is a huge perceived advantage of the convenience online grocery shopping (Raijas, 2002). However, this results in not immediate receiving the product, since it needs to be delivered first. This contradiction between the advantage and disadvantage of online grocery shopping is interesting but may vary across product categories. Therefore, the expectation is that when consumers indicate need for immediate receive high for a category, they will prefer less to shop it online.

Product variety
Online grocery shopping has an advantage in terms of the product variety, since consumers are able to spend less effort in finding alternatives (Raijas, 2002; Roberts et al., 2003; Rasmus & Asger Nielsen, 2005). This advantage may not be perceived as valuable for every category. For example, consumers may not be willing to have a wide range of products in the category non-food, since it could be unnecessary to consider lots of alternatives of toilet paper. However, for consumers with special preferences is can be perceived as very valuable to have a wide product variety.

Summarizing, to estimate which product characteristics determine the consumers' preferences to buy grocery online we will use variables. The variables that will be indicated by respondents are: price, size, weight, need of touch, perishability, enjoyment of shopping, frequency of buying, need for immediate receive and product variety.

2.3 Product categories

Groceries have a big assortment of product categories, varying from food to non-food, and perishable to non-perishable. Those categories cannot be seen as the same, since they are probably perceived different by consumers, due to differences in characteristics. This chapter presents what is known, to answer the question which product categories are preferred to be bought online.
Search (15 results): online grocery (362 individual results) OR online supermarket (261 individual results) OR egrocery (2 individual results) OR electronic grocery shopping (95 individual results)
AND: product category OR product category adoption OR product category heterogeneity

In 2003, a study mentioned that some product categories have stronger online consumer acceptance than other categories, like online grocery shopping (Grewal et al., 2003). Despite of the weaker consumer acceptance of online grocery shopping increases, this type of shopping enormously (Syndy, 2015). However, the online grocery consists of many categories, which may not automatically have the same level of adoption. Research in South Korea found that convenience variables vary across product categories (Kang et al., 2016). Therefore, it is likely to conclude that heterogeneity exists across grocery product categories. The preference to buy a category in an online supermarket or in a brick-and-mortar supermarket will be examined.
ING (2015) found that the categories household- and personal care products, drinks, non-perishable food and frozen products are most suitable to be sold online. In contrast to the categories vegetables and fruits, meat and fish, dairy products and bread and pastry, which are least likely to be bought online (Phau & Meng Poon, 2000; ING 2015).

To determine the categories that will be used for this research, the 17 categories of the biggest online food retailer in the Netherlands, Albert Heijn, are used (ah.nl, 2018):

Potatoes, vegetables and fruit
Potatoes, vegetables and fruit can be considered as highly perishable and sensory products. Sensory products are more likely to be bought a brick-and-mortar supermarket, because of a higher perceived risk when shopping it online (Campo & Breugelmans, 2015). According to the research of ING (2015), this category is not preferred to be bought in an online supermarket.

Fresh ready-to-eat meals and salads
The category of fresh ready-to-eat meals and salads also consists perishable food. Therefore, it is unlikely that this category will be preferred to be bought in an online supermarket.

Meat, chicken, fish and vegetarian
The expectation of this category is that it will be not a preferred category to be bought online, since it is a category with high perishability. According to ING (2015), this category is least likely to be bought in an online supermarket.

Cheese, meat products and delicatessen
This category has characteristics that are equal to the categories dairy and meat. Therefore, it holds the same expectation, that it will be preferred to be bought in a brick-and-mortar supermarket.

Dairy and eggs
The expectation of the category dairy and eggs is that it will be not a preferred category to be bought online, since it is a category with high perishability. According to ING (2015), this category is the least likely to be bought online.

Bakery products
The category of bakery products is expected not to be preferred to be bought online (ING, 2015). This can possibly be explained by perishability or need of touch in this category.

Cereals, sandwich spreads and snacks
This category is potentially a category that will be preferred to buy in an online supermarket, since the products are not very perishable. ING (2015) found that the category of non-perishable food is one of the most suitable to be sold in an online supermarket.

Soft drinks, juices, coffee and tea
Soft drinks, juices, coffee and tea are all part of the category drinks and therefore expected to be more suitable to shop in an online supermarket (ING, 2015). Besides, soft drinks are also packed in multi packages and can be heavy and big. This also predicts a high value for preference to buy this category in an online supermarket.

Beer, wine, spirits and aperitifs
This category also belongs to drinks and is expected to have a high preference to be bought in an online supermarket (ING, 2015). Furthermore, a crate of beer can be perceived as heavy and bulky and therefore have even more convenience advantages to buy in an online supermarket.

Pasta, rice and international cuisine
Pasta, rice and international cuisine products are usually not quickly perishable and therefore more likely to be bought online.

Soups, preserves, sauces and seasonings
This category is also practically non-perishable and therefore expected to have a high preference to be bought in an online supermarket.

Candy, biscuits and chips
A high perceived risk in terms of possibility to receive in imperfect state could lead to a preference to buy this category in a brick-and-mortar supermarket.

Frozen foods
The category frozen foods is mentioned explicitly to be expected having a high preference to be bought in an online supermarket by consumers (ING, 2015).

Drugstore and baby products
Drugstore and baby products are personal care products and therefore likely to be very suitable to be bought in an online supermarket (ING, 2015).

Conscious nutrition
Conscious nutrition is food for people with different preferences, mostly organic food, gluten free food and lactose-free food. This category can be both perishable and non-perishable. However, since it has a special niche it can be important to have a great variety. A great variety, in this case can be perceived as an advantage and therefore have a higher preference to buy in an online supermarket.

Housekeeping and pet products
This category is expected to be very suitable to be bought in an online supermarket, since research found out that household products are very likely to be bought in an online supermarket (ING, 2015).

Cooking and table accessories, non-food
This whole category consists of non-food and therefore has a high expected intention to be bought online (ING, 2015). There is a low risk on shopping this category online, but it is a category in supermarkets, so also a category in this research.

2.4 Consumer segments

This chapter will try to investigate whether consumer segments can be formed, based on their characteristics and preferences to buy products in an online supermarket or in a brick-and-mortar supermarket.
Search (71 results): online grocery (362 individual results) OR online supermarket (261 individual results) OR egrocery (2 individual results) OR electronic grocery shopping (95 individual results)
AND: consumer heterogeneity OR consumer homogeneity OR consumer adoption OR consumer acceptance

Many studies have been done to investigate the determinants of consumer intentions to buy grocery online (e.g. Huang & Oppewal, 2006; Pauzi et al., 2017). A previous study among frequent and infrequent users of online grocery shopping, shows that experience in online shopping is a determinant of consumers' intention to buy grocery online (Hansen, 2005; Campo & Breugelmans, 2015; Mortimer et al., 2016). Considering experience as variable across consumers, this suggests that consumer heterogeneity exists in general. As mentioned before, many perceived advantages and disadvantages exist. Nevertheless, those perceived advantages and disadvantages are very likely to be personal or situational. The main personal factors that play a part are health or mobility problems and household income, whereas the main situational factors are changes in family circumstances and having a baby, time available for shopping, delivery fee and travel time to supermarket (Hansen, 2005; Hand, et al., 2006; Huang & Oppewal, 2006; Hand et al., 2009; Harris et al., 2017). For example, elderly consumers can prefer to buy a grocery product category online, because of the reduction in physical effort, while vegan consumers can buy a specific grocery product category online because of greater variety in products. This suggests that different consumer segments exist with differences in preferences why to buy a grocery product category online. Especially working mothers and young professionals are consumer segments with a high potential interest in shopping grocery online (Seitz et al., 2017). Furthermore, a perceived disadvantage that is mentioned is missing the enjoyment of shopping when shopping grocery online (Rasmus & Asger Nielsen, 2005). However, ING (2015) found that this fact is varying across consumers and is therefore an indication of consumer heterogeneity.

Summarizing, the consumer characteristics that will be examined in this research will be: mobility, well-being, having a baby/child, allergen & diet, trust in supermarkets' integrity, enjoyment of shopping, need for social contact during shopping, travel time to supermarket, household income, online shopping experience in grocery, online shopping experience in non-grocery, age, gender, employment, household composition and education.
Research need to be done to estimate which consumer segments can be formed, based on their characteristics and preference to buy a category in an online supermarket or in a brick-and-mortar supermarket.

3. Methodology

In the methodology, the design of the study, respondents, measures and data-analysis are presented. This study is an exploring quantitative research. This choice is made because of the high number of variables to be indicated by respondents. By letting the respondent answer a quantitative survey, the study is more comprehensive.

3.1 Study design

This study was designed using a quantitative survey. Since it is too difficult to assess preferences per category, the most popular products of the categories were used in the questionnaire. This survey was used to examine whether segments of respondents could be formed based on the variable 'preference to buy in a brick-and-mortar supermarket or in an online supermarket'. Multiple other questions were asked to respondents to describe the segments (see section 3.3). The questions in the survey were asked in English and Dutch to increase the ability to interpret the questions correctly. The survey was conducted between 23 April 2018 and 1 May 2018 and can be found in appendix I.

3.2 Respondents

The respondents in this study were sampled within the social network of the researcher, but vary in nationality, age, education and household composition. The respondents had an average age of 32 (sd=14.1) and ranged in age from 18 to 85, with 63 male and 104 female.

3.3 Measures

Dependent variable

The dependent variable is the willingness of respondents to buy specific grocery products online. The respondents were told that they had to assume to buy 36 products and could indicate whether they would prefer to buy a product in a brick-and-mortar supermarket or in an online supermarket. The respondents had to indicate the 36 products on a 100-point scale with a slider (0= would definitely buy in a brick-and-mortar supermarket, 100= would definitely buy in an online supermarket).

Respondent characteristics

The following characteristics were measured by asking the respondents to answer with a number: year of birth, travel time to closest supermarket (in minutes), frequency of online shopping (a month), frequency of online grocery shopping (a month), number of people in household and how many hours a week work/study. The following characteristics about brick-and-mortar shopping experience were measured on a 5-point scale (1= strongly disagree, 5= strongly agree):

1. "It is easy for me to obtain groceries in a brick-and-mortar supermarket (physically and logistically)."
2. "I enjoy shopping groceries in a brick-and-mortar supermarket."
3. "I like social contact while shopping grocery in a brick-and-mortar supermarket."

To measure the trust in online supermarkets of a respondent, the next three questions were measured on a 5-point scale (1= strongly disagree, 5= strongly agree) and later merged into one new variable 'trust in online supermarket':

1. "I expect that online supermarkets will provide acceptable quality products."
2. "I expect that online supermarkets will provide products with sufficient shelf life."
3. "I expect that online supermarkets will follow-up on complaints about quality."

The next characteristics were measured on a nominal scale: special food preferences in household (1= yes, 2= no), gender (1= male, 2= female), child(ren) in household (1= yes, 2= no) and when people answered 'yes' they received the follow-up ordinal scale question about the age of the child(ren) (1= younger than 4 years old, 2= between 4 and 12 years old, 3= between 12 and 18 years old).
The following characteristics were all measured on an ordinal scale: highest education completed (1= primary school, 2= lower secondary education, 3= higher secondary education, pre-university education, secondary vocational education, 4= bachelor degree, 5= master degree, 6= PhD. / Doctorate) and gross household income per year (1= less than 20.000 euro, 11= 200.000 euro or more) and an option when prefer not to say (12= prefer not to say).

3.4 Data-analysis

First, the respondents who did not answer all of the 36 questions about preferences to buy products in an online supermarket or in a brick-and-mortar supermarket were removed from the data. Thereafter, frequency tables and bar charts of all questions were observed to check for remarkable results or outliers.
A principal component analysis (PCA) with a Varimax (orthogonal) rotation, of respondents' preferences to buy a list of 36 products in an online supermarket or in a brick-and-mortar supermarket, was conducted to form components of product categories and to use for the hierarchical cluster analysis.
After conducting this PCA, a hierarchical cluster analysis was conducted based on the components of the PCA. The hierarchical cluster analysis was conducted to use the similarity coefficients of the agglomeration schedule to determine the number of clusters to use. This was done by calculating the percentage increase in similarity coefficients of the hierarchical clustering. The right number of clusters is chosen when the value suddenly makes a big jump between two steps (i.e. combining clusters).
Cluster centers for the chosen number of clusters in the hierarchical cluster analysis were calculated and inserted in the K-Mean clustering to give a consistent outcome, since the outcome will not vary when you insert the cluster-means yourself. This K-Mean clustering technique was conducted to calculate the final cluster centers.
Then, a one-way ANOVA with LSD post-hoc test (alpha= 0.05) was used to check for heterogeneity between clusters in their preferences to buy a product in an online supermarket or in a brick-and-mortar supermarket.
Means for each cluster were used to describe the clusters in terms of the products that are preferred to be bought online or in a brick-and-mortar supermarket. A one-way ANOVA was conducted across the ordinal scale questions about respondents' characteristics to examine whether there exists heterogeneity between the clusters in terms of the characteristics of the segments.

All data was analysed by the statistical software program IBM SPSS Statistics 23. Significance level of $p < .05$ was used.

4. Results

The survey is answered to 222 respondents. After elimination of cases with missing values, 167 cases were used.

4.1 Frequency of online grocery shopping and online shopping

Bar charts of the frequencies of the means of online shopping experience were drawn based on the data of the 167 respondents (figure 1). Overall, it is affirmative that the respondents have experience in online shopping since only 7.8% shops online less than once a month, on average. At the same time, respondents have almost no experience with shopping grocery online, since 91.0% of the respondents have an average frequency of shopping grocery online less than once a month.

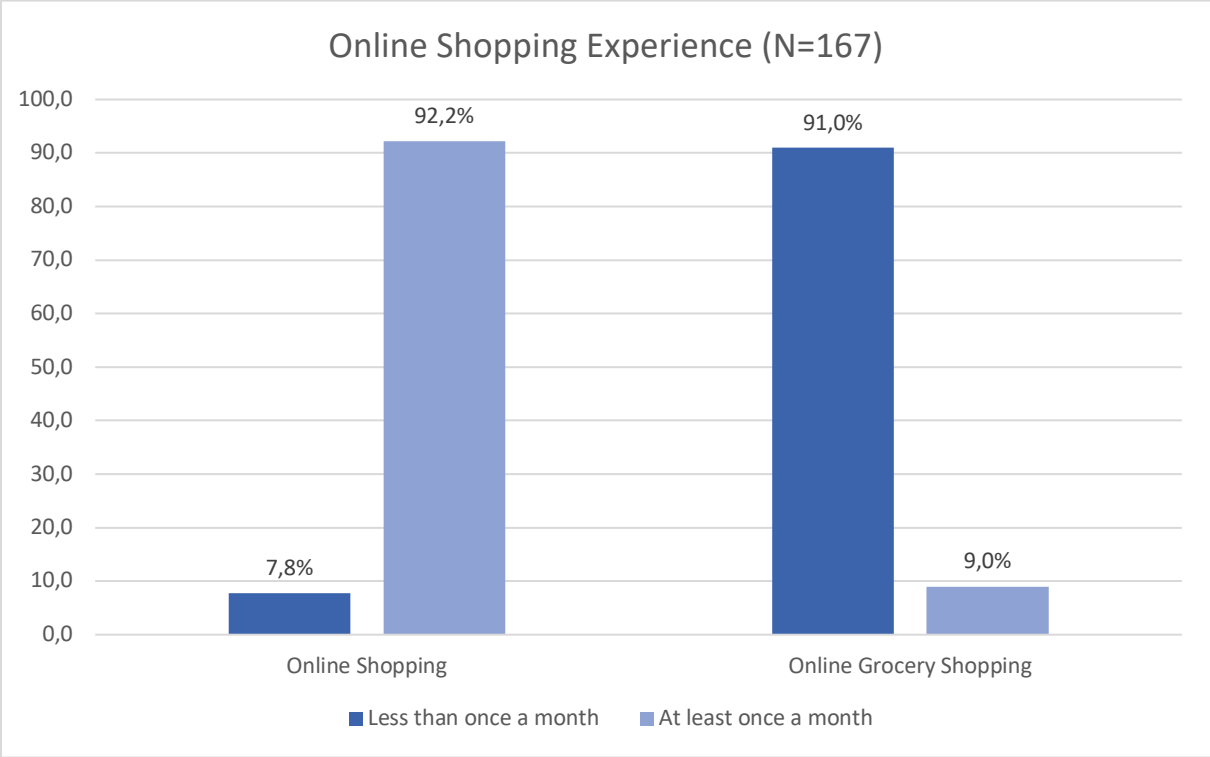

Figure 1. *Bar chart of the frequency of online shopping*

4.2 Principal component analysis

A Principal Component Analysis with a Varimax (orthogonal) rotation of respondents' preferences to buy a list of 36 products in an online supermarket or in a brick-and-mortar supermarket, was conducted on data gathered from 167 participants. An examination of the Kaiser-Meyer Olkin measure of sampling adequacy suggested that the sample was factorable (KMO=.945).
The number of components were based on eigenvalues that score higher than 1 for the final component that is included and based on the total percent of variance explained. Besides, the rotated factors must make theoretical sense. The results of the orthogonal rotation of the solutions are shown in table 1. All loadings that scored highest for a product are marked bold.

Table 1. *Varimax rotated component loadings for the 36 grocery products*

Product	Packaged goods	Perishable food products with a high need of touch	Specialty food products	Not characteristic supermarket goods
Bananas	0.028	**0.858**	-0.136	0.150
Potatoes	0.402	**0.618**	0.325	-0.190
Cucumber	0.188	**0.827**	-0.043	-0.082
Salad	0.129	**0.750**	0.194	0.147
Lasagna	**0.505**	0.502	0.308	-0.096
Minced Meat	0.160	**0.799**	0.280	-0.084
Chicken Breast	0.112	**0.851**	0.193	0.041
Salmon Fillet	-0.011	**0.880**	0.020	0.171
Cheese	0.524	**0.642**	0.133	-0.214
Salami	0.496	**0.618**	0.176	-0.262
Milk	0.422	**0.610**	0.317	-0.294
Eggs	0.343	**0.601**	0.361	-0.026
Bread	0.221	0.473	**0.568**	0.041
Cake	0.213	0.211	**0.717**	0.137
Breakfast Cereals	**0.815**	0.328	0.110	-0.046
Peanut Butter	**0.909**	0.232	0.120	-0.045
1.5L Bottle of Coke	**0.865**	0.268	0.159	-0.023
Coffee Beans	**0.852**	0.184	0.036	0.032
Crate of Beer	**0.877**	0.139	0.177	-0.008
Bottle of Wine	**0.723**	0.150	0.175	0.253
Spaghetti	**0.866**	0.179	0.264	-0.005
Rice	**0.918**	0.199	0.162	0.020
Canned Vegetables	**0.882**	0.224	0.187	0.038
Soup	**0.831**	0.199	0.196	0.169
Mayonnaise	**0.893**	0.205	0.104	0.082
Chips	**0.826**	0.232	0.009	0.205
Biscuits	**0.826**	0.218	0.074	0.167
Frozen Pizza	**0.646**	0.316	0.366	0.144
Ice Cream	0.484	0.324	**0.500**	0.183
Shampoo	**0.845**	0.044	0.196	0.242
Diapers	**0.805**	0.016	0.271	0.230
Organic Rice Cakes	**0.846**	0.217	0.006	0.192
Toilet Paper	**0.898**	0.122	0.132	0.121
Cat Food	**0.841**	0.065	0.218	0.113
Magazine	0.472	0.001	0.015	**0.727**
Baking Pan	0.328	-0.034	0.230	**0.632**
Eigenvalues	19.485	4.994	1.416	1.106
Percentage of total variance	54.126	13.873	3.932	3.073

Twenty items load onto the first component. When observing the items, it becomes clear that all items consists of products that are packaged and are less or non-perishable. This factor was labelled 'Packaged goods'.
Eleven items load onto the second component. The items are all products that are highly perishable and are likely to have a high need of touch. This factor was labelled 'Perishable food products with a high need of touch'.
Three items load onto the third component. Those items, 'Bread', 'Cake' and 'Ice cream' can be considered as specialty food that respondents could prefer to shop in a specialty shop, like a bakery. This factor was labelled 'Specialty food products'.
Only two items load onto the fourth component. Those items, 'Magazine' and 'Baking Pan', are products that are not typical supermarket products and non-food. This factor was labelled 'Not characteristic supermarket goods'.
Some items are harder to attribute to a single component, since the loadings do not differ a lot between multiple factors. Especially 'Lasagne', 'Bread' and 'Ice Cream' stand out. This is logical since 'Lasagne' can both be considered as 'Packaged product' and as a 'Perishable food product with a high need of touch'. In addition, 'Bread' can be considered as a 'Perishable food product with a high need of touch' and as a 'Specialty food product' that could be preferred to be bought in a bakery. 'Ice Cream' is a 'Packaged product' but is also a 'Specialty food product' since respondents might prefer to buy it at an ice cream parlour.

4.3 Cluster analysis

To determine the number of clusters that will be used, the agglomeration schedule of the hierarchical clustering was used. The line chart of the increase in percentage of the Ward's-Linkage Coefficients in figure 2, showed that using 5 clusters was most appropriate.

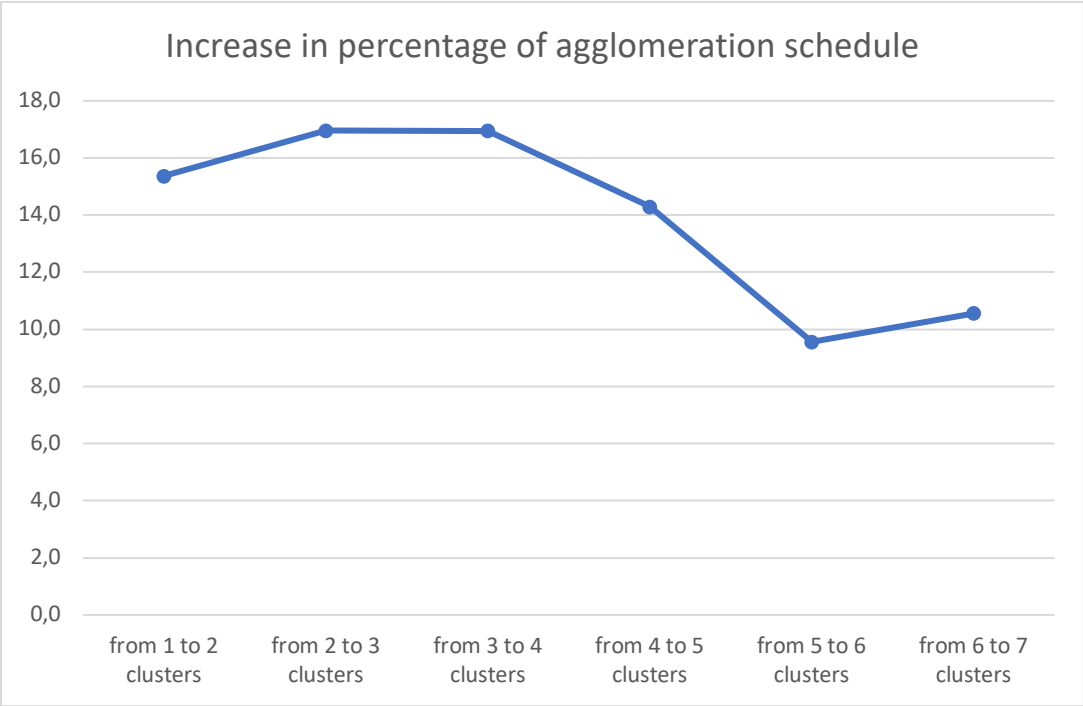

Figure 2. *Line chart of the increase in percentage when combining clusters*

The results of the clustering based on preferences to buy in an online supermarket or a brick-and-mortar supermarket are shown in table 2. In the column 'average consumer' the average means of all clusters are displayed. The scores that significantly scored higher than the other clusters are marked bold and the scores that significantly scored lower are underlined (alpha = 0.05).

Table 2. *Means of the 36 grocery products for the 5 clusters*

Product	Millennials with online preference	Risk averse generation X	Generation X online sceptics	Risk averse millennials	Millennials adopting online grocery	'Average consumer'
Bananas	20.2	16.2	6.0	16.8	**79.8**	21.7
Potatoes	46.9	27.2	6.7	**64.3**	**67.9**	39.8
Cucumber	28.5	20.8	6.1	37.8	**83.7**	29.3
Salad	41.2	19.6	6.7	23.0	**76.8**	30.8
Lasagne	**58.1**	36.1	9.1	**59.4**	**58.1**	44.3
Minced Meat	38.3	9.5	5.7	40.3	**73.8**	30.0
Chicken Breast	35.2	11.7	5.3	29.0	**80.3**	28.1
Salmon Fillet	31.7	14.7	6.8	16.0	**83.8**	26.0
Cheese	48.0	35.8	5.6	64.3	**71.3**	41.9
Salami	52.3	30.5	6.9	61.3	**65.8**	41.7
Milk	45.5	11.2	7.1	69.8	**71.8**	37.6
Eggs	46.0	23.1	5.5	49.5	**69.6**	36.3
Bread	**43.4**	11.3	3.9	33.0	**49.6**	28.3
Cake	**58.1**	17.2	13.5	35.3	40.8	36.2
Breakfast Cereals	**67.6**	**64.5**	12.1	**79.2**	**68.3**	57.6
Peanut Butter	71.4	68.9	12.0	**82.8**	57.2	59.3
1.5L Bottle of Coke	**72.3**	66.8	12.4	**84.5**	60.2	59.8
Coffee Beans	**70.0**	**75.0**	21.5	**80.4**	58.3	61.5
Crate of Beer	**77.3**	70.6	19.5	**86.6**	57.1	63.8
Bottle of Wine	**70.7**	**67.6**	16.5	**65.1**	**60.9**	57.3
Spaghetti	68.6	62.9	11.1	**82.2**	52.0	56.3
Rice	**70.2**	**67.6**	10.8	**81.4**	58.8	58.3
Canned Vegetables	**70.9**	64.5	11.3	**81.7**	56.6	57.9
Soup	**69.0**	**66.7**	10.9	**68.1**	**52.3**	55.0
Mayonnaise	**69.0**	**67.6**	11.5	**78.1**	57.8	57.4
Chips	**63.3**	**69.3**	10.7	**67.8**	**60.9**	54.2
Biscuits	**65.9**	**70.3**	11.5	**66.7**	**54.3**	54.6
Frozen Pizza	**69.2**	41.4	11.6	**63.3**	**55.9**	50.1
Ice Cream	**61.6**	28.1	10.4	**46.2**	**53.4**	41.8
Shampoo	**77.2**	**80.8**	17.1	**76.2**	56.3	63.5
Diapers	**79.9**	**76.8**	21.2	**78.8**	48.2	64.1
Organic Rice Cakes	**65.3**	**78.2**	9.1	**70.5**	**63.3**	56.9
Toilet Paper	**77.9**	**80.5**	15.3	**86.4**	57.8	65.1
Cat Food	**76.8**	**77.0**	20.1	**85.1**	52.1	64.2
Magazine	**67.1**	**81.9**	25.5	24.4	54.7	53.6
Baking Pan	**70.6**	**66.1**	32.7	35.8	47.4	54.4
Respondents in cluster (N=167)	60	31	34	26	16	

The results of the clustering with segment characteristics is shown in table 3. In the column 'average consumer' the average means of all clusters are displayed. The scores that significantly scored higher than the other clusters are marked bold and the scores that significantly scores lower are underlined (alpha = 0.05).

Table 3. *Means of the segment characteristics for the 5 clusters*

	Millennials with online preference	**Risk averse generation X**	**Generation X online sceptics**	**Risk averse millennials**	**Millennials adopting online grocery**	**'Average consumer'**
Easiness to obtain groceries from a brick-and-mortar supermarket	**4,70**	4,45	**4,74**	**4,69**	4,06	4,60
Enjoyment of shopping groceries in a brick-and-mortar supermarket	3,63	3,58	4,18	3,50	3,44	3,69
Liking social contact while shopping groceries in a brick-and-mortar supermarket	2,97	3,29	3,06	2,69	2,69	2,98
Frequency of online shopping (average frequency a month)	2,30	3,00	2,24	2,58	3,75	2,60
Frequency of online grocery shopping (average frequency a month)	0,15	0,45	0,18	0,00	0,63	0,23
Expectation of receiving acceptable quality products in an online supermarket	4,47	4,48	3,94	4,38	4,25	4,33
Expectation of receiving products with sufficient shelf life in an online supermarket	4,63	4,48	4,09	4,54	4,06	4,43
Expectation of follow-up on complaints about quality in an online supermarket	4,48	4,39	4,32	4,42	4,44	4,42
Special food preferences in household	1,63	1,68	1,65	1,73	1,75	1,67
Number of people in household	4,97	3,74	3,76	3,65	4,75	4,27
Children (under 18) in household	1,87	1,77	1,91	1,96	1,81	1,87
Highest completed education	3,72	3,65	3,62	3,69	3,69	3,68
Hours of work and/or study (in a week)	31,17	32,32	32,94	35,77	34,00	32,73
Year of birth	**1990,35**	1980,39	1978,56	**1988,23**	**1989,38**	1985,68
Gender	1,52	1,65	1,71	1,73	1,63	1,62
Gross household income (per year)	3,50	4,58	4,88	4,00	3,69	4,08
Respondents in cluster (N=167)	60	31	34	26	16	

Millennials with online preference: This segment has a light preference to buy 'Perishable food products with a high need of touch' in a brick-and-mortar supermarket. It has a light preference to buy 'Packaged goods', 'Specialty food products' and 'Not-characteristic supermarket goods' online.
This segment has the youngest average age of 28 years old and has, on average, almost no problems with obtaining groceries from a brick-and-mortar supermarket.

Risk averse generation X: This segment has a strong preference to buy 'Perishable food products with a high need of touch' in a brick-and-mortar supermarket. It has a light preference to buy 'Packaged goods' online. This segment has a strong preference to buy 'Specialty food products' in a brick-and-mortar supermarket and a strong preference to buy 'Non-characteristic supermarket goods' online.
This segment has an average age of 38 years old. Besides, it has relatively more problems with obtaining groceries in a brick-and-mortar supermarket compared to the other segments.

Generation X online sceptics: This segment has a strong preference to buy 'Perishable food products with high need of touch', 'Packaged goods', 'Specialty food products' and 'Non-characteristic supermarket goods' in a brick-and-mortar supermarket.
This segment has the oldest average age of 40 years old and has the least problems with obtaining groceries in a brick-and-mortar supermarket of all segments.

Risk averse millennials: This segment has a light preference to buy a few 'Perishable food products with a high need of touch' in a brick-and-mortar supermarket and others online. It strongly prefers to buy 'Packaged products' online. Furthermore, it has a light preference to buy 'Specialty food products' and 'Non-characteristic supermarket goods' in a brick-and-mortar supermarket.
This cluster has an average age of 30 years old and has almost no problems with obtaining groceries in a brick-and-mortar supermarket.

Millennials adopting online grocery: This segment has a strong preference to buy 'Perishable food products with a high need of touch' online. It has a light preference to buy 'Packaged goods' online. Furthermore, it remains neutral in the choice to buy 'Specialty food products' and 'Non-characteristic supermarket goods' online or in a brick-and-mortar supermarket.
This segment has an average age of 29 years old and has the most struggles with obtaining groceries in a brick-and-mortar supermarket of all segments.

5. Discussion

5.1 Conclusion

The first research question was determining the product characteristics that determine consumers' intentions to buy grocery in an online supermarket. The differences in characteristics that determine the decision for consumers' preference to buy a grocery product online depends on which category the product is. The differences in characteristics of the categories are: perishability, need of touch, packaging and speciality.
The second research question attempted to find out what grocery product categories are preferred to be bought in an online supermarket. The conclusion of this study is that the most preferred categories to buy online are the categories packaged goods and non-characteristic supermarket goods. The categories specialty food products and perishable food products with a high need of touch are preferred to purchase in a brick-and-mortar supermarket.
The third research question was identifying consumer segments based on their preferences to buy categories in an online supermarket or in a brick-and-mortar supermarket. This research concludes that age plays an important role in the preference to buy grocery online. The millennials (born between 1981 and 2000) prefer more to buy groceries online than generation X (born between 1955 and 1980). Besides, segments differ across preferences to buy specific categories online.

5.2 Limitations and future research

The findings of this study should be read within its limitations. The first limitation are the products that were used in this survey. This survey was limited to only a few products for each category, since the survey would be too extensive if more products would have been included. This would probably have led to depletion of many respondents with too few respondents as a result. Recommendations for future research will be extending the survey with more different products to create better results.
The second limitation is the lack of a pre-test with the purpose to measure the influence of product characteristics on the preferences to buy in an online supermarket or in a brick-and-mortar supermarket. An additional pre-test was not possible due to time limitations of a bachelor thesis. Performing this pre-test in future research could lead to new insights of the influence of specific product characteristics on categories in the choice to buy in an online supermarket or in a brick-and-mortar supermarket.
The third limitation is the absence of significant differences in the descriptive variables of the cluster analysis. This leads to segments that are not clearly described and makes it hard to use this segments for targeting in practice.
The fourth limitation is the sampling of the respondents. The respondents are not generalizable, since the respondents were sampled within the social network of the researcher and therefore not a good reflection of a bigger population. To increase the generalizability and the external validity of the results, this survey should be performed with a more diverse population. Besides, the results of this study are likely to differ across geographical areas globally, so performing this survey in different countries will increase the usability for international purposes.

5.3 Practical implications

This study has practical implications since this study shows that some categories within groceries are easier adopted for online grocery by consumers than other categories. It will be recommended for novice online grocery retailers to start with offering only packaged goods and targeting the segments of millennials with an online preference and risk averse consumers. Recommended extension of the assortment later, is the category of not characteristic supermarket goods. It will not be recommended to add perishable food products with a high need of touch and specialty products to the assortment in the current situation. Older consumers that are sceptic regarding online shopping are a segment that should never be targeted in the current situation of the market.
Furthermore, the segments were hard to describe. Nevertheless, it became clear that age plays a role in adoption of online grocery. For practical use, this means that targeting consumers in general should focus at the generation of millennials (born from 1981) and younger.

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Appendix I

Start of Block: Introduction

(ENG) What is your travel time to the closest supermarket, based on your most common means of transport? (In minutes)
(NL) Wat is uw reistijd naar de dichtstbijzijnde supermarkt, uitgaande van uw meest gebruikelijke vervoersmiddel? (In minuten)

_____

(ENG) "It is easy for me to obtain groceries from a supermarket (physically and logistically)"
(NL) "Het is gemakkelijk voor mij om boodschappen te verkrijgen in een supermarkt (fysiek en logistiek)"

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

(ENG) "I enjoy shopping groceries in a brick-and-mortar supermarket (a physical supermarket)"
(NL) "Ik heb plezier in het doen van boodschappen in een fysieke supermarkt"

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

(ENG) "I like social contact while shopping grocery in a brick-and-mortar supermarket (a physical supermarket"
(NL) "Ik hou van sociaal contact tijdens het doen van boodschappen in een fysieke supermarkt"

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

(ENG) On average, how many times a month do you shop something online? (Answer with a number)
(NL) Hoeveel keer per maand koopt u gemiddeld iets online? (Antwoord met een getal)

(ENG) On average, how many times a month do you order groceries online? (Answer with a number)
(NL) Hoeveel keer per maand koopt u gemiddeld uw boodschappen online? (Antwoord met een getal)

_____

(ENG) "I expect that online supermarkets will provide acceptable quality products"
(NL) "Ik verwacht dat een online supermarkt mij acceptabele kwaliteit producten verschaft"

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

(ENG) "I expect that online supermarkets will provide products with sufficient shelf life"
(NL) "Ik verwacht dat een online supermarkt mij producten verschaft met voldoende houdbaarheidsdatum"

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

(ENG) "I expect that online supermarkets will follow-up on complaints about quality"
(NL) "Ik verwacht dat een online supermarkt iets zal doen met klachten over kwaliteit"

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

End of Block: Introduction

Start of Block: Products: Intention to buy in an online supermarket

(ENG) Assume you have to shop groceries and you need the following products.
Indicate whether you would prefer to buy the product in a brick-and-mortar supermarket (physical supermarket) or in an online supermarket.

(NL) Ga ervan uit dat u boodschappen gaat doen en de volgende producten nodig hebt.

Beoordeel in hoeverre u prefereert om een product in een fysieke supermarkt of in een online supermarkt te kopen.

Definitely in a physical supermarket	Probably in a physical supermarket	Sometimes in a physical supermarket, sometimes in an online supermarket	Probably in an online supermarket	Definitely in an online supermarket

0 10 20 30 40 50 60 70 80 90 100

Banana (Bananen)	
Potatoes (Aardappels)	
Cucumber (Komkommer)	
Salad (Maaltijdsalade)	
Lasagna (Lasagne)	
Minced Meat (Gehakt)	
Chicken Breast (Kipfilet)	
Salmon Fillet (Zalmfilet)	
Cheese (Kaas)	
Salami (Salami)	
Milk (Melk)	
Eggs (Eieren)	
Bread (Brood)	
Cake (Taart)	
Breakfast Cereals (Ontbijtgranen)	
Peanut Butter (Pindakaas)	
1.5L Bottle of Coke (Cola)	
Coffee Beans (Koffiebonen)	
Crate of Beer (Krat Bier)	
Bottle of Wine (Fles Wijn)	
Spaghetti (Spaghetti)	
Rice (Rijst)	
Canned Vegetables (Blik Groenten)	
Soup (Soep)	

Mayonnaise (Mayonaise)	
Chips (Chips)	
Biscuits (Koeken)	
Frozen Pizza (Diepvries Pizza)	
Ice Cream (Ijs)	
Shampoo (Shampoo)	
Diapers (Luiers)	
Organic Rice Cakes (Biologische Rijstwafels)	
Toilet Paper (Toiletpapier)	
Cat Food (Kattenvoer)	
Magazine (Tijdschrift)	
Baking Pan (Koekenpan)	

End of Block: Products: Intention to buy in an online supermarket

Start of Block: Additional

(ENG) Do you or someone in your household have special food preferences (due to allergen, special diet, etc)?
(NL) Heeft u of iemand in uw huishouden speciale voedingswensen (door allergie, speciaal dieet, etc.)?

- ○ Yes
- ○ No

(ENG) How many people does your household consist of? (Answer with a number)
(NL) Uit hoeveel mensen bestaat uw huishouden? (Antwoord met een getal)

_____

(ENG) Does your household also consist of children under the age of 18?
(NL) Bestaat uw huishouden ook uit een kind of kinderen onder de leeftijd van 18 jaar?

- ○ Yes
- ○ No

(ENG) What is the age of the child or children? Multiple answers possible.
(NL) Wat is de leeftijd van het kind of de kinderen? Meerdere antwoorden mogelijk.

- ☐ Younger than 4 years old
- ☐ Between 4 and 12 years old
- ☐ Between 12 and 18 years old

(ENG) What is the highest level of education you have completed? If currently enrolled, highest degree received.
(NL) Wat is het hoogste niveau van opleiding dat u heeft voltooid? Als u momenteel studeert, dan geldt uw hoogst ontvangen diploma.

- ○ Primary School (Basisschool)
- ○ Lower Secondary Education (VMBO)
- ○ Higher Secondary Education, Pre-University Education, Secondary Vocational Education (HAVO/VWO/MBO)
- ○ Bachelor Degree (HBO/WO)
- ○ Master Degree (HBO/WO)
- ○ PhD. / Doctorate

(ENG) How many hours a week do you work or study? (Answer with a number)
(NL) Hoeveel uur per week werkt of studeert u? (Antwoord met een nummer)

(ENG) What is your year of birth?
(NL) Wat is uw geboortejaar?

_____

(ENG) What is your gender?
(NL) Wat is uw geslacht?

- ○ Male
- ○ Female

(ENG) What is your gross household income per year?
(NL) Wat is het bruto inkomen van uw huishouden per jaar?

- ○ Less than 20 000 euro
- ○ 20 000 - 40 000 euro
- ○ 40 000 - 60 000 euro
- ○ 60 000 - 80 000 euro
- ○ 80 000 - 100 000 euro
- ○ 100 000 - 120 000 euro
- ○ 120 000 - 140 000 euro
- ○ 140 000 - 160 000 euro
- ○ 160 000 - 180 000 euro
- ○ 180 000 - 200 000 euro
- ○ 200 000 euro or more
- ○ Prefer not to say

End of Block: Additional