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Consumer choices of perishable food products when applying dynamic pricing

A solution to food waste?

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Bachelor thesis

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Preface

This thesis is written as part of my bachelor Management and consumer studies at Wageningen University and Research. To combine my interest in food and consumer behaviour I decided to write my thesis at the chairgroup Food quality and design and came up with this subject about consumer choices when the dynamic pricing system is used in supermarkets.

First I want to thank my supervisor dr.ir. LPA (Bea) Steenbekkers. She gave me useful insights during my thesis period, wrote useful feedback so that I could continue to improve my paper and helped me out with the problems I encountered.
Also, I would like to thank Ivo van der Lans, for his good advice about the statistical part of my Bachelor thesis.

Hope you enjoy reading my bachelor thesis,

Lenneke Keulemans
Wageningen, April 2018.

Abstract

Roughly one-third of the food produced for human consumption is lost or wasted globally. The financial consequences for retailers and manufactures are severe. In addition, it makes a major contribution to the environmental problems. At the consumer stage the expiration dates are an important cause of this food waste. Stimulating consumers to buy more suboptimal foods, in this case perishables with a short shelf life, might help to reduce this problem. This is done by the dynamic pricing system; the closer a product is to expiration, the more discount is given. The aim of this research is to get more insights into the choice behaviour of consumers when dynamic pricing is applied. With an online survey, in which the variables own or group use, intended moment of use and different product categories are taken into account, this is researched. The results show a lower acceptance for products with a short shelf life in the product category chicken. Also consumers choose less often a product with a short shelf life when buying it for group usage and when buying it for longer term usage.

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1. Introduction

The study of FAO (2011) suggest that roughly one-third of food produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tons per year. The financial consequence of food waste for retailers and manufacturers is severe. In the European grocery sector, products that are not purchased before their sell-by date are estimated to cause costs running into billions of dollars each year (Kärkkäinen, 2003). Besides the fact that this is economically not optimal, the food waste has a lot of environmental consequences. The food industry produces a lot of emissions, that are unnecessary when the food is wasted (FAO, 2011).

Food waste is due to several problems in the supply chain and at the consumer stage. In the supply chain there is a lack of communication and there are quality standards which increase the food waste. At the consumer stage the expiring dates on the packages is an important cause of the food waste, this together with the careless attitude of the consumers makes the food waste increasing. Especially in the medium and high income countries food is wasted, and the products that are wasted are mostly still suitable for consumption (FAO , 2011).

Food waste occurs at any stage in the food supply chain, but food waste focusses mainly on the retail and consumer stage. Where the outputs of the food supply chain are food for consumption (Parfitt, Barthel, & Macnaughton, 2010), there is a distinction to be made between food waste and food losses or spoilage. When food products decrease in their quantity or quality, which makes it unfit for consumption, it is called food loss (Grolleaud 2002). So to decrease the food losses there needs to be changes in the supply chain. Food waste is when products are wasted despite the fact that they are still suitable for consumption. In this research is mainly focussed on the food waste, because the expectation is that food waste at the retailers will be declined by dynamic pricing.

To avoid food waste suboptimal food has to be chosen more often in the supermarkets. Suboptimal food is defined as ''products that deviate from normal or optimal products 1) on the basis of appearance standards (in terms of e.g. weight, shape, or size) 2) on the basis of their date labelling (e.g., close to or beyond the best-before date), or 3) on the basis of their packaging (e.g., a torn wrapper, a dented can)'' (Aschemann-Witzel et al., 2015). In this research is focused on the second category, products that are close to the expiring date. Previous research showed that consumers would not select a suboptimal choice if all other circumstances in comparison to the optimal food are comparable. A price reduction is needed for consumers to accept a suboptimal product (De Hooge et al., 2017).

For the products in the supermarket this means that when the price is the same, people would choose the product with the optimal conditions. So the consumer would probably choose the product with a long shelf life. This ensures that products with a short shelf life will remain and even have to be thrown away. At the Dutch supermarket Albert Heijn they work with a system of a price reduction of the product of 35% when a product is almost at the best-before-date. The price reduction is communicated with a sticker on the package. This is for consumers a motivation to buy the product with a short shelf life. But this concept has just one moment of price reduction. A new concept in the food sector is dynamic pricing. dynamic pricing is defined as the assignment of different prices to the product items of the same category, considering the individual product characteristics or the changes of the product status (Liu, Tang, & Huang, 2008). Wasteless is a company that uses Electronic price tags to change the price based on the shelf life of the product. The closer a product is to expiration, the more discount is given. This has benefits for the consumer, supermarket and

the planet. The consumer saves money when buying discounted products. The supermarket has higher sales and the food waste will be reduced.

Figure 1: Example of a price tag by a dynamic priced product based on the expiring date (Wasteless.co).

1.1 Problem description

The perishable products are important for supermarkets because this category makes that consumers prefer one supermarket over another. Despite their strategic importance, grocery retailers loose up to 15 percent of their food products due to damage and spoilage (Ferguson & Ketzenberg, 2006).

Perishable products are difficult to manage because of their random weights and their limited shelf lives under different conditions (Liu, Tang, & Huang, 2008). Thereby consumers take into account the perceived risk of buying a product based on the expiring date. In case of perishable goods, they will lower the perceived risk by looking at the visual cues of freshness, including the expiring date (Tsiros & Heilman, 2015). And consumers need a price-reduction to accept a suboptimal perceived risk (De Hooge et al., 2017). So for supermarkets it is important to price products based on the identified product value so that optimal sales and profits can be achieved (Liu, Tang, & Huang, 2008).

Nowadays the technology is developing fast and tracking and tracing products by internet-based networks appeared. RFID, Radio frequency identification, has become more popular in supply chain management (Liu, Tang, & Huang, 2008). With these technological systems possible solutions to the food waste in supermarkets can be developed by pricing products based on product value. The paper of Liu et al. (2008) proposed a mathematical model to determine pricing on the real-time and optimal ordering quantity for perishable products. Also the research of Wang & Li (2012) developed a model where the shelf-life or freshness, which is for consumer the main quality indicator of perishable food, is dynamically identified or considered for pricing. But less is known about the consumer perception of the dynamic pricing system and how dynamic pricing would influence the choice behaviour of consumers. Interesting is to know which factors have an influence on the decision making process of these consumers. Possible factors that influence these decisions are intended moment of usage and buying for own use versus buying for group use. Thereby it is useful to compare the effect of dynamic pricing on the choice behaviour in different product categories.

1.2 Aim of the research

The aim of this research is to get more insights into the choice behaviour of consumers when dynamic pricing is applied. The influence of buying products for own use versus used with a group and direct versus usage on the longer term (2 days or a week) are taken into account. Furthermore this research will look at the differences of choice behaviour regarding product categories; chicken, yogurt and pre-cut vegetables. If consumers choose the product with or without price discount is researched by the following questions:

Main research question:

What is the influence of the intended use on the choice behaviour of dynamic priced perishable products?

Sub research questions:
- What are the differences between the product categories chicken, yogurt and pre-cut vegetables regarding choices made by the consumers?
- What is the influence of own versus social usage on the choice of dynamic priced perishable products?
- What is the influence of the intended moment of use on the choice of dynamic priced perishable products?
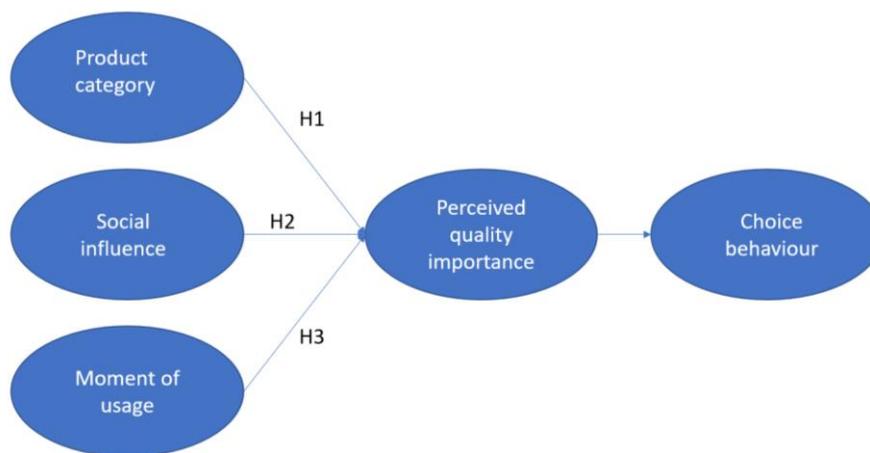
Figure 2: Conceptual model.

2. Theoretical background

2.1 Expiration dates

The topic of product expiration dates is an important social issue that influences all consumers regarding consumer protection, safety, and product freshness (Harcar & Karakaya, 2005). The expiration dates as government enables, gives the consumer information about the expected microbiological-related quality of products, when it is not yet visible. Because this is the only information about the quality of the product it is not surprising that expiration date is an important cue to judge the quality of a food product (Schut, 2013).

But according to Tsiros and Heilman (2005) consumers are not often familiar with the meanings of the expiration dates on their products. Food dating is provided in three forms; (1) "best before" which indicates the date after which the product quality is no longer optimal; (2) "use by" states that the product is decreased in quality that much that it should not be consumed anymore; (3) "sell by" indicates the last day a product should be sold. In the Netherlands the term "THT" (ten minste houdbaar tot) is used for products with a "best before date" and "TGT" (te gebruiken tot) is used for products with a "use by" date. In this research is focused on products with the best before and use by date.

The expiration dates contain a safety margin to capture deviations from handling and individual products. However, these static indicators are inaccurate and often confuse the consumer, what leads to food wastage (Schut, 2013). So food is wasted when consumers no longer accept the food. This acceptance is strongly depending on the perceived microbiological quality of the product which is stated with the expiring date. Also FAO (2011) stated that expiring 'best before dates', together with insufficient purchase and the careless attitude, causes a large amount of food waste.

2.2 Dynamic pricing

Dynamic pricing strategies became more popular. This is due to the increased availability of data, the new technologies that make changing prices possible and the availability of decision-support models for analyzing demand data. The dynamic prices of services/products where the short-term capacity (supply) is hard to change is a well-known phenomenon. Examples can be found by airlines, cruise ships, hotels and sporting events (Elmaghraby & Keskinocak, 2003). This pricing system is also called Yield management. This means that prices are set according to predicted demand level. Whereby price-sensitive customers who are willing to purchase at off-peak times can do so, while price-insensitive customers who want to purchase at peak times also are able to do so (Ingold & Yeoman, 2001).

When the dynamic pricing system is combined with the information of the article of De Hooge et al., (2017), which stated that a price reduction is needed for consumers to accept a suboptimal product, a possible opportunity to reduce the food waste in the retailer stage of the supply chain is to implement dynamic pricing in this sector. Also called EDBP, expiration date-base pricing. Theotokis et al., (2012) stated that EDBP has three characteristics on which EDBP differs from other price discrimination or promotion practices in four ways. (1) Consumers can select by themselves whether they buy a discounted product or a regularly

priced, fresher version of the product. (2) The discounted product is offered on the same time as the fresher, no discounted item. This directly communicate the price-quality trade-off to the consumers. (3) The price discrimination is based on the real value of the product. Whereas price discrimination in other industries tries to discriminate identical products. (4) EDBP is only possible in the perishable product categories.

2.3 Price-Quality relationship

Consumers take into account the perceived quality when they choose between products. But previous studies suggested that a discount on products has an influence on the quality perception of that product. So this may be of influence in the system of dynamic pricing, where products become cheaper when entering the expiring date.

A price discount before the product's expiration date may function as a signal of decreasing quality (Grewal et al., as cited in Theotokis et al., 2012). According to Olson (as cited in Zeithaml, 1988) consumers use the price as quality indicator especially if the price is the only available cue, when there are other available cues the price became less important as quality indicator. In a study of Gneezy et al. (2014) is stated that expectations are important drivers in the relationship between price and quality. The price of a product is used by consumers as a reference point by which they evaluate the product. If consumption meets this reference point, the traditional Price-quality effect is perceived. So the subjective quality assessment increases with a higher product price. But when the product with a high price does not reach the expectations, the subjective quality assessment might be lower. So different studies suggest that a discount, or lower price, can suggest that the product is of lower quality. Because of the price-quality relationship Theotokis, Pramatari, and Tsiros (2012) did a research on the effect of Expiration date-base pricing (EDBP) on Brand image perceptions. EDBP is defined as a pricing tactic in which a retailer charges different prices for the same perishable products, according to their respective expiration dates. This is comparable with the dynamic pricing system. Only loyal customers and customers who perceive low risk associated with the perishables reveal negative effects on brand quality. When consumers are already familiar with the product the EDBP has no effect on the brand image.

2.4 Perceived risk

The expected quality is related to the perceived risk of the perishable products. Perceived risk is defined as the expected negative utility associated with the purchase of a particular brand or product (Dunn et al., 1986) as stated in Tsiros et al. (2005). The perceived risk is the main factor driving the behaviour of consumers with purchasing and consuming a perishable good. The consumer want to minimize the risk associated with the product. When consumers buy a perishable good they search for visual cues and other cues such as the expiration dates to minimize the risk. Also in the article of Ruth et al., (2001) is stated that food safety risk is a psychological interpretation which influences the attitudes and behaviour of consumers with respect to the purchase of food products.

According to Tsiros et al. (2005) the willingness to pay (WTP) decreases linearly throughout the shelf life for lettuce, carrots, milk and yoghurt. For beef and chicken the WTP decreases exponentially. This difference is caused by a different perceived risk for each product category. It suggest that the perceived risk for meat is higher than for dairy and vegetables. The greater the perception of risk in terms of either probability or consequences, the greater

is the likely action to reduce the risk (Ruth et al., 2001). Based on this it might be that it is more important to buy a save option in the meat category, and thus buy the more expensive option with the long shelf life. The following hypothesis is stated;

H1; *In the product category chicken consumers will choose more often the product with the longest shelf life compared to pre-cut vegetables and yogurt.*

2.5 Intended usage

To get more insights in the consumer choices between discounted and non-discounted products with dynamic pricing factors, intended usage has to be taken into account. Information about the effect of these factors is missing in previous studies. But despite the fact that this is a knowledge gap two hypothesis has been formed;

H2; *When consumers buy products for own use they choose more often the discounted option with a short shelf-life.*

H3: *when consumers buy products they will use the same day, more often is chosen for the discounted option with a short shelf-life.*

3. Methodology

This research is designed to get more insights into the choice behaviour of consumers when they can choose between different products with their specific shelf-life and price. In this chapter the methodology is explained. It contains information about the research method, research population, chosen product categories, research procedure, data collection and data analysis.

3.1 Research method

In order to get the insights in choice behaviour of consumers a quantitative, descriptive study is done. A descriptive study tries to answer the ''what'' question (De Vaus, 2001) .This type of study collects data and gives an examination of the distribution and the number of times a single event or characteristic occurs (Blumberg, Cooper, & Schindler, 2011). So in this research we can get insight in the number of times specific consumers choose the product with or without discount. A survey is a suitable data-collection approach to study this, because abstract information of all types can be gathered by questioning (Blumberg et al., 2011). The dynamic pricing system has not yet been applied in the supermarkets, so a hypothetical and abstract system has to be tested. Thereby a survey is more efficient and costs less than other quantitative research methods. The survey is web-based, this has the advantages that it minimizes the costs, it has a wide sample accessibility and it is anonymous.

3.2 Research population

The research population chosen for this research were Dutch individuals of all ages who do the grocery shopping at least once a week. One reason why there is no restriction to age is that there could be a large difference in choice behaviour between different age groups. According to Kim and Park (1997) there are two hypothetical consumers: ''routine shoppers'' who shop at fixed intervals and have high opportunity costs and ''random shoppers'' who shop at more flexible intervals. Expected is that young people are mostly more flexible, shop more often but spent less money per visit. Older people, and families will buy more groceries at once. Interesting is to get insight in how these different shoppers react on the dynamic pricing system, thereby no distinction is made between age.

3.3 Product categories

In order to gain insights in de choice behaviour of the consumer, different product categories are taken into account. The focus is on perishable products because these products will be discounted in the dynamic pricing strategy. A commodity is called perishable if its quality or quantity is subject to deterioration. A group of perishable products comprises goods in which product quality is subject to a continuous change after the production stage (Farahani, Grunow, & Günther, 2012). This includes fresh products such as vegetables, fruits, dairy, meat and bread. Tsiros et al. (2005) suggested that consumers have a different perceived risk per category. And they state that the perceived risk for meat is higher than for dairy and vegetables. This is interesting to take into account in the research. So to check if meat is less bought with a price reduction, because of the higher perceived risk, one product category should be meat. In this study chicken is chosen because there is consumer concern

about the consumption of chicken. Consumers are mainly concerned about the microbiological risk of ''salmonella''. Thereby there are concerns about human health because of the antibiotics fed to chicken (Ruth, Yeung, & Morris, 2001). In the category vegetables is chosen for the pre-cut vegetables. Consumers evaluate vegetables as less risky than meat and thus it is interesting to check if vegetables are bought more often with the discount and a short self-life. Thereby in the Netherlands pre-cut vegetables are often bought because of their ease of use. In the dairy category Yogurt is used. Yogurt is a well-known product, and has compared to pre-cut vegetables and meat a longer shelf-life. The combination of Chicken, pre-cut vegetables and Yogurt gives a rough estimate of the perishable products and is an interesting combination to compare.

In the survey the consumer can choose between products with three different shelf-lives and each with a corresponding price. The product is discounted 15% if it is halfway through the shelf life, and 30% when it is the expiration date.

3.4 Procedure

The participants received the survey online, by mail or via social media. The survey is made with Qualtrics, this is an online survey platform. Before the participants start with the first question some information about the informed consent is given. This includes that the survey is voluntarily filled in and that the participant is free to stop the survey at any time. Thereby the answers are anonymous and for further questions or remarks they could contact the researcher. In the first question is asked about the amount of times of grocery shopping during a week. When respondents filled in less than once a week, they got a message that they did not fit in the research population and that the survey will end. For the respondents who fits into the research population, per product 3 choose options were presented short/middle/long shelf-life and an appropriate discount. In each question a certain usage goal was stated, after which the participant had to choose between the 3 price options. In total there were 12 different cases. After these case-questions some general factors that could influence the results were asked. This includes; age, gender, budget, educational attainment, household composition and frequency of grocery shopping. The last questions were some control questions about the meaning of THT/TGT. Finally the participants were thanked for participating and there was the possibility to give their email address to have a chance at winning a gift voucher. The complete survey can be found in appendix 1.

3.5 Data collection

The study focuses on Dutch consumers, so the survey will be in Dutch. To get respondents of different age categories and different household types the survey is promoted in several ways. To get young participants the survey is promoted on Facebook. To reach the participants of other age categories, with probably other family compositions, the survey is send by email to family, acquaintances and colleagues. Thereby respondents are requited from the database of consumer research from the chair group Food Quality and Design of Wageningen University.

3.6 Data analysis

The data that is conducted by the survey is analysed with the software SPSS version 23. First the data is checked on missing values and outliers. The data of the respondents that does not fit into the research population are deleted. Second, descriptive statistics are used to check the general information about the sample, like gender and age. Frequency tables are made of the times chosen for a certain shelf life for each situation. These frequencies are added up to get the cross-table (table 2). This table shows the differences in amount of times a consumer choose a specific product based on the shelf-life. A bar chart is made for every comparison, so for food categories, own versus group use and for direct versus long term use.

To check if the differences as shown in table 2 are significant, the Multinomial logistic regression model is used. The dependent variable, the shelf-life chosen, is considered to be a nominal value. It is possible to have three levels when using a multinomial model. For this research there are three choice levels, short-, middle- and long- self life. Multinomial logistic regression is used to predict categorical placement in or the probability of category membership on a dependent variable based on multiple independent variables (Starkweather & Moske, 2011). So this means for this research that the probability is checked that for example a product category contributes to the choice made according to the shelf life.

To make the original dataset of the survey usable for the multinomial logistic regression model the original data file is converted with syntax on SPSS to a new data file in which each question of every respondent is listed. For every question the condition is encoded for every variable, product category, own versus social usage and direct versus long term usage. Using the multinomial logistic model, the expected amount of change in the dependent variable for each one unit change in the (independent) predictor variable is calculated. The more close the logistic coefficient is to zero, the less influence the independent variable has on the dependent variable (Starkweather & Moske, 2011). The expected B value is greater than 1 if the independent has an influence on the dependent and smaller than 1, no effect shows a Exp(B) of 1, and a negative relation is showed by an Exp(B) of less than 1.
In the data output first is looked at the likelihood Ratio Tests. In this table is shown if the independent variables have a significant effect on de dependent variable. These likelihood statistics can be seen as overall statistic that tells us which predictors significantly enable us to predict the outcome category. To know the specific effects the individual parameters estimates had to be checked (Field, 2014).

4. Results

Sample

In total 198 persons filled in the survey. First, the respondents who did not fit the research population were deleted. This means the answers of the people who filled in ''minder dan 1 keer boodschappen doen per week''. After deleting these data, 193 respondents remained within the target group. The sample consists of 35 males, 157 females, and one person that didn't answer this question. The respondents are aged between 16 and 79 years with μ=43 and σ=19,3.

	Frequency	Percent
Male	35	18.1
Female	157	81,3
No respons	1	0.5
Total	193	

Table 1: The sample according to age and gender.

All the respondents got 12 cases, so in total (12*193) 2316 choices have been made. In 34% of the cases consumers choose the product with the low shelf life, 43% choose the product with the middle shelf-life and 23% choose the product with the longest shelf life. This information suggest that the Dynamic pricing system indeed is a stimulation for the consumer to buy a product with a shorter shelf life. This is positive because less products will be left over when reached the expiration date. The food spoilage at the retailers could be declined.

Table 2; frequency table of consumer choices between products with a short-, middle-, and long shelf life, per variable*.

	Low price- Short shelf life	Middle price- Middle shelf life	High price- Long shelf life
chicken	242 (31,3%)	336 (43,5%)	194 (25,1%)
vegetable	282 (36,5%)	308 (39.9%)	182 (23,4)
yogurt	258 (33,4%)	362 (46,9%)	152 (19,7%)
own use	426 (36,8%)	497 (42,9%)	235 (20,3%)
group use	356 (30,7%)	509 (44%)	293 (25,3%)
direct use	694 (60%)	340 (29,4%)	124 (10,7%)
long term	88 (7,6%)	666 (57,5%)	404 (34,9%)
total	2346 (33,8%)	3018 (43,4%)	1584 (22,8%)

*Each participant got 4 cases with chicken, so the total times a choice had to be made about a chicken product is 193X4=772. Same for vegetables and yoghurt. The other variables are asked in 6 cases, so the total times these variables are asked are 193x6=1158.

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4.1 Product category

The number of times the respondents choose for a product with a short-, middle- and long shelf-life with a corresponding discount, is stated in figure 3 for the product categories chicken, pre-cut vegetables and yogurt. In line with the total choice, the middle-option is most popular by all the product categories. The hypothesis stated that because of the perceived risk consumers are more careful when buying chicken in comparison to vegetables and yogurt and are thus expected to choose products with a long shelf life. Results shows that of the times a short-shelf life is chosen, this is the least in the chicken category (31,3% against 36,5 and 33,4 percent). Of all the times a long shelf life is chosen, the category of chicken is the biggest (25,1% against 23,4 and 19,7 percent). These data is in line with the first hypothesis. But it is striking that in the chicken category the product with the longest shelf life is least popular.
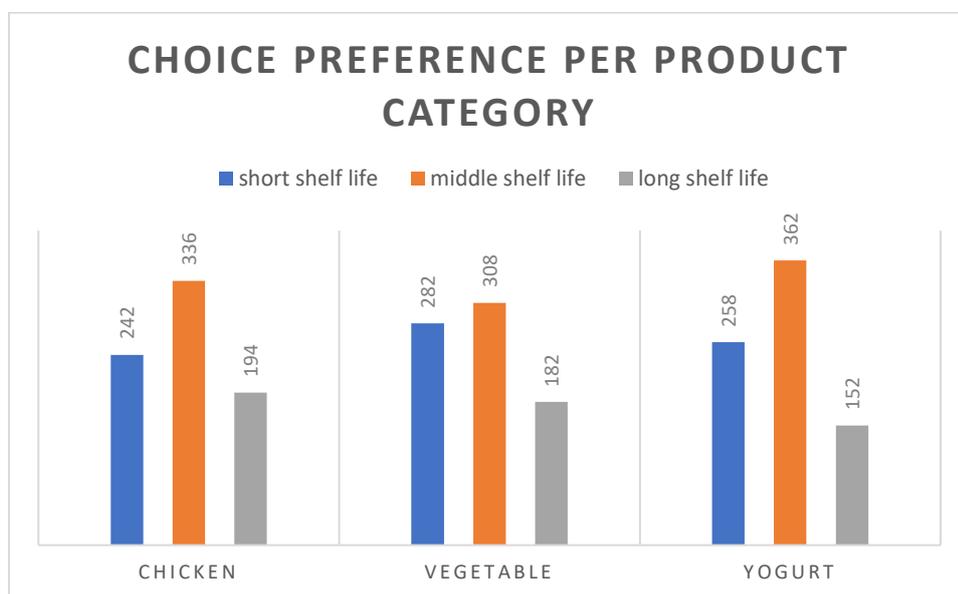
Figure 3; the number of times consumers choose for a product with a short-, middle- and long shelf-life ,with a corresponding discount, divided by the categories chicken, pre-cut vegetables and yoghurt.

The results of the likelihood ratio test confirmed that product category had a significant main effect on the preferred choice between short-, middle- and long shelf life products. $X^2(4) = 15,00$, P= 0,005.

For the specific effects the individual parameter estimates are checked. Yogurt is made the redundant, so the categories chicken and vegetables are compared to yogurt;

Chicken; The product category chicken compared to yogurt significantly predicts whether a consumer chooses for the product with a long shelf life or for a product with a short shelf life, b=0.374, Wald $\chi^2(1)$= 5,322, p=0,021. The odds ratio is Exp(B)= 1,453. So consumers choose more often the long shelf life product than the short shelf life product when buying chicken compared to yogurt. This effect when choosing between the middle shelf life and short shelf life when buying chicken is not significant (p=0.744).

Pre-cut vegetables; The product category pre-cut vegetables compared to yogurt does not significantly predict whether a consumer chooses for the product with a long shelf life or for a product with a short shelf life, b=0,039, Wald $\chi^2(1)$= 0,057, p=0,811. But the effect of choosing between the middle shelf life and short shelf life when buying pre-cut vegetables instead of yogurt is significant, b=-0.295, Wald $\chi^2(1)$= 4,761, p=0,029. The odds ratio is Exp(B)= 0.744, so consumers choose more often the short shelf life than the middle shelf life product when buying pre-cut vegetables compared to yogurt.

4.2 Own versus social usage

When consumers have to buy a product for own usage 36,8% of them choose the product with the lowest price and shortest shelf life. When consumers have to buy a product they will consume with a group, 30,7% of them choose the one with the short shelf life. So respondents prefer the short shelf life option more when the product is meant for own usage. Only 1% percent of difference between the middle choice option of own use and group use is perceived. 20,3% of the respondents choose the product with the long shelf life when they will use the product themselves, against 25,3% when they will use it with a group. So the respondents prefer the long shelf life option more when buying products for a group. This results are in line with the second hypothesis that consumers choose more often the discount option with a short shelf-life when buying products for own usage.
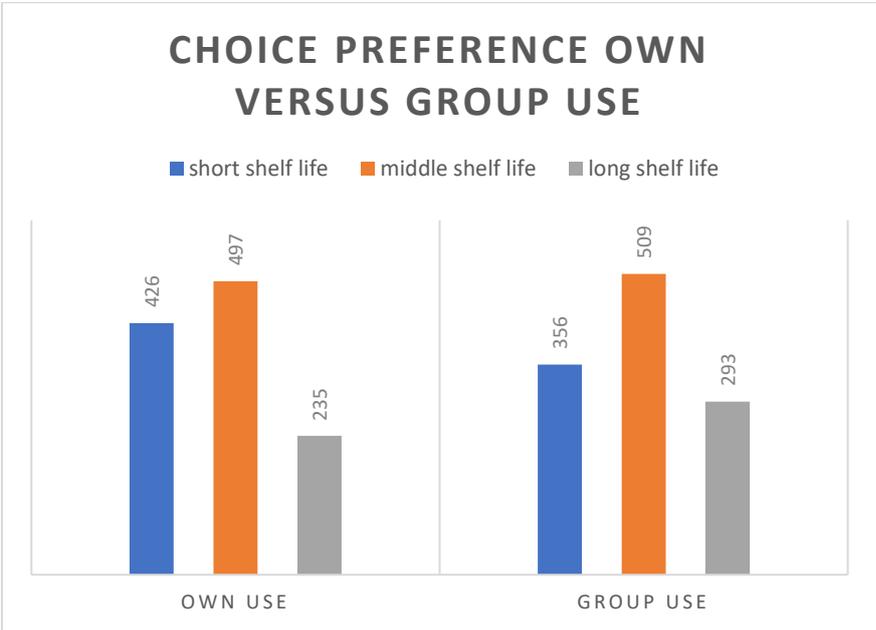
Figure 4: the number of times consumers choose for a product with a short-, middle- and long shelf-life, with a corresponding discount, divided by the intended usage of own versus group use.

The results of the likelihood ratio test confirmed that intended use had a significant main effect on the preferred choice between short-, middle- and long shelf life products with their corresponding discount. $X^2(2)$= 17,869, P= 0,000.

For the specific effects the individual parameter estimates are checked. The intended usage, that consists of own use versus group use, significantly predicted whether a consumer chooses for the product with a long shelf life or for a product with a short shelf life, b=-0,550, Wald $\chi^2(1)$= 17,416, p=0,000. The odds ratio is Exp(B)=0,577, this means that the odds of choosing the long shelf life product instead of the short shelf life product is 0,577 when buying a product for own use instead of group use. So the chance that someone chooses a product with a short shelf life over a product with a long shelf life is greater when buying for your own use than for group use.

The intended usage also significantly predicted whether a consumer chooses for the product with a middle shelf life over a product with a short shelf life, b=-0,329, Wald $\chi^2(1)$= 8,77, p=0,003. The odds ratio is Exp(B)=0,72, this means that the odds of choosing the middle shelf life product instead of the short shelf life product is 0,577 when buying a product for own use instead of group use. So the chance that someone chooses a product with a short shelf life over a product with a middle shelf life is greater when buying for your own use than for group use

4.3 Intended moment of usage

According to figure 5 there is a clear variation between the choice preferences when using the product directly or using it within a few days or a week. For chicken and pre-cut vegetables usage on the long term is in 2 days. For yogurt usage on the long term means that it has to be consumed during a week. In 60% of the cases when the respondents had to choose their product for direct use they choose the one with the most discount and short shelf life. 29,4% choose the middle option, and 10,7% prefer the product with the longest shelf life. These percentages differ from the cases where people had to buy a product for usage over the longer term. In this cases the respondents choose in 7,6% of the times for the short shelf life, 57,5% for the middle option and 34,9% for the longest shelf life. These results are in line with the third hypothesis that when consumers buy products they will use the same day, more often is chosen for the discounted option with a short shelf-life.

CHOICE PREFERENCE PER MOMENT OF USE

■ short shelf life   ■ middle shelf life   ■ long shelf life

| | DIRECT USE | | | LONG TERM | |
| 694 | 340 | 124 | 88 | 666 | 404 |
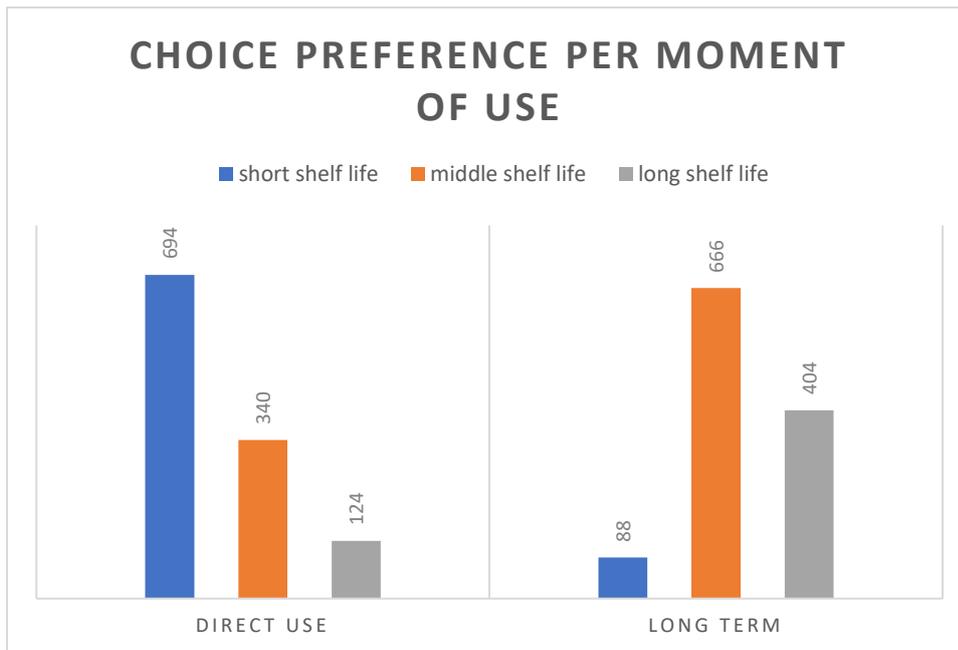
Figure 5: the number of times consumers choose for a product with a short-, middle- and long shelf-life, with a corresponding discount, regarding the intended moment of usage.

The results of the likelihood ratio test confirmed that intended moment of use had a significant main effect on the preferred choice between short-, middle- and long shelf life products with their corresponding discount. $X^2(2)$= 804,944, P= 0,000.

For the specific effects the individual parameters estimates are checked. The intended moment of usage significantly predicted whether a consumer chooses for the product with a long shelf life or for a product with a short shelf life, b=-3,288, Wald $\chi^2(1)$= 453,806, p=0,000. The odds ratio is Exp(B)=0,037, this means that the odds of choosing the long shelf life product instead of the short shelf life product is 0,037 when buying a product for direct instead of long term use. So the chance that someone chooses a product with a short shelf life over a product with a long shelf life is greater when buying for direct use than for long term use.

The intended usage also significantly predicted whether a consumer chooses for the product with a middle shelf life or for a product with a short shelf life, b=-2,766, Wald $\chi^2(1)$= 436,863, p=0,000. The odds ratio is Exp(B)=0,063, this means that the odds of choosing the middle shelf life product instead of the short shelf life product is 0,063 when buying a product for direct use instead of group use. So the chance that someone chooses a product with a short shelf life over a product with a middle shelf life is greater when buying for direct use than for long term use.

4.4 Combined effects

In figure 6 the number of times the consumer choose for a short-, middle- or long shelf life with their corresponding price are stated for each situation in the chicken category. What stands out in this figure is that consumers choose most often the product with the lowest price and shortest shelf life when buying it for own and direct use. This is in line with the hypotheses.

The very low number of times the consumer choose the low price, short shelf life product in situation CGL is explained by the fact that people will not buy a product they want to use after the use by date (TGT).

When buying for group use compared to own use, people prefer slightly more often more expensive products with a longer shelf life. It is remarkable that COD and CGD roughly have the same pattern, this holds also for COL and CGL. This suggests that people determine their choice especially on whether they want to use the product directly or over the longer term.
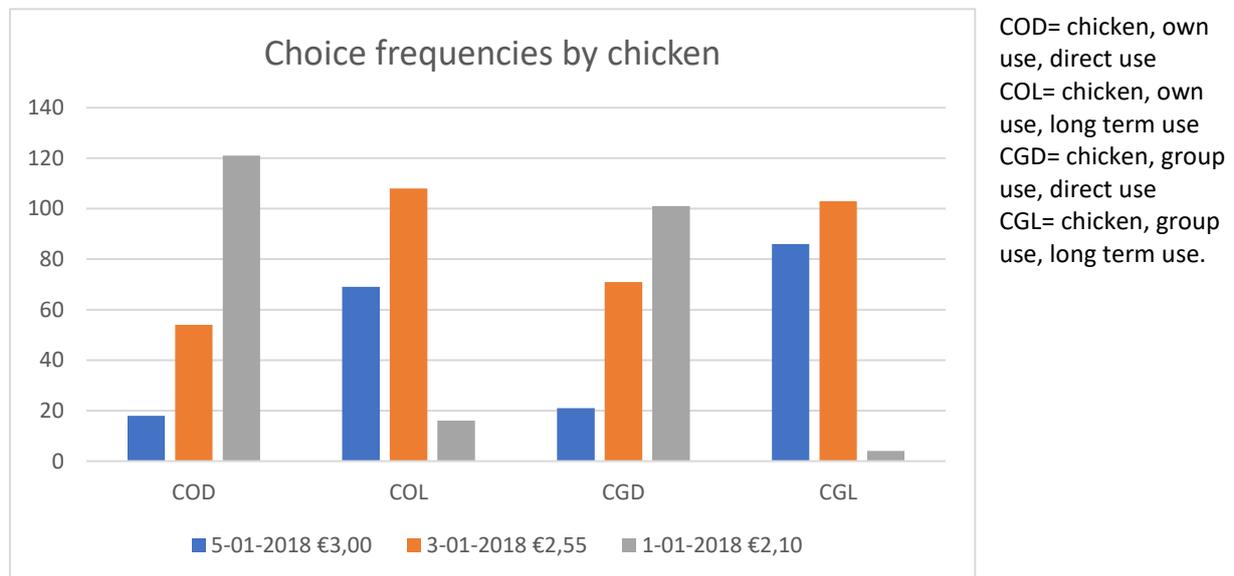
COD= chicken, own use, direct use
COL= chicken, own use, long term use
CGD= chicken, group use, direct use
CGL= chicken, group use, long term use.

Figure 6; the number of times consumers choose for a product with a short-, middle- and long shelf-life, with a corresponding discount, for each situation in the chicken category.

In figure 7 the number of times the consumer choose for a short-, middle- or long shelf life with their corresponding price are stated for each situation in the pre-cut vegetables category. What stands out is that the patterns found in this figure are very similar to the patterns found in figure 6. This means that also in the vegetable category consumers choose most often the product with the lowest price and shortest shelf life when buying it for own and direct use. Also in the vegetable category the patterns of VOD and VGD are roughly comparable, this hold also for VOL and VGL. This together with the fact that VOD compared to VOL, and VGD compared to VGl differs much more, it seems that the most important factor in the choosing behaviour is the intended moment of usage.
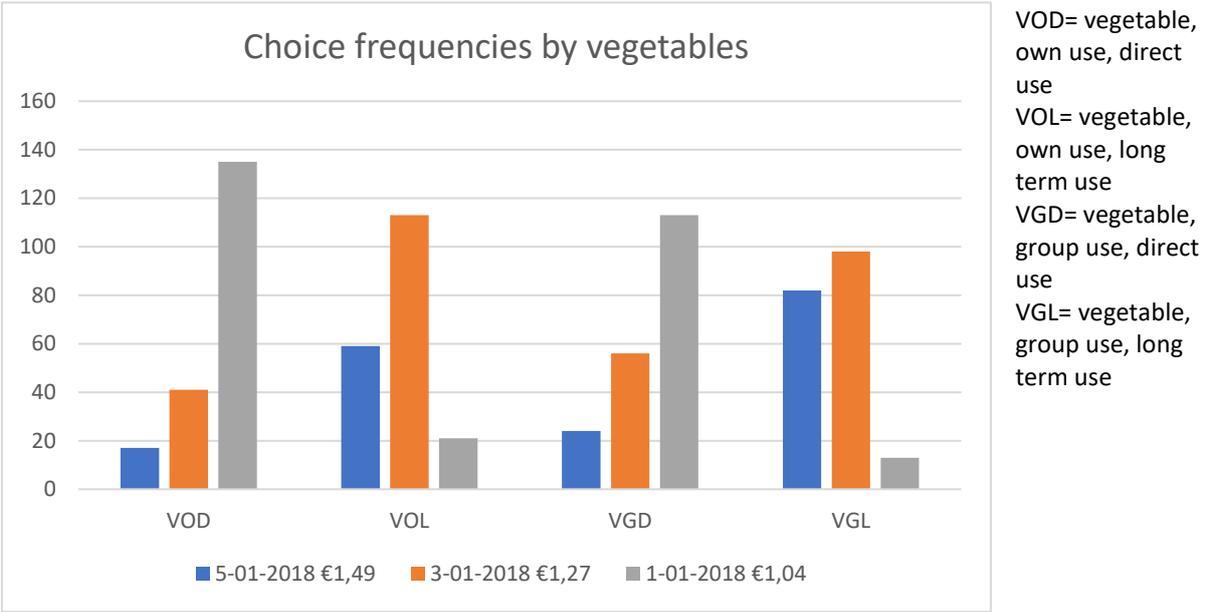
VOD= vegetable, own use, direct use
VOL= vegetable, own use, long term use
VGD= vegetable, group use, direct use
VGL= vegetable, group use, long term use

Figure 7; the number of times consumers choose for a product with a short-, middle- and long shelf-life, with a corresponding discount, for each situation in the pre-cut vegetables category.

The statement that the most important factor in the choosing behaviour is the intended moment of usage also holds for the yogurt category. As seen in figure 8 the situations YOD and YGD have roughly the same pattern and the categories YOL and YGL have the same pattern.

What stands out in the yogurt category compared to the other two categories is that the lowest price, short shelf life option is almost as much chosen in the YGD situation as in the YOD situation. So less difference is showed between own and group use compared to the other product categories. It might be that this difference is caused by the fact that yogurt has a ''best before'' date while chicken and vegetables have a ''use by'' date.

YOD= yogurt, own use, direct use
YOL= yogurt, own use, long term use
YGD= yogurt, group use, direct use
YGL= yogurt, group use, long term use
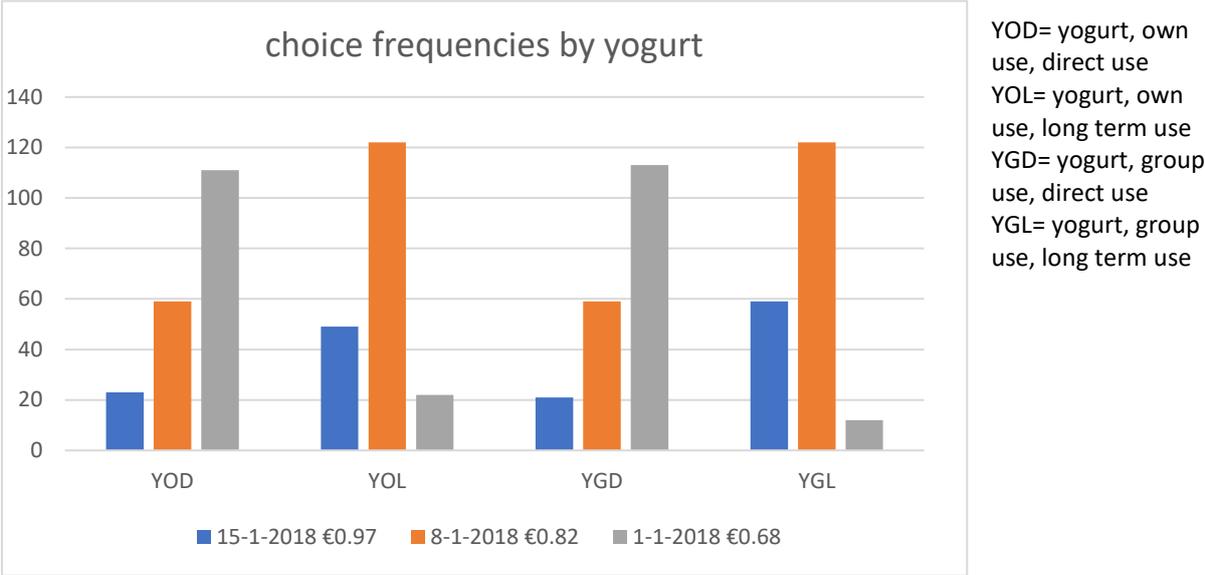
Figure 8; the number of times consumers choose for a product with a short-, middle- and long shelf-life, with a corresponding discount, for each situation in the yogurt category.

5. Conclusion

The aim of this research is to get more insights into the choice behaviour of consumers when dynamic pricing is applied. Different variables that could influence the choice for a product with a short-, middle-, or long shelf life with a corresponding discount are taken into account. The question that is answered in this research is; What is the influence of the intended use on the choice behaviour of dynamic priced perishable products? Taken into account three products, chicken, pre-cut vegetables and yogurt.

The first question that is tested is; What are the differences between the product categories chicken, yogurt and pre-cut vegetables regarding choices made by the consumers? Results showed that consumers choose significantly more often the long shelf life product than the short shelf product when buying chicken compared to yogurt. Thereby the product category pre-cut vegetables compared to yogurt does not significantly predict whether a consumer chooses for the product with a long shelf life or for a product with a short shelf life. This is in line with the first hypothesis that in the product category chicken consumers will choose more often the product with the longest shelf life compared to pre-cut vegetables and yogurt. Despite these finding the results did not give a full answer on the first sub question, this is because the three product categories are not all compared with each other. This is a consequence of the multinomial model that is used, were yogurt is made the redundant.

The difference in consumer choices regarding to own use versus group use is tested. The results showed that own use versus group use significantly predict whether a consumer chooses for the product with a long shelf life instead of a product with a short shelf life. People are more likely to choose a product with a short shelf life over a product with a long shelf life when buying for own use than for group use. The intended usage also significantly predicted whether a consumer chooses for the product with a middle shelf life over a product with a short shelf life, so people are also more likely to choose a product with a short shelf life than a middle shelf life when buying the products for own use. Hypothesis 2 can be accepted.

> H2; *When consumers buy products for own use they choose more often the discounted option with a short shelf-life.*

The third variable, intended moment of usage, also results in a significant outcome. The intended moment of usage significantly predicted whether a consumer chooses for the product with a long shelf life over a product with a short shelf life. People are more likely to choose a product with a short shelf life over a product with a long shelf life when the product is bought for direct use than when it is bought for the longer term.
These statement also holds for the comparison between middle- and short shelf life. So people are more likely to choose a products with a short shelf life over a product with a middle- shelf life when the product is bought for direct instead of long term usage. So hypothesis 3 can be accepted.

> H3: *when consumers buy products they will use the same day, more often is chosen for the discounted option with a short shelf-life.*

Although the fact that hypothesis two and three are both accepted, the combined effects showed that presumably the intended moment of usage is a more important factor in the choice of consumers than the intended use (own use vs. group use).

6. Discussion

6.1 Discussion of the results

The current study found that consumers choose significantly more often the long shelf life product than the short shelf product when buying chicken compared to yogurt. The product category pre-cut vegetables compared to yogurt does not significantly predict whether a consumer chooses for the product with a long shelf life or for a product with a short shelf life. These results are in agreement with Tsiros et al. (2005) findings which suggested that consumers have a different perceived risk per category. And they state that the perceived risk for meat is higher than for dairy and vegetables. So this could be an explanation why consumers choose more often the product with the longer shelf life when buying chicken compared to yogurt, and why there is no significant difference between the product category vegetables and yogurt on the choice.

Another important finding is that the intended usage, own use versus group use, has a significant influence on the choice for a product with a specific shelf life. Consumers are more likely to choose a product with a shorter shelf life when buying it for own use then when they buy it for group use. It may be reasonable that the perception of quality influence these choices. According to Grewal et al (as cited in Theotokis et al., 2012) a price discount before the product's expiration date may function as a signal of decreasing quality. It is possible that consumers accept a lower quality when the product is for own use compared to a product that is bought for group use.

The intended moment of usage significantly predict whether a consumer choose for the product with a long shelf life or for a product with a short shelf life and their corresponding prices. Consumers are more likely to choose a product with a shorter shelf life when buying it for direct use then when they buy it for longer term usage. A possible explanation for this can be that of the perceived risk. According to Tsiros et al., (2005) the perceived risk is the main factor driving the consumers with purchasing and consuming a perishable good. Consumers want to minimize the risk and thereby it is reasonable that when consumers buy a product which they will use on the longer term they choose for a more expensive option and a longer shelf life.

6.2 theoretical contributions

This thesis extends on previous literature since to my knowledge no research is done before about the consumer choice behaviour when dynamic pricing is applied to perishable products. Previous research focused on the mathematical models behind the dynamic pricing system for perishable products (Lui et al., 2008; Wang & Li, 2012). Thereby studies are done about dynamic pricing systems, but these are done for other kind of products or services in which they call it yield management. For example in the airline, cruise ships or hotel industry (Elmaghraby & Keskinocak, 2003; Ingold & Yeoman, 2001).

The knowledge gained by this research about the choice behaviour of consumers when the dynamic pricing is applied is of value for the retailers and manufacturers. This because they can take the consumer perspectives and buying behaviour into account when implementing the dynamic pricing system.

In addition to the advantages for the retailers and manufacturers, this research confirmed that dynamic pricing is a possible solution for reducing food waste. According to FOA (2011) expiration dates on the packages in an important cause of the food waste. The result of this study that in only 23% of the cases the respondents choose the product with the longest shelf life proofs that discounts on products with a shorter shelf life stimulates consumers to buy products with a shorter shelf life and thus reduces food waste at retailers.

6.3 Limitations

Based on the descriptive statistics, literature and comments of respondents some limitations on this research are found.

6.3.1 Product categories
In this research the difference of choice preferences at different perishable food categories is measured. The three products used in the survey represent each one product category: yogurt is a dairy product, pre-cut vegetables are representing the fruits and vegetables category and chicken represents the meat category. In the meat category chicken is chosen because the expected perceived risk is higher for chicken than other kinds of meat. Because of the difference in risk perceptions of different kinds of meat, the results of this research about chicken is not generalizable for the whole meat category. This also applies for the dairy category, yogurt is a totally different product than milk and cheese, so the conclusion about the preferred shelf life of yogurt is not applicable to the whole dairy category without further research. Also with regard to the pre-cut vegetables there is no guarantee that the preferences can be generalized for all fruit and vegetables.

6.3.2 Visibility
In this research only the independent variables expiration date, intended usage and product category are taken into account. The photo showed in the survey was the same for every choice option. In reality the product would probably look less fresh when the expiration date is almost reached. In the additional comment question in the survey, different respondents filled in that they also take the visibility of the product into account. ''Ik kijk niet alleen naar de datum maar ook hoe het product er uit ziet'' and ''bij bepalen of ik een product koop terwijl de THT datum verloopt, kijk ik hoe de groente eruitziet'' are two examples of these comments. Also previous literature stated that visual cues influence the buying behaviour of consumers. According to Nazlin (1999) ''the first taste is almost always with the eye''. Visual sensations will contribute to the willingness to accept a product, because the visual cues are the first encounter with food products.

6.3.3 Unequal gender distribution
The research population of this study includes males and females but the number of male and female respondents is not equal. Only 18% of the respondents are male and 81% are female. One respondent did not answer this question. This distribution does not adequately

represent the entire research population. As reported by Roeters (2017) men spent in 2016 on average 4.3 hours per week on shopping, which includes grocery shopping. Women spent in 2016 on average 5.6 hours per week on shopping. So women do a bit more shopping than man do, but the difference is not that much that the sample of this research is representative.

6.4 Recommendations

The aim of the research is to get more insights into the choice behaviour of consumers when dynamic pricing is applied. The information that is generated thus relates to choices made in a real supermarket. In this research the respondents were asked with an online survey about their choice preferences, this could be different of the choices made when buying at the physical stores. So for further research is would be interesting to test these choice behaviours in more real life situations. This way of research also has the advantage that the visible appearance of the products can be taken into account.
The percentages of discount used in the survey are 15% and 30%. The choices people made probably differ for different discounts. More discount could lead to a higher trigger to buy the product with the shorter shelf life, and the food waste could be minimized. So it is interesting to do further research into the optimal discount – shelf life combination.
The main suggestion for further research is taken different types of products into account. As mentioned in the discussion this research focusses on a very small number of products. The results of chicken are not generalizable for the whole meat category, and the same holds for pre-cut vegetables for the fruits and vegetables and by yogurt for the whole dairy category. So to get more detailed information about the choice preferences of consumers regarding the dynamic pricing system, more different products have to be included in the research.

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Appendix 1

Survey

Name survey; Dynamic pricing

Beste Deelnemer, Ik ben een derde-jaars studente Bedrijfs-en consumentenwetenschappen, en deze enquête is onderdeel van mijn Bachelor thesis. De enquête gaat over productkeuzes. De antwoorden zijn volledig anoniem en zullen alleen gebruikt worden voor dit onderzoek. Daarnaast is het invullen geheel vrijwillig en kan er op elk gewenst moment gestopt worden. Alvast bedankt voor het invullen!

Q25

Hoe vaak doet u gemiddeld boodschappen per week?

- ○ Minder dan 1 keer
- ○ 1 tot 2 keer
- ○ 3 tot 4 keer
- ○ 5 tot 6 keer
- ○ Meer dan 6 keer

Q5

De datum van vandaag is 01-01-2018

Q6

Het is vandaag 01-01-2018. U doet de boodschappen voor **eigen** gebruik, en gaat de kip **dezelfde dag** consumeren. Welke optie zou u kiezen?

- ○ TGT 05-01-2018 €3.00
- ○ TGT 03-01-2018 €2.55
- ○ TGT 01-01-2018 €2.10

Q7

 Het is vandaag 01-01-2018. U doet de boodschappen voor **eigen** gebruik, en gaat de kip **over 2 dagen** consumeren. Welke optie zou u kiezen?

- ○ TGT 05-01-2018 €3.00
- ○ TGT 03-01-2018 €2.55
- ○ TGT 01-01-2018 €2.10

Q8

Het is vandaag 01-01-2018. U doet de boodschappen omdat u gaat koken **voor een groep** mensen. De kip wordt **dezelfde dag** geconsumeerd.
Welke optie zou u kiezen?

○ TGT 05-01-2018 €3.00

○ TGT 03-01-2018 €2.55

○ TGT 01-01-2018 €2.10

Q9

Het is vandaag 01-01-2018. U doet de boodschappen omdat u gaat koken **voor een groep** mensen. De kip wordt **over 2 dagen** geconsumeerd.
Welke optie zou u kiezen?

○ TGT 05-01-2018 €3.00

○ TGT 03-01-2018 €2.55

○ TGT 01-01-2018 €2.10

Page Break

Q10

De datum van vandaag is: 01-01-2018

Q11

Het is vandaag 01-01-2018. U doet de boodschappen voor **eigen** gebruik, en gaat de voorgesneden groente **dezelfde dag** consumeren. Welke optie zou u kiezen?

○ TGT 05-01-2018 €1.49

○ TGT 03-01-2018 €1.27

○ TGT 01-01-2018 €1.04

Q12

Het is vandaag 01-01-2018. U doet de boodschappen voor **eigen** gebruik, en gaat de voorgesneden groente **over 2 dagen** consumeren. Welke optie zou u kiezen?

○ TGT 05-01-2018 €1.49

○ TGT 03-01-2018 €1.27

○ TGT 01-01-2018 €1.04

Het is vandaag 01-01-2018. U doet de boodschappen omdat u gaat koken **voor een groep** mensen. De voorgesneden groente wordt **dezelfde dag** geconsumeerd. Welke optie zou u kiezen?

○ TGT 05-01-2018 €1.49

○ TGT 03-01-2018 €1.27

○ TGT 01-01-2018 €1.04

Q14

Het is vandaag 01-01-2018. U doet de boodschappen omdat u gaat koken **voor een groep** mensen. De voorgesneden groente wordt **over 2 dagen** geconsumeerd. Welke optie zou u kiezen?

○ TGT 05-01-2018 €1.49

○ TGT 03-01-2018 €1.27

○ TGT 01-01-2018 €1.04

Page Break

Q15

De datum van vandaag is: 01-01-2018

Q16

Het is vandaag 01-01-2018. U doet de boodschappen voor **eigen** gebruik, en gaat de yoghurt **dezelfde dag** consumeren. Welke optie zou u kiezen?

○ THT 15-01-2018 €0.97

○ THT 08-01-2018 €0.82

○ THT 01-01-2018 €0.68

Q17
Het is vandaag 01-01-2018. U doet de boodschappen voor **eigen** gebruik, en wil de yoghurt gedurende **een week** kunnen consumeren. Welke optie zou u kiezen?

○ THT 15-01-2018 €0.97

○ THT 08-01-2018 €0.82

○ THT 01-01-2018 €0.68

Q18
Het is vandaag 01-01-2018. U doet de boodschappen omdat u gaat koken **voor een groep** mensen. De yoghurt wordt **dezelfde dag** geconsumeerd.
Welke optie zou u kiezen?

○ THT 15-01-2018 €0.97

○ THT 08-01-2018 €0.82

○ THT 01-01-2018 €0.68

Q19
Het is vandaag 01-01-2018. U doet de boodschappen omdat u gaat koken **voor een groep** mensen. De yoghurt wilt u gedurende **een week** kunnen consumeren.
Welke optie zou u kiezen?

○ THT 15-01-2018 €0.97

○ THT 08-01-2018 €0.82

○ THT 01-01-2018 €0.68

Page Break

Q20
Wat is uw geslacht?

○ man

○ vrouw

○ anders

Q21
Wat is uw leeftijd?

Q22
Wat is uw hoogst voltooide opleiding, of welke opleiding volgt u nu?

○ Basisonderwijs

○ Middelbaar onderwijs

○ Lager/ voorbereidend beroepsonderwijs (lbo/ vmbo)

○ Middelbaar beroepsonderwijs (mbo)

○ Hoger beroepsonderwijs (hbo)

33

○ Wetenschappelijk onderwijs (wo)

Uit hoeveel personen bestaat uw huishouden?

○ 1

○ 2

○ 3

○ 4

○ 5

○ 6

○ meer dan 6

Wat geeft u gemiddeld per week uit aan boodschappen per persoon in uw huishouden?

○ Minder dan 30

○ Tussen de 30 en 50 euro

○ Tussen de 50 en 70 euro

○ Tussen de 70 en 90 euro

○ Tussen de 90 en 110 euro

○ Meer dan 110 euro

THT betekent;

Q28
TGT betekent;

Q29
eventuele opmerkingen over het onderzoek

Bedankt voor het invullen van de enquête, vul hier uw emailadress in als u kans wil maken op de cadeaubon. Voor vragen en/of opmerkingen stuur een email naar: lenneke.keulemans@wur.nl

When people filled in ''minder dan 1 keer'' at Q26, people doesn't fit the research population. They got the message;
'' Helaas valt u buiten de doelgroep van dit onderzoek. De enquête zal hierna beëindigd worden''

Appendix 2

Table 3; Results Multinomial logistic regression analysis.

	b (SE)	95% CI for odds Ratio		
		lower	Odds ratio	Upper
Long shelf life vs. short shelf life				
intercept	1.679			
category				
chicken	0.374	1.06	1.45	2
vegetables	0.039	0,756	1.04	1.43
intended use (own/group)	-0.555	0.45	0.58	0.75
moment of use (direct/longterm)	-3.288	0.03	0.04	0.05
Middle shelf life vs. Short shelf life				
category				
chicken	0.044	0.80	1.05	1.36
vegetables	-0.295	0.57	0.74	0.97
intended use (own/group)	-0.329	0.58	0.72	0.90
moment of use (direct/longterm)	-2.77	0.05	0.06	0.08