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THE IMPACT OF SUSTAINABILITY LABELING ON CONSUMERS' FOOD CHOICES

Thesis submitted in fulfillment of the requirements
for the degree of Doctor (PhD) in Applied Biological Sciences

Dutch translation:

De impact van duurzaamheidslabels op de voedselkeuze van consumenten

Way of citation: Van Loo, E. J. 2016. The impact of sustainability labeling on consumers' food choices. Doctoral thesis. Ghent University

ISBN-number: 978-90-5989-885-1

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Acknowledgements

Hier is het dan, het doctoraat, het eindresultaat van de voorbije paar jaar. Maar dit is enkel het eindresultaat, zoals een foto met verbazingwekkend uitzicht op een bergtop. Het zegt niets over hoe dit resultaat tot stand is gekomen. Net zoals bij het bereiken van een bergtop, ging hier het één en ander aan vooraf: stijgen en dalen, zweet en tranen, mooie uitzichten onderweg en, hoe kan het ook anders, nu en dan een blein. In mijn eentje was het me niet gelukt om deze piek te beklimmen tot het einde. Maar gelukkig legde ik deze weg niet alleen af en maar in een gezelschap om "U" tegen te zeggen. Tochtgenoten die samen met mij genoten van de prachtige uitzichten onderweg, die me motiveerden om niet op te geven en ervoor te gaan en die pleisters bij de hand hadden voor de bleinen. Nu ik op deze bergtop sta, wil ik even stilstaan bij degenen die ik onderweg tegenkwam, en die samen met mij deze weg (deels) bewandeld hebben en me een duwtje in de rug gaven wanneer het nodig was.

Here it is, the dissertation, the final result of the past few years. However, this is only the end result, similar as a picture with an amazing view on the top of a mountain. It does not say anything about how this result came about. Similar as with reaching a mountain peak, there are several things that preceded before accomplishing this: climbing and descending, sweat and tears, beautiful views on the way and how could it be otherwise, occasionally a blister. By myself, I would not have succeeded to complete this hike to the peak. Fortunately, I did not walk this journey on my own, but I had the best travel companions I can imagine. Travel companions who enjoyed, together with me, the wonderful views on the way to this mountain top and who gave me bandages for my blisters. Now, standing on this mountain top, I want to acknowledge those who walked this trail (partly) with me and gave me an extra push when needed.

I would like to thank my promotors Prof. Wim Verbeke and Prof. Rudy Nayga for their guidance and support during this journey. Wim, bedankt voor de begeleiding en ondersteuning bij hebben bijgedragen tot dit eindresultaat. Ik ben je zeer dankbaar voor alle kansen en voor de vrijheid om me als onderzoeker verder te ontwikkelen. Rudy, thanks for guiding me in this PhD research adventure. Your exceptional enthusiasm for research make it so fascinating to work with you and has greatly inspired me. I am grateful for all the opportunities.

I also want to say a special thanks to Prof. Vincenzina Caputo. Vincenzina, thanks for teaching me so much, but also thanks for your advice, not only on research, but also on academic world in general and on life. Thanks also for your hospitality. Visiting you in Korea was one of the best scientific stays abroad (Although, I do believe that this is where my coffee addiction started).

I would also like to express my gratitude to the members of the examination committee: Prof. dr. Klaus Grunert, Prof. dr. Carl Lachat, Prof. dr. Mieke Uyttendaele, dr. Filiep Vanhonacker, Prof. dr. Iris Vermeir. Thanks for thoroughly reviewing my dissertation, despite your busy schedules. Your valuable comments and suggestions certainly improved the quality of my dissertation.

A special thanks to Filiep. Bedankt om me in het begin op te vangen en vanaf dag één "mijn grote broer" te zijn op het werk. Je stond me altijd bij met raad en daad en dat maakte mijn start aan de vakgroep meteen ook een aangename start. Filiep bedankt hiervoor! Ook Zuzanna en Pieter zorgden voor een huiselijke sfeer op ons buro, waardoor ik me vlug thuis voelde. Toen jullie plots allemaal vertrokken had ik toch wel vraagtekens…. Wat nu?! Maar gelukkig was de buurvrouw van het andere buro er steeds, Christine. Bedankt voor de babbels en voor je enthousiasme. Luckily, new office mates arrived: Silke and Ou, who were my office mates for over two years. Thanks for the enjoyable work atmosphere, for your encouragements and the enriching joint coffee breaks. My and Christine2, my new office mates, thanks for trying to calm me down when I was stressed over the past few months. I want to thank all the (ex-)members of Wim's gang ("bende van Wim") to have walked a part of this path with me. This includes my office mates throughout the years, Filiep, Zuzanna, Pieter, Silke, Ou, My and Christine2, and also the other gang members Lynn, Christine1 and Rongduo. Thanks for your support, friendship and enjoyable working environment.

I want to say a special thanks to all the colleagues at the department. You were there during this long walk and especially when it was steep, you helped and carried some of the baggage or gave me the extra push I needed. You were there to enjoy the great views along the path, to celebrate joy and happiness; specially on Fridays, after a long week or just whenever there was a need for it. Some of you even tried the impossible… teaching me Spanish and even some reggaeton dance moves (Julia, muchas gracias por la distracción perfecta). But the colleagues were also there to listen to whatever went wrong or when I had a bad day (or week) and to badminton the frustrations away. Btw, now that this book is finished, I have no longer excuses to not join for badminton… so be ready! Bedankt ook voor alle technische en praktische (en ook mentale) ondersteuning van het secretariaat. Jozef, Sibylle, Annick, Marleen, en Frederik, bedankt voor alles! Bedankt aan alle collega's om tijdens lunch- en koffiepauzes voor wat afleiding te zorgen zodat ik nadien met frisse moed terug aan de slag kon.

I also want to thank the faculty of the Food Science Department at University of Arkansas. This is where this journey truly started (before I even started as an assistant at Ghent University); in Fayetteville, where I was lost at first, not knowing what trail to hike, what mountain to climb. I would like to express my gratitude to Prof. Steve Ricke and Prof. Philip Crandall for giving me the opportunity to be part of their group. Dr. Ricke your enthusiasm for research and your management skills are truly remarkable. I believe working with you is where I started to embrace research and to consider that I might need to

enroll in a PhD program after all. Even with your busy schedule, you always made time for me and mentored me. Your advice on my career plans and goals meant and still means a lot to me. Thanks for everything!

Ik wil ook mijn vrienden en familie bedanken om voor mij te supporteren gedurende deze tocht. Jullie steun langs de zijlijn was opmerkelijk. Jullie zorgden voor wat afleiding en moedigden me aan om door te zetten. Bedankt!

In het bijzonder wil ik mijn ouders bedanken voor hun onvoorwaardelijk steun en liefde. Jullie warme nest maakt alles zoveel makkelijker en zorgde ervoor dat ik een forse aanloop had om aan deze klim te beginnen. Mama en papa, bedankt om er altijd voor me te zijn, voor alle kansen die jullie me geven, en om, wat ik ook wil doen, me altijd te steunen.

There is one special person who deserves my warmest gratitude and who has been at my side for almost 10 years now. Will, you moved with me (and for me) to little, little Belgium. You embraced my country, its traditions, history and culture (It is amazing that you now know more facts about Belgium than me). Even when things are not easy, I can always count on you. I want to thank you for your understanding, your support and your love. Thanks for walking this PhD journey with me. It was a long trip, longer than expected, but together we made it to the top of this mountain. Now that we are here, we see many more mountains to climb. I am not sure which mountain we will climb next, but I know together we can pick any and reach the top! Love you!

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List of abbreviations

ANA	Attribute non-attendance
ANOVA	Analysis of Variance
AOI	Area of interest
CE	Choice experiment
CFI	Comparative Fit Index
DF	Degrees of Freedom
EC	European Commission
EU	European Union
GCSD	German Council for Sustainable Development
GFI	Goodness of Fit Index
NCA	National Coffee Association
NNFI	Non-Normed Fit Index
M	Mean
RMSEA	Root Mean Square Error of Approximation
SD	Standard Deviation
SFA	Swedish Food Agency
SEM	Structural Equation Modelling
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
WTP	Willingness to pay

Chapter 1

General introduction, objectives and thesis outline

1.1 General introduction

This dissertation focuses on sustainable food consumption and sustainability labeling. An increasing number of consumers are concerned about the way their food is produced. While consumers care about the physical properties of their food, they also increasingly consider the ethical and environmental attributes (Briggeman and Lusk, 2011; Vermeir and Verbeke, 2006) which has led to a growth in the number of sustainability food claims. The influence of sustainability labeling on food choice and the consumer preferences towards a range sustainability labels are studied in this dissertation. In addition the motivation and ability to use these labels as well as the visual attention given to them during food choice are studied. Grunert et al. (2014) use the motivation-opportunity-ability framework to explain the determinants of behavior with respect to the use of sustainability labels. Sustainability labels give consumers the opportunity to take sustainability characteristics into account but do not imply they will be. Whether they will use these labels is influenced by their degree of motivation and ability to use the information (Grunert et al., 2014). Before further elaborating on the use of sustainability labeling in consumer food choice (section 1.2), this general introduction first describes sustainability, its importance in the context of food policies and more details on the types of sustainability labeling. Following this general introduction, the conceptual framework is discussed in detail (section 1.2).

1.1.1 Defining sustainability and sustainable diets

Sustainability is a multidimensional concept and is defined by the World Commission on Environmental Development (WCED, 1987, p 8) as “meeting the needs of the present without compromising the ability of future generations to meet their needs”. The three pillars of sustainable development have been defined as social, environment and economic (UN, 2014), and are also referred to as the three Ps (People, Planet, and Profit). In this dissertation, similarly as Grunert et al. (2014) who studied the effect of sustainability labeling on food products on consumers, the approach from the WCED (1987) was followed describing sustainability with two dimensions: the temporal and the social dimension. “The temporal dimension is related to trade-offs between present and future and mainly related to environmental issues, whereas the social dimension is related to trade-offs between consumers and others, commonly subsumed under the heading of ethical issues” (Grunert et al., 2014, p 178). Consequently, as in line with Grunert et al. (2014), environmental and ethical labels can be distinguished (see Section 1.1.3) which are both included in the dissertation.

Several organizations have attempted to define a sustainable and healthy diet. The World Wide Fund for Nature (WWF) defines it as "a diet that is healthy, affordable, environmentally sustainable and culturally acceptable - … its focus is on mitigating greenhouse gas emissions, but it incorporates health, socio-cultural, economic and qualitative elements as well" (WWF LiveWell, 2013a, p 4). The Food and Agriculture Organization of the United Nations (FAO, 2012, p 7) on the other hand, considers health aspects to be inextricably linked to sustainability in the food context and defines sustainable diets as "diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources". As argued by Garnett (2014, p 4), these definitions about (healthy and) sustainable diets are definitions most people can agree upon, but "broad definitions tend to lack meaningful specificity". Sustainability is a broad, multidimensional concept; however, when referring to a sustainable diet, the concept is often narrowed down to environmental sustainability (Garnett, 2014). This is also the approach in Chapter 2, which is focused on environmentally sustainable diets. In the other research chapters (3 to 6), however, both the environmental and the ethical sustainability labels are included.

1.1.2 Gaining importance of sustainability in food policies

The integration of public health nutrition and environmental sustainability goals is a primary challenge for twenty-first century food policies (Lang and Barling, 2013). A growing amount of evidence shows that Western dietary habits negatively impact both the environment and people's health, leading to irreversible resource depletion and pollution as well as the rising incidence of diet-related non-communicable chronic diseases (FAO, 2006; Linseisen et al., 2002; Tukker et al., 2006; Westhoek et al., 2014). Given this double burden associated with contemporary Western food and dietary choices, there is an urgent need to encourage the adoption of healthy diets that are also environmentally sustainable.

Given the inseparable environmental and health impact of dietary choices, integrating health and sustainability goals has become a highly topical issue in policy development and consumer communication with the potential to encourage consumers adopting healthier and more sustainable eating behavior. Increasing evidence shows the possibility to compose diets that are both sustainable and healthy, but their potential success largely depends on consumers' willingness and ability to change behavior. Although the majority of interventions and food policy actions in the past have focused on achieving specific health goals (Capacci et al., 2012), some more recent policy initiatives

initiated by national governments or at the European Union (EU) level started addressing explicitly healthy and sustainable food consumption and production (see Barling, 2011; GCSD, 2013; HCN, 2011; SFA, 2015 and also see more details in Chapter 2). Garnett et al. (2015), European Commission (EC, 2012a) and Reisch et al. (2013) provided an overview of the policy instruments, approaches and actions that could foster healthy and sustainable food consumption including communication or information provision tools, economic or fiscal tools, regulatory tools and behavioral tools. Economic and regulatory tools are approaches which target to change the market environment. Regulatory tools include laws, directives and regulations targeting local and national authorities, producers or retailers rather than consumers. Examples are regulations influencing food quality and food production and green public procurement. Economic tools are market-based instruments that influence purchasing decisions through taxation, incentives, subsidies, and penalties to make sustainable products more competitive and affordable (EC, 2012a; WWF Livewell, 2013b). The communication and information provision tools are tools enabling more informed food choices and refer to food labeling, information, advertising and marketing campaigns, educational programs, printed materials and website and other awareness-raising tools (EC, 2012a; Garnett et al., 2015). This dissertation focuses on information provision tools to enable more informed food choices. As mentioned by EC (2012a, p45), these tools "aim at providing information on a product or service to consumers, with the hope that informing consumers and raising awareness about certain product attributes will influence consumer behavior".

While there are policy tools in place aiming to encourage healthy food consumption, fewer tools are applied to encourage sustainable food consumption. While most consumers are educated on the importance of healthy eating, they do not necessarily know about the importance of sustainable food consumption (EC, 2012a). Knowledge is not enough to lead to sustainable behavior but it is a starting point. A priority action identified by the European Commission (EC, 2012a) is to encourage sustainable food patterns by instruments that support more informed food choices. This includes information-oriented approaches listed earlier which educate, promote and empower consumers to make sustainable food choices, such as food labeling, marketing and advertising campaigns, educational programs (EC, 2012a; Garnett et al., 2015). While these tools empower them to take sustainability into account, they are also aimed at increasing the motivation to consume sustainable and thus to make sustainable food choices. Motivational factors include engagement in sustainability issues, interest and involvement in sustainable food, importance of sustainability characteristics, the awareness and concern about sustainability issues related to food which are all linked to consumer's motivation and these terms might be used interchangeably. While many consumers may be interested in sustainable and healthy food (Grunert et al., 2010; 2014; Verain et al., 2012), the success of policy actions aimed

at informed choices largely depends on whether consumers' motivation such as interests and favorable attitudes are turned into action.

Since sustainability characteristics of foods are typical credence attributes, consumers should be informed about their presence, their exact nature and about the benefits these attributes provide in order to be able to make informed decisions. Sustainability labeling gives consumers the opportunity to consider sustainability characteristics. Sustainability labels are thus tools that can help to translate consumers' motivation in sustainable food consumption into action and assist them in making sustainable food choices. In addition to being a tool to identify a sustainability character, being exposed to these labels and their meaning helps to build consumer awareness and concern about sustainability issues (Garnett et al., 2015). This dissertation focuses on the preferences, willingness-to-pay (WTP) and knowledge of sustainability labels as well as the use of these labels during the decision-making.

While many studies have evaluated factors influencing the use of nutrition labels, less research has focused on factors influencing the use of sustainability labels on food. Nutrition labels on food packages provide information about the product's nutritional content and health value. However, even if consumers are motivated to eat healthily, several barriers exist for the use of this information to be translated into healthy food choices, such as the lack of attention, knowledge and understanding of the nutrition information on pack (Grunert and Wills, 2007; Grunert et al., 2010; 2012). While the nutritional composition of foods is consistently reported, health-related information provided through claims and symbols may be more difficult for consumers to understand and use in assessing the health-related food quality (Hieke et al., 2015). For sustainability aspects, it is perhaps even more difficult for consumers to make informed choices as information about the sustainability impact of food products is not always available or not reported in a consistent way. Similarly as with nutritional labels, various barriers exist regarding the use of sustainability labels (Grunert, 2011) and these are discussed in the conceptual framework (Section 1.2).

1.1.3 Sustainability labeling

An increasing number of consumers are concerned about the way their food is produced. While consumers care about the physical properties of their food, they also increasingly consider ethical and environmental attributes in food (Briggeman and Lusk, 2011; Vermeir and Verbeke, 2006) which are referred to as sustainability attributes. The United Nations Conference on Trade and Development (UNCTAD, 2013) defines sustainability claims as "distinctive marks, marketing labels and brands, developed by public and private sector institutions and placed on products and services attesting that their products and supply chains incorporate the pillars of sustainability (economic, social and

environmental) into their agricultural production, processing, manufacturing and export processes and services". The difficulty of signaling the sustainable properties of food products is a major challenge for producers, policy makers, and non-governmental organizations. Properties of sustainability are credence attributes which can only be taken into account by consumers if these attributes are properly signaled at the point-of-sale, e.g. by means of claims. The increasing demand for sustainable food has led to a growth in the number of sustainability claims used by food manufacturers to differentiate their products. Such claims[1] can include textual, pictorial, graphic or symbolic representation, which states, suggests or implies that a food has sustainability characteristics and is generally backed up by a certification system. These sustainability claims, especially when they are more than a textual message, are often referred to as sustainability labels. In this dissertation, these terms are used interchangeably.

Voluntary sustainability labels and their corresponding standards have emerged during the past decades focusing on a range of sustainability issues. The growth in sustainability labels is one of the signs of their increasing popularity. The European Commission (EC) reported the existence of a total of 129 food information schemes related to sustainability at the European Union (EU) level as a whole or at the national level in a specific EU Member State (EC, 2012b). Several sustainability labeling standards for food have been developed in recent years dealing with one or more sustainability aspects. In this dissertation, similarly as Grunert et al. (2014), sustainability labels primarily related to environmental issues (i.e. environmental labels) and ethical issues (i.e. ethical labels) can be distinguished. Sustainability claims on ethical issues include topics as animal welfare (e. g. Animal Welfare Approved, Certified Humane), free range (EU free range rules) and fair trade (Fairtrade and US Fair Trade). Other sustainability claims that address environmental issues refer to local food production, carbon footprint (Carbon Trust carbon footprint), food miles, or sustainable fisheries and aquaculture labeling (MSC, Marine Stewardship Council and ASC, Aquaculture Stewardship Council). Rainforest Alliance and UTZ certified mainly addresses environmental aspect for agricultural commodities such as coffee, tea and cocoa. Organic food labeling addresses both environmental and ethical aspects (EC, 2014).

Some national dietary guidelines now include advice consumers to purchase food with sustainability labels. The Sustainable shopping basket, a guide of the German Council for Sustainable Development (GCSD, 2013) refers to sustainability labeling on foods including as organic, Rainforest Alliance, MSC, Fair trade. The Swedish Food Agency (SFA, 2015) refers MSC, ASC, organic and free-range in their

[1] Definition for claim (EC 1924/2006): "'claim' means any message or representation, which is not mandatory under Community or national legislation, including pictorial, graphic or symbolic representation, in any form, which states, suggests or implies that a food has particular characteristics"

dietary guidelines. The WWF LiveWell for LIFE identified six principles to promote and facilitate the adoption of healthy and sustainable diets of which one is the advice to "buy food that meet a credible certified standard- consider MSC, free-range and fair trade" (WWF Livewell, 2015).

Consumers need sustainability-related information to guide sustainable food choices. Ideally, this information should be clear, comprehensive, comparable and credible so that consumers trust the information. While these sustainability labels provide information to consumers and aid in making sustainable food choices, the proliferation labels however may have a negative impact. This is a challenge for the future as large number of labels may lead to confusion. Consumer could become overwhelmed and insecure about which information they can trust. The proliferation of labels may thus lead to information overload and loss of credibility among consumers rather than helping them.

1.2 Conceptual framework: From sustainability labels sustainable food choice

Sustainability characteristics of food are credence attributes. This type of attribute is neither directly observable by consumers before purchase, nor can it be experienced after purchase. Sustainability labeling programs are designed to support consumers' food choice since they serve as a tool to explicitly communicate the presence of sustainability aspects on food products. Sustainability labels empower consumers to take certain sustainability aspect into account when making food choices. There is a hierarchy of effects (or stages) that the consumer should go through before making a purchasing decision going from sustainability labels exposure to decision-making (Figure 1.1) (Grunert, 2011; Thøgersen, 2002). Since this decision-making process consists of a number of consecutive stages, it is rather lengthy and it might be disrupted at one of the stages in the decision-making process.

Consumers encounter several barriers that may prevent sustainability labels from affecting their food choice and leading them into more sustainable eating behavior (Grunert, 2011; Vermeir and Verbeke, 2006). Grunert (2011) identified four barriers along the process from exposure to decision-making which may prevent consumers, even when motivated, from using sustainability labels to make sustainable food choices. A first barrier is that consumers who are exposed to sustainability labels do not notice or perceive the label. Secondly, the information might not be processed in-depth but only peripheral processed, without much effort to understand what the label stands for. However, even when the label is not understood, it can still be liked. Thus even peripheral processing of the label may still result in a positive attitude towards the label and consumers may still use it in their decision-making without putting effort into understanding the label. When consumers are applying in-depth processing, they may still make wrong inferences, which is identified as the third barrier. A fourth barrier preventing sustainability labels to lead motivated consumers to sustainable food choices is

during the decision-making when the sustainability attributes is traded-off against other criteria such as price, taste, convenience, brand, origin, health-related aspects (e.g. healthfulness, nutrition information) and other quality attributes. All these other attributes compete with sustainability labels and may influence the choice behavior. This fourth barrier may cause an attitude-behavioral gap which shows that positive attitudes towards sustainable food choices are not always strongly linked to sustainable food choice behaviors (Krystallis et al., 2012; Vermeir and Verbeke, 2006). This refers to consumers who are concerned about sustainability aspects of food and have a positive attitude towards sustainable food but still put sustainability aspects of food as a lower priority compared to these other product attributes at the time of purchase.

Grunert et al. (2014) use the motivation-opportunity-ability framework to explain the determinants of the use of sustainability labels. The motivation-opportunity-ability framework is also applied in the theoretical framework (Figure 1.1). Sustainability labels give the opportunity to take sustainability characteristics into account but do not imply they will be taken into account. First of all, consumers need to notice the labels present (visual attention). Whether consumers will use the label depends on their motivation (willingness) and ability to use the information (Grunert et al., 2014). Thus motivation to behave sustainably and support sustainability (even at the time of purchase) has an influence. Additionally, the process is also affected by consumers' knowledge and awareness about the label and whether they find it credible (Grunert, 2011). This is described in more detail in the following sections.

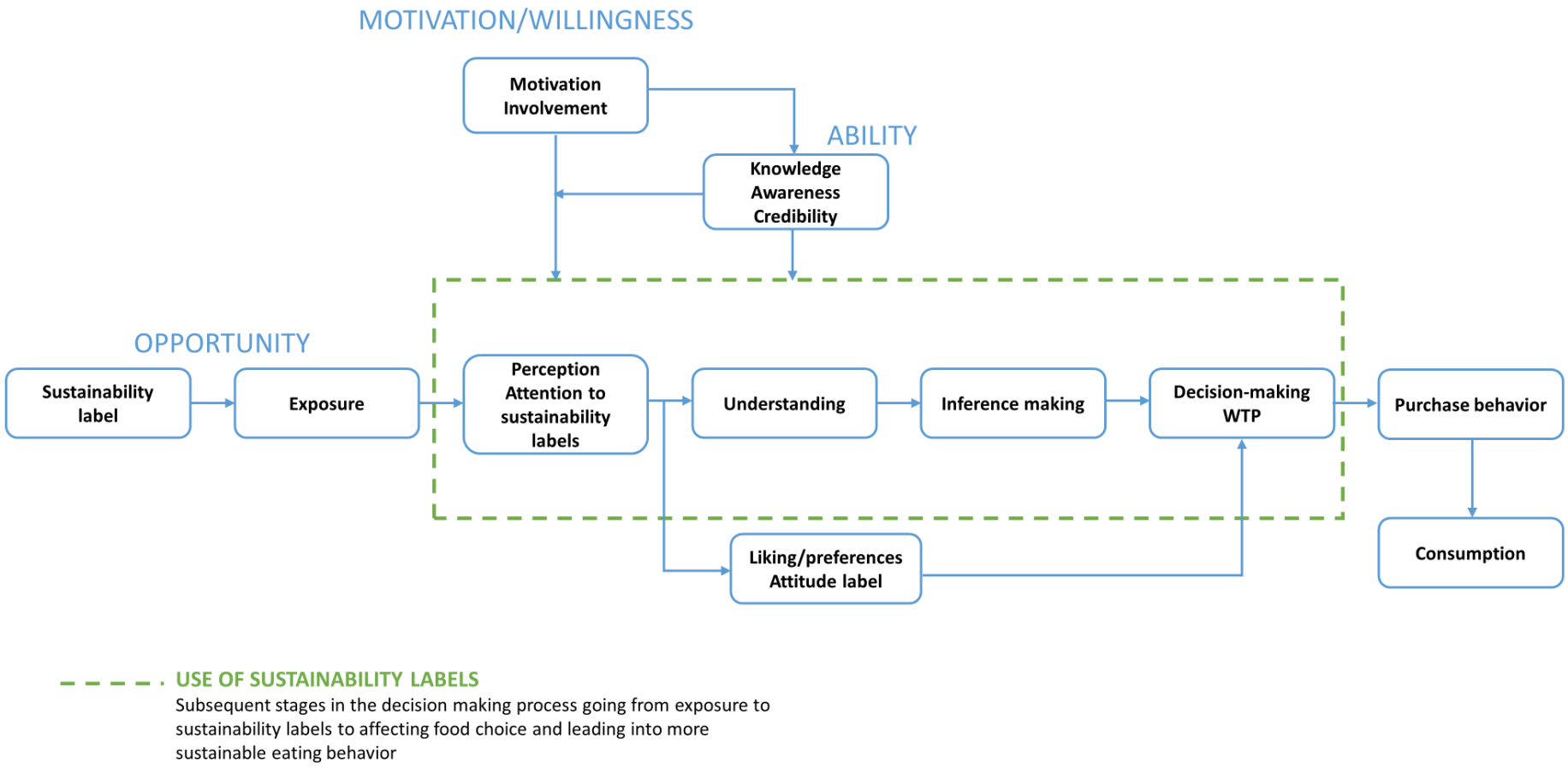


Figure 1.1. Hierarchical framework of effects of exposure to sustainability labels on sustainable food choice (based on Grunert, 2011 and Grunert et al., 2014 adapted)

1.2.1 Degree of motivation

Grunert et al. (2014) mentioned that motivation can be defined at different levels such as the more abstract human values (Schwartz, 1992) which was linked to sustainable behavior (de Boer et al., 2007, Vermeir and Verbeke, 2006) or as sustainability concerns, a more concrete a source of motivation (Grunert et al., 2014). Other factors are linked to the motivation to use sustainability labels and make sustainable food choices such as awareness and interest in sustainability, attitude towards sustainability and sustainable food, beliefs, involvement, perceived consumer effectiveness (PCE), involvement in sustainable food and the importance attached to sustainability attributes (Grunert, 2011; Grunert et al., 2014; Vermeir and Verbeke, 2006; Thøgersen, 2000).

Consumers are more likely to choose sustainable food products, when they are interested in sustainable food, and involved in sustainable eating. Involvement in the context of this dissertation refers to "the personal relevance and importance attached to these concepts based on inherent needs, values and interests" (Zaichkowsky, 1985, p 342). Verbeke and Vackier (2004) described involvement is a motivational force, which may have an influence of various steps in the consumer decision-making process including the extensiveness of information search, length of decision-making process, formation of beliefs, attitudes and intentions and behavioral outcomes (Verbeke and Vackier, 2004). Involvement is thus an important motivational aspect related to attitude, behavior and food choice (Pieniak et al., 2008, 2010a) and has been shown to have robust effects on consumers' purchase and eating decisions (Marshall and Bell, 2004). Vermeir and Verbeke (2006) reported that consumers with a high involvement have more positive attitudes and are more willing to consume sustainable food.

Motivation may thus affects whether consumers exposed to sustainability labels will use the labels to make a choice. Higher motivation is likely to result in more effort to understand the meaning of the labels, more in-depth information processing and higher likelihood to use them during the decision-making and weigh them against other attributes (Grunert et al., 2014). However, as previously described even for motivated consumers, their positive attitude towards sustainable food does not necessarily translate in sustainable food purchases when sustainability labels are present as they may not be motivated to support sustainability at the time of purchase (Grunert, 2011; Krystallis et al., 2012; Vermeir and Verbeke, 2006).

1.2.2 Taking the opportunity: attention as a first step

The sustainability label on the food package should at a minimum be noticed by consumers (Grunert, 2011; Thøgersen, 2000). Consequently, exposure to the label followed by attention are the first steps

in information processing (Solomon, 2013), possibly leading to informed sustainable food choice. However, when shopping for food, consumers may be overwhelmed with the information provided and time constraints may prevent them from attending to the wealth of available information on food products. Overloading the package with a lot of information make it more difficult to extract the desired information and more difficult to process it and may even lead to confusion as well as a lack of interest and confidence (Verbeke, 2005). As mentioned by Grunert (2011), the information (over)load may limit the use of sustainability labels. Consumers may apply heuristics to simplify their decision and as a result not pay attention to all the product attributes when choosing food (Verbeke, 2008).

Attention is an important step in the consumer decision-making process as it is a prerequisite for information processing. Solomon et al. (2013, p 134) define attention as "the degree to which consumers focus on a stimulus within their range of exposure". With eye-tracking technology, respondent's gaze can be recorded to monitor their visual attention when making food choices. Visual attention is influenced by bottom-up and top-down factors (Behe et al., 2015; Corbetta and Shulman, 2002; Pieters and Wedel, 2004; van der Laan et al., 2015). Bottom-up or stimulus-driven factors are characteristics of the stimulus itself (color, size, location, saliency of the background) and top-down factors are related to the person and his attention-process including involvement/motivation and familiarity (Pieters and Wedel, 2004). Consequently bottom-up or stimulus-driven form of attention is an automatic form of attention caused by characteristics of the stimulus itself and occurs without specifically searching for it (Wolfe, 1998). Top-down or goal-directed form of attention, on the other hand, is caused by interest and motivation and is the voluntary search for specific information (Koch, 2004). This is based on pre-existing preferences, interests, personal goals and involvement (Ares et al., 2013; Pieters and Wedel, 2004).

Consumers' willingness to consider sustainability attributes, thus consumer motivation, influences the search for this information and information processing. This is based on the elaboration likelihood model (ELM) (Petty and Cacioppo, 1986) which states that the motivation, ability and opportunity influence the information processing. Central processing will take place when both motivation and ability are high and leads to in-depth information processing. On the other hand, low motivation or low ability may lead to no processing or peripheral processing. With peripheral processing, consumers might still form a positive attitude for the label, although likely a less stable attitude, and may even use it in decision-making, without putting much effort into understanding what the label stands for (Grunert, 2011). Verbeke and Vackier (2004) relate information processing directly to involvement, a motivational force. Highly involved consumers will likely more actively search for information and use

more information before buying (Laaksonen, 1994; Verbeke and Vackier, 2004). This is because high involvement by leads to more cognitive effort in order to satisfy an important personal need and thus leads to an active search and use of information (Verbeke and Vackier, 2004). Low involvement, on the other hand, is "associated with routine, habitual or impulsive behavior without extensive processing of information" (Verbeke and Vackier, 2004, p 159).

Behe et al. (2015) reported that the level of consumers' involvement and the importance placed on products (garden plants) can influence visual attention. Specifically, they reported that highly involved consumers exhibit greater fixation counts and greater total fixation duration on product information compared to consumers with a lower product involvement. Similarly, it is likely that consumers attaching more importance to sustainability aspects of food are more motivated and will visually attend more to sustainability information during food choice.

1.2.3 Degree of ability: Awareness, knowledge and credibility

A lack of awareness and understanding of the meaning of a sustainability label may prevent consumers with positive attitudes towards sustainability to use the label correctly. As mentioned by Thøgersen (2000, p 288), "knowing a label is a prerequisite for using it in decision-making and understanding is a prerequisite for using it correctly". Awareness thus forms the basis for understanding and effective use of labels. It is also necessary that consumers deems the label as credible, trust it and feel that the information provided by the label assists him to make more sustainable choices (Grunert, 2011). Although even when the label is not understood, consumers may still like the label and may still use it in their decision.

Grunert et al. (2014) reported that sustainability label use is related to understanding and that motivation and understanding can be related. A higher motivation leads to more effort to learn about the sustainability labels and this higher degree of understanding leads to more use of the labels. On the other hand, knowledge also has a moderator effect since better understanding of the labels makes it easier to translate motivation into behavior and use of the labels. A wide range of sustainability labels have been developed and the knowledge of the meaning of each of these labels is rather low but differs across the labels (Gadema and Oglethorpe, 2011; Grunert et al., 2014).

While this dissertation (Figure 1.1) applied the motivation-opportunity-ability framework, it is important to acknowledge other factors influencing the consumer decision-making process, which can be divided into person-, product- and environmental-related factors. As mentioned by Kotler et al. (2013), there are four sets of consumer characteristics (i. e. personal-related factors) that influence

the consumer decision-making process. These include personal (demographics, personality, lifestyle), psychological (knowledge, perceptions, motives, attitudes, involvement), cultural (social class), reference group) and social factors (family, reference groups). In addition to consumer characteristics, environmental factors (e.g. situational influences such as time and occasion), and product-related factors (e.g. price, place, promotion, product attributes) may influence the process. Product attributes will influence the final choice as sustainability attributes will be traded off against other quality characteristics such as price, taste, convenience, brand, origin, health-related aspects (such as nutrition information). The use of a sustainability label may also be influenced by the type of product as well as specifics of the sustainability label on the package (format, color, representation, size, front or back of the package etc).

1.3 Research objectives and research questions

From an empirical point of view, this doctoral dissertation investigates separate phases from the framework as described in Figure 1.2. Firstly, the involvement in sustainable diets and healthy diets are studied, which can be a motivation to use sustainability labels. Secondly, consumers' preferences towards and WTP for a wide range of sustainability labels, focusing on different facets of sustainability, on yoghurt, chicken and coffee are investigated. Thirdly, the knowledge and awareness of organic labels are examined. This relates to the ability to use the information from the framework. Fourthly, visual attention to the labels is investigated which is identified as one of the first steps in the consumer decision-making process and gives an indication of the use of sustainability labels without relying on self-reported measures. From a methodological point of view, the doctoral dissertation studies the use of eye-tracking as a tool to evaluate visual attention and visual attribute non-attendance (ANA) which are incorporated in the choice modeling. Consequently, five main research objectives are distinguished. Figure 1.2 relates the research objectives to the conceptual framework. An overview of the research objectives and corresponding research questions are shown in Table 1.1. The empirical and methodological contributions are elaborated more in detail in section 1.5.

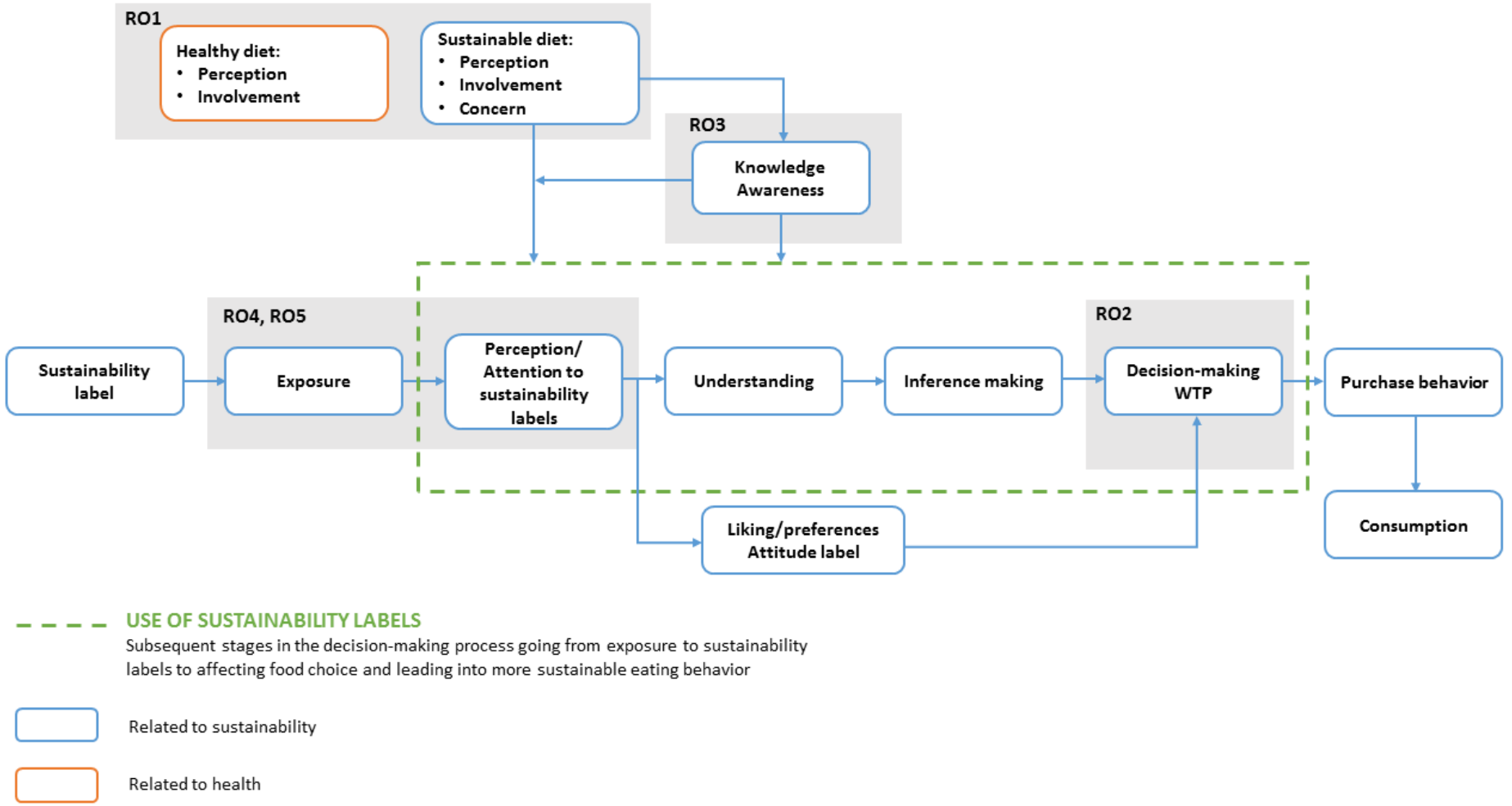


Figure 1.2. Research objectives in relation to the research framework

Table 1.1. Overview research objectives and corresponding research questions

Research objectives	Research questions	
1: Identify the involvement in sustainable eating	*RQ1*	*How are sustainable diets perceived?*
	RQ2	*Which consumer segments can be identified based on their involvement in healthy and sustainable eating?*
	RQ3	*What determines involvement in sustainable eating?*
2: Examine the consumers' preferences and WTP toward sustainability labeling (on yoghurt, meat and coffee)	*RQ4*	*What are the consumers' preferences and WTP for organic labels on yoghurt?*
	RQ5	*How do people with a different buying behavior differ in terms of WTP premium for organic yoghurt?*
	RQ6	*What are the consumers' preferences and WTP for sustainability labels on meat (including free range claims, organic labels (EU logo and Belgian Biogarantie), EU Animal welfare label, and Carbon Footprint label)?*
	RQ7	*What are the consumers' preferences and WTP for sustainability labels on coffee (including Organic, Fair Trade, Rainforest Alliance and Carbon footprint labeling)?*
3: Explore the consumers' awareness and knowledge of organic labels	*RQ8*	*Do consumers recognize organic labels (EU organic logo and the Belgian Biogarantie organic logo) and do they know what it stands for?*
	RQ9	*Is there an association between consumer attitudes, objective knowledge about organic logos and organic yoghurt purchase frequency?*
4: Examine the visual attention to sustainability labels and its relation with choice behavior	*RQ10*	*How much visual attention is given to price and sustainability attributes during food choice and does it correlate with stated attribute importance?*
	RQ11	*Does visual attention to sustainability labels and price for coffee contribute to explaining choice behavior?*
5: Account for attribute non-attendance in food choice experiments using eye-tracking measures	*RQ12*	*Were the attributes identified as ignored truly ignored?*
	RQ13	*Does accounting for visual attendance influence the model estimates?*

1.3.1 Research objective 1: Identify the involvement in sustainable eating

The first objective aims to investigate the perceptions about healthy and environmentally sustainable[2] diets and consumers' involvement in sustainable and healthy eating. More specifically, three questions are formulated. The first research question asks *How are sustainable diets perceived (RQ1)*. The second research question addresses *which consumer segments can be identified based on their involvement in healthy and sustainable eating (RQ2)*. The third research question explores *what determines involvement in sustainable eating (RQ3)*. Involvement in healthy and sustainable eating may motivate consumption of healthy and sustainable food products. Previous studies have focused either on involvement in healthy eating or in sustainable eating. Specifically, studies have identified health involvement and involvement in healthy eating as important factors explaining eating behavior (Olsen, 2001; Pieniak et al., 2010a,b). Other studies indicated that reported that consumers with a high involvement have more positive attitudes and are more willing to consume sustainable products (Vermeir and Verbeke). Involvement is a motivational force, which may have an influence of various steps in the consumer decision-making process including the extensiveness of information search, length of decision-making process, formation of beliefs, attitudes and intentions and behavioral outcomes (Verbeke and Vackier, 2004) and sustainable food consumption can be stimulated through raising involvement. Segmentation on involvement in healthy and sustainable diet identifies the heterogeneity in involvement healthy and sustainable eating among consumers.

1.3.2 Research objective 2: Examine the consumers' preferences toward and WTP for sustainability labeling (on yoghurt, meat, and coffee)

From an empirical point of view, this doctoral dissertation investigates consumers' preferences towards sustainability labels on dairy (yoghurt), meat (chicken) and coffee. As animal-based products are associated a large environmental burden, dairy and meat are included as specific food categories. With coffee having the largest market share among Fair Trade products, coffee was included as a third food category. A wide range of sustainability labels exists, focusing on different facets of sustainability (see section 1.1.3). Consequently, a variety of sustainability labels were incorporated in this dissertation, related to ethical and environmental issues of sustainability, and in line with the food categories investigated. Since organic labeling is the most common sustainability labeling and applicable on many

[2] In this research objective, sustainable diets are defined as environmentally sustainable diets to make it more specific as "broad definitions tend to lack meaningful specificity" (Garnett, 2014, p4).

food products, it was included as one of the sustainability labels for all three food categories. For meat and coffee, specific sustainability labels for these food categories were included.

This research investigates what consumers are willing to pay extra for a range of sustainability labels on three different products categories (dairy, meat, and coffee). For each of the food categories, the consumer preferences and WTP for the sustainability labels are compared. Next, the specific research questions for each of the food categories and a justification of the sustainability labels included are listed.

In Belgium, similarly as in other EU countries (Soil Association, 2012), dairy products rank second in terms of importance within the organic food basket, preceded only by the fresh fruit and vegetables category (VLAM, 2012). Organic dairy products were occasionally bought by one third (32%) of the Belgian households in 2011 (VLAM, 2012). This indicates that dairy is popular among organic food. Specifically, the research questions related to organic yoghurt are: *What are the consumers' preferences and WTP for organic yoghurt (RQ4).* It also evaluates *how people with a different buying behavior differ in terms of WTP premium for organic yoghurt (RQ5).*

Various sustainability claims are possible on meat products. The most common sustainability claims on the food market are organic food labels. No study has compared the consumer preferences towards the new EU organic logo with national organic logos from governments or private organizations. This has been identified as one of the key research gaps in studies on organic food labeling (Schleenbecker and Hamm, 2013). Meat was included as a product category as the sustainability of meat consumption is highly contested, both for ethical and environmental reasons (de Jonge and van Trijp, 2013a; FAO, 2006). In addition to organic labeling, ethical claims related to farming systems such as free range and animal welfare labels are also possible on meat products. The EU regulates three existing free range claims for poultry meat; however no research has compared consumer preferences and WTP for the three existing EU free range claims on poultry meat. Due to the success of the EU's organic program, the EC is considering a similar approach of creating a harmonized EU animal welfare label, modeled on the EU organic labeling regulations (EC, 2009a). Labels focusing on the environmental dimensions of sustainability such as carbon footprint are also possible and were included. The next research objective focuses on sustainability labeling on chicken breast. Specifically, the research question is *What are the consumers' preferences and WTP for sustainability labels on meat (including free range claims, organic labels (EU and Belgian Biogarantie), EU animal welfare label, and carbon footprint label) (RQ6)*.

Finally, the third food category is coffee. The coffee industry is viewed as a pioneering industry for sustainability certification schemes (Pierrot et al., 2011; Reinecke et al., 2012). Coffee has the largest market share compared to other Fair Trade products. In addition to having more established initiatives in the sustainable certified coffee market such as Fair Trade and Organic coffee, various other third-party sustainability certification schemes have emerged including Rainforest Alliance, Bird Friendly, and UTZ certified (Consumers International, 2005; Dragusanu et al., 2014; Pierrot et al., 2011). Consumer preferences among various sustainability labels on coffee are compared: *What are the consumers' preferences and WTP for sustainability labels on coffee (including Organic, Fair Trade, Rainforest Alliance and Carbon footprint labeling)?* (*RQ7*).

1.3.3 Research objective 3: Explore the consumers' awareness and knowledge of organic labels

Recognition of the label is an indicator for label awareness (Thøgersen, 2002) which may influence the decision-making process in respect to organic food purchases. A lack of awareness and understanding of the meaning of a sustainability label may prevent consumers with positive attitudes towards sustainability to use the label (correctly). The research question addresses this by investigating *whether consumers recognize organic labels (EU organic logo and the Belgian Biogarantie organic logo) and whether they know what it stands for (RQ8)*. Additionally, the next research question explores: *is there an association between consumer attitudes, objective knowledge about organic logos and organic yoghurt purchase frequency* (*RQ9*).

1.3.4 Research objective 4: Examine the visual attention to sustainability labels on coffee and its relation with choice behavior

This objective aims to explore how visual attention relates to importance, preferences and consumer food choice behavior for sustainable certified coffee by measuring visual attention to price and sustainability attributes during food choice. It measures the attention to sustainability information which might be related to the involvement (Pieters and Wedel, 2004). It gives insights on the use of sustainability information on food packages. Instead of relying on self-reported use, visual attention to sustainability labels is measured by eye-tracking. While past studies have evaluated consumers' visual attention to nutrition information during food choice with the use of eye-tracking, no studies have applied this method to sustainability information. The current study contributes to this research gap by studying the visual attention paid to several sustainability labels on coffee. Consequently, the next research questions investigate *how much visual attention is given to price and sustainability attributes during food choice and does it correlate with stated attribute importance (RQ10)* and d*oes*

visual attention to sustainability labels and price for coffee contribute to explaining choice behavior (RQ11). In particular, it is investigated whether a participant's degree of visual attention relates to his or her preference and WTP for that particular attribute when having to make trade-offs with other attributes. Overall, the analyses allow determining if consumers who pay more attention to an attribute value it more.

1.3.5 Research objective 5: Account for attribute non-attendance in food choice experiments using eye-tracking measures

This objective aims to investigate the incorporation of eye-tracking measures to help address attribute non-attendance (ANA) in choice experiments (CEs). In a CE, respondents are asked to select their preferred alternative from a given set (i.e., the choice set) in which each alternative is described by attributes of varying levels. Respondents are then asked to make selections from a series of choice sets. The analysis of CE data is based on the economic theory of consumer behavior (Lancaster, 1966; McFadden, 1974), which assumes continuous preferences and thus unlimited substitutability between the attributes employed (Hoyos, 2010). This continuity axiom implies that respondents, when choosing their most preferred alternative, consider all the attributes presented to them as well as the trade-offs in terms of gains and losses between attributes (Hensher et al., 2005). However, a growing number of studies have questioned the assumption of compensatory behavior because respondents may ignore some of the described attributes while evaluating alternatives in a choice task (Campbell et al., 2008; 2011; Carlsson et al., 2010; Hensher, 2006; Hensher and Greene, 2010; Hensher et al., 2005; 2012; Hole, 2011; Kragt, 2013; Lancsar and Louviere, 2006; Scarpa, et al. 2009; 2010). In the CE literature, this is referred to as attribute non-attendance (ANA). This decision heuristic has gained increased attention in the CE literature (Hensher, 2014). Not accounting for ANA has been found to affect coefficient estimates and model performance (Campbell et al., 2008, 2011; Carlsson et al., 2010; Hensher and Rose, 2009; Mariel et al., 2013; Scarpa et al., 2009; 2010).

Two methods have been proposed to identify ANA in CEs. The first is to ask the respondents additional questions about which attributes they ignored (i.e., stated ANA). The second is to infer ANA based on observed choices (i.e., inferred ANA). With this research objective, a third method is proposed namely visual ANA, measured by eye-tracking while respondents are answering the CE questions. Balcombe et al. (2015) defined visual ANA as visually ignoring information about attribute levels. This method uses eye fixation, which is an eye-tracking measure that can be used as an indicator of visual attention (Balcombe et al., 2015). Specifically, eye fixation counts were used to develop a discrete measure of visual attendance to determine whether a respondent visually attended to an attribute. In this

research objective, two definitions for detecting whether a specific attribute was ignored during a choice task were applied based on the visual attention (1) to the specific attribute in the choice set as a whole and (2) to the specific attribute in each of the alternatives within the choice set. Two fixation count of cutoff points were used (fixation count one and fixation count two). In addition, two modelling methods were used to account for visual ANA, one at the choice set level (choice task visual ANA) and one at the respondent level (serial visual ANA). This results in a total of six approaches to account for visual ANA. The research question investigates, for each of the six approaches, *whether the attributes identified as ignored were truly ignored* (*RQ12*). The final research question is *whether accounting for visual attendance influences the model estimates* (*RQ13*).

1.4 Research design, data sources

Data required to meet the research objectives and to investigate the research questions are collected through quantitative research procedures (surveys) as well as observational procedures (eye-tracking). Table 1.2 gives an overview of the data sources used for the five research chapters in this dissertation. More detailed descriptions of the study samples are included in each of the research chapters.

Table 1.2. Research design and data sources

Empirical application	Type of data	Country	Chapter	Methodology applied
Study 1: Involvement in healthy and sustainable eating	Survey	Belgium, Germany UK, the Netherlands (n=2783)	Chapter 2	Segmentation and linear regression
Study 2: Organic yoghurt	Survey	Flanders, Belgium (n=774)	Chapter 3	Payment card and SEM
Study 3: Sustainability labels on meat	Survey	Flanders, Belgium (n=359)	Chapter 4	CE
Study 4: Sustainability labels on coffee, visual attention and visual ANA	Survey and observational (eye-tracking)	Fayetteville, AR, United States (n=81)	Chapter 5	CE, including visual attention
			Chapter 6	CE, including serial and choice task visual ANA

The primary data used in Chapter 2 were collected in May 2014 through a cross-sectional quantitative online survey with samples representative for age, gender and region in four EU countries (UK, Germany, Belgium, and the Netherlands) (n=2783). Participants were selected from nationally representative consumer panels managed by the market research agency responsible for the data

collection which abides the ICC/ESOMAR International Code on Market and Social Research (ICC/ESOMAR, 2008). Ethics approval for the study protocol, participant information materials and research instruments was obtained (approval registration number B670201420982, May 15, 2014). The master questionnaire was developed in English and translated by a professional translation office into the three respective national languages (German, French and Dutch).

Data for Chapter 3 and 4 were collected through a cross-sectional consumer survey in the Northern Dutch speaking part of Belgium (Flanders) in March 2012 targeting the main responsible for food purchasing. Total sample sizes were 774 and 359 respondents for Chapter 3 and 4 respectively. Participants were selected from the proprietary consumer panel, managed by the market research company responsible for data collection.

Chapter 5 and 6 are based on survey and lab experiment data. Participants were recruited from a consumer database (N=6,500) managed by the University of Arkansas Sensory Service Center (Fayetteville, AR, US). The consumer database contains area residents of Northwest Arkansas, In total, 81 consumers who purchased coffee in the last two months (March, April 2013) and did not have any eye disease or eye surgery in the past participated.

1.5 Research contributions

1.5.1 Empirical contributions

The empirical contributions of this dissertation lie in the topics investigated. Many studies have evaluated consumers' perception of health-related food aspects (Carrillo et al., 2011; Hoefkens et al., 2013; Mazzochi et al., 2015; Van Wezemael et al., 2014) or sustainability aspects (Grunert et al., 2014; Siegrist et al., 2015a; Vanhonacker et al., 2013). However, there is scant literature investigating both aspects simultaneously (Aschemann-Witzel, 2015; Garnett et al., 2015; Verain et al., 2015). With plant-based diets being advocated as healthier and more sustainable, the match or mismatch between the images of sustainable, healthy and plant-based diets is investigated.

Health and environmental sustainability challenges with respect to food need to be tackled together from a policy perspective as they are closely connected (Aschemann-Witzel, 2015; Kjærgård et al., 2014). Food policies targeting both healthy and sustainable food consumption behavior may be potentially effective if, firstly, healthy and sustainable diets are available, affordable and attractive, and, secondly, consumers are motivated and able to make healthy and sustainable food choices. Regarding the first condition, various studies have shown the possibility to compose a diet that is both healthy and has a low environmental impact (Ciati and Ruini, 2012; Garnett, 2011, 2014; Macdiarmid

et al., 2012; Van Dooren et al., 2014; Westhoek et al., 2014), although sometimes trade-offs are needed as healthy food options may not necessarily be the most sustainable or cheapest option (Aschemann-Witzel, 2015; Macdiarmid, 2013). Specifically, reducing meat and dairy consumption, while eating more plant-based foods have been set forth as being beneficial for both the environment (Baroni et al., 2006; Pimentel and Pimentel, 2003; Reynolds et al., 2014; Sabaté and Soret, 2014; Stehfest et al., 2009), and public health (Reiss et al., 2012; Slavin and Lloyd, 2012). This was also suggested by the Barilla Center for Food and Nutrition who proposed a double food pyramid and suggested a connection between health and environmental sustainability as food with a higher recommended consumption level also has a lower environmental impact (Ciati and Ruini, 2012). However, nutritional and sustainability characteristics of diets are not necessarily aligned, meaning that healthier diets are not necessarily more environmentally friendly, nor are more environmentally beneficial diets necessarily healthier (Macdiarmid, 2013). Nonetheless, diets exist that are both healthy and have a low environmental impact (Garnett, 2014; Macdiarmid et al., 2012). For example, the Health Council of the Netherlands (HCN, 2011) identified dietary choices resulting in a win-win in terms of health and ecological benefits and recommended in this respect a shift to a less animal-based and a more plant-based diet. As part of an introduction to the sustainability in the food context, the first research objective of the dissertation focusses on the environmental dimension of sustainability and examines how an environmental sustainable diet is perceived and whether this aligns with a healthy and plan-based diet. It also evaluates current consumer involvement to healthy and sustainable eating. The involvement in sustainable diets can be a motivation to use sustainability labels, which leads to the main topic of this dissertation.

The main empirical contribution of the dissertation is on the influence of sustainability labeling on food choice, including both ethical and environmental labels (see also Section 1.1.3). Sustainability labeling can be used by policy makers as a policy tool to promote sustainable food choices and by producers, retailers, as a marketing tool. For policy makers but also for producers and others in the food supply chain, it is important to know about consumers' preferences for sustainability claims. From an empirical point of view, this dissertation investigates consumers' preferences and WTP for sustainability labels in three food categories: dairy (yoghurt) in Study 2, meat (chicken breast) in Study 3 and coffee in Study 4. A wide range of sustainability labels focusing on different facets of sustainability are included: Organic, Carbon footprint, Animal welfare, Free range, Fair Trade and Rainforest Alliance. The knowledge and awareness of organic labels are examined, which relates to the ability to use the label. Visual attention to sustainability label during food choice is investigated.

Since animal-based food products have the highest environmental impact, these products are under more pressure. Food policies which incorporate sustainability recommend limiting meat consumption and advice to choose sustainably produced meat, referring to organic, free range and improved animal welfare (SFA, 2015). For this reason, sustainability labels for dairy and meat products might gain in importance. For the study on yoghurt (Study 2), the focus is on organic labeling, including the awareness and knowledge of the EU organic logo. There are sustainability labels covering ethical aspects specifically for animal-based products such as animal welfare and free range labels. Consequently, in the study on meat (Study 3), consumers' preferences and valuation for four types of sustainability claims are compared related to organic meat, free range, animal welfare and carbon footprint. Poultry (chicken breast) was chosen to be able to include the existing EU free range claims, which only exist for poultry meat. The coffee industry is viewed as a pioneering industry for sustainability certification schemes (Pierrot et al., 2011; Reinecke et al., 2012). Coffee also has the largest market share compared to other Fair Trade products. Due to the proliferation of these sustainability certification schemes for coffee and the trend for producers towards multiple certifications (Pierrot et al., 2011), it is common for coffee packages to carry several sustainability labels (Consumers International, 2005). For these reasons, coffee is used as a third food category (Study 4) in which trade-off between sustainability labels is studied.

1.5.2 Methodological contribution

This dissertation methodologically contributes to the literature on consumers' valuation and WTP. Consumers' WTP for sustainability labels are studied and analyzed using different stated preference methods including both contingent valuation (CV) and choice modelling (CM). CV uses direct elicitation by asking what respondents are willing to pay such as payment cards, while CM refers to making choices, ranking or rating different options described by attributes and attributes levels (such as choice experiments) (Batema et al., 2002). Firstly, payment cards were used where respondents select their maximum amount they were willing to pay extra for organic yoghurt from a list of possible prices (Study 2). Secondly, choice experiments (CE) are applied to study preferences for organic, free range, animal welfare, carbon footprint labels on chicken breast (Study 3). This is a more realistic approach as it mimics the choices consumers are confronted with at the point-of-purchase. In CEs, respondents make choices among different products. Each respondent is asked to make repeated choices between different product alternatives. Each product is described based on attribute and attribute levels which vary according to an experimental design. Respondents are asked to make trade-offs between changes in attribute levels. A no-buy alternative was also included in each set of alternatives which could be

selected if they would not choose any of the presented product alternatives. Based on the choices made, the WTP can be estimated. Thirdly, survey data from the CE was combined with observational data based on eye-tracking technology (Study 4). Eye-tracking data, a type of observational data, were recorded during the performance of the CE. This more advanced methodological approach incorporates visual attention based on the eye-tracking measures into the choice model. The use of eye-tracking technology in agricultural economic research is an innovative approach. Little studies incorporated eye-tracking measures in choice modeling (Balcombe et al., 2015).

A large body of literature employs self-reported use of sustainability labels (Grunert et al., 2014) or importance of sustainable food attributes when examining the effect of sustainability on food choices (Vanhonacker et al., 2013). This dissertation moves beyond the reliance on self-reported measures of sustainability label use, and instead uses eye-tracking measures to quantify the visual attention given to sustainability labels while making food choices.

Eye-tracking technology has led to useful insights into consumers' use of nutritional information on food packages (Antúnez, et al., 2013; 2015; Ares et al., 2014; Bialkova and van Trijp, 2010; 2011; Bialkova et al., 2013; 2014; Graham and Jeffery, 2011; Graham et al., 2015; Jones and Richardson, 2007; Siegrist et al., 2015b; van Herpen and van Trijp, 2011; Visschers et al., 2010). For a review of eye-tracking and nutrition information, I refer to Graham et al. (2012). For example, Visschers et al. (2010) reported health motivation to stimulate consumers to attend to nutrition information when making a food choice. However, eye-tracking technology has not yet been applied to the assessment of the effect of visual attention to sustainability information on food packages. With an increasing number of sustainability labels, it is important to improve our understanding of consumers' visual attention to sustainability labels. This dissertation hereby provides a first study addressing this research gap by studying visual attention to sustainability labeling and its relation to choice behavior. In addition to visual attention to attributes, which is "a continuous measure of the degree to which a respondent evaluates the attribute" (Balcombe et al., 2015, p 449), this dissertation also investigates visual attribute non-attendance (ANA). In contrast, attendance is "a discrete measure indicating whether respondents will be considered to have attended an attribute or not" (Balcombe et al., 2015, p 449). For a methodological point of view, this dissertation also contributes to the literature on ANA in CEs by implementing visual ANA using the eye-tracking technology.

1.6 Thesis outline

This dissertation is a compilation of four studies, resulting in five research chapters in lie with the five scientific manuscripts which have been published, accepted or submitted as contributions to international peer-reviewed journals, covering the scientific disciplines of agricultural economics, food marketing, consumer behavior and food choice. Table 1.3 relates the studies (Study 1 to 4) to the chapters (Chapter 2 to 6) and identifies the specific research questions (RQ1 to RQ13) covered in each of the chapters. In addition to the five research chapters, a general introduction and a general conclusion are included resulting in a total of seven chapters.

As mentioned before, in Chapter 2, the focus is on environmental sustainability. The chapters specifically on sustainability labeling (Chapter 3 to 6) include both ethical and environmental labels.

Chapter 2 examines the involvement in healthy and sustainable eating and identifies consumer segments with differences in involvement. Sustainability is gaining importance next to health. Also more food policies are incorporating sustainability together with health. This study looks at consumer involvement in sustainable eating, next to healthy eating and duality of healthy and sustainable diets from a consumer's point of view.

Chapters 3, *4* and *5* focus on consumers' valuation of sustainability labels. More specifically, *Chapter 3* examines consumer attitudes, knowledge and WTP of organic yoghurt. *Chapter 4* and *Chapter 5* study consumer preferences for sustainability labeling on chicken breast and coffee respectively. *Chapter 5* gives also insight into visual attention towards sustainability labels (and price) and its relation to preferences. *Chapter 6* has rather a methodological focus and studies the use of eye-tracking as a measure of visual ANA to account for ANA in CEs.

Finally *Chapter 7* provided the general conclusion based on the former mentioned research objectives. Limitations are reported and perspectives for further research are proposed. Since the research chapters (Chapter 2 to 6) are a collection of published and submitted articles, they can be read independently, but may overlap to some extent with the introduction (Chapter 1) and conclusion (Chapter 7).

Table 1.3. Studies, research chapters and research questions

Study	Chapters	Research questions	
Study 1	Chapter 2	*RQ1*	*How are sustainable diets perceived?*
		RQ2	*Which consumer segments can be identified based on their involvement in healthy and sustainable eating?*
		RQ3	*What determines involvement in sustainable eating?*
Study 2 (yoghurt)	Chapter 3	*RQ4*	*What are the consumers' preferences and WTP for organic labels on yoghurt?*
		RQ5	*How do people with a different buying behavior differ in terms of WTP premium for organic yoghurt?*
		RQ8	*Do consumers recognize organic labels (EU organic logo and the Belgian Biogarantie organic logo) and do they know what it stands for?*
		RQ9	*Is there an association between consumer attitudes, objective knowledge about organic logos and organic yoghurt purchase frequency?*
Study 3 (chicken)	Chapter 4	*RQ6*	*What are the consumers' preferences and WTP for sustainability labels on meat (including free range claims, organic labels (EU logo and Belgian Biogarantie), EU Animal welfare label, and Carbon Footprint label)?*
Study 4 (coffee)	Chapter 5	*RQ7*	*What are the consumers' preferences and WTP for sustainability labels on coffee (including Organic, Fair Trade, Rainforest Alliance and Carbon footprint labeling)?*
		RQ10	*How much visual attention is given to price and sustainability attributes during food choice and does it correlate with stated attribute importance?*
		RQ11	*Does visual attention to sustainability labels and price for coffee contribute to explaining choice behavior?*
Study 4 (coffee)	Chapter 6	*RQ12*	*Were the attributes identified as ignored truly ignored?*
		RQ13	*Does accounting for visual attendance influence the model estimates?*

Chapter 2

Match or mismatch between sustainable, healthy and plant-based diets: Consumer perceptions and involvement

This chapter is based on:

Van Loo, E.J., C. Hoefkens, and W. Verbeke. 2015. Match or mismatch between sustainable, healthy and plant-based food choice: consumer insight and policy implications. under review.

Abstract

Given the inseparable environmental and health impact of dietary choices, integrating health and sustainability goals has become a highly topical issue in policy development and consumer communication with the potential to encourage consumers to adopt healthier and more sustainable eating behavior. Increasing evidence shows the possibility to compose diets that are both environmentally sustainable and healthy, but their potential success largely depends on consumers' willingness and ability to change behavior. This study investigates consumers' perception of the match or mismatch between the concepts of health and sustainability in a food context; their involvement in sustainable and healthy eating; and the role of attitudinal determinants. Data were collected in Spring 2014 through a cross-sectional quantitative online survey with samples representative for age, gender and region in four EU countries (UK, Germany, Belgium, and the Netherlands) (n=2783). The image profiles of 'a healthy diet', 'a sustainable diet' and 'a plant-based diet' were found to be highly compatible based on the strong match between European consumers' perceptions of these concepts. Half of participants were highly involved in healthy eating and one third in both healthy and sustainable eating. Differences in involvement in healthy eating were explained by the degree of health concerns and variation in perceptions of healthy diets as being tasty, natural, easy to prepare, and filling. Similarly, the involvement in sustainable eating was mainly driven by sustainability concerns and the perception of a sustainable diet as being tasty, cheap, easy to prepare, and filling. The findings of this study imply that food policy targeting both healthy and sustainable food consumption behavior may be effective if European consumers' involvement in healthy and sustainable eating can be increased and turned into actual behavior. Raising consumers' awareness about health and sustainability emerges as a key trigger.

RQ1: How are sustainable diets perceived?

RQ2: Which consumer segments can be identified based on their involvement in healthy and sustainable eating?

RQ3: What determines involvement in sustainable eating?

2.1 Introduction

A primary challenge for twenty-first century food policy is the integration of public health nutrition and environmental sustainability goals (Lang and Barling, 2013). A growing amount of evidence shows that Western dietary habits negatively impact both the environment and people's health, leading to irreversible resource depletion and pollution as well as the rising incidence of diet-related non-communicable chronic diseases (Linseisen et al., 2002; FAO, 2006; Tukker et al., 2006; Westhoek et al., 2014). Given this double burden associated with contemporary Western food and dietary choices, there is an urgent need to encourage the adoption of adoption of healthy diets that are also environmental sustainable. Several definitions for healthy and sustainable diet exists (FAO, 2012; WWF, 2013a) (see Chapter 1); however, these "broad definitions tend to lack meaningful specificity" (Garnett, 2014, p 4). Sustainability is a broad, multidimensional concept with three dimensions/pillars: environmental, economic and social. (for details see Chapter 1) However, when referring to a sustainable diet, the concept is often narrowed down to environmental sustainability (Garnett, 2014), which is also the approach followed in this chapter.

Health and environmental sustainability challenges with respect to food need to be tackled together from a policy perspective as they are closely connected (Aschemann-Witzel, 2015; Kjærgård et al., 2014). Food policies targeting both healthy and sustainable food consumption behavior may be potentially effective if, firstly, healthy and sustainable diets are available, affordable and attractive, and, secondly, consumers are motivated and able to make healthy and sustainable food choices. Regarding the first condition, various studies have shown the possibility to compose a diet that is both healthy and has a low environmental impact (Ciati and Ruini, 2012; Garnett, 2011, 2014; Macdiarmid et al., 2012; Van Dooren et al., 2014; Westhoek et al., 2014), although sometimes trade-offs are needed as healthy food options may not necessarily be the most sustainable or cheapest option (Aschemann-Witzel, 2015; Macdiarmid, 2013). Specifically, reducing meat and dairy consumption, while eating more plant-based foods have been set forth as being beneficial for both the environment (Baroni et al., 2006; Pimentel and Pimentel, 2003; Reynolds et al., 2014; Sabaté and Soret, 2014; Stehfest et al., 2009), and public health (Reiss et al., 2012; Slavin and Lloyd, 2012).

Since the health and sustainability characteristics of foods are typical credence attributes, consumers should be informed about their presence, exact nature and benefits these attributes provide to be able to make informed decisions. Garnett et al. (2015) pointed at an imbalance between policies and actions that focused on health and on the environment, and at the fact that few policies and actions thus far have been designed with the aim of achieving integrated health and sustainability outcomes.

Table 2.1. Policy advice on sustainable food consumption and production in European countries

Country/ region and date	Government agency	Policy document and scope
UK 2006 [a]	Sustainable Development Commission (SDC) & National Consumer Council set up the Sustainable Consumption Roundtable	Sustainable Consumption Roundtable report *"I will if you will"* – generic identification of challenges in moving to more sustainable consumption and identified the concept of "choice editing"
UK 2009 [a]	Sustainable Development Commission (SDC) report to Department Environment Food Rural Affairs (Defra)	*Setting the Table: advice to Government on priority elements of sustainable diets*: Recommendations based on literature review, stakeholder and expert opinion on a low impact (sustainable) healthy diet
UK 2008-2010	SDC, Cabinet Office, Council of Food Policy Advisors, & Defra	*Recognition of need for new direction. Food 2030 makes sustainable healthy diet one of 6 goals*
UK 2012-2013	*Green Food Project*	*Outlines Principles for Sustainable Consumption*
Germany 2008 onwards [b]	German Council for Sustainable Development	*Sustainable Shopping Basket: a guide to better shopping* produced since 2008 and updated regularly (latest version: 2013). Includes food and lists labels and certification schemes including organic, fair trade, sustainable fisheries, etc.
Netherlands 2009 [a]	LNV Ministry Ministry of Agriculture, Nature and Food Quality	*Sustainable Food: Public Summary of Policy Document*. Policy outline for achieving Sustainable Food; emphasized the role of sustainable food production & consumer education campaigns
Netherlands 2011 [a]	Health Council for Ministry Economic Affairs, Agriculture & Innovation	*Guidelines Healthy Diet: Ecological Perspective*: Review based on expert advice
Sweden 2009 [a]	National Food Administration (& Swedish EPA) - notification to EU Council for adoption as official standards	*The National Food Administration's Environmentally effective food choices: Proposal notified to the EU*. Science based assessment by range of product groups e.g. meat, fish & shellfish, fruits and berries etc.
Sweden	Swedish National Food Agency	Food and environment
Sweden 2015	Swedish Food Agency (SFA)	*Find your way to eat greener, not too much and be active* Dietary guidelines and advice considering environmental impact
Nordic countries 2012		*Nordic Nutrition Recommendations 2012*, Nordic Council of Ministers, Copenhagen.

[a] From Barling (2011)

[b] Based on Barling (2011) but updated with a new version of the document

Although the majority of interventions and food policy actions focused on achieving specific health goals in the past (Capacci et al., 2012), some more recent policy initiatives initiated by national governments or at the European Union (EU) level started addressing explicitly healthy and sustainable food consumption and production (see Barling, 2011; HCN, 2011) (Table 2.1). Policy advice to help consumers making environmentally sustainable food choices emerged in the UK, Germany, the Netherlands and Sweden (Barling, 2011). Currently, Germany, Sweden, and the Netherlands are the three EU countries which developed guidelines that integrate sustainability into their nutrition policies, while the Sustainable Development Commission in the UK have developed advice on sustainable diets for governments (Table 2.1). Reisch et al. (2013) provided an overview of the policy instruments that exist and can foster healthy and sustainable food choice including information-based, market-based, regulatory and self-committing policy instruments. Stehfest (2014) stressed that more effort will be needed to incorporate both health and environmental factors in food policy and dietary guidelines. A first step in achieving effective public and private policy actions is increasing consumers' motivation in health and sustainability food-related aspects (Garnett et al., 2015). However, even when they are motivated and have positive attitudes towards healthy and sustainable (Grunert et al., 2010; 2014; Verain et al., 2012), the success of related policy actions largely depends on whether consumers' interests and favorable attitudes are turned into action.

Many studies have evaluated factors linked to consumers' motivation (such as interest, perceptions, importance, awareness, involvement) to consume healthy on the one hand (Carrillo et al., 2011; Hoefkens et al., 2013; Mazzochi et al., 2015; Van Wezemael et al., 2014) and sustainable on the other hand (Grunert et al., 2014; Siegrist et al., 2015a; Vanhonacker et al., 2013). However, there is scant literature investigating both aspects simultaneously (Aschemann-Witzel, 2015; Garnett et al., 2015; Verain et al., 2015). The present study addressed this gap with a fourfold purpose.

Firstly, this study explores what consumers associate with sustainability in a food context. After these questions, the study focusses on environmental sustainability and investigates the (dis)similarities between consumers' perceptions of an environmental sustainable diet, a healthy diet and a plant-based diet. While there is a growing interest in healthy and sustainable food consumption, little is known about the match or mismatch between these two concepts as perceived by consumers and to what extent the perception of plant-based diets (being set forth as a possible solution in this debate) matches with these two concepts.

Secondly, the study quantifies consumers' involvement in healthy and sustainable eating. Involvement in the context of this study refers to "the personal relevance and importance attached to these concepts based on inherent needs, values and interests" (Zaichkowsky, 1985, p 342). Verbeke and Vackier (2004) described involvement is a motivational force, which may have an influence of various steps in the consumer decision-making process including the extensiveness of information search, length of decision-making process, formation of beliefs, attitudes and intentions and behavioral outcomes (Verbeke and Vackier, 2004). Involvement is thus an important motivational aspect related to attitude, behavior and food choice (Pieniak et al., 2008, 2010a) and has been shown to have robust effects on consumers' purchase and eating decisions (Marshall and Bell, 2004). Thus involvement in healthy and sustainable eating may contribute to explain consumption of healthy and sustainable food products. Previous studies have focused either on involvement in healthy eating or in sustainable eating. Specifically, studies have identified health involvement and involvement in healthy eating as important factors explaining eating behavior (Olsen, 2001; Pieniak et al., 2010a,b). Vermeir and Verbeke (2006) reported that consumers with a high involvement have more positive attitudes and are more willing to consume sustainable products. The present study addresses both involvement in healthy and in sustainable eating, and identifies consumer segments using these measures of involvement as segmentation variables.

Thirdly, with plant-based diets being advocated as healthier and more sustainable, consumer attitudes towards and consumption of plant-based foods are studied as well. Consuming less animal source foods, which are the most greenhouse-gas-intensive food types, has been identified as beneficial for both the environment and human health (Biesbroek et al., 2014; Reynolds et al., 2014; Van Dooren et al., 2014; Yip et al., 2013). Moreover, many consumers have a positive attitude towards reduced meat consumption or towards consuming more plant-based diets (de Boer et al., 2014; Latvala et al., 2012; Schösler et al., 2012; Vanhonacker et al., 2013). Consumption of plant-based foods is measured in this study to verify whether a high involvement in healthy and sustainable eating is also reflected in a corresponding consumption pattern. The expectation is that consumers who are involved in healthy and sustainable eating have a diet that is richer in plant-based foods.

Fourthly, the attitudinal determinants of involvement in healthy and in sustainable eating are investigated to identify the most promising approaches or triggers to influence consumers' involvement in healthy and in sustainable eating, which in its turn may lead to increased consumption of healthy and sustainable diets.

Table 2.2. Socio-demographics (%) of the total sample and the segments

		All	S1, Uninvolved	S2, Moderately involved	S3, Health involved	S4, Health and sustainability involved	p-value
	n	2783	428	850	626	879	
	%		15	31	22	32	
Gender	Male	49.9	63.1	57.9	39.5	43.1	
	Female	50.1	36.9	42.1	60.5	56.9	<0.001[1]
Age	18-24 years	13.0	15.2	12.0	15.7	11.2	
	25-34 years	20.3	14.7	23.5	21.4	19.0	
	35-44 years	20.9	21.0	21.1	20.5	21.1	
	45-54 years	24.3	29.2	24.6	22.0	23.1	
	55-65 years	21.5	19.9	18.8	20.5	25.7	<0.001[1]
Age	Mean (SD)	41.99 (13.40)	42.30[a,b] (13.24)	41.26[b] (13.02)	40.99[b] (13.73)	43.25[a] (13.51)	0.003[2]
Urbanization Degree	Mean (SD)	3.27 (1.43)	3.36[a] (1.41)	3.26[a] (1.40)	3.24[a] (1.42)	3.26[a] (1.48)	0.546[2]
Living situation	Living alone	22.1	28.7	23.8	17.7	20.5	
	Co-habiting without children	51.9	49.5	50.9	53.8	52.7	
	Co-habiting with children	25.9	21.7	25.3	28.4	26.9	0.001[1]
Education	Low	30.3	34.1	34.6	28.1	25.7	
	Medium	25.4	23.8	26.0	23.3	27.0	
	High	44.4	42.1	39.4	48.6	47.3	<0.001[1]
Occupational status	Working full-time	47.0	48.1	50.6	41.1	47.1	
	Working part-time	15.6	15.0	14.7	16.0	16.6	
	Unemployed	7.9	10.3	8.2	7.7	6.5	
	Retired	7.9	6.8	6.8	8.2	9.4	
	Student	8.7	8.2	7.4	12.1	7.6	
	Not working for another reason	12.9	11.7	12.2	15.0	12.7	0.005[1]
Country	UK	25.7	25.7	24.5	25.9	26.6	
	Germany	25.2	21.7	27.4	18.8	29.1	
	Belgium	24.6	22.7	24.5	24.6	25.6	
	The Netherlands	24.6	29.9	23.6	30.7	18.7	<0.001[1]

[1] Pearson Chi-square, [2] Kruskal-Wallis rank test and if differences exist, these were identified with the Two sample Wilcoxon rank sum (Mann-Whitney) test, $p<0.05$

2.2 Material and methods

2.2.1 Data collection and sample

An online quantitative survey was performed in June 2014 with a total sample of 2783 adults from the United Kingdom (n=714), Germany (n=700), Belgium (n=684), and the Netherlands (n=685). These countries were chosen based on similar Western dietary habits; however, differences exist with regard to the implementation of sustainability into these countries' national food policies (Table 2.1). Participants were recruited by a subcontracted professional market research agency that abides the ICC/ESOMAR International Code on Market and Social Research (ICC/ESOMAR, 2008). Ethics approval for the study protocol, participant information materials and research instruments was obtained (approval registration number B670201420982, May 15, 2014). Samples were representative for the national populations in terms of gender, age and region in each country (Appendix B). Descriptive statistics of the pooled sample are presented in Table 2.2.

2.2.2 Questionnaire content and pretesting

The master questionnaire was developed in English and translated by a professional translation office into the three respective national languages (German, French and Dutch). The web-based surveys were pretested for clarity of content, language/wording, and overall understanding. Order bias was avoided by rotating between the blocks of questions about health and about sustainability and by randomization of the items within a question. The individual items, type of scale and Cronbach's alpha reliability coefficient for each of the constructs are provided in Appendix A.

Meaning of sustainability. Participants were asked about what they associate with sustainability by indicating to what extent they believe certain issues are related to sustainability in a food context. Based on previous research (Grunert et al., 2014), 19 items were included on environmental and ethical issues related to food. Each item was scored on a 5-point scale from "Not at all" (1) to "Definitely" (5).

However, when referring to a sustainable diet, the concept is often narrowed down to environmental sustainability (Garnett, 2014), which is also the approach followed in this chapter. Therefore, after answering this question regarding the meaning of sustainability, respondents were informed that the rest of the survey will specifically go about environmental sustainability. Before proceeding with the other questions, participants received an explanation on sustainability and environmental sustainability.

Perceptions of healthy, sustainable and plant-based diets. Participants' perceptions of healthy, sustainable and plant-based diets were measured for the attributes: taste, cost, availability, naturalness, easiness of preparation, personal applicability, traditionalness, nutritional value, satiety level, healthfulness, plant-based origin, and sustainability.

To compare between sustainable food/diets and healthy food/diets, similar attitudinal and behavioral constructs were used for both health and sustainability including (1) self-reported healthy and sustainable eating, (2) subjective healthiness and sustainability of the personal diet, (3) involvement in healthy and sustainable eating, and (4) food-related health and sustainability concerns.

Self-reported healthy and sustainable eating. Participants were asked to indicate to what extent healthy eating behavior statements applied to them. Eight statements on concrete actions were included based on the World Health Organization recommendations to promote and support healthy eating (WHO, 2014) (Appendix A). Similarly, self-reported sustainable eating was measured by the rating of seven statements based on the food-related environmental-friendly lifestyle behavior items used by Vanhonacker et al. (2013) and Whitmarsh and O'Neill (2010). Two items were added related to food waste and plant-based alternatives for meat (Appendix A).

Subjective healthiness and sustainability of the personal diet. Adapted from the construct measuring subjective health (Pieniak et al., 2010b), participants self-rated the healthiness and sustainability of their diet by comparing it to the diets of others.

Involvement in healthy and sustainable eating. Involvement was measured through four items based on the health involvement scale applied by Pieniak et al. (2010b). The involvement scale was developed by Zaichkowsky (1985), which also corroborates the food involvement scale suggested by Bell and Marshall (2003). The four items from Pieniak et al. (2010b) were adjusted to correspond with involvement in healthy eating and involvement in sustainable eating.

Food-related health and sustainability concerns. Nine items on food-related health concerns were included. Four items based on Eurobarometer (EC, 2010); three items adapted from Roininen et al. (1999); and two additional items were included. Similarly, food-related sustainability concerns were measured by nine items referring to environmental sustainability based on Grunert et al. (2014).

Consumption of plant-based foods and attitudes towards plant-based diets. To measure the consumption of plant-based foods, participants were asked which share (percentage) of their diet consists of plant-based foods, and their attitude towards plant-based diets was assessed using a 10-point semantic differential scale.

Socio-demographic variables. Participants were finally asked about demographic characteristics including gender, age, occupational status, composition of the family (partner and children), education, and financial situation.

2.2.3 Statistical analysis

Descriptive statistics were used to report percentages, means and standard deviations. Principal components analysis (PCA) with varimax rotation was performed to identify the underlying dimensions of sustainability. Factor loadings of 0.40 and higher are considered significant (Hair et al., 2010). Cronbach's alpha was used to assess the internal reliability and consistency of the multi-item scales. Involvement in healthy eating and involvement in sustainable eating were used as segmentation variables in a cluster analysis. Segments were profiled by comparing their responses to attitudinal and behavioral constructs including self-reported healthy and sustainable eating, subjective healthiness and sustainability of the diet, food-related health concerns and sustainability concerns, and consumption of and attitudes towards plant-based diets. The cluster centers from a hierarchical clustering with Ward's method were used as initial cluster centers for a K-means cluster analysis. Cross-tabulations with $\chi 2$-statistics were used to test for associations between categorical variables. For the comparison of mean scores, the Kruskal-Wallis rank test and two-sample Wilcoxon rank-sum (Mann-Whitney) test were used. To identify the key determinants driving involvement in healthy and in sustainable eating, two linear regression models were applied. A first model regressed involvement in healthy eating as the dependent variable over food-related health concerns and attribute perceptions of healthy diets including taste, cost, availability, naturalness, easiness to prepare, traditionalness, and satiety, as explanatory variables. The second model specified involvement in sustainable eating as the dependent variable, and food-related sustainability concerns and attribute perceptions of sustainable diets including taste, cost, availability, naturalness, easiness to prepare, traditionalness, and satiety as explanatory variables. Statistical significance was assessed at $\alpha = 0.05$.

2.3 Results

2.3.1 Meaning of sustainability

When ranking all the items (Table 2.3) according to the extent to which the participants associated them with sustainability, items related to deforestation, the environmental impact of human use of land and water, and recyclable package scored the highest. The factor analysis revealed two underlying dimensions in the meaning of sustainability. The item related to animal welfare had a high factor loading on both factors. Due to the significant cross-loading, this item was deleted (Hair et al., 2010)

and the factor procedure was repeated resulting in a two-factor solution accounting for 61.4% of the total variance of the sustainability concept. Table 2.3 reports the items with their respective factor loadings and illustrates the two factors: an environmental and societal factor explaining 36.6% and 24.9% of the variance, respectively. Factor loadings are all larger than 0.50 which is reported to be necessary for practical significance (Hair et al., 2010). Participants associated sustainability more with items related to the environmental factor (on average rated between 3.45 to 3.89 on a 5 point scale), compared to the items related to the societal factor (average 2.94 to 3.35). Additionally, the average value for environmental sustainability was higher than for societal sustainability (Table 2.3).

Table 2.3. Extent to which items are perceived to relate to sustainability (n=2783)

	Mean (St. Dev.)	Factor loadings Environmental factor	Factor loadings Societal factor
Deforestation	3.89 (1.07)	0.80*	0.14
The environmental impact of human use of land and water	3.89 (1.00)	0.82*	0.20
Recyclable packaging	3.83 (1.00)	0.75*	0.21
The environmental impact of food production	3.78 (1.01)	0.83*	0.21
The amount of packaging used on products	3.76 (1.01)	0.80*	0.23
Food waste	3.74 (1.06)	0.67*	0.33
Carbon emissions caused by food production	3.69 (1.04)	0.80*	0.23
Energy use when transporting food products	3.68 (1.02)	0.77*	0.27
The use of pesticides in food production	3.66 (1.08)	0.66*	0.33
World food supply	3.63 (1.04)	0.63*	0.40
The amount of energy used when cooking food products	3.45 (1.01)	0.64*	0.32
Prices paid by consumers for food products	3.35 (1.02)	0.28	0.66*
The healthiness of food and drinks	3.35 (1.07)	0.28	0.74*
Food and drink safety	3.33 (1.05)	0.25	0.75*
Working conditions and wages for food producers	3.28 (1.03)	0.34	0.71*
The quality of public health services	3.21 (1.05)	0.20	0.77*
Using child labour in food production	3.16 (1.18)	0.30	0.65*
Levels of unemployment	2.94 (1.10)	0.07	0.77*
Explained variance (%)		36.61	24.86
Cronbach's α internal reliability coefficient		0.94	0.88
Construct mean (S.D.)		3.73(0.81)	3.23 (0.82)

* Factor loading above the recommended threshold of 0.5 (Hair et al., 2010)

2.3.2 Consumers' perceptions of sustainable, healthy and plant-based diets

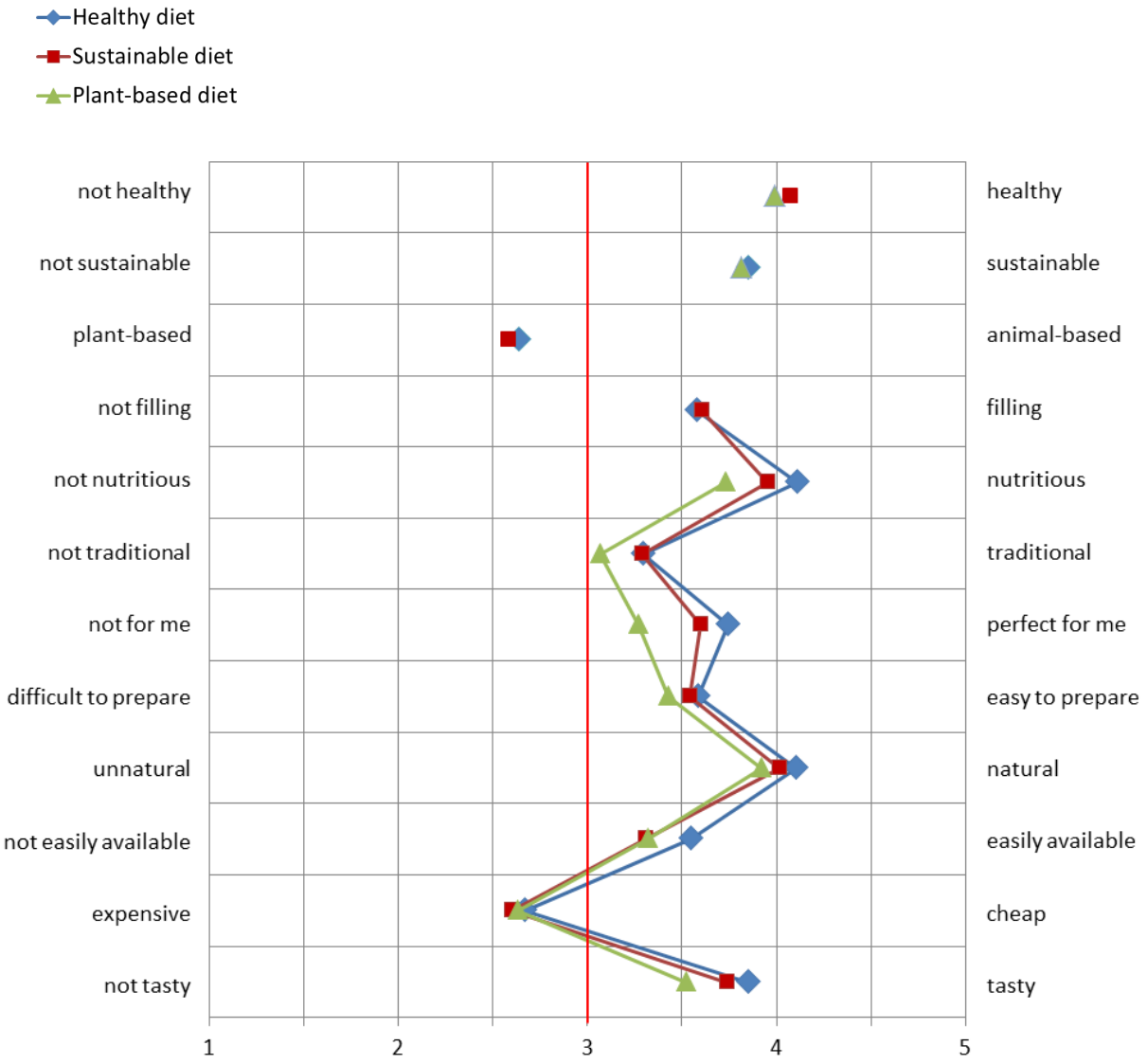
Figure 2.1 shows that a healthy, a sustainable and a plant-based diet are perceived very similarly. Based on the differences from the midpoint[3], it is clear that each of the three concepts was most strongly associated with the attributes 'nutritious' and 'natural', whereas the concepts were the least associated with 'traditional'. Although the differences in mean perception scores across the three concepts are small, most of them are significant. Based on the Wilcoxon matched-pairs signed-ranks test, in which 30 pairs were compared, only five pairs were not significantly different from each other. A healthy and a sustainable diet were not perceived significantly different in terms of being traditional and being filling. A healthy and a plant-based diet were not perceived different in terms of being sustainable. Also the availability and price of plant-based and sustainable diets were not perceived differently. For all the other items, a healthy diet scored higher than a sustainable diet which in turn scored higher than a plant-based diet. A healthy diet was thus perceived as tastier, cheaper, more easily available, easier to prepare, and more nutritious compared to a sustainable and a plant-based diet. Thus a healthy diet scored better on several attributes than a sustainable and a plant-based diet.

2.3.3 Involvement in healthy and sustainable eating across consumer groups

Four distinct consumer segments were identified based on participants' involvement in healthy and sustainable eating (Figure 2.2). Table 2.4 shows the sizes of the segments and their respective mean scores on the segmentation variables. The smallest segment (S1, 15%) was neither involved in healthy nor sustainable eating. The largest segments were moderately (S2, 31%) respectively highly (S4, 32%) involved in both healthy and sustainable eating. Another segment (S3, 22%) was highly involved in healthy eating while moderately involved in sustainable eating. It is interesting to note that there was no segment with a high involvement in sustainable eating while being low involved in healthy eating. Moreover 46% of the study participants were uninvolved or moderately involved in both healthy and sustainable eating. When there is a higher level of involvement this is in the first instance involvement in healthy eating, which for some people is combined with a high involvement in sustainable eating. For three out of the four segments involvement in healthy and sustainable eating go hand in hand, while for the remaining segment a discrepancy exists between both types of involvement.

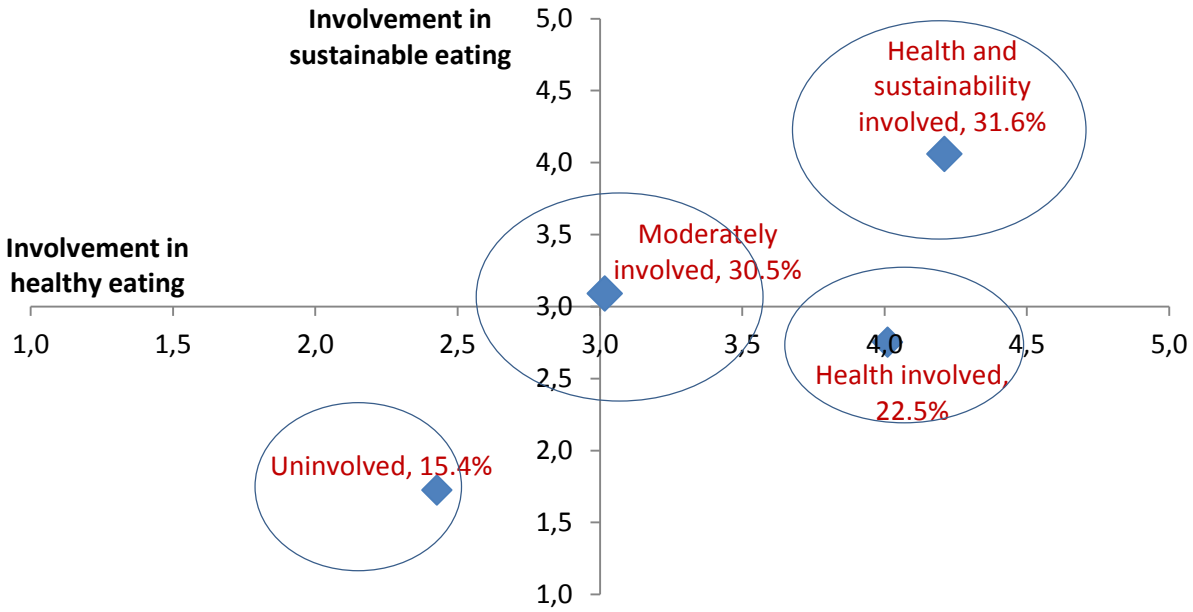
[3] For semantic differential, the strength of the association is indicated by the difference from the midpoint

Figure 2.1. Perception of a healthy, sustainable and plant-based diet (5-point semantic differential scale)



The segments differ in terms of distribution of gender, age, living situation, education level, occupational status and country (Table 2.2). While the uninvolved (S1) and the moderately involved (S2) segments consist of a larger share of males than females, the opposite is true for more involved segments (S3 and S4) that consist of more females. Approximately 29% of the uninvolved segment lives alone while this share is lower in the other segments which include more co-habiting persons, with or without children. The more involved segments (S3 and S4) also have a larger proportion of highly educated consumers compared to uninvolved and moderately involved segments (S1 and S2). S4 consists of only 18.7% Dutch respondents while the share in S1 and S3 is 29.9% and 30.7%, respectively. The share of Germans in S3 is only 18.8% while the other segments have higher portions of Germans.

Figure 2.2. Positioning of the four cluster solution based on mean scores for involvement in sustainable and healthy eating[1]: S1 uninvolved (n=428), S2 moderately involved (n=850), S3 health involved (n=626), S4 health and sustainability involved (n=879).



[1] Construct were measured on 5-point scale ranging from "Strongly disagree"(1) to "Strongly agree"(5).

Attitudinal and behavioral constructs with respect to food and health. The scores for all constructs with respect to food and health significantly increase going from the uninvolved segment (S1), to the moderately involved (S2), to the health involved (S3) to the health and sustainability involved segment (S4) (Table 2.4). Going from the uninvolved segment to the more involved segments (from S1, to S2, to S3, to S4), the segments consist of consumers who report to perform more healthy eating actions, who perceive their own diet also as healthier and who are more concerned about food-related health aspects.

Attitudinal and behavioral constructs with respect to food and sustainability. Similarly for the constructs related to food and sustainability, the scores increase from the uninvolved segment (S1), to the moderately involved (S2) and the health involved (S3), to the health and sustainability involved segment (S4) (Table 2.4). Going from the uninvolved segment to the more involved segments, consumers report to eat more sustainably, perceive their own diet as more sustainable and they are also more concerned about food-related sustainability aspects. With an exception of S2 and S3, who

differ very little in the constructs related to food and sustainability[4] (see Appendix C) and do not significantly differ in terms of food-related sustainability concerns.

Table 2.4. Characteristics of the segments [Mean (Standard Deviation)]

	S1, Uninvolved	S2, Moderately involved	S3, Health involved	S4, Health and sustainability involved
n	428	850	626	879
%	15	31	22	32
Food and health				
Involvement in healthy eating[1]	2.43 (0.70) [d]	3.02 (0.35) [c]	4.01 (0.36) [b]	4.21 (0.46) [a]
Self-reported healthy eating [2]	2.33 (0.64) [d]	2.80 (0.58) [c]	3.18 (0.63) [b]	3.60 (0.64) [a]
Subjective healthiness of the diet [1]	2.62 (0.69) [d]	2.96 (0.51) [c]	3.41 (0.59) [b]	3.71 (0.58) [a]
Food-related health concerns [3]	2.00 (0.74) [d]	2.51 (0.75) [c]	2.84 (0.84) [b]	3.16 (0.91) [a]
Food and sustainability				
Involvement in sustainable eating[1]	1.72 (0.52) [d]	3.09 (0.34) [b]	2.75 (0.46) [c]	4.06 (0.40) [a]
Self-reported sustainable eating[2]	2.34 (0.61) [d]	2.90 (0.58) [c]	2.99 (0.59) [b]	3.64 (0.63) [a]
Subjective sustainability of the diet [1]	2.59 (0.66) [d]	3.06 (0.46) [c]	3.14 (0.55) [b]	3.70 (0.59) [a]
Food-related sustainability concerns[3]	2.42 (0.85) [c]	3.06 (0.73) [b]	3.11 (0.77) [b]	3.85 (0.72) [a]
Plant-based diets				
Consumption of plant–based foods (%)	38.51 (22.17) [d]	47.76 (20.25) [c]	52.5 (20.92) [b]	61.56 (20.36) [a]
Attitude toward plant–based diets [4]	4.85 (2.09) [d]	6.15 (1.83) [c]	6.79 (1.88) [b]	7.81 (1.78) [a]

[a,b,c] Values with the same letter as superscript indicate not statistically significant differences between the segments (columns) based on Kruskal-Wallis rank test and if differences exist, these were identified with the Two sample Wilcoxon rank sum (Mann-Whitney) test, $p<0.05$

[1] measured on a 5-point scale from “Strongly disagree” (1) to “Strongly agree” (5)
[2] measured on a 5-point scale from “Does not apply to me at all” (1) to “Fully applies to me” (5)
[3] measured on a 5-point scale from “Not at all worried” (1) to “Extremely worried” (5)
[4] measured on a 10-point semantic differential scale

[4] There is a significant difference for self-reported sustainable eating and for subjective sustainability of the diet for S2 and S3: however the effect size is <0.10 (see Appendix C)

2.3.4 Attitudes towards plant-based diets and consumption of plant-based foods

The self-reported share of plant-based foods in the diet is 39% for the uninvolved segment (S1). This share gradually increases for the more involved segments reaching 62% for the health and sustainability involved segment (S4) (Table 2.4). There is a similar trend for attitude towards plant-based diets. While the uninvolved segment (S1) has a slightly negative attitude towards plant-based diets (4.85), the moderately involved segment (S2) has a positive attitude. The health involved segment (S3) is even more positive and the health and sustainability involved (S4) is strongly positive towards plant-based diets with a mean score of 7.81 out of 10.

Table 2.5. Determinants of involvement in healthy eating (n=2,766) [1]

Variables	Standardized coefficient β	t-value[4]
Food-related health concerns[2]	0.41***	25.79
Healthy diet is ...-not tasty:tasty[3]	0.24***	10.82
Healthy diet is ...-unnatural:natural[3]	0.16***	8.41
Healthy diet is ...-difficult to prepare:easy to prepare[3]	0.07***	3.62
Healthy diet is ...-not filling:filling[3]	0.06**	3.09
R^2	0.388	

[1] Using the backward method, first the perception of being traditional was removed (p=0.817), followed by availability (p=0.705) and price (p=0.273). Model diagnostics for outlier identification based on standardized residuals, Cook's distance, leverage, Mahalanobis distance, covariance ratio identified 17 outliers. These outliers were removed resulting in a total of 2,766 valid responses for final regression analysis.

[2] measured on a 5-point scale from "Not at all worried" (1) to "Extremely worried" (5)

[3] measured on 5-point semantic differential scale

[4] p- and t-values were calculated based on robust standard errors because of the presence of heteroscedasticity (Breusch-Pagan test: $Chi^2(1) = 29.14$; $p < 0.001$)

* p<0.05, ** p<0.01, *** p<0.001

2.3.5 Attitudinal determinants of involvement in healthy and sustainable eating

In order to identify the most promising communication messages to increase the involvement in healthy and sustainable eating behavior, determinants of both the involvement in healthy eating and in sustainable eating were analyzed. The regression model accounts for 39% of the variation in involvement in healthy eating (Table 2.5). Food-related health concerns is the most important positive

predictor of involvement in healthy eating followed by perceived tastiness, naturalness, easiness to prepare and satiety of a healthy diet (Table 2.5). Stronger beliefs on these attributes associate positively with involvement in healthy eating. Beliefs about the cost, availability and traditional character of a healthy diet did not significantly contribute to explaining involvement in healthy eating.

In a similar vein, involvement in sustainable eating is positively influenced by food-related sustainability concerns, followed by perceived price, tastiness, easiness to prepare and satiety of a sustainable diet (Table 2.6). The regression model accounts for 42% of the variation in involvement in sustainable eating. Beliefs about a sustainable diet as being natural, traditional, and easily available did not significantly contribute to explaining involvement in sustainable eating. Comparing the effects of concerns and taste across the two models shows that concerns have a greater effect on involvement in sustainable eating than on involvement in healthy eating, while the opposite is true for the perception of taste.

Table 2.6. Determinants of involvement in sustainable eating (n=2,768) [1]

	Standardized coefficients, β	t-value[4]
Food-related sustainability concerns[2]	0.55***	31.25
Sustainable diet is ...-not tasty:tasty[3]	0.09***	4.48
Sustainable diet is ...-expensive:cheap[3]	0.13***	7.52
Sustainable diet is ...-difficult to prepare:easy to prepare[3]	0.05*	2.54
Sustainable diet is ...-not filling:filling[3]	0.04*	2.41
R^2	0.420	

[1] Using the backward method, first the perception of the naturalness of a sustainable diet was removed (p=0.597), followed by traditional (p=0.190), and availability (p=0.110). Following outlier identification, 15 cases were removed resulting in a total of 2,768 valid responses.

[2] measured on a 5-point scale from “Not at all worried” (1) to “Extremely worried” (5)

[3] measured on 5-point semantic differential scale

[4] p- and t-values were calculated based on robust standard errors because of the presence of heteroscedasticity (Breusch-Pagan test: $Chi^2(1) = 24.33$; $p < 0.001$)

* p<0.05, ** p<0.01, *** p<0.001

2.4 Discussion

Participants associate sustainability more with environmental issues than with societal issues as according to other studies (Grunert et al., 2014, Hanss and Böhm, 2012). In the following results, sustainability refers to environmental sustainability. The evaluation of (dis)similarities between 'a healthy diet', 'a sustainable diet' and 'a plant-based diet' as perceived by consumers in this study illustrates the highly compatible image profiles of these three concepts. This finding suggests a close match between consumer perceptions of health, sustainability and plant-based with regard to food and diets. Each of the three concepts was most strongly associated with the attributes 'nutritious' and 'natural', whereas the concepts were the least associated with 'traditional'. This is in line with other research mentioning a strong link between health and sustainability from a food consumer's point of view (Aschemann-Witzel, 2015). The insights from this study hereby support the design of food policies and the formulation of dietary guidelines combining health and sustainability aspects; such a combination will make sense to consumers as these concepts are not perceived as being conflicting.

Four distinct consumer groups based on differences in involvement in healthy and sustainable eating were identified. About 15% is uninvolved and 31% is moderately involved In both healthy and sustainable eating. More than half of consumers (54%) are highly involved in healthy eating and nearly one-third (32%) are also highly involved in sustainable eating. Thus, segments that are involved in sustainable eating are also involved in healthy eating, while the opposite is not necessarily true. Pelletier et al. (2013) reported that positive attitudes toward sustainable agricultural practices were associated with higher dietary quality suggesting that consumers interested in sustainable food (production) are also inclined to eat healthier. The findings of our study also illustrate that health still matters more – and to more consumers - than sustainability. Studies on organic food (Magnusson et al., 2003; Mondelaers et al., 2009) have also shown that people attach more importance to health, an egoistic motive, than to sustainability, an altruistic motive, when making food choices. Therefore, health aspects should remain the focal message when communicating about and promoting healthy and sustainable diets as health-focused messages are likely to appeal to a larger target audience.

Food policy and marketing strategies targeting both healthy and sustainable food consumption behavior may be potentially effective if consumers' involvement in healthy and sustainable eating can be increased and turned into actual behavior. Presented results confirm that involvement with healthy eating and sustainable eating associates with higher shares of plant-based foods in the diet. This illustrates that perceived importance of health and sustainability in relation to food is translated, at least to some extent, into a corresponding consumption patterns. This result is consistent with de Boer

et al. (2013), who found that consumers who valued nature more, were also more willing to switch to meat-free diets. Public policy or private marketing strategies that trigger involvement in healthy and sustainable eating, are therefore likely to boost the share of plant-based foods in consumers' diets. However, the success of such policy actions cannot be taken for granted since some barriers at the point of purchase may prevent consumers to choose for healthy and sustainable foods, which has previously been referred to as the attitude-behavior gap (Vermeir and Verbeke, 2006). Nevertheless, in our study sample, there is a strong association between involvement and plant-based food consumption, showing a clear relation between attitude and behavior. Additionally, the most involved segment reported a share of 60% for plant-based foods on average, so even in this segment there is still a large potential for growth in plant-based food consumption.

In order to promote healthy, sustainable and plant-based eating patterns, both the involvement in sustainable and healthy eating can be triggered through policy actions. From the determinants tested, food-related health and sustainability concerns are the most important determinants for involvement in healthy and sustainable eating respectively. Thus in order to stimulate the involvement in healthy and sustainable eating, consumers should be made more aware and concern about the health and sustainability implications of their food choices. Educating consumers on the consequences of their dietary choices for their personal health and on the environment may raise awareness and concern. Subsequently, they might become more involved in healthy and sustainable eating. Thus in order to stimulate the involvement in healthy and sustainable eating, increasing awareness about the health and sustainability implications of their food choices is suggested. Educating consumers on the consequences of their dietary choices for their personal health and on the environment may raise awareness. Subsequently, they might become more concerned about these issues, attach more personal importance to it and be more interested in it when making food choices, leading to a higher involvement in in healthy and sustainable eating. This might be difficult to achieve for the uninvolved segment. However involvement in healthy and sustainable eating can be promoted in the moderately involved segment. This segment is likely uncertain about heath and sustainable issues related to food and thus increasing their knowledge and awareness is advisable.

While concerns were identified as the most important determinants, perceptions on product characteristics also relate to involvement. Involvement in healthy and sustainable eating can thus also be increased by strengthening beliefs about some experience product characteristics such as the beliefs that healthy and sustainable foods are tasty and filling. Policy actions can therefore include free sampling in order to expose consumers to these products. Increasing the belief that healthy and sustainable diets are easy to prepare by demonstration activities or by providing recipes may also

result in increased involvement. For involvement in healthy eating specifically, the use of natural food claims can be a potential communication activity, since the perception of healthy diets as being natural is also associated with involvement in healthy eating. Involvement in sustainable eating could be triggered by increasing the belief that sustainable diets are not necessarily expensive, e.g. through providing concrete examples of prices of sustainable food items or overall costs of sustainable meals. This will be particularly important for the health involved segment which is already highly involved in healthy eating but whose involvement in sustainable eating is only moderate as yet. The latter can be realized by educating this segment on the affordability of a sustainable diet and on the sustainability issues related to their dietary choices, which is expected to increase their awareness and concern about sustainability and, thus, their involvement in sustainable eating.

Based on the four segments identified, the advice on how to increase involvement might have a different focus. More specifically, for the segments who are not yet highly involved in healthy eating (S1 and S2), the focus is recommended on increasing involvement in healthy eating. Once they are involved in healthy eating (S3), the focus can be shifted to increasing the involvement in sustainable eating next to increasing the involvement in healthy eating. From the determinants tested, food-related health/sustainability concerns were identified as the most important, thus increasing awareness through education/information campaigns in health and sustainability aspects of food are recommended to increase involvement in health and sustainable eating respectively. Even for segment S4, based on their concerns for food-related healthy and sustainability issues (less than 4), increasing awareness on these issues is suggested to foster involvement.

Involvement has an influence on the consumer decision-making process. The level of involvement reflects the perceived personal importance, interest or relevance. As mentioned by Verbeke and Vackier (2004, p 159), involvement influences various steps in the consumer decision-making process such as “the extensiveness of information search, the length of the decision-making process, formation of beliefs, attitudes and intentions, as well as behavioral outcomes such as variety-seeking behavior, brand-switching behavior, brand-commitment or loyalty, frequency of product usage or shopping enjoyment” (Beharrell and Dennison, 1995; Mittal and Lee, 1989). We did not evaluate the effects of involvement in healthy eating and sustainable eating on the different steps in the decision-making process since respondents did not make any food choices. However, based on the known influence of involvement on the consumer decision-making process, a different approach to stimulate healthy and sustainable food choice can be recommended for low and high involvement segments, as described in the next paragraphs. Depending on the degree of involvement, the attention given to each of the

stages of the consumer decision-making process will differ. Those with a low involvement will move from recognizing a need to product choice and will spend little time to the stages of information search and of evaluation of the product.

High involvement leads to more cognitive effort to fulfill an important personal need and thus leads to an active search and use of information, careful processing of information weighing and evaluating many product attributes before developing an attitude and moving to behavioral intention or behavior (Verbeke and Vackier, 2004). It is thus important for these groups that are involved, to give them to information that they are looking for. Specifically, S3, the health involved, and S4, the health and sustainably involved, are likely to put more time and effort into searching and using information about health and about health and sustainability aspects, respectively. Information such as health and/or sustainability labeling can help them make an informed decision as they are more motivated to look at this information. Information about the existence of the healthier /more sustainable alternatives can help to increase the number of products in their awareness set and could also be advisable for these two involved segments.

Low involvement refers to satisfied needs resulting in routine, habitual or impulsive behavior, without extensive information processing (Verbeke and Vackier, 2004). Thus consumers from the uninvolved segment (S1) are likely to engage in a routine behavior or impulse buying without putting a lot of cognitive effort in the information provided about the healthy or sustainability information of the foods. Attracting their attention to this information caused by the characteristics of the food packaging itself (color, size, location, saliency etc) will be important, especially in an information overloaded environment.

In addition to information provision, non-informational approaches where consumers are nudged into more healthy and sustainable habits are attaining attention (Thaler and Sunstein, 2008). Nudging could softly and voluntarily shift consumers toward more sustainable food choices and includes for example the effects of social norms, product accessibility, default options, and priming. Especially when involvement is low, and thus the information search is limited, nudging can be a helpful tool. However, instead of using only one approach, a combination of information provision and nudging can be suggested for both low and high involved consumers. Olander and Thorgersen (2014), in their study on environmentally friendly choices, suggest to not choose between informing and nudging but apply both. They demonstrated that providing people with information, which they consciously process, together with nudging cues targeted at unconscious motivations, can encourage a desired shift in lifestyle habits.

Involvement and motivation is one aspect but of course consumers also need to have the knowledge and tools to translate this into action and make sustainable and healthy food choices. Nutrition labels on food packages may provide clear and understandable information about the product's nutritional content and health value. However, even if consumers are motivated to eat healthily, several barriers exist for the use of this information to be translated into healthy food choices, such as the lack of attention, knowledge and understanding of the nutrition information on pack (Grunert and Wills, 2007; Grunert et al., 2010; 2012). While the nutritional composition of foods is consistently reported, health-related information provided through claims and symbols may be more difficult for consumers to understand and use in assessing the health-related food quality (Hieke et al., 2015). For sustainability aspects, it is perhaps even more difficult for consumers to make informed choices as information about the sustainability impact of food products are not always available or not reported in a consistent way. A wide range of labels have been developed resulting in possible information overload, while the knowledge about the meaning of each of these labels is low (Gadema and Oglethorpe, 2011; Grunert et al., 2014). Similarly as with nutritional labels, various barriers exists regarding the use of sustainability labels (Grunert, 2011). Consumers may make trade-offs between health and sustainability and other products criteria when making food choices, such as taste, price, origin and brand. Consumers may prefer the immediate benefits of tasteful food products over the long-term personal benefits of healthy foods (Verbeke, 2006) and the societal benefits of sustainable food. More studies are needed on food choices at the point of purchase, and their eventual impact on health and sustainability.

Information provision, awareness raising and educational activities play an important role in increasing consumer involvement in health and sustainability issues (Garnett et al., 2015). This study provides valuable insights for communication policies on how to effectively increase consumer involvement in healthy and sustainable eating. Presented results provide support for so-called 'soft' policy approaches, i.e. policies supporting informed choice such as public information campaigns, education and labeling. An increased consumer involvement in health and sustainability aspects of food due to such information provision can in its turn encourage both policy makers and the food industry to take more radical actions to stimulate healthy and sustainable diets (Garnett et al., 2015). These radical actions refer to policies targeting the market environment such as fiscal measures, regulations and mandatory standards. An EU wide review on policy interventions to promote healthy eating found these 'hard' approaches to be more effective to translate into action than the 'soft' approaches but also more intrusive (Brambila-Macias et al., 2011; Capacci et al., 2012). In recent years, non-intrusive approaches such as public awareness campaigns and labeling have mostly been used in healthy

promoting policies to foster behavioral change (Garnett et al., 2015) as these are more politically acceptable than regulatory or fiscal measures. Likely for policy approaches aiming at achieving integrated health and sustainability outcomes, 'soft' approaches are advised first to increase awareness and engagement (Garnett et al., 2015). In a later stage, when consumers are more aware and concerned about these issues, they are more likely to accept more radical actions. Then a combination of different approaches including regulatory, fiscal, voluntary, contextual and information oriented is recommended (Garnett et al., 2015), as approaches aiming at individuals to voluntary change behavior have limited impacts.

Some limitations should be acknowledged when interpreting our findings, which identify some opportunities for further research. First, this study was focused on the involvement in healthy and in sustainable eating. Whereas involvement and motivation are important determinants for making healthy and sustainable food choices, future study could extend this by including other factors. As mentioned by Kotler et al. (2013), there are four sets of consumer characteristics that influence the consumer decision-making process (cultural, social, personal and psychological). Thus in addition to perceptions and involvement, a wider range of cultural, social, personal and psychological factors are suggested. Examples are knowledge, interest, personality, social norms etc. Personal values (for example based on Schwartz Portrait Values) are linked to sustainable food behavior (Grunert et al., 2014; Vermeir and Verbeke, 2006). While our study measured the perception of food attributes, importance of attributes is also importance as this relates to the motives for food choices (Onwezen et al., 2010). Additional, it is suggested to include measures for social norms or social pressure from peers to account for the willingness to comply with the opinion of others, as it may contribute to explaining intention to sustainable behavior (Vermeir and Verbeke, 2006). In addition to consumer characteristics, investigating environmental factors (e.g. situational influences such as time and occasion), and product-related factors (e.g. price, place, promotion, product-categories) are recommended. When addressing the relation between healthiness and sustainability perceptions, Verain et al. (2016) suggests to taken into account different food categories.

Second, the study respondents did not make food choices. Future studies could combine this food choice data to investigate the relation between involvement and healthy and sustainable food choice.

Finally, the use of an online data collection method may have some consequences and limitations. The present study, just like most research in this field, depended on self-reported measures. Although these provide valuable insights, they likely suffer from social desirability bias and hence may deviate from actual behavior (Fisher, 1993). This study did not control for social desirability, common method

error bias and cognitive consistency. To overcome these limitations, more experimental and observational research are recommended. A convenience sampling approach was adopted, which is vulnerable to a sampling bias because of subject self-selection. The use of a convenience sample limits the interpretation of the findings to its specific sampling frame. Although we had representative samples for age, gender and location in each of the four countries, extrapolation to other populations remains to be further validated.

2.5 Conclusion

This study concludes that there is a close match between European consumers' image of a healthy, a sustainable and a plant-based diet. This finding suggests that food policies combining health and sustainability aspects into communication actions and guidelines may not be perceived as conflicting by consumers. It will be important that consumers' involvement in healthy and sustainable eating can be increased and turned into actual behavior. Food-related health and sustainability concerns are the main drivers for consumers' involvement in healthy and sustainable eating, respectively. Policy actions aiming at informing consumers about the consequences of their dietary choices for their personal health and the environment are recommended, as these may consecutively raise awareness and involvement.

Chapter 3

Consumers' valuation of organic yoghurt

This chapter is based on:

Van Loo, E.J., M. Nguyen Hoang Diem, Z. Pieniak, and W. Verbeke. 2013. Consumer attitudes, knowledge and consumption of organic yoghurt. Journal of Dairy Science 96:2118-2129.

Abstract

The segment of organic products occupies an increasingly important place in dairy assortments. The European Union (EU) introduced a new EU organic logo in 2010 with the aim of harmonizing its organic sector and boosting consumer trust in organic food. This study focuses on organic yoghurt and investigates consumer awareness and knowledge of the new EU logo. Consumers evaluate organic yoghurt as superior compared to conventional yoghurt on healthiness, environmental friendliness, quality and safety. More frequent buyers of organic yoghurt have a stronger belief that organic yoghurt is superior. The willingness-to-pay (WTP) for organic yoghurt ranged from a premium of 15% for non-buyers to 40% for habitual buyers, indicating the market potential for this product. The structural equations model reveals the positive association between knowledge, attitudes and the self-reported frequency of purchasing organic yoghurt. Nevertheless, consumer awareness of the EU organic logo remains rather low, which suggests a need for more effective information campaigns and marketing actions.

RQ4: What are the consumers' preferences and WTP for organic labels on yoghurt?

RQ5: How do people with a different buying behavior differ in terms of WTP premium for organic yoghurt?

RQ8: Do consumers recognize organic labels (EU organic logo and the Belgian Biogarantie organic logo) and do they know what it stands for?

RQ9: Is there an association between consumer attitudes, objective knowledge about organic logos and organic yoghurt purchase frequency?

3.1 Introduction

Within the dairy industry, organic dairy is gaining importance in the EU. Dairy products together with fresh fruit and vegetables are the most popular organic food categories (Soil Association, 2012). The production of organic milk is the largest in Germany (595 million kg organic milk in 2010), Denmark (440 million), UK (470 million), Austria (425 million), France (266 million), Sweden (180 million), Switzerland (205 million) and The Netherlands (140 million) (BioForum, 2011). In some EU countries such as Austria and Denmark, the organic milk production reached a remarkable 14% and 9.8% of the total milk production in 2010 (BioForum, 2011). For Belgium, the annual organic milk product was estimated at 32 million kg in 2010, 1.1% of the total milk production and is expected to continue to expand. In most European countries (with the exception of UK), the supply of organic milk is unable to keep up with the growing demand resulting in a shortage of organic milk. As a result, several countries are importing organic milk from elsewhere. For example, France, the Netherlands and Belgium are importing organic milk from the UK (BioForum, 2011). An estimated 23 million liters of raw organic milk was imported in Belgium in 2010 (BioForum, 2011).

The EU organic food sales were estimated at 19.6 billion euros in 2010 (IFOAM/FiBL, 2012). In Belgium, the organic food sector was valued at 435 million in 2011 (VLAM, 2012). The Belgian consumers' spending on organic dairy products was 46 million in 2011 (VLAM, 2012) which is an 84% increase compared to 2007. In Belgium, similarly as in other EU countries (Soil Association, 2012), dairy products rank second in terms of importance within the organic food basket, preceded only by the fresh fruit and vegetables category (VLAM, 2012). In 2011, approximately 60% of the Belgian consumers chose occasionally for organic vegetables followed by organic fruit with 39% and organic dairy which was bought occasionally by one third (32%) of the Belgian consumers (VLAM, 2012).

The expanding organic food industry is the result of the growing demand for organic food. One of the reasons is the raising consumer concerns about the conventional food production. The key driver for organic food consumption is most likely the belief that organic food is healthier and safer compared to its conventional counterparts (Aertsens et al., 2011; Gracia and Magistris, 2008; Hughner et al., 2007; Magnusson et al., 2003; Padel and Foster, 2005; Van Loo et al., 2010; Yiridoe et al., 2005). On the other hand, some factors prevent consumers from purchasing organic food. The key deterrents are the high premiums for organic food in combination with the low availability (Hughner et al., 2007; Van Loo et al., 2010; Yiridoe et al., 2005). According to Mondelaers et al. (2009), consumers frequently buying organic food are less affected by the high prices compared to light users. Other barriers are the unfamiliarity of the organic food logos, the skepticisms of the organic certification logos, and the

disbelief that organic food is better (Van Loo et al., 2012). For an organic label to be successful, it is important that the logo is well-known and trusted by the consumers (Janssen and Hamm, 2012a).

Numerous different organic food certifications exist across Europe, both governmental and of private organizations. With the aim of harmonizing the EU organic food sector and to increase consumer trust in the organic certification, the EU introduced a new organic food logo in 2010. This new logo became mandatory in 2012 for use on all organic food sales in the EU after a 2-year transition period (EG 834/2007, EG 889/2008 and EG 271/2010) (the EU logo used before 2012 will further be referred to as the "former organic EU logo"). With the introduction of the mandatory organic food logo, the EU aims to establish a harmonized organic certification system and hopes to improve the recognition of organic food by consumers with one harmonized logo (EG 271/2010). The European Commission reported that two-thirds of the Europeans check foods for quality labels; however, recognition of individual quality labels is fairly low. Only 24% of the Europeans are aware of the new EU organic food logo (European Commission, 2012c). Both national organic logos (such as BioSiegel) and organic logos certified by private organizations (for example Biogarantie, BioSuisse, Soil Association) co-exist with the EU organic logo. On the Belgian organic food market, there are two organic food logos present: 1) the new EU organic food logo, and 2) the logo "Biogarantie" which is a logo of a private Belgian organization. The EU organic logo is mandatory present on all organic foods in Europe, while the Biogarantie logo is voluntary. The Biogarantie logo has some additional ethical requirements based on four principles: health, ecology, fairness and care (BioForum, 2012). Many organic food producers and retailers still use the voluntary governmental logos or private organic certification along with the mandatory EU organic food logo, most likely to prevent losing consumers only familiar with the voluntary logos (Janssen and Hamm, 2012a). However, to be certified by the private organic organization such as Biogarantie, additional conditions need to be fulfilled besides those from the EU organic certification.

Consumers are willing to pay a premium price for organic food. Studies reported willingness to pay (WTP) values ranging from 5% to 250% (Batte et al., 2007; Turco, 2002; Van Loo et al., 2011) depending on the country, product, and socio-demographic factors. The reported WTP values also differ depending on the type of organic food logo. Janssen and Hamm (2012a) reported different WTP values for the former organic EU logo, governmental organic logos and organic logos from private organizations such as farmers' and organic sector associations. Consumers from different countries have different preferences for the type of organic logo. For example, in Italy, the old EU organic logo was preferred over the governmental or private organic logos while in Denmark and Germany the opposite was observed (Janssen and Hamm, 2012a). The average premium for organic food in Belgium was 30% in 2011 (VLAM, 2012). The premium for organic milk in Belgium compared to conventional

milk was 64% in 2010 and decreased to 55% in 2011. For yoghurt, the average premium for organic raised from 29% in 2010 to 37% in 2011 (VLAM, 2012).

Research on consumer preferences and attitudes towards organic dairy is limited. Lusk (2011) reported that consumer demand for organic milk is significantly influenced by their food values. The demand for organic milk is higher for consumers who are more concerned about the environment and lower for those who are more conscious about the price. Although organic dairy is the third largest organic food sector (following organic fruit and organic vegetables), there is little research focusing on consumer perception and attitudes towards organic dairy and organic yoghurt specifically.

In this study, we address the need to broaden the knowledge on consumer attitudes towards organic dairy. Our study gives insight on the consumer recognition of the new EU organic logo vis-à-vis the most prevalent organic food logo in Belgium certified by a private organization. This gives information about the success of the introduced mandatory EU organic logo which had as aim to increase the consumer recognition and knowledge. Only the European Commission Eurobarometer evaluated the new EU organic logo after the 2-year transition period along with other consumer attitudes of food quality and food security (European Commission, 2012). However, this study only investigated the awareness of the logo and did not explore attitudes and purchase frequencies. To our knowledge no study has evaluated this new EU organic logo in combination with attitudes and consumption behavior of organic foods. In addition, limited research has focused on organic dairy products and consumer attitudes and knowledge towards these products. This study focuses on both of these issues.

Finally, this study examines whether knowledge about organic food and consumer attitudes are associated with self-reported frequency of organic yoghurt consumption. Both knowledge about organic food and attitudes towards organic food are important determinants for organic food consumption (de Magistris and Gracia, 2008; Pieniak et al., 2010a). Different consumer segments exist based on their attitude towards organic food. Several other studies have indicated the importance of recognizing and identifying consumer segments based on their product usage (Hoek et al., 2011; Pino et al., 2012; Van Loo et al., 2011) to develop communication strategies tailored towards the different consumer segments. Based on the self-reported frequency of consuming organic yoghurt, different consumer groups are defined.

3.2 Material and methods

Quantitative descriptive data were collected through a cross-sectional consumer survey in the Northern Dutch speaking part of Belgium (Flanders) in March 2012 targeting the main responsible for food purchasing. Total sample size was 774 respondents. A market research company was responsible for data collection and invited participants from their consumer panel (convenience sampling). All contact and questionnaire administration procedures were electronic and anonymity was guaranteed.

The questionnaire consisted of different parts related to awareness and knowledge of organic food labels, attitudes towards conventional and organic yoghurt, purchase behavior of organic yoghurt, including willingness to pay (WTP), involvement and socio-demographics (Appendix D).

3.2.1 Awareness and knowledge of organic food logos

To quantify awareness of the EU organic food logo, the recognition and objective knowledge were measured. Respondents were asked if they recognized the EU organic logo shown (yes/no) as well as the Biogarantie logo (yes/no). Next, their objective or factual knowledge of the meaning of the EU organic logo was measured by asking respondents whether four statements were true or false, presented in Table 3.1. Following a similar approach as Pieniak et al. (2010a), no "don't know" answer was included to force the respondents to answer the question. The objective knowledge measure was calculated as the total number of correct responses to the four statements, thus ranging from 0 to 4.

Table 3.1. Knowledge statements on the meaning of the EU organic logo

The logo indicates that …	**Correct answer**	**% Correct answer**
At least 95% of the ingredients are organic	True	52
At least 70% of the ingredients are organic	False	37
This product can contain up to 20% of genetically modified materials or ingredients	False	79
It can be used for products derived from fishing and hunting wild life activities	False	70

3.2.2 Purchase behavior of organic yoghurt

Purchase frequency of organic yoghurt. Respondents were asked 'On 10 times that you buy yoghurt, how often do you choose yoghurt with an organic logo'. A 11-point scale ranging from 'never = 0' to 'always = 10' was used to identify the frequency of organic yoghurt purchases. Throughout the

presentation of the results, there is a comparison between consumers who never, occasionally and regularly purchase organic yoghurt. The grouping is based on the question "on 10 times that you buy yoghurt, how often do you purchase one with an organic logo?" Those answering 0 or 1 time are considered as "non-organic yoghurt buyers", from 2 to 6 times as "occasional buyers" and 7 to 10 times as "habitual buyers". As indicated by Pino et al. (2012) and Van Loo et al. (2010), who also applied a classification of consumers according to their buying frequency, this distinction is important to be able to target tailored communication strategies by food marketers and policy makers to the different consumer groups.

Purchase intention of organic yoghurt. Respondents indicated with three statements, how likely or unlikely it is that they 'expect', 'plan', and 'desire' to eat organic yoghurt in the next 7 days (Pérez-Cueto et al., 2011). A 7-point interval scale ranging from "very unlikely" to "very likely" was used. The purchase intention was calculated as the average of the three answers (Cronbach's $\alpha = 0.977$).

WTP. The average price of 500 g conventional yoghurt was set at €1.50 (reference price). Respondents were asked how much they are willing to pay extra for yoghurt (500 g) with an organic logo. Possible answers ranged from €0 to €1.50 euro. A no-buying option was also included, "I would buy regular yoghurt independent on the price of organic yoghurt", to make the design more comparable to real shopping experiences where consumers can also decide not to purchase organic yoghurt (Van Loo et al., 2011).

3.2.3 Attitudes and involvement towards (organic) yoghurt

Importance of yoghurt attributes. The importance of yoghurt attributes was scored on a 7-point Likert scale ranging from "totally disagree" to "totally agree". Ten attributes (such as taste, quality, and availability) were included based on previous studies (Grankvist and Biel, 2001; Vanhonacker and Verbeke, 2009).

Beliefs about organic yoghurt compared to conventional yoghurt. Adapted from Hoogland et al. (2007) and Vanhonacker and Verbeke (2009), participants compared nine aspects of organic yoghurt with conventional yoghurt such as taste, healthiness and environmental friendliness. Perceived differences among organic and conventional yoghurt were identified with the question: "Organic yoghurt scores (worse/better) than conventional yoghurt in terms of…?", with a 7-point scale with '1= much worse', '2= worse', '3= somewhat worse', '4= same', '5= somewhat better', '6= better', '7= much better'.

General attitudes towards organic yoghurt. General attitudes towards organic yoghurt were measured using 7-point semantic differential scales. Respondents were presented with the statement: "Please indicate which word best describes your feeling of organic yoghurt compared to conventional

yoghurt". The bipolar adjectives were bad/good, unpleasant/pleasant, and negative/positive, a commonly used scale for assessing general attitudes (Honkanen et al., 2006; Olsen et al., 2007; Pérez-Cueto et al., 2011; Pieniak et al., 2010a; Stayman and Batra, 1991). The construct "general attitude towards organic yoghurt" is the average across the three items (Cronbach's $\alpha = 0.963$).

Involvement. Involvement relates to the importance of the product and the extent to which the right product choice is important to the consumer (Zaichkowsky, 1985). The degree of involvement will impact the time and effort devoted to making the purchasing decision. The involvement in organic food was measured according to the procedure of Bell and Marshall (2003) and Pieniak et al. (2008) using the four items: "Organic food means a lot to me", "I care a lot about organic food", "Organic food is very important to me", "I appreciate organic food very much". Involvement with organic food was calculated as the average score across the four items (Cronbach's $\alpha = 0.966$).

3.2.4 Data Analysis

The survey data was analyzed in SPSS 19. Constructs were formed as indicated after testing the reliability (Cronbach's alpha). To test for independence in cross-tabular data, chi-square tests were performed. T-test was applied to compare two means and ANOVA to compare more than two means. Scheffe or Dunnett T3 Post Hoc were performed, in case of equal variances could or could not be assumed. In all statistical tests, a significance level of 0.05 was used to identify significant differences.

3.2.5 Structural Equation Modeling

Structural equation modeling (SEM) was performed to analyze whether knowledge about organic food and consumer attitudes are associated with organic yoghurt consumption frequency. First, with confirmatory factor analysis (LISREL 8.72) construct validity was estimated, including both convergent validity and discriminant validity. Convergent validity measures the extent the measured items of a specific construct share a high proportion of the variance in common while the discriminant validity measures the extent a construct is distinct from other constructs (Hair at al., 2010).

Second, structural equations model parameters were estimated and the general fit of the model was assessed. With the use of SEM, all the relationships between constructs and items are examined simultaneously, which is a substantial advantage compared with single equation modelling (Bollen, 1989). To evaluate the models fits, the χ^2-value together with degrees of freedom are reported, as well as three other indices: the Root Mean Square Error of Approximation (RMSEA), the Goodness of Fit Index (GFI) and the Comparative Fit Index (CFI). Values below 0.08 for RMSEA (Browne and Cudeck, 1993) and above 0.90 for GFI and CFI (Bollen, 1989) indicate an acceptable fit of the model.

3.3 Results and discussion

3.3.1 Characteristics of the sample

A total of 774 respondents completed the survey (Table 3.2). The demographic analysis reveals a gender distribution of 62% female and 38% male, which corresponds with females being the main responsible person for food purchasing in most households. Each age category is represented as well as different compositions of households (number of adults and children). The sample is slightly biased towards higher educated respondents (>70% with education beyond the age of 18 years), which may be attributed to the use of an electronic survey method. Most of the respondents worked full- or part-time. Most participants had moderate (35%) or moderate to well-off (53%) financial status. This subjective assessment of the household's financial situation is a proxy of socio-economic class.

3.3.2 Frequency of buying: Types of consumers

Approximately 57% of the respondents were identified as non-buyers while 43% of the respondents purchase organic yoghurt (26% occasional and 17% habitual buyers). Similarly, based on GfK Panel data, VLAM (2012) found that 33% of the Belgian households purchased organic dairy products in 2011.

3.3.3 Profile of organic yoghurt consumers

Little demographic differences among the three types of buyers were prevalent (Table 3.2). The frequency of buying differs significantly among men and women ($p<0.001$), with women being more likely to purchase organic yoghurt. This might be due to women being more concerned about food safety and health (Tsakiridou et al., 2008), which have been shown to be important motives for purchasing organic food (Hoefkens et al., 2009). The other demographics are not significantly different among the three consumer groups including age ($p=0.56$), number of adults ($p=0.84$) and children ($p=0.42$) in the household, education ($p=0.24$), working status ($p=0.16$) and self-reported financial situation ($p=0.56$). Some inconsistency exists in the socio-demographic profile of organic consumers across different studies and a clear profile remains elusive (Pearson et al., 2011; Van Loo et al., 2012). Organic food buyers exist across all demographic segments, although some small trends have been reported: organic consumers are more likely to be women, high income earners, be younger and have young children.

Table 3.2. Organic yoghurt consumption among different demographic groups

	Total sample	Frequency of buying			P-value (χ^2-test)
		Non-buyers (%) (n=433)	Occasional buyers (%) (n=202)	Habitual buyers (%) (n=131)	
Gender					0.001*
Male	37.9	66.4	22.6	11.1	
Female	62.1	50.9	28.3	20.8	
Age group					0.557
18-24 years	13.4	60.2	25.3	14.5	
25-34 years	24.3	64.0	24.0	12.0	
35-44 years	15.0	53.8	25.8	20.4	
45-54 years	25.1	51.0	27.7	21.3	
55-64 years	16.3	58.4	23.8	17.8	
65 years or older	5.8	50.0	30.6	19.4	
Living situation					0.955
Single	14.1	58.0	25.0	17.0	
With others	85.9	56.4	26.4	17.2	
Household members of 15 years and older					0.843
1	14.5	56.8	26.1	17.0	
2	50.5	57.3	24.8	17.9	
3	14.8	57.8	23.3	18.9	
4	14.0	51.8	32.9	15.3	
≥ 5	6.3				
Children younger than 15 years					0.424
0	76.3	56.8	27.4	15.8	
1	9.7	56.7	21.7	21.7	
2	10.0	58.1	24.2	17.7	
≥ 3	4.0	44.0	24.0	32.0	
Educational level					0.235
Elementary school or high school	25.5	62.3	24.5	13.2	
Higher education (not university)	43.1	56.1	24.2	19.7	
University	31.4	53.1	30.1	16.8	
Working status					0.160
Full-time employed	61.0	61.2	22.6	16.3	
Part-time employed	12.3	49.4	31.2	19.5	
Retired	9.6	45.0	31.7	23.3	
Student	11.0	58.0	29.0	13.0	

Unemployed (seeking work)	2.6	43.8	43.8	12.5	
Houseman/housewife	3.5	40.9	36.4	22.7	
Financial situation					0.558
Difficult	12.3	54.5	32.5	13.0	
Moderate	34.9	54.6	26.6	18.8	
Moderate to well off	52.7	58.4	24.6	17.0	

Our study is consistent with most studies reporting organic consumers to be typically female (Bellows et al., 2008; Hughner et al., 2007; Pearson et al., 2011; Yiridoe et al., 2005; Zander and Hamm, 2010). However, not all studies are consistent about the other demographics characteristics of organic consumers. Some studies report that organic consumers are older (Bellows et al., 2008; Hughner et al., 2007; Van Loo et al., 2010), others report that they are likely to be younger (Krystallis et al., 2006a; Magnusson et al., 2001; Mintel, 2011) while O'Donovan and McCarthy (2002) similarly to our study, reported no relationship between age and organic food purchase behavior. Earlier studies also found that income does not have an influence on organic food purchases (Van Loo et al., 2010) while other studies report high income families to be more likely to purchase organic foods (Gracia and Magistris, 2008; Mintel, 2011; Pearson et al., 2011). Hughner et al. (2007) reported that children in the household may increase the likelihood of purchasing organic food, while Mintel (2011) reported that households without children, with one child and with more than one child have an equal consumption of organic yoghurt and yoghurt drinks (45%) which is comparable to our results.

3.3.4 Consumers' recognition and objective knowledge of organic food logos

More than two thirds of the participants (69%) did not recognize the new European organic food logo (Table 3.3). This is consistent with the results of the Eurobarometer study were only 24% of the EU respondents indicated to recognize the new EU organic food logo. However, awareness of the EU organic logo among EU member states varied and for Belgian consumers the awareness was even lower (20%) (European Commission, 2012c). A first requirement for a successful logo is that consumers recognize it. Our findings together with those from the European Commission suggest some major challenges for the EU organic food logo. As stated by Janssen and Hamm (2012a) logo awareness is a first prerequisite; however, in addition to the logo recognition, a successful logo also requires trust and credibility. Several studies indicated the uncertainty and lack of trust towards the organic food logo to be barriers for organic food purchases (Aertsens et al., 2009; Hughner et al., 2007; Padel and Foster, 2005; Van Loo et al., 2010).

Table 3.3. Recognition and objective knowledge of organic food logos (%)

	Total sample	Frequency of buying			P-value
		Non-buyers	Occasional buyers	Habitual buyers	
Recognition of EU organic logo					
Yes	31	22	39	49	<0.001[1]
No	69	79	61	51	
Recognition of Belgian organic logo					
Yes	54	44	62	73	<0.001[1]
No	47	56	38	27	
Objective knowledge (Number correct answers to 4 statements)					
0	5.0	4.2	7.9	3.2	0.01[1]
1	16.7	15.2	20.9	14.7	
2	36.1	37.7	36.7	28.4	
3	19.1	21.7	14.1	17.9	
4	23.1	21.2	20.3	35.8	
Mean	2.39	2.41[a,b]	2.18[a]	2.68[b]	0.002[2]

[a,b] Scores within a row with different superscripts are significantly different, [1] χ^2-test, [2] F-test

The "Biogarantie" logo, a logo certified by a Belgian private organization, has a much higher recognition, with more than half of the respondents (54%) reporting to recognize this logo. This logo has been introduced in 1988 and has not changed since then. Janssen and Hamm (2012b) studied in 2010 the consumers' perception of the new EU organic food logo. The results revealed that some consumers would still orient themselves by using the existing logos instead of the additional new EU organic logo. Even in 2012, after being exposed for two years to this new logo, our study has similar findings with higher recognition of the private organic certification logo compared to the EU logo. The consumers' familiarity with the EU logo is likely related to the visibility of the EU organic logo in the marketplace (Janssen and Hamm, 2012b). The limited use of the old EU logo in previous years when the EU logo was not mandatory yet; while the "Biogarantie" logo was present on most organic food sales in Belgium since 1988 can explain these large differences in logo recognition between the two logos. Additionally, the lack of a large campaign about the EU organic logo also contributes to its limited familiarity. In Germany, similar results are found as the consumer trust and awareness of the mandatory EU logo was much lower compared to the German governmental Bio-Siegel logo, which Janssen and Hamm (2014) attribute to the large promotional campaign of the Bio-Siegel logo after its introduction in 2001 while no large campaign for the EU logo was undertaken. Two years after the introduction of the Bio-Siegel logo (2003), 67% of the Germans recognized it, while for the EU logo in

2012 in German it was only 33%. Since the EU logo is now mandatory on organic food packages, its awareness is likely to increase in future (Janssen and Hamm, 2014). However, not only awareness but also knowledge in its meaning and trust in the inspection system are important (Janssen and Hamm, 2012b). This suggests a need for information campaigns and marketing actions to increase the awareness, trust and understanding of the meaning of the EU logo. Consumers currently not purchasing organic yoghurt report the lowest recognition of both the EU organic and the Belgian organic food logo, followed by the occasional buyers and next the habitual buyers ($p<0.001$) (Table 3.3).

The objective knowledge of the meaning of the EU organic food logo was relatively low. Only 23% of the study participants provide a correct answer to the four true-or-false statements (Table 3.3). Habitual buyers have a significantly greater knowledge about the EU organic food logo compared to occasional buyers (Table 3.3). The objective knowledge did not differ between non-buyers and occasional buyers. However, credibility and trust in the label were not measured and could differ between these groups.

These results clearly indicate the need to increase the awareness of the EU organic food logo among consumers. Not only is there a low recognition of the logo, but also the knowledge of the rules the EU organic food need to comply with, are unknown to many consumers. The low consumer knowledge on organic food certification has previously been reported (Aertsens et al., 2009; Janssen and Hamm, 2012b) and may act as a barrier for organic food purchases (Vermeir and Verbeke, 2006). Janssen and Hamm (2012b) also reported consumer concerns in 2010 with respect to the introduction of the EU logo. Consumers were afraid that the new logo would lead to downscaling of standards and trustworthiness of the inspection system. Janssen and Hamm (2012b) warned us that sufficient communication would be needed about the meaning of this new EU logo during its introduction and that this would be a major challenge during the introduction phase of the logo. Our results indicate that in 2012 there is still not sufficient knowledge of EU organic logo and that further communication campaigns are needed to increase the knowledge of the new EU logo which on its turn may boost organic food purchases. Since the voluntary organic certification logo "Biogarantie" carries a higher awareness, it might be advisable to use both the mandatory EU logo and the "Biogarantie" logo during a transition period (Janssen and Hamm, 2012b). However, it is not clear how long a transition period will be required. It seems that even two years after the introduction on the EU logo, the awareness in Belgium is still much less than the "Biogarantie" logo and hence the "Biogarantie" logo is still needed.

Table 3.4. Importance of yoghurt attributes, beliefs about organic yoghurt, concerns and other factors

		Frequency of buying			
	Total sample	Non-buyers	Occasional buyers	Habitual buyers	P-value (F-test)
Involvement	4.07	3.30[a]	4.61[b]	5.78[c]	<0.001
General attitude	4.95	4.36[e]	5.38[f]	6.27[g]	<0.001
Purchase intention	2.96	1.76[a]	3.69[b]	5.90[c]	<0.001
Importance of yoghurt attributes					
Taste	6.40	6.29[a]	6.54[b]	6.55[b]	0.009
Quality	6.17	6.02[a]	6.23[a]	6.55[b]	<0.001
Trustworthiness	5.68	5.46[a]	5.79[b]	6.26[c]	<0.001
Nutritional value	5.31	5.07[a]	5.47[b]	5.83[c]	<0.001
Price	5.23	5.24[a,b]	5.43[a]	4.89[b]	0.009
Availability	5.12	4.98[e]	5.17[e,f]	5.51[f]	0.002
Environmental friendliness	4.69	4.10[a]	5.06[b]	6.03[c]	<0.001
Packaging	3.71	3.43[a]	3.83[b]	4.45[c]	<0.001
Brand name	3.69	3.64	3.68	3.86	0.505
Provided with an organic logo	3.68	2.78[a]	4.22[b]	5.85[c]	<0.001
Beliefs: organic vs conventional yoghurt					
Healthiness	5.11	4.73[e]	5.30[f]	6.08[g]	<0.001
Environmental friendliness	4.95	4.71[e]	5.05[f]	5.60[g]	<0.001
Quality	4.78	4.43[a]	4.95[b]	5.70[c]	<0.001
Safety	4.54	4.38[a]	4.56[a]	5.05[b]	<0.001
Taste	4.50	4.08[a]	4.64[b]	5.63[c]	<0.001
Trustworthiness	4.49	4.20[a]	4.61[b]	5.28[c]	<0.001
Packaging	4.06	3.88[a]	4.11[b]	4.58[c]	<0.001
Availability	3.40	3.26[e]	3.40[e]	3.83[f]	<0.001
Price	2.68	2.53[a]	2.71[a]	3.16[b]	<0.001

[a, b, c] indicate significantly different means using Dunnett T3 Post Hoc

[e, f, g] indicate significantly different means using Scheffe Post Hoc

3.3.5 Organic food involvement and general attitudes towards organic yoghurt

The three consumer groups also differ in terms of involvement with organic food. Habitual consumers have the highest involvement followed by the occasional buyers and then by the non-buyers (Table 3.4) which is consistent with Vermeir and Verbeke (2006) who reported high involvement to have a positive influence on organic food purchases. Increasing frequency of organic yoghurt purchases also associates with more favorable general attitudes towards organic yoghurt, similar as reported by Pieniak et al. (2010a) for organic vegetable consumption (Table 3.4). As expected, purchase intention also increases with an increasing purchase frequency (Table 3.4).

3.3.6 Importance of yoghurt attributes

The most important attributes of yoghurt are taste, quality and trustworthiness, followed by nutritional value, price, availability and environmental friendliness (Table 3.4). Packaging, brand name and being provided with an organic logo are considered as less important. Thus, having an organic logo is considered as one of the least important attributes compared to the other listed yoghurt attributes. This is consistent with other studies that indicated sensory quality or taste as an important attribute for organic food buyers (Kihlberg et al., 2005; Magnusson et al., 2001; Torjusen et al., 2001; Van Loo et al., 2010).

The importance of the different yoghurt attributes depends on the type of consumer except for the brand name (Table 3.4). With an increasing frequency of purchasing organic yoghurt, going from non-buyer, to occasional buyer to habitual buyer, the importance of nutritional value, trustworthiness, environmental friendliness, packaging and organic logo increases (all $p<0.001$). The habitual buyer gives more importance to availability and quality and less to price compared to the two other consumer groups.

3.3.7 Beliefs about differences between conventional and organic yoghurt

Consumers have a positive perception of the quality of organic food. They evaluate organic yoghurt better than conventional yoghurt on the aspects healthiness, environmental friendliness, quality, safety, taste, trustworthiness, and packaging (Table 3.4). Consumers rate the healthiness of organic yoghurt as the attribute with the greatest difference with conventional yoghurt. This is consistent with other studies indicating that health, together with food safety are key drivers for organic food purchases (Gracia and Magistris, 2008; Hughner et al., 2007; Magnusson et al., 2003; Padel and Foster, 2005; Van Loo et al., 2010; Yiridoe et al., 2005) or for organic yoghurt purchases specifically (Howlett et al., 2002). The second largest perceived difference between conventional and organic yoghurt is the

perception that organic yoghurt is environmentally friendlier which has also been identified as one of the main drivers of organic food purchases (Gracia and Magistris, 2008; Mondelaers et al., 2009; Yiridoe et al., 2005).

Furthermore, the taste of organic yoghurt is also perceived better than conventional yoghurt. Previous studies on organic food showed similar results, i.e. organic food products are perceived as having a superior taste compared to conventional food products (Gankvist and Biel, 2001; 2007; Lockie et al., 2004; Van Loo et al., 2010). Kihlberg et al. (2005) reported that providing information about organic production has a positive effect on the liking of bread measured as the perceived sensory properties. Similarly, Toschi et al. (2012) reported taste as an important factor for organic yoghurt purchases since organic yoghurt manufacturers and retailers claim that their product has a superior taste. Toschi et al. (2012) compared the sensory properties of conventional and organic yoghurt and the effect of information on liking (blind and labeled test). Their results indicate no difference in odor, taste and texture between organic and conventional yoghurt. Their study confirms the presence of the labeling effect: conventional yoghurt scored significantly higher when (misleadingly) labeled as organic compared to a blind test condition (unlabeled), and scored significantly lower when labeled as conventional compared to the blind test.

The price and availability of organic yoghurt are evaluated worse than conventional yoghurt. Other studies revealed similar results reporting price and availability to be the key barrier for organic food purchases (Hughner et al., 2007; Van Loo et al., 2010; Yiridoe et al., 2005).

Comparing the beliefs among the three consumer groups reveals that the beliefs towards organic yoghurt are more positive with an increasing frequency of organic yoghurt purchases. The beliefs about organic yoghurt become more positive going from non-buyers, to occasional buyers to habitual buyers (all $p<0.001$), except for safety, availability and price where no significant differences exist among non-buyers and occasional buyers (Table 3.4). Consumers buying organic yoghurt more frequently have a stronger belief that organic yoghurt is healthier, environmental friendlier, safer, more trustworthy, tastier, and has a better quality and packaging. Even the consumers who are currently not purchasing organic yoghurt believe that organic yoghurt is superior compared to conventional yoghurt: healthier, better for the environment better quality and taste, safer and more trustworthy and better packaging. Despite the positive beliefs towards organic yoghurt, there are barriers preventing consumers from purchasing it (Grunert, 2011), such as the high price and low perceived availability. Both non-buyers and occasional buyers evaluate the price and availability of organic yoghurt to be worse compared to habitual buyers (Table 3.4).

3.3.8 WTP for organic yoghurt

Approximately 11% of the participants would choose conventional yoghurt instead of organic yoghurt independent of its price. The other 89% prefer organic yoghurt and would, on average, be willing to pay €0.33 extra for a yoghurt priced at €1.5. This reveals an average premium of 22% (Table 3.5), which is clearly lower than current premiums in the Belgium market, being 37% in 2011 on average (VLAM, 2012). Anstine (2007) reported that consumers are also willing to pay more for yoghurt labeled "organic" and Napolitano et al. (2008) found WTP values of 6.5% and 4.7% for plain and low fat yoghurt with higher animal welfare standards.

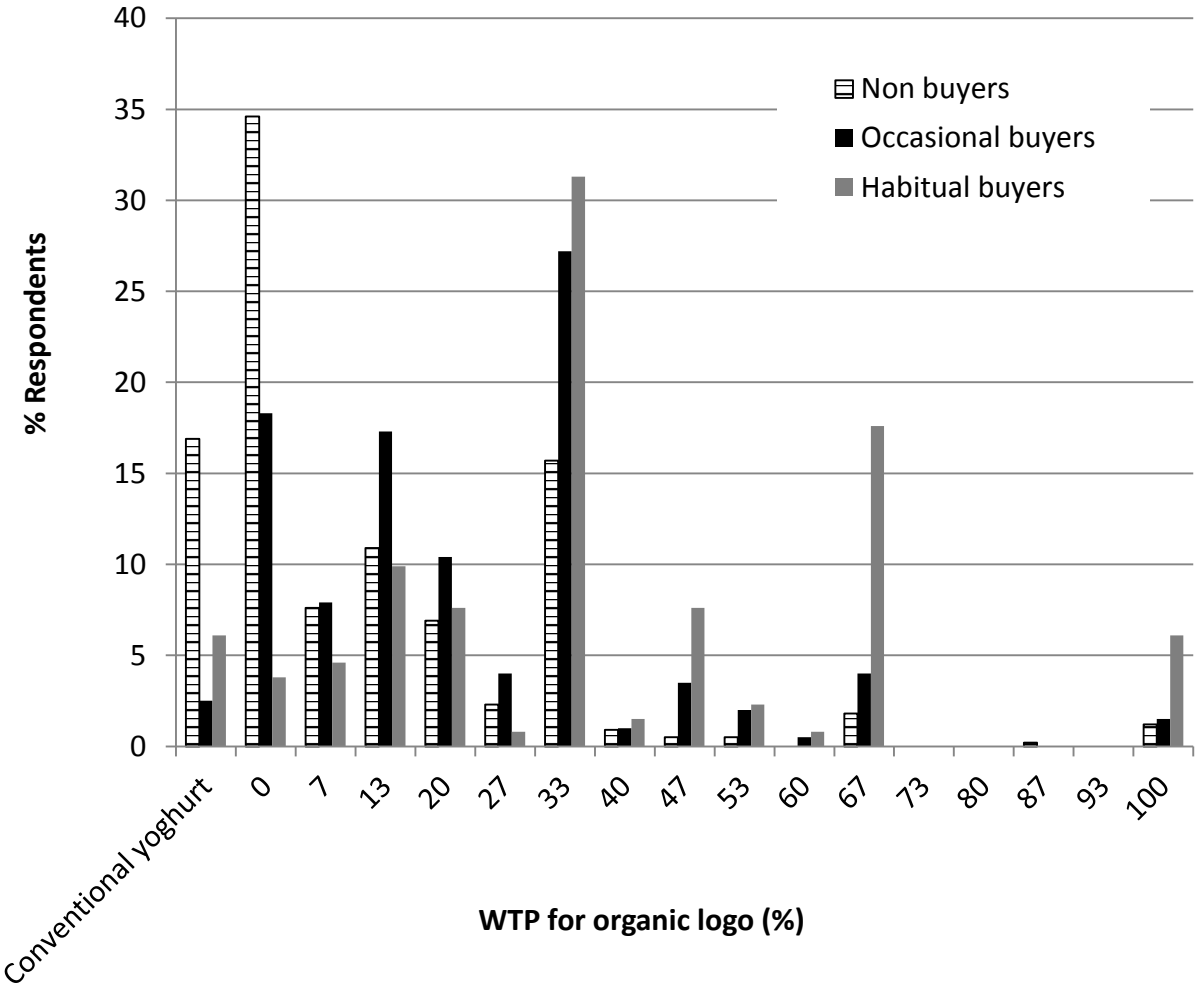
Table 3.5. Willingness-to-pay a price premium for three different types of buyers (%, n=687)

	Total sample	Non-buyer	Occasional buyer	Habitual buyer	P-value (F-test)
Mean (% extra)	21.9	15.2[a]	23.1[b]	39.9[c]	<0.001
St. Dev. (% extra)	22.4	19.1	19.7	25.0	
St. Error (% extra)	0.9	1.0	1.4	2.3	

[a, b, c] indicate significantly different means using Dunnett T3 Post Hoc

Differences among the different groups of buyers are seen ($p<0.001$) (Table 3.5 and Figure 3.1). A large group of those currently not purchasing organic yoghurt indicate to either choose conventional yoghurt independent of the price of organic yoghurt (17% of non-organic buyers) or choose organic yoghurt only if there is no price premium (35% of non-organic buyers) (Figure 3.1). These percentages are a lot lower for the occasional and habitual buyers who are more likely to be willing to spend a higher premium for organic yoghurt. When comparing the average WTP among the three groups, the habitual buyer is willing to pay a premium (40%) which is nearly two and a half times as high compared to the non-buyers (price premium of 15% on average) (Table 3.4). The occasional buyers reported an average premium of 23% (Table 3.5). This is consistent with previous studies reporting higher WTP values for frequent buyers of organic food (Van Loo et al., 2011; Janssen and Hamm, 2012a). The habitual yoghurt buyer is willing to pay a premium (40%) similar to current price premium charged for organic yoghurt on the Belgian market in 2011(37%). The occasional buyer is willing to spend less than the current market price (22% compared to 37%); however, the small differences between the WTP and the current market price reveal market potential. If more organic yoghurt becomes available and prices drop, more occasional buyers might purchase the yoghurt and could become habitual buyers. Conversely, the non-buyers are only willing to spend a premium of 15% meaning that the premium would need to decrease considerably before they would consider choosing organic yoghurt.

Figure 3.1. Percentage premium that three types of buyers would be willing to pay for organic yoghurt



3.3.9 Association between consumer attitudes, knowledge about logos and consumption

In a first step, a confirmatory factor analysis is used to assess the measurement model's construct validity (both convergent validity and discriminant validity). The overall model fit of the measurement model (Table 3.6) indicates a satisfactory goodness-of-fit indices (GFI and CFI>0.90 and RMSEA<0.08) (Hair et al., 2010). All factor loadings in the model are statistically significant ($p<0.001$) which is a basic requirement for the convergent validity of the measurement model. The individual standardized item loadings exceeded the 0.70 threshold (Table 3.6). The construct's average variance extracted (AVE) exceeded the 0.50 threshold (Fornell and Larcker, 1981) and its Cronbach's alpha internal reliability coefficient is above the threshold value of 0.7 for satisfactory scales (Table 3.6), suggesting adequate reliability and internal consistency of the measured variables representing the latent construct. To evaluate the discriminant validity, Hair et al. (2010) suggests, based on Fornell and Larcker (1981), to compare the AVE of the constructs to the squared correlation coefficient between these constructs.

The AVE estimate is greater than the interconstruct squared correlation estimates. Based on the fit statistics, and the construct validity, we can conclude that the CFA results support the measurement model.

Table 3.6. Factor loadings, variance extracted, and construct reliability

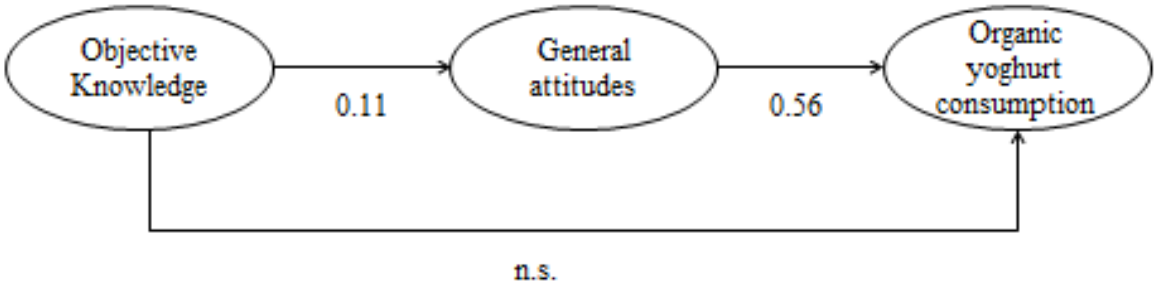
Constructs and items	Standardised factor loadings	Variance extracted
Objective knowledge	1.00 (fixed)	
Organic yoghurt consumption	0.96	
General attitudes	(0.96)	0.90
Bad/Good	0.93	
Unpleasant/Pleasant	0.95	
Negative/Positive	0.96	

Note: All factor loadings are significant at P<0.001. Cronbach's alpha construct reliability is reported between in parentheses. Fit statistics: $\chi^2(4) = 4.361$, p=0.359; RMSEA =0.0208; GFI=0.997 and CFI=1.00

Next, structural equation modeling was performed to analyze whether knowledge about the organic food logo and consumer attitudes are associated with the frequency of organic yoghurt consumption. The tested model performs very well in explaining the variance in the dependent variable (Figure 3.2). The χ^2 for the model is 4.3 with 4 degrees of freedom. The RMSEA value is 0.011; the GFI is 0.99 and the CFI is 0.99, indicating that the goodness-of-fit indices are satisfactory. The R^2 value for the model explaining organic yoghurt consumption is 0.32; thus consumer attitudes and knowledge account for 32% of the variance in self-reported organic yoghurt consumption.

Objective knowledge has a relatively weak relationship with attitude towards organic yoghurt. The association between objective knowledge and organic yoghurt consumption is fully mediated by attitude. A direct relationship between objective knowledge and organic yoghurt consumption has been included in the model but failed to reach significance. Finally, the structural equation analysis supports that attitude towards organic yoghurt has a direct positive and relatively strong relationship with organic yoghurt consumption, which corroborates classical attitude-behavior theories, suggesting that attitude is a predictor of behavior (e.g. Ajzen and Fishbein, 2005; Armitage and Conner, 2001). Vermeir and Verbeke (2006) reported that, despite a strong relationship between attitude and behavior towards sustainable dairy products, attitudes may not match consistently with behavioral intentions and behavior, which explains part of the share of variance not accounted for by the model. Consumer knowledge and attitudes have already been proven to be associated with organic food consumption, particularly organic vegetables consumption (Pieniak et al., 2010a).

Figure 3.2 Structural model (standardised solution) reveals the positive association between knowledge, attitudes, and the frequency of yoghurt purchasing. Coefficients are significant at p <0.001; n.s. = insignificant paths.



3.3.10 Limitations

This study faces a few limitations. A first limitation of our study pertains to its narrow geographic scope and sample bias towards younger and higher educated consumers. As a result, the findings of this study should be interpreted within the specific frame of its sample, and generalizations to the broader public remain to be further validated. There could be some self-selection bias which limits the amount of generalization. Next, similarly as Pieniak et al. (2010a), we have used a self-reported single-item measure for organic yoghurt consumption. The measure we used can be considered valid as long as it adequately captures actual behavior or the "normal" or "usual" behavior of consumers without being influenced by attitudes. Although recent conclusions regarding the predictive validity of single-item measures are positive (Bergkvist & Rossiter, 2007), justifications for their use in scientific marketing research remains an issue of debate (e.g. Rossiter, 2002). Future research using multiple-items measure for behavior or real marketplace behavior data, in order to validate our results, is recommended. Another limitation is the hypothetical nature of the WTP estimates. More research using non-hypothetical and incentive aligned methods are desirable such as experimental auctions or non-hypothetical choice experiments to validate our findings in relation to willingness-to-pay. The EU organic regulation includes numerous rules. Future studies could evaluate consumer knowledge of organic food production more in-depth and differentiate knowledge on various aspects of the regulation (production, processing, controlling and labeling of organic food). Even knowledge of rules for specific food categories can be evaluated. In addition to the use of true/false statements, open-ended questions can be used to measure objective knowledge.

Our study assessed the importance of brand name as an attribute for yoghurt in general, but it did not account for the possible effect of brand names on organic versus conventional yoghurt products. This

area of study deserves more attention in future research since an increasing amount of retailers are expanding their private label (store brand) product assortment and sometimes even incorporate an organic alternative into these store brand product categories. Very few organic food studies have investigated the implications of this trend thus far (Perrini et al., 2010). An important issue in this respect is whether and to what extent brands in general and private labels in particular can reinforce the consumer appeal and value of organic products. Future studies could test the effect of other variables, such as subjective or perceived knowledge on organic yoghurt consumption. It is expected that the new EU organic food logo will gain awareness in future, so future studies can evaluate the evolution of awareness over time and its impact on consumer behavior.

3.4 Conclusions

In order for the new EU organic food logo to be a success, consumers need to recognize it and know its meaning. However, both the recognition and the knowledge are relatively low. The study hereby flags a need to inform and educate consumers more about this new logo. After being introduced on the market since 2010, a higher recognition would be expected by 2012 than the 31% reported in this study. One of the objectives of the EU organic food program is to have a harmonized EU organic food logo with a high recognition to increase consumer confidence and stimulate organic sales. However, our study indicates that more effective communication campaigns may be needed in order to achieve these goals. With the much higher recognition of the private organic certification logo compared to the EU organic label, it is likely that retailers and manufacturers will continue to include the voluntary private organic certification logos on their product in combination to the EU organic logo until consumers have a better awareness and trust in the EU logo. If consumers become more aware of the EU organic logo, there will be no need for the voluntary organic food logos in addition to the mandatory EU organic logo. This would free up some space on the front of package which is important from a marketing point of view for manufacturers and retailers. Furthermore, it can reduce (transaction) costs because there is no need to be compliant to an additional organic certification scheme. Most importantly, one label less will lower the risk of possible information overload and ignorance among consumers; as such, consistent use of one label only may reduce uncertainty, increase trust and facilitate consumer choice (Verbeke, 2005).

Our results can contribute to improve the effectiveness of current marketing strategies of organic yoghurt to both existing and potential future consumers. Our study indicates that the organic yoghurt consumption is not strongly influenced by socio-demographics since only gender is found to have a significant impact. Consumers believe that organic yoghurt is better in many aspects compared to

conventional yoghurt, which provides a strong potential to capitalize on. These positive beliefs about organic yoghurt are stronger for consumers who purchase organic yoghurt compared to those who do not. Consumers purchasing organic yoghurt have a stronger perception that organic yoghurt is healthier, environmental friendlier, more trustworthy, tastier and has a better quality than those who do not purchase organic yoghurt. Food marketers are advised to reinforce the positive image of organic yoghurt in their communications aiming at increasing consumption.

Furthermore, consumers are willing to pay a premium for organic yoghurt, however too high prices are barriers for organic yoghurt purchases, especially among the current non-users. The WTP for organic yoghurt ranged from 15% for non-buyers to 23% for occasional buyers and 40% for habitual buyers indicating the market potential for this product. The WTP for organic yoghurt for the occasional buyers is currently less than the current market price, however, it suggests that a drop in market price can result in occasional buyers to become habitual buyers. This may also indicate some opportunities for compromise products (de Jonge et al., 2015) also referred to as conventional-plus products (Stolz et al. (2011) which go beyond the regulatory standards but are less strict and less expensive than the organic food production. However additional research would be needed to identify its market potential.

Since objective knowledge is indirectly positively linked to organic yoghurt consumption through consumer attitudes, it confirms the importance of improving the consumer knowledge about organic food certification. Thus educating consumers about the organic logo and its meaning is essential. However, objective knowledge does not have a direct impact suggesting that only education will not suffice. Additionally, marketing strategies should reinforce positive attitudes towards organic yoghurt. Based on our findings, positive attitudes towards organic yoghurt would on their turn result in increased organic yoghurt consumption. This information is relevant for both food marketers and food and health policy makers who are recommended to put effort in educating consumers about organic food as well as reinforcing positive attitudes towards organic yoghurt.

Chapter 4

Consumers' valuation of sustainability labels on meat

This chapter is based on:

Van Loo, E.J., V. Caputo, R. M. Nayga Jr., and W. Verbeke. 2014. Consumers' valuation of sustainability labels on meat. Food Policy 49:137-150.

Abstract

There are various sustainability certifications and claims for food products that focus on environmental or ethical benefits. These claims empower consumers to make informed purchasing decisions that take environmental and ethical considerations into account. This chapter compares consumers' preferences for four types of sustainability claims related to organic meat, free range, animal welfare and carbon footprint. Using a choice experiment on a chicken breast product, our results show that nine in every ten Belgian consumers favor free range claims, which are also valued the most highly, attracting premiums ranging from 43% to 93%. Our study also shows that a vast majority of consumers (87%) would welcome the introduction of an EU level animal welfare label. The carbon footprint labels and the organic labels are less appealing to consumers, who have lower willingness to pay for these labels. Belgian consumers prefer the national Belgian organic food logo, certified by a private organization, to the newly-introduced EU organic food logo.

RQ6: What are the consumers' preferences and WTP for sustainability labels on meat (including free range claims, organic labels (EU logo and Belgian Biogarantie), EU Animal welfare label, and Carbon Footprint label)?

4.1 Introduction

The public is increasingly concerned about the way their food is produced: while they care about the physical properties of their food, they also increasingly consider its social, ethical and environmental attributes (Briggeman and Lusk, 2011; Vermeir and Verbeke, 2006). However, consumers' interest in such labeling cannot be taken for granted (Verbeke and Ward, 2006). While there has been an increase in sustainability labeling, the difficulties of signaling the sustainable properties of food products is a major challenge for producers, policy makers, and non-governmental organizations. Properties of sustainability are credence attributes which can only be taken into account by consumers if the attributes are properly signaled at the point-of-sale, e.g. by means of claims. This chapter assesses consumers' preferences, and willingness to pay (WTP), for a set of sustainability claims on chicken breasts using a choice experiment (CE). It also investigates and quantifies the size of the various taste (preference)-based consumer segments for the different sustainability claims.

Several sustainability labeling standards for food have been developed in recent years covering different aspects of sustainability. Some are public initiatives, others private. Sustainability is a broad term that includes several dimensions (Hanss and Böhm, 2012) generally categorized into environmental, social/ethical and economic aspects. The United Nations Conference on Trade and Development (UNCTAD, 2013) defines sustainability claims as "distinctive marks, marketing labels and brands, developed by public and private sector institutions and placed on products and services attesting that their products and supply chains incorporate the pillars of sustainability (economic, social and environmental) into their agricultural production, processing, manufacturing and export processes and services". Claims about the ethical or social dimension of sustainability include animal welfare, free range and Fair Trade labels. Other sustainability claims that address the environmental dimension of sustainability refer to local food production, carbon footprint, food miles or sustainable aquaculture and fisheries. Organic food labeling addresses both environmental and ethical aspects.

Increasing demand for sustainable food products has led to a growth in the number of sustainability food claims with food manufacturers using sustainability claims to differentiate their products. Such claims can include textual, pictorial, graphic or symbolic representation, which states, suggests or implies that a food has sustainability characteristics and is backed up by a certification system. For producers and others in the food supply chain, it is important to know about consumers' preferences towards, and valuation of, sustainability claims. Making sustainability claims and changing production practices to meet these claims is not a cost-free option owing to the more stringent production standards imposed as compared to conventional production. The study on which this chapter is based

assessed consumers' preferences and WTP for a set of sustainability claims on chicken breast. The claims selected were free range claims, organic labels, a European Union (EU) animal welfare label, and carbon footprint labels. To our knowledge, no other study has examined how consumers value such a set of sustainability claims on meat products. We specifically chose a meat product as the sustainability of meat consumption is highly contested, both for ethical and environmental reasons (de Jonge and van Trijp, 2013a; FAO, 2006). The valuation of these claims is useful not only for food marketers but also for public policy makers, who are currently looking into labeling regulations related to the sustainability of food products. No research has compared consumer preferences and WTP for the three existing EU free range claims on poultry meat and little research has examined the WTP for carbon footprint labels on meat. This chapter gives more insights on these issues and allows comparison between different sustainability claims. It also quantifies the sizes of the various taste-based consumer segments.

4.2 Literature review on sustainability labels on meat

4.2.1 An overview of sustainability claims on meat

The most common sustainability claims on the food market are organic food labels. The main one in use in Europe today is the EU organic logo, the standards for which are defined in Regulations EC 834/2007 and EC 889/2008 (EC, 2007a; 2008a, respectively). In 2010, the European Commission developed a new harmonized EU organic food logo, the use of which became mandatory in 2012 on pre-packaged organic food produced in the EU following a 2-year introductory period when its use was voluntary. Most countries have their own organic food logos (sometimes several in one country) which are either certified by governments, private organizations (farmers' and organic sector associations) or a combination of the two (Janssen and Hamm, 2012a). Organic animal products have to fulfil certain requirements related to animal feed, foodstuffs, disease prevention, veterinary treatments, animal welfare, and livestock breeding. The market for organic products in Europe was valued at 21.5 billion euros in 2011, an increase of 9% on the previous year (FiBL and IFOAM, 2013). Organic meat sales are increasing in Western Europe and were estimated to account for nearly 2% of total meat sales in Western Europe in 2009 (Organic Monitor, 2010 cited in Naspetti and Zanoli, 2012). In Belgium organic chicken has a 1.9% market share (GfK, 2012). The number of buyers of organic meat has doubled in Belgium since 2005 (Samborski and Van Bellegem, 2013), making organic meat one of the fastest growing segments of the organic food market.

Another category of sustainability claims includes ethical claims related to farming systems such as free range and animal welfare labels. The European Commission (EC, 2008b) regulates poultry meat

marketing standards according to the farming system used. Examples of these claims include free range, traditional free range, and free range-total freedom (EC 543/2008). Products carrying these free range claims must comply with specific requirements related to feed, stocking density, age, amount of area, etc. For example, for free range poultry products, birds need to have had access to the outside for at least half of their lives. The more stringent traditional free range has requirements for greater minimum age for slaughter (81 days as opposed to 56 days), more extensive open-air access and a lower stocking density. The free range–total freedom is the strictest claim, and has similar requirements as traditional free range but requires open-air runs of unlimited area (Table 4.1). The requirements for organic livestock production are more stringent than those for all the free range farming systems and cover more areas (see comparison in Table 4.1) (EC, 2008a,b; DEFRA, 2010).

Several studies in recent years have highlighted consumer concerns about animal welfare (Bennett et al., 2012; de Jonge and van Trijp, 2013a,b; EC, 2007b; Hanss and Böhm, 2012; Lagerkvist and Hess, 2011; Vanhonacker and Verbeke, 2014) and the need for a harmonized animal welfare labeling scheme at the EU level, that could also act as a communication and marketing tool (EC, 2009a; Ingenbleek et al., 2012; Nocella et al., 2012; Vanhonacker and Verbeke, 2009). Due to the success of the EU's organic program, the EC is considering a similar approach of creating a harmonized EU animal welfare label, modeled on the EU organic labeling regulations (EC, 2009a).

There are also labels that focus on the environmental dimensions of sustainability such as carbon footprint, food miles, and local food production. Consumers are becoming more interested in these labels as concerns grow about the environmental impact of food (Caputo et al., 2013a, b; Gadema and Oglethorpe, 2011; Grebitus et al., 2013a; Onozaka and McFadden, 2011). A carbon footprint label can provide consumers with information about a product's environmental impact by taking the carbon emissions at every stage in its lifecycle into account. With increasing concerns about global climate change and its effects (Vanhonacker et al., 2013), carbon footprint labels could become more widespread. Gadema and Oglethorpe (2011) reported a strong consumer demand for products with carbon footprint labels. The Eurobarometer study on sustainable consumption and production (EC, 2009b) showed that 72% of a sample of EU citizens believed that a label indicating a product's carbon footprint should be mandatory in the future. No harmonized carbon footprint labeling regulations exist yet in the EU although recent private sector initiatives are emerging in several countries (Carbon Trust, 2012).

Table 4.1. EU rules for marketing standards for free range farming systems on poultry meat (based on European Commission Regulation, EC, No 543/2008) and organic poultry meat (based on European Commission Regulation, EC, No 889/2008)

	Free range	Traditional free range	Free range - total freedom	Organic
Flock size	No limit	Max 4800 birds per poultry house	Max 4800 birds per poultry house	Max 4800 birds per poultry house
Stocking density	≤13 birds/m^2 ≤27.5 kg live weight/m^2	≤12 birds/m^2 ≤25 kg live weight/m^2	≤12 birds/m^2 ≤25 kg live weight/m^2	≤10 birds/m^2 ≤21 kg live weight/m^2 (Mobile housing: ≤16 birds/m^2 and ≤30 kg live weight/m^2)
Minimum age of slaughter	56 days	81 days	81 days	81 days
Daytime access to open-air runs	At least half of their lifetime	Starting at age of 6 weeks	Starting at age of 6 weeks	At least 1/3 of their lifetime
Area of open-air run	1 m^2 per chicken	2 m^2 per chicken	Unlimited area	4 m^2 per chicken (Mobile housing: 2.5 m^2 per chicken)
Feed	Min. 70% cereals during fattening stage	Min. 70% cereals during fattening stage	Min. 70% cereals during fattening stage	Organic feed

4.2.2 WTP for sustainability claims

A number of studies have investigated consumers' WTP for organic foods. However, only a few studies have focused on organic meat (Gifford and Bernard, 2011; Nocella et al., 2012; Van Loo et al., 2012; Zanoli et al., 2013). The most important drivers for purchasing organic meat are the perception that it is safer, healthier, more environmentally-friendly and has better animal welfare standards (Aertsens et al., 2009; Mondelaers et al., 2009; Van Loo et al., 2010).

O'Donovan and McCarthy (2002) reported that 44% of participants in their Irish study were willing to pay 1 to 5% extra for organic meat while 29% of the participants were willing to pay a premium of 6 to

10%. A US study reported a WTP premium of 35% ($1.2/lb) for chicken breast with a generic organic food logo and 105% ($3.5/lb) for the USDA organic logo (Van Loo et al., 2011). Regular consumers of organic chicken reported values of twice this level (147% for the general label and 244% for the USDA organic label). The WTP for organic meat depends on the information given about the production method (Gifford and Bernard, 2011) and also on the type of meat (Krystallis et al., 2006b). Krystallis et al. (2006b) reported a WTP premium of 85% to 130% for organic chicken, 103% to 125% for organic pork, and more than 115% for organic beef in Greece. Nocella et al. (2012) reported that 74% of their European participants preferred organic meat to conventional meat with 49% willing to pay €0.65/kg extra for organic meat and 26% willing to spend €0.27/kg extra. Scarpa et al. (2013) found that consumers in Italy were willing to pay an estimated premium of €15.11/kg and €13.79/kg for organic beef and organic chicken respectively, which is higher than the actual prices for organic meat on the Italian market (Zanoli et al., 2013). A study from Gunduz and Bayramoglu (2011) revealed that 81% of Turkish participants were willing to pay a premium for organically raised chicken meat and 24% of the participants were willing to pay a premium of more than 10%. Michel et al. (2011) studied the WTP of value-added chicken product attributes that included the production method (conventional, free range and organic) in Canada. A change from conventional to free range or organic production led to a 9.7% increase in the probability of individuals being willing to pay more for a value-added chicken product (Michel et al., 2011). Additionally, 22% of participants in this study expressed a desire for organic and/or free range meat products. This all indicates that there is a market for organic as well as free range chicken products and that these production methods are associated with an increased WTP.

To our knowledge there has been no research that examines consumers' WTP for the three free range labels for poultry meat set out under Regulation EC 543/2008 (EC, 2008b). There has been research however, on a general free range claim on meat. Scarpa et al. (2013) reported a WTP premium of €11.64/kg for beef and €10.25/kg for chicken in Italy when the animals were allowed to range freely. European consumers were willing to pay 5% more for pork produced in outdoor systems and labeled 'raised outside' with some willing to pay 20% extra (Dransfield et al., 2005). The popularity of free range farming is mainly related to animal welfare issues as animals raised under free range conditions are not confined in intensive production systems and can express natural behavior.

Vanhonacker and Verbeke (2009) have highlighted the need for an animal welfare label as a communication and marketing tool that could also reduce the search costs for animal friendly products for consumers who wished to buy them. Several studies have explored the WTP for animal welfare. For example, Swanson and Mench (2000) reported that 44% of US participants would be willing to pay 5% more for meat from 'humanely raised' animals and 20% declared themselves prepared to pay up

to 10% more. In Spain, Gracia et al. (2011) reported an average WTP premium of between 19% and 23% for cured ham with a European animal welfare label, while Bennett et al. (2012) reported a price premium of 16% in UK for meat from animals with improved animal welfare. A study by Nocella et al. (2012) found that 74% of European participants preferred animal-friendly meat to conventional meat. They found differences in WTP for animal-friendly meat across two different segments (representing 48.5% and 26% of participants respectively). Those belonging to the smaller of these segments were willing to pay €0.30/kg more for animal welfare than those in the largest segment, who preferred organic meat to an animal welfare product.

A few studies have evaluated consumer preferences and WTP for animal welfare in broiler production (Campbell and Dohertyl, 2013; Carlsson et al., 2005, 2007; de Jonge and Van Trijp, 2013b; Pouta et al., 2010). Campbell and Doherty (2013) reported that 60% of their British participants were willing to pay a price premium for chicken breast produced with higher animal health and welfare standards with marginal WTP estimates ranging between zero and over £2 per pair of chicken breasts. Altogether, the aforementioned suggests that there are huge differences in the WTP for animal welfare labels depending among others on the country, year, meat type, and the study method used.

In this study we also include an environmental claim; a carbon footprint label. There are already some studies on WTP for food carbon footprint labels (Caputo et al., 2013a,b; Onozaka and McFadden, 2011). Caputo et al. (2013a) investigated consumers' preferences for two labels on transport footprint, using food miles and CO_2 emissions on tomatoes. They found that their participants paid more attention to the CO_2 label than to food miles. Although livestock production is responsible for 18% of all greenhouse gas emissions (FAO, 2006), hardly any study has looked at WTP for carbon footprint labeling on meat. We only found one study, by Koistinen et al. (2013) that explores this issue. They reported on the impact of carbon footprint information on minced meat and found that Finnish consumers were in general willing to pay 2.9% extra for a carbon footprint label on minced pork but not on minced beef. The consumer segment conscious of the production method is willing to pay even 14% extra for a carbon footprint label on pork. The lack of work in this area is an important research gap.

This chapter contributes to the literature in several ways. First of all, our study is the first to evaluate consumers' WTP for the three existing free range claims for poultry meat regulated by the EU (Table 4.1). Second, no study has compared the new EU organic logo with national organic logos from governments or private organizations. This has been identified as one of the key research gaps in studies on organic product labeling (Schleenbecker and Hamm, 2013). A study by Janssen and Hamm

(2012a) compared consumers' preferences and WTP for organic logos, including the EU organic logo, governmental organic logos and organic logos from private organizations. However, this study was based on the old (voluntary) EU organic logo and not the one introduced in 2010. Third, apart from Koistinen et al. (2013), our study is the only one that evaluates the WTP for a carbon footprint label on meat. Fourth, no other study has compared consumers' preferences for this set of sustainability claims on meat. Fifth, we identify and estimate taste-based consumer segments taking into account the possibility that unobserved heterogeneity may exist, due to interdependence between preferences for certain attributes. Specifically, we estimated a random parameter logit model with error component (RPL-EC) and with correlated taste parameters. We then used this correlation structure to investigate and quantify the size of the various taste-based consumer segments, an important consideration when developing policies and marketing strategies (Scarpa and Del Giudice, 2004).

4.3 Material and methods

4.3.1 Survey procedures and experimental design

The data were collected through a cross-sectional consumer survey in the northern, Dutch speaking, part of Belgium (Flanders) in March 2012 that targeted the main person in the household responsible for food purchasing. The total sample size was 359 participants. Participants were selected from a proprietary consumer panel, managed by the market research company responsible for data collection. All contact and questionnaire administration procedures were done electronically and participants' anonymity was guaranteed. Our survey instrument included Choice Experiment (CE) questions and other questions regarding consumption behavior, attitudes, and the socio-demographic characteristics of the participants (Appendix E).

The CE design followed the procedures suggested by Street and Burgess (2007) and involved a three step approach: (i) specifying the characteristics of the design, (ii) constructing an orthogonal design for the first alternative of the design, and (iii) applying suitable design generators to construct new alternatives to add to the set of choices within the first alternative. We acknowledge that there are several alternative approaches to designing a CE and refer readers to Johnson et al. (2013) who give an overview of the most common experimental design approaches used in discrete choice studies.

In the first step, we described chicken breasts using a combination of five attributes: organic label, EU animal welfare label, free range claim, carbon footprint label and price. The definitions of these attributes are shown in Table 4.2. For the organic logo, three levels were considered, the two organic logos currently available on the Belgian market: the recently established EU organic logo, the Belgian

private Biogarantie logo which has been in use since 1988, and no organic logo. The levels for the free range claim included those currently regulated in the EU (EC, 2008b) (Table 4.1): free range, traditional free range and, free range-total freedom. The levels of the price attribute were chosen based on the actual prices of chicken breast gathered during a store check in food stores in Belgium in February 2012, shortly before the survey was conducted. The levels for carbon footprint were based on reported values in the literature for producing a chicken breast (Foster et al., 2006; Just Bare, 2010) and adopt a 20% and a 30% carbon footprint reduction.

Table 4.2. Attributes and levels for the choice experiment

Attributes	Levels considered
Organic logo	- None - Biogarantie logo - EU Organic logo
Animal welfare label	- None - European animal welfare label
Free range claims	- None - Free range - Traditional free range - Free range-total freedom
Carbon footprint label	- None - 20% CO_2-reduction: 5.6 kg CO_2e compared to 7 kg CO_2 - 30% CO_2-reduction: 4.9 kg CO_2e compared to 7 kg CO_2
Price	- €10/kg - €15/kg - €20/kg - €25/kg

In the second step, we used the selected attributes and their levels to come up with an orthogonal factorial design for the first alternative of our CE design using the SPSS software, reducing the original 288 (3^2x4^2x2) combinations to just 16.

In the third step, the generators described by Street and Burgess (2007) were used to obtain a practical set of 16 pairs, with a D-efficiency of 95.7%. The 16 choice sets were divided into two blocks of eight and the participants were randomly assigned to one of the two blocks. To increase the similarity with a real shopping experience, a no-buy alternative was added to each choice set. Hence, in each choice

set, participants were presented three alternatives: two types or product profiles of chicken breast as well as a no-buy option (Figure 4.1). Due to the hypothetical nature of our CE, a 'cheap talk script' was included, explaining to participants the importance of reacting as realistically as possible (Aprile et al., 2012; Silva et al., 2011) (Appendix E). The eight questions were randomized. Before answering the questions participants were provided with information about the products' attributes.

Figure 4.1. Example of a choice set question

	Alternative A	Alternative B	Alternative C
Organic logo	EU Organic logo	No logo	Neither alternative A nor B is chosen
Animal welfare label	EU Animal welfare label	No label	
Free range claim	Traditional free range	Free range—total freedom	
Reduced carbon footprint label	No label	5.6 kg CO_2 compared to 7 kg CO_2	
Price	€20/kg	€25/kg	
I prefer	O	O	O

This design was evaluated ex-post in terms of D-error for the multinomial logit (MNL) model estimated from the data. To be able to conduct an ex-post evaluation of the relative efficiency of a design, one has to derive an efficient design based on the estimates obtained from the sample (see Scarpa and Rose 2008). Accordingly, an efficient design optimized on the MNL estimates produces a D-error half the size of that found in our design. We found our design to require 103 design replicates, given that the two blocks were obtained with 206 participants. Since our sample consisted of 359 participants, it far exceeded this requirement. Hence, our design seems to have performed adequately, with the sample size compensating for the lack of efficiency in terms of D-error.

4.3.2 Empirical model

In accordance with random utility theory (McFadden,1974), CEs are based on the assumption that the utility of individual n of choosing alternative j in choice situation t can be represented as:

$$U_{njt} = \beta_n^{'} x_{njt} + \varepsilon_{njt} \quad (1)$$

where x_{njt} is a vector of observed variables relating to alternative j and individual n; β_n is a vector of structural taste parameters which characterize choices; ε_{njt} is the unobserved error term, which is

assumed to be independent of β and x. Different random utility models can be derived by making different assumptions about the composition and distribution of the unobserved factors $f(\varepsilon_{ijt})$. The selection of this function will depend on the assumptions underlying consumer preferences.

A number of studies suggest that heterogeneity is an issue that should be addressed when analyzing consumer preferences for food labeling (Bonnet and Simioni, 2001; Loureiro et al., 2001; Lusk et al., 2003). Hence, it is appropriate to employ a model, such as the random parameter logit (RPL) model which allows for and captures such random taste variations. Using a panel data approach, as shown in Train (2003), if we consider a sequence of observed choices *i* by individual *n*, one for each choice task in an assigned sequence of T choice tasks (i1,…., iT), then conditional on β, the probability L_{ni} that individual *n* makes this sequence of choices is represented as:

$$\mathrm{L}_{n\mathrm{i}}(\beta) = \prod_{t=1}^{T} \left[\frac{e^{\beta_n' x_{nit}}}{\sum_j e^{\beta_n' x_{njt}}} \right] \qquad (2)$$

since the error terms ε_{njt}'s in equation (1) are independent over utilities, choices and participants. Consequently, the unconditional probability is the integral of this product over all values of β:

$$\mathrm{P}_{n\mathrm{i}} = \int \mathrm{L}_{n\mathrm{i}}(\beta) f(\beta) d\beta \qquad (3)$$

Because equation (3) lacks a closed form solution the parameters of the model are estimated by simulated maximum likelihood estimation techniques (see Train, 2003).

4.3.3 Correlation across utilities

When estimating a RPL model, additional modeling issues, such as correlation across utilities and across taste parameters also need to be taken into account to ensure that the estimates are robust and consistent with consumer behavior theory (Scarpa et al., 2005, 2007a). There may well be correlation between utilities within this application since participants in the CE survey were asked to elect a preferred alternative between the three options listed in each choice task, which included two chicken profiles and one no-buy option (status quo). According to Scarpa et al. (2005), the no-buy alternative is actually experienced by participants while the experimentally designed alternatives can only be conjectured, so the utilities of the latter are likely to be more correlated between themselves than with the no-buy option. To account for this correlation pattern, we employed a RPL-EC as proposed by Scarpa et al. (2005) and Scarpa et al. (2007a). The error component is a zero-mean normally distributed random parameter and is assigned to the two buying options but not to the no-

buy option. Compared with the typical RPL model with only taste variation, the RPL-EC accounts for both *(i)* heterogeneous consumer preferences, by allowing the coefficients of the different sustainability claims to vary randomly across individuals and to deviate from the population mean, and for *(ii)* the additional variance of utility of experimentally designed alternatives to differ from the no-buy option (see Scarpa et al., 2005).

4.3.4 Correlation across taste parameters

In the standard RPL-EC, taste parameters are assumed to be uncorrelated. However, in this study, we can expect that consumers' emphasis on issues relevant to all sustainability food claims might be interconnected. For example, we might expect some correlation between the free range claims because these claims provide similar information, albeit in different ways. To take this into account, the structure of the random parameters β_n was assumed to follow a multivariate normal distribution with vector mean μ and variance–covariance matrix Ω. If at least one of the elements of the Cholesky matrix C (where $C`C = \Omega$) shows statistical significance, this is supportive of dependence across tastes (Scarpa and Del Giudice, 2004). This correlation structure can then be used to investigate and quantify the size of fractions liking certain labels, as well as various taste-based consumer segments. We applied the Cholesky decomposition method to establish the independent contribution of each random parameter estimate (Hensher et al, 2005). Thus we simulated vectors of variates $\mu + C'z$ with 10,000 observations each, where μ is a 1 x k vector, C is the k x k lower triangular Cholesky matrix and z is the k x r vector of standard normal variates. These simulated values were then used for several analyses.

First, we estimated the fractions of consumers with a positive preference for each of the sustainability claims separately. Taking zero as the threshold, values lower than zero ($\beta<0$) are associated with negative effects on the utility function and reflect disliking the attribute, while values higher than zero ($\beta>0$) reflect liking the attribute. For each of the attributes, the size of consumer fraction that liked or disliked the attribute was predicted. Hence, the predicted fractions of consumers with positive preferences were based on the marginal utility simulation, accounting for the estimated correlation structure of the random parameters.

Second, as Scarpa and Del Giudice (2004) advise, we estimated the relative sizes of the various taste-based consumer segments. With eight different random parameters included in our indirect utility function, which can give up two potential outcomes (positive and negative), there is a total of 256 (2^8) mutually exclusive like-dislike combinations, each defined by a certain taste combination. The relative sizes of these taste-based consumer segments were estimated by simulating the vectors of the jointly distributed taste values using the Cholesky decomposition method to reconstruct the empirical

distribution of the standard deviation parameter estimates (Hensher et al., 2005). Finally, we predicted the size of the fraction of Belgian consumers liking two labels.

4.3.5 Model specification

In choice modeling studies, the price coefficient is typically assumed to be invariant across individuals, and the coefficients of the attributes are treated as random parameters with a normal distribution. This is because relaxing the assumption of fixed price coefficient poses complications when computing marginal WTP measures, as this would involve a ratio between two random variables. On the other hand, a constant price coefficient implies a constant marginal utility of money across participants. Hence, the household income of participant *n* has no effect on the probability of product *j* being selected due to the linear relationship between price and income. However, it is plausible to hypothesize that consumers with different financial situations might have different WTPs for sustainable food labels on meat. For example, it might be expected that the WTP for participants with a moderate or well-off financial situation (Inc_High) would be higher than the WTPs of participants with a difficult financial situation (Inc_Low). As also argued by Scarpa et al. (2007b), a fixed marginal utility of money runs against economic intuition as the same money unit can have different values for participants with different income constraints. That is to say, participants with a difficult financial situation would value a marginal euro/dollar more than those in higher income households. The survey questionnaire identified income on a 7-point scale (with 1=Difficult, 4=Moderate and 7=Well-off), which we aggregate into two categories identified by dummy variables: difficult financial situation (less than 4) (Inc_Low) and moderate to well-off financial situation (4 to 7) (Inc_High).

Morey et al. (2003) proposed a simple way to incorporate income effects in random utility models. Recognizing that income is the main determinant of the marginal utility of money, they assumed that a change in the marginal utility of money (e.g. price coefficient) is a piecewise function of the amount of the household's income. This allows the marginal utility of income to vary across income groups, but remain constant within each group. An application of this approach in the context of consumers' preferences for environmentally friendly food attributes information can be found in Scarpa et al. (2007b).

Following Scarpa et al. (2007b), we specified the marginal utility of income (e.g. price coefficient) either as a constant γ or as a step function of the high income γ^h. Thus, γ is considered as baseline taste, which refers to tastes common to all participants, while γ^h expresses intensity over or above this baseline. The utility that individual *i* obtains from alternative *j* at choice situation *t* takes the following form:

$$U_{ijt} = \beta_0\, No\_Buy_{ijt} + \gamma\, Price_{njt} + \gamma^h\, 1(Inc\_high) Price_{ijt} + \beta_1\, Organic\_EU_{ijt} + \beta_2\, Organic\_Belgium_{ijt} + \beta_3\, AnimalWelfare_{ijt} + \beta_4\, FreeRange_{ijt} + \beta_5\, Trad\_FreeRange_{ijt} + \beta_6\, FreeRange\_TotalFree_{ijt} + \beta_7 CO20_{ijt} + \beta_8\, CO30_{ijt} + \eta_{ij} + \varepsilon_{ijt} \quad (4)$$

where *j* pertains to option A, B and C. No_Buy_{njt} is a dummy variable taking the value equal to 1 when the no-buy option is chosen, and 0 when either product profile A or B is selected. β_0 is an alternative-specific constant representing the no-buy option. Price, which is considered a linear effect variable, is the price of 1 kg of chicken breast. γ is the marginal utility of income (i.e. the price coefficient) and γ^h is the coefficient of the interaction term between the price and the indicator function for high income effects. Inc_high is a dummy variable taking the value of 1 when the participant belongs to the high income group and 0 otherwise. In order to account for correlation patterns across utilities, we tested for the presence of error components associated with the two alternatives involving purchase in each choice set. As a result, the model includes a zero-mean normal error, the error component term η_{ij} which is associated only with alternatives that portray a purchase decision, and is absent in the utility of the no purchase alternative (Scarpa et al., 2007a). ε_{ijt} is the unobserved random error term. The rest of the attributes such as the EU organic logo (Organic_EU), the Belgian organic Biogarantie logo (Organic_Belgium), the European animal welfare label (AnimalWelfare) as well as the free range (FreeRange), the traditional free range (Trad_FreeRange), the free range-total freedom (FreeRange_TotalFree), the 20% CO_2-reduction (CO20) and the 30% CO_2-reduction (CO30) enter the model as dummy variables and take the value of 1 if they are present in option *j* and 0 if not. No organic logo, no animal welfare label, no free range claim and no carbon footprint label were the baseline levels. According to Scarpa and Willis (2010), dummy coding has the advantage that the utility coefficients offer a more intuitive and straightforward interpretation than those obtained from the effect coding approach. However, when the number of levels exceeds two, it is less than ideal because of potential confounding with the no-buy alternative specific constant. Nevertheless, following Caputo et al. (2013a), we used dummy coding since this confounding issue should be mitigated by the very low probability predicted for the no-buy option in our model.

Table 4.3. Socio-demographic characteristics of the sample (%, n = 359)

Gender	
Male	40.3
Female	59.7
Age group	
18-24 years	12.0
25-34 years	23.1
35-44 years	14.5
45-54 years	27.6
55-64 years	18.2
65 years or older	4.6
Living situation	
Alone	14.1
With others	85.9
Household members of 15 years and older	
1	14.1
2	50.1
3	16.7
≥4	19.1
Children younger than 15 years	
0	77.5
1	9.7
2	9.7
≥3	3.1
Educational level completed	
Elementary school or high school	27.7
Higher education (not university)	42.9
University	29.4
Occupation	
Full-time employed	61.8
Part-time employed	12.8
Retired	9.1
No paid job	16.3
Financial situation	
Difficult	13.2
Moderate to well-off	86.8

Since choice experiments are based on the random utility theory (McFadden, 1974) and the Lancasterian theory (Lancaster, 1966), they permit a transformation of parameter estimates of each attribute into WTP measures for specific product characteristics (Hanemann, 1984). In this application, marginal WTP values are calculated as a negative ratio, where the nominator is the estimated mean value of the coefficient associated with a particular sustainability claim and the denominator is the price coefficient γ in the case of low income group and $\gamma + \gamma^h$ (price coefficient and the coefficient of the interaction term with high income) in the case of the high income group. This is because, as discussed above, the coefficient of the price γ is considered as baseline taste, which refers to taste common to all participants, while the coefficient of the interaction term between the price and the dummy variable of Inc_High (γ^h) expresses intensity over or above this baseline, and so it is not the coefficient of the price for high income category per se. Data were analyzed using NLOGIT.

4.4 Results

4.4.1 Characteristics of the sample

A total of 359 participants completed the survey (Table 4.3). Sixty per cent of the sample was female and 40% male, which matches with women being the main individuals responsible for food purchasing in a majority of households. Each age category was adequately represented as well as the different household compositions (numbers of adults and children). The sample was slightly biased towards better educated participants, which may be attributed to the use of an electronic survey method. Most of the participants worked, full or part-time. Most participants (87%) reported a moderate to well-off financial status.

4.4.2 Estimates from RPL-EC model

The RPL-EC estimation is based on 2,872 observations (359 individuals performing eight choice tasks each), with three options per choice task giving a total of 8,616 alternatives to be evaluated.

As expected, the coefficient of the no-buy option was negative and statistically significant suggesting that consumers increase their utility more when choosing one of the presented chicken breast alternatives (options A and B) than when choosing the no-buy option (option C). This indicates that the attributes selected for the experiment were relevant and important to consumers. Moreover, the hypothesis of correlation across utilities was verified since the standard deviation of the error component (η_{ij}) for the purchase alternatives was statistically significant. Also, some of the values of the Cholesky matrix were statistically significant indicating that some random parameters are indeed correlated. This confirms that an error component model was appropriate for further analysis.

Table 4.4. RPL model with correlated error component (RPL-EC) estimates (n=359)

		Coefficients	Standard errors	p-values
Non-random parameters				
No-buy		-6.39	0.59	<0.001
Price (γ)		-0.30	0.03	<0.001
Price x high income (γ^h)		0.10	0.03	<0.001
Standard deviation of Err. Comp		5.17	0.33	<0.001
Random parameters				
Organic_EU	Mean	0.34	0.17	0.037
	St.dev	2.20	0.25	<0.001
Organic_Belgium	Mean	0.65	0.13	<0.001
	St.dev	1.42	0.15	<0.001
AnimalWelfare	Mean	0.74	0.10	<0.001
	St.dev	0.86	0.13	<0.001
FreeRange	Mean	1.23	0.16	<0.001
	St.dev	0.90	0.28	0.002
Trad_Free Range	Mean	1.42	0.18	<0.001
	St.dv	0.70	0.24	0.003
Free Range_Total Free	Mean	1.78	0.19	<0.001
	St.dv	1.46	0.25	<0.001
CO_2 minus 20%	Mean	0.51	0.12	<0.001
	St.dv	1.21	0.17	<0.001
CO_2 minus 30%	Mean	0.69	0.15	<0.001
	St.dv	1.53	0.32	<0.001
N				2872
Log likelihood				-1863.327
AIC				3838.7
AIC/N				1.337
BIC				4172.6
BIC/N				1.453

The coefficient of price is negative and statistically significant at the 0.01 level, indicating that consumer utility decreases with increasing price. The positive sign of γ^h supports the theoretical validity of the study as an existing high income decreases the marginal utility of income. All the other

coefficients are positive and statistically significant at the 0.01 level (except Organic_EU at 0.05 level) suggesting that consumer utility increases when a sustainability claim is made for a chicken breast product. The free range-total freedom label gave the largest increase in utility, followed (in descending order) by traditional free range, free range, the EU animal welfare label, the carbon footprint label indicating a 30% CO_2-reduction, the Biogarantie organic logo, the carbon footprint label indicating a 20% CO_2-reduction, and the EU organic logo. There is heterogeneity in consumers' preferences for sustainable food claims since the derived standard deviations of the coefficients of all the claims are statistically significant at the 0.01 level (Table 4.4).

To further evaluate preference heterogeneity, we also examined the estimated Cholesky matrix and the derived correlation matrix (Appendix F). The diagonal values reported in the Cholesky matrix represent the true level of variance for each random parameter once the cross-related parameter terms have been unconfounded (Hensher et al., 2005). It should be noted that, despite all the standard deviations of the parameter estimates being statistically significant, only the Organic EU, Organic Belgium, and error component diagonal elements are statistically significant in this matrix. This suggests that the statistically significant standard deviation parameters for the other random variables are due to cross-product correlations with other random parameter estimates and are not due to heterogeneity around the mean of each of the random parameters (Hensher et al., 2005). The off-diagonal elements of the Cholesky matrix illustrate the presence of some significant cross-correlations across attributes, indicating that some random parameters are indeed correlated.

4.4.3 Prediction of fraction that like certain claims and taste-based consumer segmentation

The RPL-EC model with correlated random taste and error provides distributional information that can be used to predict the different fractions of consumers with specific values. Accordingly, the fractions of consumers with positive preferences ($\beta>0$) for each of the sustainability labels could also be predicted (Table 4.5) to compare the probabilities of the liking of each of the eight individual sustainability labels.

As shown in Table 4.5, only a small predicted fraction of Belgian consumers find the three free range claims unattractive. Almost 97% find the traditional free range claim appealing. Even the least strict free range claim is liked by 93% of consumers. The animal welfare label is also liked by most consumers (87%). The other labels are less popular, with the carbon footprint labels and the organic food labels disliked by more than 20% of the consumers. Just over a half of the population (56%) likes the EU organic logo.

Table 4.5. Predicted portion of consumers with positive preferences (%, n=359)

Organic_EU	55.9
Organic_Belgium	78.5
AnimalWelfare	87.1
FreeRange	93.3
Trad._FreeRange	97.2
FreeRange_TotalFree	91.9
CO_2 minus 20%	76.9
CO_2 minus 30%	78.1

Finally, we also simulated the probabilities of each of the eight variate taste combinations. Each of these eight taste parameters can give two potential outcomes (like or dislike) resulting in 256 (2^8) possible taste combinations. Table 4.6 shows the sizes of the largest segments of these joint distributions of tastes (we only report on the segment sizes of more than 4%, the rest are available upon request).

By chance alone, the probability of each segment would be 0.39% (1÷256). However, the RPL-EC model predicted that the largest segment would account for 18.8% of consumers (Table 4.6). This segment has positive preferences for all of the eight sustainability labels. The second largest segment (15.3%) includes those who like all the sustainability labels apart from the EU organic label. Also, almost 6% like all the labels except the 20% CO_2-reduction label and a slightly smaller sized segment likes all labels except the 30% CO_2-reduction label. Another group, consisting of 5.3% of consumers dislikes the Belgian organic label but likes all the other seven labels. The next largest segments are those with positive preferences for all labels except for the EU organic label combined with the 20% CO_2-reduction label (4.8%) or the 30% CO_2-reduction label (4.4%). The eighth largest consumer segment accounts for 4.0% of consumers who like all the labels except both organic labels. When evaluating the largest eight-variate taste combinations, the results show that a large portion of the consumers (almost one in five) like all the sustainability labels included in the study. If they dislike one or two labels, these are mostly the organic labels and/or the carbon footprint labels.

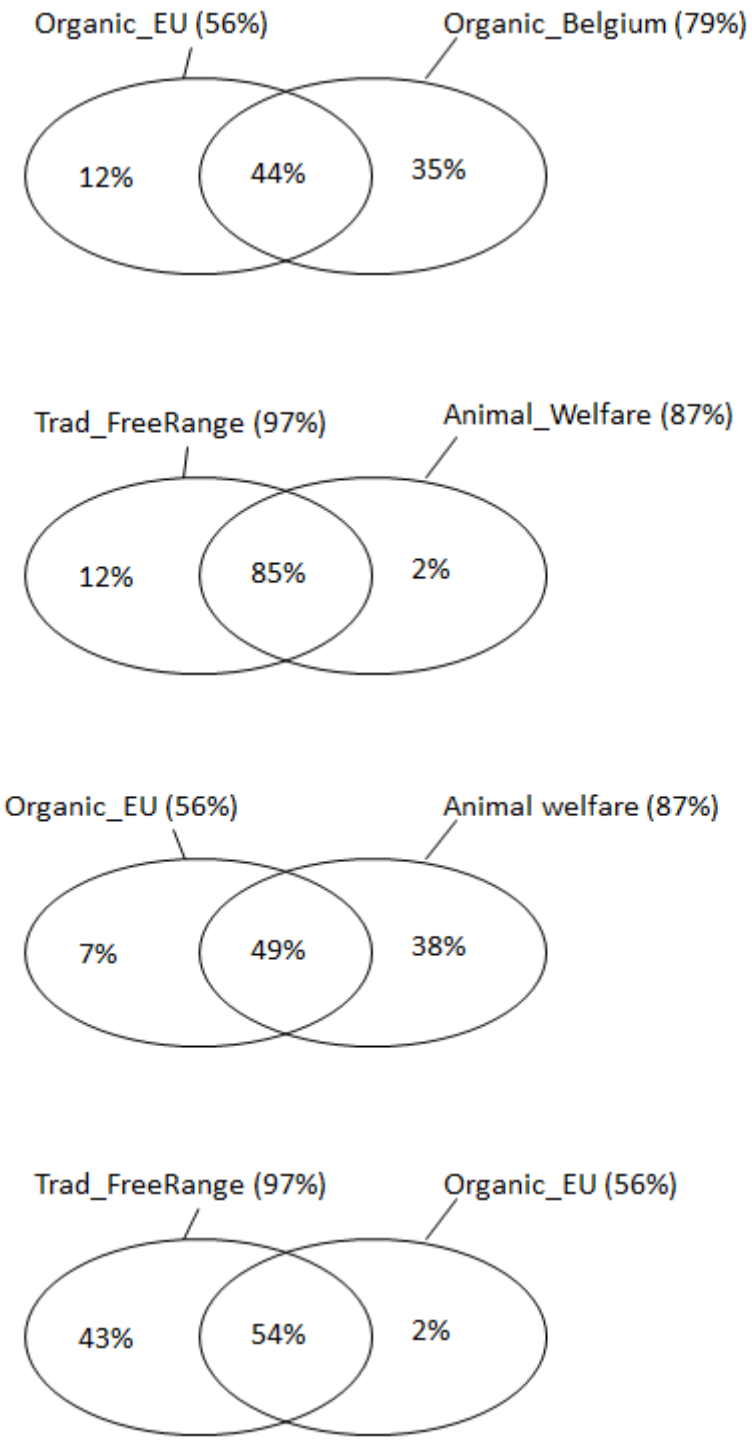
Table 4.6. Consumer segmentation based on joint probability

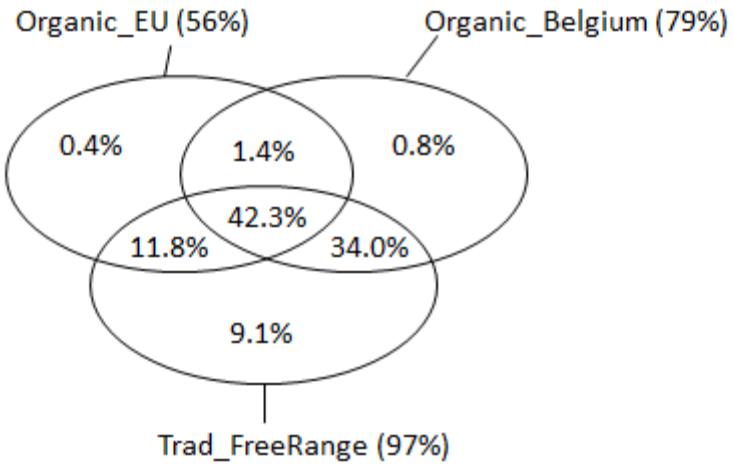
Positive preferences	Negative preferences	Segment size (%)
Organic_EU, Organic_Belgium, AnimalWelfare, FreeRange, Trad_FreeRange, FreeRange_TotalFree, CO2 minus 20%, CO2 minus 30%	/	18.8
Organic_Belgium, AnimalWelfare, FreeRange, Trad_FreeRange, FreeRange_TotalFree, CO2 minus 20%, CO2 minus 30%	Organic_EU	15.3
Organic_EU, Organic_Belgium, AnimalWelfare, FreeRange, Trad_FreeRange, FreeRange_TotalFree, CO2 minus 30%	CO2 minus 20%	5.9
Organic_EU, Organic_Belgium, AnimalWelfare, FreeRange, Trad_FreeRange, FreeRange_TotalFree, CO2 minus 20%	CO2 minus 30%	5.3
Organic_EU, AnimalWelfare, FreeRange, Trad_FreeRange, FreeRange_TotalFree, CO2 minus 20%, CO2 minus 30%	Organic_Belgium	5.3
Organic_Belgium, AnimalWelfare, FreeRange, Trad_FreeRange, FreeRange_TotalFree, CO2 minus 30%	Organic_EU, CO2 minus 20%	4.8
Organic_Belgium, AnimalWelfare, FreeRange, Trad_FreeRange, FreeRange_TotalFree, CO2 minus 20%	Organic_EU, CO2 minus 30%	4.4
AnimalWelfare, FreeRange, Trad_FreeRange, FreeRange_TotalFree, CO2 minus 20%, CO2 minus 30%	Organic_EU, Organic_Belgium	4.0

Only those segments 4% or higher are shown. The sizes of all 256 segments are available upon request.

We then simulated the fractions of consumers liking two labels simultaneously to find out which combinations of two labels are the most preferred (Appendix G). There are 24 possible combinations (taking into account that a product can only be labelled with one of the three free range claims and one of the two carbon footprint labels). Consumers show the strongest preference for the combination of the animal welfare label and any of the free range claims, all liked by more than 80% of the consumers. The combination of traditional free range and animal welfare is the most preferred with 85% of consumers liking both claims (Figure 4.2). Other plausible combinations are presented in Figure 4.2.

Figure 4.2. Predicted portion of consumers with positive preferences to plausible combinations of sustainability labels (%, n=359)





Note: The sizes of the total portion liking the claim are presented between brackets. In the figure, the numbers in the intersection (A ∩ B) represent the fractions simultaneously liking both labels while the other number represents the fractions liking one label and not the other (A \ B and B \ A).

One of the diagrams shows a combination of three labels as the Belgian organic one must, by law, be accompanied by the EU organic label.

4.4.4 Consumers' WTP for sustainability claims

The estimated means and standard deviations of marginal WTPs for the sustainability claims included in our design, broken down by income constraints, are summarized in Table 4.7. From the RPL-EC model, the average WTP for the free range-total freedom attribute for low income consumers is €5.99/kg (=1.785 ÷ 0.298) while the corresponding average WTP for the high income consumers is €8.81/kg (=1.785 ÷ (0.298-0.096)). The WTP estimates are 50% higher for consumers with a higher income than those with lower income, illustrating the advantage of taking into account the systemic heterogeneity in the marginal utility of income.

Consumers are willing to pay the highest premium price for chicken breast products with free range claims (Table 4.7). For low income consumers, the premium ranges from 63% (€5.99/kg) for 'free range-total freedom' products, 50% (€4.77/kg) for 'traditional free range' ones, and 43% (€4.12/kg) for the least strict 'free range' claim. For high income consumers, these values are much higher, ranging between €8.81/kg and €6.06/kg. The second most preferred label is the EU animal welfare label (26% premium for the low income group) followed by the carbon footprint labels (18% and 24% respectively for the 20% and 30% CO_2-reduction, for the low income group) and the organic logos (23% for the Belgian Biogarantie logo and 12% for the EU organic logo for the low income group). These values are 50% higher for the high income consumers (Table 4.7).

Table 4.7. Marginal WTP estimates of sustainability claims using RPL-EC model (€/kg)

	Mean (€/kg)	Standard errors (€/kg)	Mean[a] (%)	Standard errors[1] (%)
Low income				
Organic_EU	1.16**	0.56	12	6
Organic_Belgium	2.16***	0.44	23	5
AnimalWelfare	2.50***	0.39	26	4
FreeRange	4.12***	0.62	43	7
Trad_FreeRange	4.77***	0.66	50	7
FreeRange_TotalFree	5.99***	0.72	63	8
CO_2 minus 20%	1.73***	0.41	18	4
CO_2 minus 30%	2.31***	0.51	24	5
High income				
Organic_EU	1.70**	0.83	18	9
Organic_Belgium	3.18***	0.64	34	7
Animal Welfare	3.67***	0.50	39	5
FreeRange	6.06***	0.80	64	8
Trad_FreeRange	7.02***	0.82	74	9
FreeRange_TotalFree	8.81***	0.87	93	9
CO2 minus 20%	2.54***	0.58	27	6
CO2 minus 30%	3.40***	0.74	36	8

Note: ** and *** indicate WTP values statistically significant at 5% and 1% level, respectively.

[a]Based on the average price for conventional chicken breast in Belgium in 2012 (€9.49/kg (Gesellschaft fur Konsumforschung (GfK) Panel data)

4.5 Discussion

The largest segment of consumers (almost 19%) has positive preferences towards each of the eight sustainability labels, suggesting that consumers appreciate being informed, through labeling, about the sustainable characteristics of the food they consume. Studies report that income has an effect on organic food (Bellows et al., 2008) and organic meat (Van Loo et al., 2011; AMI and FMI, 2010) purchases, which is confirmed by our study, where the WTP estimates for participants with a higher income are 50% higher than for those with a lower income (Table 4.7).

The free range claims are the most appealing out of the studied sustainability claims (Table 4.5), with more than 90% of all consumers liking each individual free range claim (with the traditional free range claim being liked by 97% of the participants). The free range claims also have the highest mean WTP

values. The animal welfare label is the next most popular label (being liked by 87%), followed by the carbon footprint labels and organic food labels. This supports the findings of Gadema and Oglethorpe (2011) who also reported free range labels to be more important to people in the UK than organic food and carbon footprint ones. The popularity of free range claims shows that consumers have a preference for poultry produced with continuous daytime access to open-air runs. Vanhonacker et al. (2008) have reported that consumers find it important that poultry should exhibit natural behavior, have a lower stocking density, more available space, and outdoor access, all key aspects of free range production. This is also in line with previous studies which indicate that consumer concerns about animal welfare are mostly related to space (stocking density) and outdoor access (Bracke et al., 2005; de Jonge and Van Trijp, 2013b, Vanhonacker et al., 2009), two of the main foci of free range poultry farming (Table 4.1). De Jonge and Van Trijp (2013b) studied which production practices most influence consumers' perceptions of the animal friendliness of broiler production systems. They found that outdoor access, stocking density and day-night rhythm were the most important (out of a total of seven features of animal welfare) to consumers. Similarly, Vanhonacker et al. (2008) analyzed how consumers interpret animal welfare and found that they attach a high importance to aspects related to the ability to engage in natural behavior and to housing and climate such as stocking density and outdoor access. The high importance of space and outdoor access might be linked to the fact that these are more 'tangible' issues. Consumers with a low awareness of details in animal production, can more easily picture something about these issues.

It is worth noting that the free range claims are preferred to and valued more highly than the organic logos. This is interesting since the retail prices of free range chickens are generally lower than those for certified organic poultry. The average price for conventional chicken breast in Belgium in 2012 (the time of our survey) was €9.49/kg (Gesellschaft fur Konsumforschung (GfK) Panel data). Based on the GfK panel data of 2012, an organic roaster and an organic chicken breast were on average 93% and 59% more expensive, respectively, than their conventional equivalents (GfK, 2012). Since the GfK data does not provide information on free range chicken but these exist on the Belgian market, we compared the prices, prior to this study, of chicken from the same store and same brand. For chicken breast, we found prices of €9.15/kg for conventional, €14.95/kg for free range, and €22.79/kg for organic. For whole chickens, there is a similar pattern, with prices of €3.69/kg for conventional, €6.39/kg for free range, and €9.99/kg for organic in the same store.

Moreover if we compare the EU organic livestock production standard with free range poultry standards (Table 4.1), it is clear that the regulations for organic chicken production are more demanding (and thus more costly for producers) than those for free range chickens (see also DEFRA,

2010; Soil Association, 2007; 2013). For example, the organic livestock regulation has stricter requirements for stocking density and additional requirements concerning the use of organic feed and prohibiting the routine use of antibiotics. For a broiler producer looking to diversify, it is useful to know that consumers value free range poultry products more than organic ones and prefer free range claims to organic ones. However, given the current market prices for organic chicken and free range chicken, both types of claims have their advantages. De Jonge and Van Trijp (2013a,b) report that there is potential for the meat sector to further differentiate and appeal to different specific consumer segments (e.g., people who are concerned about animal welfare but neither want to give up meat consumption nor want to pay the very high price premium for organic meat). They also identify the potential for 'conventional-plus' standards in broiler production systems, with management practices between conventional and organic production system practices that focus on animal welfare aspects. Our findings suggest that these animal welfare production practices could be communicated to the consumers through a free range claim or an animal welfare label.

The EU animal welfare logo receives the second highest WTP (a 26% to 39% premium, depending on the income category) after the free range claims, with a predicted fraction of 87% of consumers liking this label. This is in line with other studies which highlighted the popularity of this issue (EC, 2007b; Vanhonacker et al., 2008; 2009; Vanhonacker and Verbeke, 2014). Pouta et al. (2010) found that consumers preferred animal welfare claims to organic ones. This is confirmed in our study. While the animal welfare and free range labels address overlapping concerns, people preferred the free range labels (91-97% of consumers liking them as opposed to 87% for an animal welfare label) and are willing to pay twice as much for free range products than those carrying an EU animal welfare label (Table 4.7). It is pertinent to note here that a report on the attitudes of EU consumers towards animal welfare (EC, 2007b) showed that consumers favored the indicator of animal welfare practices to be on-package written information rather than a logo or grading system. In our study the free range claims consisted of written information, while the EU animal welfare logo was a logo. This may partially explain the discrepancy between these two overlapping standards.

The organic and carbon footprint claims are less well liked, and both are disliked by more than 20% of the consumers (Table 4.5). The 8-variate taste combinations show that many of the larger segments like all the claims except the organic and/or carbon footprint labels (Table 4.6). This illustrates that animal welfare aspects (including free range) are more important to consumers than the organic or carbon footprint claims. The premium for the carbon footprint label indicating a 30% CO_2-reduction is 24% to 36% (according to income) while the premium for a 20% CO_2-reduction is 18% to 27% (according to income) (Table 4.7). These values are much lower than those for the free range claims,

but carbon footprint labeling is a newer concept and this type of label does not yet exist in the Belgian food market. In addition, a considerable portion of consumers are still relatively uninformed about carbon footprints and labeling, although this is expected to change over time (Gadema and Oglethorpe, 2011; Vanhonacker et al., 2013). Hartikainen et al. (2014) found that many consumers are confused about the meaning of a product's carbon footprint and carbon labels do not appeal that much to them. Nevertheless with sustainable food production being a hot topic, carbon footprint labels could become more important in the future. Even though such labels do not yet exist in the Belgian food market, more than three quarters of the sample (77 to 78%) express a positive preference for them and the WTP premiums for them are significant (see above). This suggests that this type of label could be successful in Belgium in the future, especially if targeted at the 'active' consumer segment which attaches a high importance to the environmental impact of their food choices (Vanhonacker et al., 2013).

A comparison of the two organic food labels reveals that Biogarantie, the Belgian private organic food logo, is more valued than the EU organic logo. The EU organic label accounts for the largest fraction of consumers with a negative preference (44%), compared to only half as many consumers (22%) disliking the national Biogarantie organic label. This difference may be the result of familiarity, as the Belgian logo is well-established and the EU logo has only recently been introduced and there have not been big campaigns to promote awareness of it. The WTP for the EU organic label is also the lowest of any of the sustainability labels included in the study. It should be noted that even for the high income category the average WTP premium for the organic food labels is much lower than the current market prices for organic chicken in Belgium (59% premium for organic chicken breast and 93% premium for organic roaster, 2012 data GfK panel data, 2012). Janssen and Hamm (2012a) studied the WTP for the old EU organic logo, governmental organic logos and organic logos from private organizations. Their results showed that consumers' preferences for the type of organic logo varied between countries. In Italy, the old EU organic logo was preferred over the governmental or private organic logos, while in Denmark and Germany the opposite was observed (Janssen and Hamm, 2012a). In our study, 44% of consumers have a positive preference for both the EU and the Belgian organic food label (Figure 4.2). About 35% of consumers have a positive preference for the Belgian Biogarantie label but a negative preference for the EU organic label (Figure 4.2). This indicates that more than one third of the consumers like the organic logo of the private organization while disliking the EU organic logo. In addition, the mean WTP for the EU organic logo is lower than for any other of the labels studied, despite the organic food market being quite well-developed in Belgium. These results could be explained by low recognition of the new EU organic logo (which was only introduced in 2010) among

Flemish consumers (Van Loo et al., 2013) compared to the Biogarantie logo. One study, carried out in 2012 by van Loo et al. (2013) found that 54% of a sample of Flemish consumers recognized the Biogarantie logo but only 31% recognized the EU logo, two years after its introduction. Similarly, a Eurobarometer study reported that only 24% of EU citizens recognized the EU organic logo (EC, 2012c). Hanss and Böhm, (2011) report that people need to be familiar with, and have trust in, sustainability labels before they will purchase these products. Van Loo et al. (2013) also found very low knowledge levels about the new logo among Flemish consumers with only 23% of the participants correctly answering four true/false statements. These results indicate that there is potential to increase consumer awareness of the EU organic logo and awareness of what the standards entail. Our study confirms that Belgian consumers currently prefer the national Biogarantie logo on their organic food packages.

It is recognized that consumers like to be informed about the food they purchase. However, one concern about presenting consumers with a wide range of sustainability claims is that they might become overwhelmed with different types of information, creating an information overload (Verbeke, 2005). For this reason, we also focused on combinations of labels that could plausibly appear together on food labels (Figure 4.2). If an EU animal welfare label were to be introduced, it is quite likely that its requirements would overlap with the free range claims. As such, it would not require much additional effort for producers to achieve both types of certification on the same product. Combining the animal welfare label and the traditional free range label could open up a broad market for this product since 85% of consumers find both labels desirable (Figure 4.2).

Similarly, the existing EU organic livestock regulation includes rules about animal welfare practices and consumers appreciate having information on animal welfare on organic animal products (Zander and Hamm 2010). Thus, the combination of an EU organic label and an EU animal welfare label would also be plausible. This would result in a potential market of up to 94% of consumers liking at least one of the labels and even 49% desiring both labels (as opposed to only 56% who find the EU organic label desirable – see Figure 4.2). And, since the EU organic standards fulfill the requirements of the free range claims it would appear to be feasible to meet both sets of criteria at no additional cost. Almost all of the 56% of the consumers who like the EU organic logo also like the traditional free range claim, resulting in a total of 54% liking both labels simultaneously (Figure 4.2). Thus, from a marketing perspective the organic broiler sector could be well advised to include the free range claim in addition to the organic logo. Similar combinations could be made with the Biogarantie label, although by law such products also have to carry the EU organic logo. This would then result in triple labeling (EU organic, Biogarantie and free range). More than 40% of consumers like all three of these labels.

However, less than 1% is attracted by the Biogarantie label alone, thus – assuming consumer awareness of the EU organic label will improve – it might be advisable to skip this national label when the free range claim is also used in order to avoid possible information overload.

4.6 Conclusions

Public interest in sustainability issues has significantly increased in recent years due to concerns about climate change and the environment. An increasing number of consumers are concerned about the environmental, ethical and animal welfare impacts of how their food is produced. This is having a significant impact on public and private sector policies towards food and has led to the growth of the number of voluntary sustainability labeling schemes. Hence, information about consumers' preferences for and valuation of sustainability labeling is important to the food industry (food producers and manufacturers, food marketers), policy makers and governmental agencies. There is now a plethora of different sustainability labels on the European food market, which might potentially give rise to issues of incoherence, reliability, information overload or confusion. A recent report by the European Commission (EC, 2012a) suggested the development and examination of an EU-level sustainable food labeling scheme backed up by credible certification mechanisms. Our study has policy relevance here as it evaluates the popularity of, and possible overlaps between, different sustainability criteria.

We developed a choice experiment (CE) to investigate consumer preferences and WTP for a set of sustainability claims on chicken breasts. We chose to focus on a meat product because meat is one of the most contested food products in terms of sustainability. To address unobserved taste heterogeneity, we: (1) estimated a panel RPL-EC model with correlated random taste and error; (2) acquired information on the joint distributions of taste attributes to estimate the size of various taste-based consumer segments; and (3) accounted for differences in the marginal utility of income by using a piecewise linear specification. Several studies have evaluated consumers' WTP for different sustainability labels, but to our knowledge this study is the first CE study that jointly compares a diverse set of sustainability claims on a meat product. Equally there has been no research done in examining consumer preferences and WTP for the EU's free range labels and carbon footprint labeling on poultry meat. This study makes a contribution to the literature since it brings together several sustainability claims, whereas previous studies have focused on just one or two sustainability claims. By doing so we have been able to infer not only how consumers value these different claims but also how the claims compare with each other and how they might be combined.

Our study illustrates that consumers like to be informed about the sustainability issues related to their food choices. Our results show that consumers are willing to pay the highest price premium for free range chicken breast (i.e., free range-total freedom, traditional free range, and free range), followed by chicken breast with an EU animal welfare label, carbon footprint labels (30% and 20% CO_2-reduction), and organic logos (the Belgian Biogarantie and EU organic logos). High income consumers are willing to pay a 50% higher price premium for sustainability labels on chicken breast compared to those in the low income group.

Overall, our study suggests that the free range claims are liked the most, with more than 9 out of every 10 consumers stating to place the highest value on them in terms of WTP. These are followed by an animal welfare label, carbon footprint label and, lastly, organic logos. While labels for both certified organic production and carbon footprint are of importance to consumers, these are valued less than a label on animal welfare certification at the EU level. The Belgian organic food label performs better in terms of consumer liking than the EU organic food label, although this may be due to lower recognition of the new EU organic logo and poorer knowledge of its meaning. Therefore, it makes sense – at least temporarily – to still supplement the mandatory EU organic logo with the voluntary national one. Adding a free range claim to organic meat products seems to be an attractive option. All three labels together, however, might result in information overload in which case the national organic logo is the most logical to be dropped.

Although the carbon footprint label does not yet exist on the Belgian market, the large share of consumers who express positive preferences for one suggests that, if made available in the future, it may become successful, especially if targeted at those consumers who attach a high importance to ecological footprints when making food choices. Our study also suggests that new harmonized labeling, incorporating information about environmental impacts would be appreciated by consumers. This is relevant given that the European Commission has recently been considering rules on food labeling that includes information about the sustainability of food products (EC, 2012a).

Consumers' WTP studies are often used to determine the market potential of products, as they show consumer preferences for a range of attributes. This study provides evidence that can help producers decide which sustainability label(s) (and practices) to focus on. It also provides information on the size of the segment liking each of the sustainability labels examined. Our findings also provide information for producers about the potential of converting their current (mostly conventional) production system and of becoming certified for certain claims. The use of combinations of different claims might also be considered, especially when this would not require major changes in farming practice or additional

investments. For example, organic meat labels could be complemented by free range claims, which are liked and valued by more than 90% of consumers. Since organic poultry production already fulfills the free range requirements, this could be a low cost strategy for additionally differentiating the product and providing more information and value to consumers.

However, our study faces a few limitations. First limitation is the hypothetical nature of the WTP estimates. While our study shows which labels are valued more than others, we have to be cautious with the absolute values as these are likely to be influenced by the hypothetical nature of the study. More research using non-hypothetical and incentive aligned methods are desirable such as experimental auctions or non-hypothetical CE to validate our findings in relation to WTP values. Secondly, the study only focuses on chicken meat. Given that the EU free range claims only apply to poultry, our findings might not hold for other livestock and meat products. Additionally, the study pertains to its narrow geographic scope and the findings of this study should be interpreted within the specific frame of its sample, and generalizations to the broader public remain to be further validated. Future studies could test the robustness of our results for other meat products and in other countries. Thirdly, consumers were asked to make food choices solely based on sustainability attributes and price. However, in real life additional information cues might be used to derive to food choice such as brand, origin, taste, healthfulness, nutritional labeling and health claims, etc. For future studies, it is thus suggested to include a wider range of attributes, which would be more realistic and is likely to lead to smaller impacts of sustainability labeling on food choice.

Chapter 5

Visual attention during food choice: The case of sustainable coffee labeling

This chapter is based on:

Van Loo, E.J., V. Caputo, R. M. Nayga Jr., H.-S. Seo, B. Zhang, and W. Verbeke. 2015. Sustainability labels on coffee: Consumer preferences, willingness-to-pay and visual attention to attributes. Ecological Economics 118:215-225.

Abstract

Sustainability labels are important tools that help consumers assess the sustainability aspects of food. While past studies have focused on visual attention to nutrition information, no study has investigated the visual attention paid by consumers to the sustainability information on food. Our study contributes to the need to better understand consumers' attention to sustainability information when making food choices. The objective was to explore the importance that consumers attach to sustainability attributes and investigate how this relates to the visual attention paid to these attributes during the choice decision and to willingness-to-pay (WTP). Visual attention during the decision-making process was measured in terms of fixation time and fixation count, which were then analyzed in relation to the stated attribute importance. Our results suggest that consumer segments with differences in stated attribute importance, visually attend differently to these attributes. Higher valued attributes also exhibited higher visual attention. Our results suggest that consumers who spend more time attending to and fixate more on sustainability attributes value them more.

RQ7: What are the consumers' preferences and WTP for sustainability labels on coffee (including Organic, Fair Trade, Rainforest Alliance and Carbon footprint labeling)?

RQ10: How much visual attention is given to price and sustainability attributes during food choice and does it correlate with stated attribute importance?

RQ11: Does visual attention to sustainability labels and price for coffee contribute to explaining choice behavior

5.1 Introduction

Sustainability characteristics in food are credence attributes. This type of attribute is neither directly observable by consumers before purchase, nor can it be experienced after purchase. Sustainability labeling programs are designed to support consumers' food choice since they serve as a tool to explicitly communicate the presence of sustainability aspects on food products. Voluntary sustainability labels and their corresponding standards have emerged during the past decades focusing on a range of sustainability issues, and empowering consumers to make more sustainable food choices. The growth in sustainability labels is one of the signs of their increasing popularity. The European Commission (EC) reported the existence of a total of 129 food information schemes related to sustainability at the European Union (EU) level as a whole or at the national level in a specific EU Member State (EC, 2012b). However, when shopping for food, consumers may be overwhelmed with the information provided and time constraints may prevent them from attending to the wealth of available information on food products. As mentioned by Grunert (2011), the information load may limit the use of sustainability labels. Consumers may apply heuristics to simplify their decision and as a result not pay attention to all the product attributes when choosing food (Verbeke, 2008). While past studies have evaluated consumers' visual attention to nutrition information during food choice with the use of eye-tracking, no studies have applied this method to sustainability information. The current study contributes to this research gap by studying the visual attention paid to several sustainability labels on coffee.

Consumers encounter several barriers that may prevent sustainability labels from affecting their choice and leading them into more sustainable eating behavior (for an overview see Grunert, 2011). First of all, the label on the food package should at a minimum be noticed by consumers (Grunert, 2011; Thøgersen, 2000). Consequently, exposure to the label followed by attention are the first steps in information processing (Solomon, 2013), possibly leading to informed sustainable food choice. A large body of literature employs self-reported use of sustainability labels (Grunert et al., 2014) or importance of sustainable food attributes when examining the effect of sustainability on food choices (Vanhonacker et al., 2013). Our study moves beyond the reliance on self-reported measures of sustainability label use, and instead uses eye-tracking measures to quantify the visual attention given to sustainability labels while making food choices.

Attention is an important step in the consumer decision-making process as it is a prerequisite for information processing. Solomon et al. (2013, pg 134) define attention as "the degree to which consumers focus on a stimulus within their range of exposure". With eye-tracking technology,

respondent's gaze can be recorded to monitor their visual attention when making food choices. Visual attention is influenced by bottom-up and top-down factors (Corbetta and Shulman, 2002; Pieters and Wedel, 2004; van der Laan et al., 2015). Bottom-up or stimulus-driven form of attention is caused by characteristics of the stimulus itself (color, size, location, saliency) and occurs without specifically searching for them (Wolfe, 1998). Top-down or goal-directed form of attention, on the other hand, is caused by the voluntary search for specific information (Koch, 2004) based on pre-existing preferences, interests, personal goals and involvement (Ares et al., 2013; Pieters and Wedel, 2004). Involvement, defined by Zaichkowsky (1985, pg 342) as "a person's perceived relevance of the object based on inherent needs, values, and interests", influences the information search during the buying process. Highly involved consumers will more actively search for information and will use more information before buying (Laaksonen, 1994; Verbeke and Vackier, 2004). Behe et al. (2015) reported that the level of consumers' involvement and the importance placed on products can influence visual attention. Specifically, they reported that highly involved consumers exhibit greater fixation counts and greater total fixation duration on product information compared to consumers with a lower product involvement. Similarly in our study, it is likely that consumers attaching more importance to sustainability aspects of food are also more involved in these aspects and will visually attend more to sustainability information during food choice.

Eye-tracking technology has led to useful insights into consumers' use of nutritional information on food packages (Antúnez, et al., 2013; 2015; Ares et al., 2014; Bialkova and van Trijp, 2010; 2011; Bialkova et al., 2013; 2014; Graham and Jeffery, 2011; Graham et al., 2015; Jones and Richardson, 2007; Siegrist et al., 2015b; van Herpen and van Trijp, 2011; Visschers et al., 2010). For a review of eye-tracking and nutrition information, see Graham et al. (2012). For example, Visschers et al. (2010) reported health motivation to stimulate consumers to attend to nutrition information when making a food choice. However, eye-tracking technology has not yet been applied to the assessment of the effect of visual attention to sustainability information on food packages. With an increasing number of labeling schemes on sustainability aspects of food, it is important to improve our understanding of consumers' visual attention to sustainability labels. We hereby provide a first study addressing this research gap by studying the visual attention paid to several sustainability labels on coffee.

The aim of this study is to explore how visual attention affects attitudes and consumer choice behavior for sustainable certified coffee by measuring visual attention to sustainability and price attributes during a choice experiment (CE). The study is divided into five parts. Part 1 gives an overview of the self-reported importance of coffee attributes including attributes related to sustainability.

Furthermore, we identify three consumer segments based on the self-reported importance of sustainability labels on coffee and the importance of coffee price. Part 2 presents the results of the eye-tracking measures and gives insights on the use of sustainability information. In Part 3, we study the relationship between stated attribute importance and visual attention to these attributes. In particular, we first explore if there is any relationship between visual attention and perceived importance of various attributes, including sustainability labels and price. Second, we test if visual attention differs across consumer segments that attach different degrees of importance to sustainability and price. In Part 4, we study consumers' preferences and willingness-to-pay (WTP) based on choice behavior for coffee. We determine the consumer preferences and WTP for the sustainability labels for the overall sample and also across the consumer segments. In Part 5, we study the effect of visual attention to sustainability labels choice behavior for coffee and determine whether visual attention plays a role in explaining choice behavior. In particular, we investigate whether a participant's degree of visual attention influences his or her preference and WTP for that particular attribute when having to make trade-offs with other attributes. Overall, the analyses allow us to determine if consumers who pay more attention to an attribute effectively value it more.

5.2 Literature review of sustainability labels on coffee

The coffee industry is viewed as a pioneering industry for sustainability certification schemes and as such, it became the model for other commodity groups (Pierrot et al., 2011; Reinecke et al., 2012). The first Organic coffee was produced in 1967 and coffee became the first Fair Trade[5] labeled product in 1989 (Consumers International, 2005). Coffee is one of the most popular Fair Trade products in terms of number of products (632 in the US and Canada, see DiMarcello et al., 2014), number of farmers involved (660,700 globally in 2012, see Fairtrade International, 2013), and in terms of sales volume (Fairtrade International, 2013). It is the most commonly bought Fair Trade product in the US (Mintel, 2009) and has the largest market share compared to other Fair Trade products (Dragusanu et al., 2014). In addition to having more established initiatives in the sustainable certified coffee market such as Fair Trade and Organic coffee, various other third-party sustainability certification schemes[6] have emerged

[5] "fair trade", "Fair Trade" or "fairly traded" refer to the general concept without reference to a particular certification, whereas "Fairtrade" refers to the specific certification system run by Fairtrade International (FLO) (cf Davies et al., 2010 and Dragusanu et al., 2014). As of 31 December 2011, the "Fair Trade USA" ended its membership with FLO and launched an independent standard and certification system. While FLO "believes that certification should generally be restricted to small producers, Fair Trade USA feels that large producers and plantations should also be certified" (Dragusanu et al., 2014, p 218).

[6] In our study, we focus on coffee packages present in the store and therefore focus on third-party sustainability schemes. In the coffee market, there was also a strong growth in corporate programs, also called "in-house standards" (e. g. Nespresso AAA Sustainability Quality, Starbucks C.A.F.E. practices) and the sector initiative 4C

including Rainforest Alliance, Bird Friendly, and UTZ certified (Consumers International, 2005; Dragusanu et al., 2014; Pierrot et al., 2011). All these schemes include sustainability criteria with varying emphasis (for a detailed comparison see Kolk (2013), Reinecke et al. (2012), SCAA (2010) and Giovannucci and Ponte (2005)). For example, Fair Trade has the primary goal of improving the livelihoods and well-being of producers. It also stands for improved working conditions, and better buyer-seller relations (Dragusanu et al., 2014; Giovannucci and Ponte, 2005). The Fair Trade scheme emphasizes having a price premium for the producers (Reinecke et al., 2012). Rainforest Alliance or Organic has a greater focus on goals other than income for producers (Dragusanu et al., 2014). For instance, Rainforest Alliance assures that the products have been grown and harvested using environmentally and socially responsible practices and focuses on biodiversity conservation (Reinecke et al., 2012), while the USDA Organic label indicates that the coffee is produced according to the USDA Organic standards. Finally, Bird Friendly certification requires Organic production in addition to providing a forest-like habitat for birds. UTZ certified, founded in 2003, is the most recent of the major certification schemes. It focuses on better business practices and incorporates the GLOBAL G.A.P standards for coffee (Pierrot et al., 2011). It is focused on transparency in the supply chain and responsible production (Reinecke et al., 2012). Carbon Footprint labeling is another sustainability label which could be present on coffee but is rather rare. This label indicates that the producer is reducing its carbon emissions. A specific example is the Carbon Trust's carbon reduction label, which indicates that the company displaying the label is making a commitment to reduce the carbon footprint of their product.

Due to the proliferation of these sustainability certification schemes for coffee and the trend for producers towards multiple certifications (Pierrot et al., 2011), it is common for coffee packages to carry several sustainability labels (Consumers International, 2005). Producers of coffee are often certified for more than one certification scheme since "many of the difficult requirements, such as recordkeeping, traceability, and good agricultural practices are commonly shared among the different certifications" (Pierrot et al., 2011, p 12). For example, in 2012, 73% of the Fair Trade certified producer organizations reported having at least one additional certification (51% held Organic, and 8% held Rainforest Alliance) (Fairtrade International, 2013, p 49). DiMarcello et al. (2014) also report that 90% of the Fair Trade products sold in the US and Canada made an additional claim, with Organic followed

(the Common Code for the Coffee Community), which is a business-to-business initiative. All three of these standard are verification systems, not certification (Kolk, 2013).

by kosher and environmental claims being the most popular (e.g., "Fair Trade +" claims[7]). For coffee in particular, about 37% of Fair Trade coffee is also Organic certified (Fairtrade International, 2013), making it the most popular combination of certifications on the coffee market (Pierrot et al., 2011).

However, sustainable certified coffee still has a modest market penetration, with a market share of 8% of exported coffee in 2009, and 12% in 2012 (SSI, 2014; Pierrot et al., 2011). In more mature markets such as the US, EU and Japan, it is evolving from a niche market towards the mainstream (Pierrot et al., 2011). In the US, the market share of sustainable certified coffee reached 16%, while in the Netherlands, the market share is higher with about 40% of the imported coffee being certified (Pierrot et al., 2011). When looking at specific coffee certifications, Organic and Fair Trade are dominant in most countries, although the market shares differ across countries. Organic certification is dominant in Germany and Italy, while Fair Trade is the most important sustainability certification for coffee in the UK, France and US, and Rainforest Alliance is dominant in Japan and also important in some Western European countries. UTZ certified coffee is dominant in the Netherlands but this scheme is also strongly represented in other Northern European countries (Pierrot et al., 2011).

While many studies have compared consumer preferences and WTP for various sustainability labels (for example: Caputo et al., 2013a,b; Grebitus et al., 2013a; Grunert et al., 2014; Sirieix et al., 2013; Van Loo et al., 2011, 2013, 2014; Vecchio and Annunziata, 2015; Vlaeminck et al., 2014), there is scant literature on consumer preferences for sustainability labels on coffee and the existing literature is primarily focused on Fair Trade coffee. Literature shows a large range of WTP premiums for Fair Trade coffee. For example, Rotaris and Danielis (2011) reported an average WTP premium for Fair Trade coffee among Italian consumers of 110% (€2.20) for a 250 g coffee package, while De Pelsmacker et al. (2005a) reported an average price premium of 10% (€0.19/250 g) for Fair Trade coffee among Belgium consumers. Rotaris and Danielis (2011) pointed out that the large heterogeneity in WTP values across studies can be attributed to a variety of factors such as the geographical context, sampling method and sample characteristics, data collection and analysis methods, type of coffee, number and type of other coffee attributes used in the study, and the certifying institution considered. Basu and Hicks (2008) illustrated that the WTP also changes depending on the information given about the Fair Trade scheme's performance. Some studies identified consumer segments differing in terms of preferences for Fair Trade coffee. While the average premium for Fair Trade coffee in De Pelsmacker et al. (2005a) was 10%, a consumer segment identified as "Fair Trade-lovers" were willing to pay a premium of 36%.

[7] Fair Trade + claims is a term used by DiMarcello et al. (2014) for the claims which are present on food products in addition to the Fair Trade claim

Based on an Italian study, Cicia et al. (2010) reported a premium for Fair Trade coffee for a consumer segment with a high sensitivity to ethical issues of €6.7/250g versus no more than €0.3/250g for a segment that attached a great importance to price and low importance to ethical issues.

In addition, while most of the studies on sustainable certified coffee focused only on Fair Trade (Cicia et al., 2010; de Ferran and Grunert, 2007; De Pelsmacker et al., 2005a; Hainmueller et al., 2015; Koppel and Schulze, 2013; Rotaris and Danielis, 2011, Schollenberg, 2012; Yang et al., 2012, 2013), or eco-friendly (Sörqvist et al., 2013), only a few have assessed the consumer trade-offs between Fair Trade and other sustainability labels such as Organic (Basu and Hicks, 2008; Cranfield et al., 2010; De Pelsmacker et al., 2005b; Langen, 2011), or shade grown coffee (Loureiro and Lotade, 2005). These studies found that Fair Trade coffee was generally preferred over Organic coffee by consumers in Belgium (De Pelsmacker et al., 2005b), Germany (Basu and Hicks, 2008) and the US (Basu and Hicks, 2008; Loureiro and Lotade, 2005). Finally, to the best of our knowledge, our study is the first that compares consumer preferences for all major sustainability certifications for coffee.

5.3 Material and methods

During this study, three sets of data were collected based on the choices made during the CE, eye-tracking measures, and answers to a survey on attitudinal variables such as attribute importance, general attitudes towards coffee and sustainability concern (Appendix H).

5.3.1 Recruitment and sample characteristics

Participants were recruited from a consumer database (N=6,500) managed by the University of Arkansas Sensory Service Center (Fayetteville, AR, US). The consumer database contains area residents of Northwest Arkansas, with the majority of them aged between 18 and 60 years. In total, 81 consumers who purchased coffee in the last two months (March, April 2013) and did not have any eye disease or eye surgery in the past participated. For an eye-tracking study, this is a rather large sample. Past eye-tracking studies employed far less subjects (e.g. 53 in Ares et al., 2013; 71 in Ares et al., 2014; 40 in Balcombe et al., 2015; 24 in Bialkova and van Trijp, 2010; 10 in Bialkova and van Trijp, 2011; 50 in Varela et al., 2014; 22 in van der Laan et al., 2015; 51 in Vidal et al., 2013; 32 in Visschers et al., 2010; 39 in Zhang and Seo, 2015). Each participant was given a $20 gift card as participation fee. About half (53%) of the participants were females (Table 5.1). Each age and income category is represented. The sample is slightly biased towards higher education.

Table 5.1. Socio-demographic characteristics of the sample (%, n = 81)

	Overall sample	S1 Indifferent	S2 Sustainability and price conscious	S3 Price-oriented
Segment size	100.0	9.9	58.0	32.1
Gender				
Male	46.9	50.0	51.1	38.5
Female	53.1	50.0	48.9	61.5
Age group				
18-24 years	17.3	0.0	19.1	19.2
25-34 years	37.0	12.5	36.2	46.2
35-44 years	21.0	37.5	19.1	19.2
45-54 years	14.8	37.5	12.8	11.6
55-64 years	7.4	0.0	10.7	3.8
65 years or older	2.5	12.5	2.1	0.0
Children				
Yes	54.3	62.5	53.2	53.8
No	45.7	37.5	46.8	46.2
Educational level completed				
Less than high school	1.2	0.0	2.1	0.0
High school/GED	6.2	0.0	6.4	7.7
Some college	23.5	25.0	19.1	30.8
2-year college degree (Associate)	3.7	12.5	4.3	0.0
4-year college degree (BA,BS)	39.5	37.5	40.4	38.4
Master's or PhD degree	25.9	25.0	27.7	23.1
Household income				
Less than $20,000	25.9	0.0	29.8	26.9
$20,000-$39,999	21.0	37.5	21.3	15.4
$40,000-$59,999	22.2	25.0	14.9	34.6
$60,000-$79,999	11.1	25.0	12.7	3.9
$80,000 and more	19.8	12.5	21.3	19.2

5.3.2 Choice experiment

The CE was designed on roasted ground coffee as this is the most common type of coffee consumed in the US, with 53% of the coffee buyers preferring this type of coffee over whole bean, ground, instant, ready-to-drink and single-cup coffee using pods or capsules (Mintel, 2012). The coffee products were described using a combination of sustainability labels and price. A range of different schemes for sustainability labels have merged (Consumer International, 2005) and as discussed above, coffee packages could carry not just one sustainability label but a combination of several ones. In our study,

we used four sustainability labels including Fair Trade (the specific Fair Trade certification system dominating in the US is called Fair Trade USA), Rainforest Alliance, USDA Organic, and Carbon Footprint (carbon reduction label from Carbon Trust). While the first three labels are commonly present in the US coffee market, the Carbon Footprint label is generally not. For each of the sustainability labels, two levels were considered: present or not present. The four levels of the price attribute ($4.30, $6.30, $8.30, $10.30) per 12 oz (340 g) were chosen based on the actual prices of coffee as assessed during a store check in April 2013 in food stores in Arkansas, US. The design of the two presented coffee packages followed Street and Burgess (2007) using the full factorial design with 64 (2^4x4) original combinations, resulting in a practical set of eight pairs, with a D-efficiency of 97.6%. As a result, participants were asked eight times to make a choice between two different coffee products or a no-buy option. The no-buy option was added to increase the similarity with a real shopping experience (Figure 5.1).

Figure 5.1. Example of how the areas of interest (AOI) were defined (red frames indicate the AOI for Carbon Footprint label, Rainforest Alliance label, Fair Trade label, USDA Organic label and price)

To avoid an order-effect of the labels present on the package, the locations of the labels on the packages were randomized in each of the eight choices. This was repeated ten times resulting in ten

treatments. Each participant was randomly assigned to one of these ten treatments. Additionally, within each treatment, the eight choice questions were randomly presented to avoid order effects of the choice questions.

5.3.3 Eye-tracking: Procedures and measures

To obtain information on what participants looked at when evaluating and choosing the coffee products during the CE, participants' visual attention to the coffee packages was recorded using a contact-free eye-tracking device (Model: RED, SensoMotoric Instruments, GmbH, Teltow, Germany) connected to a high-resolution computer screen (22"). This eye-tracking device was located in a panel beneath the computer screen. The sampling rate and tracking resolution of the eye-tracking device were 120 Hz and 0.03°, respectively. Visual stimuli were randomly presented using stimulus presentation software (Experiment Suite 360°™, SensoMotoric Instruments, GmbH, Teltow, Germany). Before the CE task, participants received instructions and the eye-tracking device was individually calibrated using the five-point calibration method with a low tracking error (less than 0.4°). After a successful calibration, two warm-up questions were presented to explain the method to the participants. As visual stimuli, pictures of coffee packages were presented and then the participants clicked on the option they preferred. After the two warm-up questions, they were randomly assigned to one of the ten treatments and were then asked to answer each of the eight choice set questions. Between the choice sets (i.e., during the inter-stimulus interval), participants were asked to maintain their fixation on a central black cross against a white background for approximately 8 s. The duration of each task depended on the time that each participant took to evaluate and answer the choice set question. Similar to Balcombe et al. (2015), participants viewed each choice set as long as they wanted and then clicked on an option (i.e., one of the two product alternatives or the no-buy option) to indicate their choice in each of the choice sets. On average, participants spent 73 s to answer all the eight choice questions.

The eye-tracking data analysis was based on defining areas of interests (AOIs) on the coffee packages, corresponding to the possible information cues on the packages, including an AOI for each of the labels (Fair Trade, Rainforest Alliance, USDA Organic, Carbon Footprint label), and the prices at the bottom of the pictures. See Figure 5.1 for an example of how the AOIs were defined. Using the eye-tracking software (BeGaze™, ver. 3.0, SensoMotoric Instruments, GmbH, Teltow, Germany), eye-tracking measures (i.e., the fixation count and fixation time) were collected for each AOI. The fixation count is the number of times the participant fixates his or her gaze on the AOI. The number of fixations within the AOI has been considered a reliable measure for the visual attention given to that AOI (Bialkova and

van Trijp, 2011). More fixations are an indication that the area is more noticeable or more important to viewers than the other areas (Poole et al., 2005). The total fixation duration is the total fixation time within the AOI. A longer duration may relate to the difficulty to extract information or to the degree of involvement or relevance to viewers (Behe et al., 2015; Holmqvist et al., 2011; Just and Carpenter, 1976). For all the eight choice sets combined, two measures of visual attention were calculated for each of the attributes: the total fixation time and the total fixation count. As a result, we obtained ten visual attention measures per respondent, two for each of the four sustainability labels and two for price.

5.3.4 Measurement of attitudinal variables

After completing the CE and eye-tracking study, participants completed a short survey about the importance of various coffee attributes, their sustainability concern, and socio-demographic information.

Importance of coffee attributes. The importance of coffee attributes was scored on a 7-point scale ranging from "Not at all important" (1) to "Extremely important" (7). Twelve attributes (such as taste, quality, availability, price) were included based on previous studies (Grankvist and Biel, 2001; Mintel, 2012; Van Loo et al., 2010) as well as the importance of sustainability labels on coffee such as Fair Trade, USDA Organic, Rainforest Alliance labeling. The importance scores of the three sustainability labels (Fair Trade, USDA Organic, Rainforest Alliance) were merged in one construct (Cronbach's α = 0.86).

Sustainability concern. Following Grunert et al. (2014), sustainability concern was measured by asking how concerned participants were with 14 different aspects related to sustainability in the food sector. These items were measured using a 5-point scale ranging from "Not at all concerned" (1) to "Extremely concerned" (5) and were merged in one construct (Cronbach's α = 0.93).

General attitude towards coffee. General attitudes towards coffee were measured using 7-point semantic differential scales. Respondents were presented with the statement, "Please indicate which word best describes how you feel when you drink coffee". The bipolar adjectives were bad/good, unpleasant/pleasant, unhappy/happy, depressive/cheerful, terrible/delightful and negative/positive; a commonly used scale for assessing general attitudes (Honkanen et al., 2006; Olsen et al., 2007; Perez-Cueto et al., 2011, Pieniak et al., 2010a; Stayman and Batra, 1991). The construct "general attitude towards coffee" is the average across the six items (Cronbach's α = 0.90).

5.3.5. Statistical analysis of attitudinal and eye-tracking variables

Attitudinal and eye-tracking variables were analyzed using SPSS 22 (SPSS Inc., Chicago, IL). Descriptive statistics were used to report percentages, means and standard deviations. Construct reliability was tested by Cronbach's alpha. Correlations between attitudinal and eye-tracking variables were tested with the Spearman's correlation coefficient. The participants' stated attribute importance of sustainability labels on coffee and of the coffee price were used as segmentation variables in a cluster analysis. Cluster analysis allows "grouping of observations into clusters where observations within the same cluster are similar and observations belonging to different clusters are quite dissimilar" (Mazzocchi, 2011, p 263). As such homogeneity within clusters and heterogeneity between clusters is maximized and distinct clusters can be identified. As suggested by Mazzocchi (2011), a two-step procedure was applied. First, a hierarchical clustering with Ward's Method was performed to determine the number of clusters and initial cluster seeds. Secondly, a non-hierarchical method (K-means method) was applied for more accurate clustering. Following Mazzocchi (2011), the number of clusters was determined based on the agglomeration schedule of the hierarchical clustering. The agglomeration schedule shows, for each step, the two clusters being merged and the nested distance. A three cluster solution was finally selected as this number of clusters corresponded to the step before a large increase in nested distance is observed. The resulting cluster centers were then used as initial cluster centers for K-means cluster analysis. Cross-tabulations with χ^2 statistics were used to test for association between categorical variables. For the comparison of mean scores, the independent samples *t*-tests, ANOVA, Kruskal-Wallis rank tests, and Wilcoxon rank sum tests (also called Mann-Whitney tests) were used.

5.3.6 Econometric analysis of choice experiment

In accordance with random utility theory (McFadden,1974), CEs are based on the assumption that the utility of individual *i* of choosing alternative *j* in choice situation *t* can be represented as:

$$U_{ijt} = \beta_i^{'} x_{ijt} + \varepsilon_{ijt} \quad (1)$$

where x_{ijt} is a vector of observed variables relating to alternative *j* and individual *i*; β_i is a vector of structural taste parameters which characterize choices; ε_{ijt} is the unobserved error term, which is assumed to be independent of β and x. Different random utility models can be derived by making different assumptions about the composition and distribution of the unobserved factors $f(\varepsilon_{ijt})$.

In this study, the data collected from the choice experiment were analyzed with the Error Component Random Parameter Logit (RPL-EC) model. Unlike the RPL model which only allows for correlation across

taste parameters, the RPL-EC model also allows for correlation across utilities (see Scarpa et al., 2005 and Scarpa et al., 2007a for details). This is an important issue to account for in our data since the implemented design consists of two designed alternatives and one no-buy option, and hence, correlation across utilities may exist (Scarpa et al., 2005). The no-buy option is truly experienced by participants while the designed product alternatives can only be imagined. Therefore, the utilities of the product alternatives are likely to be more correlated between themselves than with the no-buy option.

Several empirical models were tested. Model 1 is the basic specification of the RPL-EC, which accounts for both preference heterogeneity around the mean population parameters and correlation across utilities. With five attributes, the utility that the *i*th individual obtains from alternative *j* at choice situation *t* takes the following form:

$$U_{ijt} = \beta_0 \, No\_Buy_{ijt} + \beta_1 \, Organic_{ijt} + \beta_2 \, Rainforest_{ijt} + \beta_3 \, Fairtrade_{ijt} + \beta_4 \, Carbonfootprint_{ijt} + \beta_5 \, Price_{ijt} + \eta_{ij} + \varepsilon_{ijt}. \quad (2)$$

where *j* pertains to option A, B and C. No_Buy_{ijt} is a dummy variable taking the value equal to 1 when the no-buy option is chosen, and 0 when either product profile A or B is selected. β_0 is an alternative-specific constant representing the no-buy option. Price is the price ($) of a 12 oz (340 g) coffee package. The four variables referring to the four sustainability labels for USDA Organic, Rainforest Alliance, Fair Trade, Carbon Footprint labeling enter the model as dummy variables and take the value of 1 if they are present in option *j* and 0 otherwise. η_{ij} is the zero-mean normal error term, the error component term, which is associated only with alternatives that portray a purchase decision, and is absent in the utility of the no-buy option. We assumed the price coefficient to be fixed and the coefficients of the four sustainability labels to be random. Using the model estimates, the marginal WTP values were calculated. These are calculated as a negative ratio, where the nominator is the estimated mean value of the coefficient associated with a particular sustainability label and the denominator is the price coefficient. These econometric models were estimated using NLOGIT 5.0.

In order to investigate the effects of visual attention on consumer choice behavior and preferences, we specified two additional models which incorporate the visual attention in the utility function. In particular, it was hypothesized that the extent to which a participant visually attended to the attributes during the decision-making influences his/her preferences for the respective attributes. Accordingly, two additional econometric models were specified: Model 2, which includes visual attention in terms of fixation count, and Model 3, which includes visual attention in terms of fixation time expressed in s. In line with Grebitus et al. (2013b) who included interaction terms based on personality traits, the

fixation count and fixation time variables were re-scaled to have a zero mean. These mean-centered variables were obtained by subtracting the overall mean from each respondent's value. This approach has a number of advantages. Firstly, these variables become relative to their mean. Hence, positive values for these variables indicate values that are above the mean while negative values indicate values below the mean. In addition, mean-centering of the eye-tracking variables facilitates the interpretation of the coefficients. For instance, the parameter estimates for the main effects in Models 2 and 3 can then be simply interpreted as the marginal utility for that attribute at the mean fixation time or fixation count. The interaction terms between the visual attention variables and the experimentally designed attributes allow us to capture the differences in term of preferences depending on how the visual attention differs from the mean visual attention. Thus, we incorporate visual attention as a possible source of heterogeneity and evaluate how preferences vary with visual attention by including these interaction terms. A total of five interaction terms between these visual attention variables and the experimentally designed attributes were added (one for each sustainability label and one for price). Accordingly, the utility that individual *i* obtains from alternative *j* at choice situation *t* in Models 2 and 3 takes the following form:

$$U_{ijt} = \beta_0\, No\_Buy_{ijt} + \beta_1 Organic_{ijt} + \beta_2\, Rainforest_{ijt} + \beta_3\, Fairtrade_{ijt} + \beta_4\, Carbonfootprint_{ijt} + \beta_5\, Price_{ijt} + \gamma^{ORG}\, VA\_Organic * Organic_{ijt} + \gamma^{RF}\, VA\_Rainforest * Rainforest_{ijt} + \gamma^{FT}\, VA\_Fairtrade * Fairtrade_{ijt} + \gamma^{CFP}\, VA\_Carbonfootprint * Carbonfootprint_{ijt} + \gamma^{P}\, VA\_Price * Price_{ijt} + \eta_{ij} + \varepsilon_{ijt}. \quad (3)$$

where γ^{ORG} is the coefficient of the interaction term between the USDA Organic attribute level and the visual attention variable VA_Organic. In Model 2, VA_Organic is the mean-centered fixation count of the USDA Organic label whereas in Model 3, it is the mean-centered fixation time for the USDA Organic label. Similarly, the γ^{RF} , γ^{FT}, γ^{CFP}, and γ^{P} are the coefficients of the interaction terms between the attribute levels and the visual attention variables for, respectively, Rainforest Alliance, Fair Trade, Carbon Footprint, and price. The other variables are specified as in Model 1.

5.4 Results and discussion

5.4.1 Stated importance of coffee attributes and consumer segmentation

When evaluating the coffee attributes, participants attached the highest importance to the flavor followed by the price, type of roast and in-store promotions (Table 5.2). This result is relatively consistent with a 2012 Mintel report on coffee which identified price, type of roast, brand, flavor, and in-store promotions as the most important attributes when purchasing coffee. Our results suggest that the sustainability labels are perceived as less important compared to other coffee attributes, with USDA Organic and Fair Trade being more important than Rainforest Alliance.

Table 5.2 Importance of coffee attributes [1]

	Mean	Std. Deviation
Flavor	6.05 [a]	1.32
Price	6.00 [a]	1.46
Type of roast (light, medium, dark, etc)	5.72	1.15
In-store promotion (whatever is on sale)	5.16	1.48
Size of packaging	4.83 [b]	1.54
Brand	4.74 [b]	1.53
Caffeine content	4.64 [b,c]	1.69
Appearance of packaging	4.37 [c]	1.50
Organic certified	4.09 [c,d]	1.72
Fair Trade certified	3.99 [d]	1.67
Country-of-origin	3.90 [d]	1.62
Rainforest Alliance certified	3.49	1.75

[a] Values with the same letter as superscript indicate not statistically significant differences based on Wilcoxon matched-pairs signed-ranks test, $p<0.05$

[1]Measured on a 7-point scale from 1-Not at all important to 7-Extremely important

From the cluster analysis with importance of sustainability labels and price as segmentation variables, three distinct consumer segments were obtained Table 5.3). Segment 1 (S1, “Indifferent”, 9.9% of the sample) does not attach importance to both the sustainability labels and the price. Segment 2 (S2, “Sustainability and price conscious”, 58.0% of the sample) attaches importance to both price and sustainability labels on coffee while Segment 3 (S3, “Price oriented”, 32.1% of the sample) attaches a very high importance to price and does not consider sustainability labels on coffee important during purchase.

The χ^2-test revealed no significant differences across the segments in terms of the socio-demographic variables gender, income (less than $40,000, between $40,000-$79,999 and above $80,000), education (no university degree vs university degree), and presence of children (yes/no) (all p>0.05) (Table 5.1). To further describe the segments, attitudinal variables were compared (Table 5.3). The sustainability and price conscious segment (S2) was more concerned about sustainability than the price-oriented segment (S3).

Table 5.3. Three-cluster solution and profiling of consumer segments (n=81)

	S1 Indifferent	S2 Sustainability and price conscious	S3 Price-oriented
Segment size (n)	8 (9.9%)	47 (58.0%)	26 (32.1%)
Segmentation variables			
Importance of sustainability	3.58[b] (1.71)[4]	4.80[a] (0.84)	2.23[c] (0.85)
Importance of price[1]	2.25[c] (0.71)	6.26[b] (0.82)	6.69[a](0.55)
Attitudinal variables			
Sustainability concern[2]	3.60[a,b] (1.23)	3.58[a] (0.83)	3.10[b] (0.83)
General attitude towards coffee[3]	6.23[a] (0.79)	6.04[a] (0.79)	6.10[a] (0.68)
Fixation count			
USDA Organic	21.88[a,b] (11.03)	19.02[a] (8.63)	13.69[b] (7.46)
Rainforest Alliance	17.88[a,b] (8.34)	21.66[a] (10.31)	14.46[b] (10.06)
Carbon Footprint	16.00[a,b] (8.07)	20.47[a] (9.25)	15.15[b] (7.29)
Fair Trade	21.75[a,b] (9.82)	22.57[a] (10.28)	15.54[b] (8.60)
Price	14.13[b] (7.06)	24.47[a] (13.15)	23.92[a] (8.49)
Fixation time (s)			
USDA Organic	5.57[a,b] (3.13)	5.21[a] (2.62)	3.59[b] (2.16)
Rainforest Alliance	5.83[a,b] (3.65)	7.31[a] (4.30)	4.35[b] (3.34)
Carbon Footprint	5.02[a,b] (2.82)	6.86[a] (3.77)	4.82[b] (2.52)
Fair Trade	6.07[a,b] (2.96)	6.73[a] (3.63)	4.27[b] (2.34)
Price	2.91[b] (1.72)	5.46[a] (3.13)	5.60[a] (2.10)

[a,b,c] Different superscripts indicate statistically significant differences based on Kruskal-Wallis rank test and if differences exist, these were identified with the Two sample Wilcoxon rank sum (Mann-Whitney) test, p<0.05

[1] Measured on a 7-point scale from 1-Not at all important to 7-Extremely important

[2] Measured on a 5-point scale from 1-Not at all concerned to 5-Extremely concerned

[3] Measured on a 7-point semantic scale

[4] Mean (Standard deviation)

5.4.2 Visual attention to sustainability information based on eye-tracking measures

Fixation count and fixation time are reported in Table 5.4. Participants had the highest fixation count for price, with an average of 23 fixations suggesting that price is the most important attribute considered by the participants when making their choices. The USDA Organic, the Carbon Footprint and the Rainforest Alliance label received less fixations than the price, on average. There were no significant differences for the fixation time across the AOIs, except a lower fixation time for USDA Organic as compared to the other sustainability labels.

Table 5.4. Average eye-tracking measures for the total of the eight stimuli (n= 81)

	Fixation count		Fixation time (s)	
Area of interest	Mean	Std. Dev.	Mean	Std. Dev.
USDA Organic	17.59[a]	8.88	4.72[d]	2.62
Carbon Footprint	18.32[a]	8.83	6.02[e]	3.44
Rainforest Alliance	18.98[a,b]	10.48	6.21[e]	4.14
Fair Trade	20.23[b,c]	10.15	5.88[e]	3.37
Price	23.27[c]	11.64	5.25[d,e]	2.81

[a,b] Different superscripts indicate statistically significant differences based on paired t-test, $p<0.05$
[c,d,e] Different superscripts indicate statistically significant differences based on Wilcoxon matched-pairs signed-ranks test, $p<0.05$

5.4.3 Relation between visual attention and stated attribute importance

Correlation between visual attention and stated attribute importance

There are several significant relationships between the total fixation count and fixation time within an AOI and the attitudinal variables of the participants (Table 5.5). There is a significant positive relationship between the stated importance of price when purchasing coffee and the fixation count or fixation time for the price. This confirms that those stating to attach more importance to price when purchasing coffee have higher fixation counts for price, and thus truly do pay more attention to this attribute when making choices.

When evaluating the fixation counts and time for the four sustainability labels, we find that there is also concordance between the sustainability attributes that the participants say they find important when purchasing coffee and the attention given to these attributes as measured by eye-tracking. The importance of Fair Trade, USDA Organic and Rainforest Alliance is positively correlated with the

fixation counts and fixation time for the respective labels. As participants' stated importance of Fair Trade, USDA Organic and Rainforest Alliance increase, the fixation count as well as fixation time for these labels' corresponding AOI also increase. This result confirms that the importance of the sustainability attributes plays a role in the visual attention.

Table 5.5. Spearman's correlation coefficients between stated importance and visual attention to the attributes

	Total fixation count				
	Carbon Footprint	Fair Trade	Rainforest Alliance	Organic	Price
Importance price	0.025	-0.124	-0.122	-0.168	0.233*
Importance Fair Trade	0.263*	0.221*	0.267*	0.193	0.033
Importance Organic	0.290**	0.224*	0.279*	0.303**	-0.045
Importance Rainforest Alliance	0.247*	0.233*	0.271*	0.202	0.004

	Total fixation time (s)				
	Carbon Footprint	Fair Trade	Rainforest Alliance	Organic	Price
Importance price	0.050	-0.087	-0.135	-0.129	0.327**
Importance Fair Trade	0.246*	0.227*	0.238*	0.168	0.005
Importance Organic	0.240*	0.265*	0.285**	0.329**	-0.083
Importance Rainforest Alliance	0.229*	0.253*	0.218*	0.180	-0.032

** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed)

Differences in visual attention across segments

Differences in visual attention across segments that attach different degrees of importance to sustainability aspects and price of coffee were tested (Table 5.3). Fixation count and time for the various attributes are indicators of the relevance of these attributes when making their choices. As such, we can expect the segments that stated to attach a higher importance to certain attributes to also have a higher visual attention, expressed by a higher fixation time and count, for these attributes.

We find significant differences in the fixation counts and time for the various sustainability labels examined (Table 5.3). The small indifferent segment (S1) has a significantly lower fixation count and fixation time for the price attribute as compared to the other two segments. This is in line with the

much lower stated importance for price for S1 (mean= 2.25) as compared to the other segments (mean= 6.26 and mean= 6.69 for S2 and S3, respectively). Thus, as expected, the segment S1, that attached a much lower importance to price than the other segments, also visually paid less attention to the price attribute. S1 only differs from the other segments in terms of visual attention to the price attribute.

Visual attention differs between S2 and S3 except for the price attribute. Although the price-oriented segment stated to attach a slightly higher importance to price than S2 (mean= 6.69 versus 6.26), the visual attention for price in term of fixation count and time does not differ significantly. However, for all the sustainability labels, S2 has a significantly higher visual attention than S3, based on both fixation count and time. This is in line with our expectations since S2 attached a higher importance to sustainability labels than S3 (mean= 4.80 versus 2.23) and thus also visually paid more attention to these attributes when making food choices. Our results illustrate that the segments that attach more importance to sustainability aspects and/or price will also pay more attention to this information when making choices among coffee products.

5.4.4 Consumer preferences and WTP

Consumer preferences and WTP for the sustainability labels for the overall sample were determined based on the standard RPL-EC model (Model 1). As expected, the coefficient for the no-buy option (Table 5.6) is significant and negative indicating that participants gain a higher utility from choosing a coffee alternative than from the no-buy option. Also, the price coefficient is significant and of the expected negative sign.

The coefficients of the USDA Organic, Rainforest Alliance and Fair Trade labels are significant, while the coefficient for the Carbon Footprint label is not, implying that, except for the Carbon Footprint label, participants' utility increased when one of the labels was present on the coffee package (Table 5.6). These results further show that USDA Organic is the highest valued attribute, resulting in the strongest utility increase, followed by Rainforest Alliance and Fair Trade. The standard deviations of the random parameters are significantly different from zero which indicate the presence of considerable unobserved heterogeneity in taste preferences across the participants. The error component associated with the product alternatives is significantly different from zero, which signifies that the error component should be included in the model.

Table 5.6. RPL model with error component (RPL-EC) coefficient estimates (n=81)

		Model 1	Model 2 Fixation Count	Model 3 Fixation Time
USDA Organic	Mean	0.94***	1.03***	1.06***
	St. Dev.	0.88***	0.84***	0.73***
Rainforest Alliance	Mean	0.68***	0.73***	0.76***
	St. Dev.	0.50***	0.53**	0.51**
Fair Trade	Mean	0.55***	0.60***	0.62***
	St. Dev.	0.63***	0.60***	0.62***
Carbon Footprint	Mean	0.22	0.26	0.29
	St. Dev.	0.76***	0.87***	0.86***
Price		-0.81***	-0.91***	-0.92***
No_buy		-8.68***	-10.50***	-10.84***
Interaction terms with eye-tracking information[1]				
VA_Organic x USDA Organic			0.06***	0.24***
VA_Rainforest alliance x Rainforest Alliance			0.02	0.04
VA_Fair trade x Fair Trade			0.04***	0.15***
VA_Carbon Footprint x Carbon Footprint			0.02	0.08
VA_Price x Price			-0.02***	-0.10***
Error Component	St. Dev.	2.52***	3.50***	3.71***
K (parameters)		21	26	26
N		648	648	648
Log likelihood		-349.87	-321.20	-314.23
AIC		741.7	694.4	680.5
AIC/N		1.145	1.072	1.050
BIC		835.7	810.7	796.8
BIC/N		1.290	1.251	1.230

***, **, * indicate significance at 1%, 5% and 10% level, respectively.

The marginal WTPs for the overall sample (Table 5.7) illustrate that the USDA Organic label has the highest WTP among all the sustainability labels examined, resulting in a WTP premium of $1.16 for a package of 12 oz (340 g). This is followed by the Rainforest Alliance label and the Fair Trade label ($0.84 and $0.68, respectively). The presence of the Carbon Footprint label did not result in a significant premium. Loureiro and Lotade (2005) reported that U.S. consumers wanted to pay more for Fair Trade coffee than for shade grown or Organic coffee. However, their study was based on data from 2002, the same year when the USDA national standard for organic production and processing was

established and the USDA Organic seal was introduced. Since then the US organic market has grown significantly, with annual growth rates of 10-15%, except during the recession when growth rates were lower than 10% (ERS, 2013). A more recent study (Zepeda et al., 2013) found that the USDA Organic label is preferred by US consumers over the Fair Trade label, which is in line with our results. Vecchio and Annunziata (2015) compared the WTP for Fair Trade, Rainforest Alliance and Carbon Footprint labels on chocolate and also found the Carbon Footprint to result in the lowest WTP.

The differences in WTP across the investigated sustainability labels can be due to several reasons such as the credibility of the label, trust in the label, beliefs about the label, knowledge about the label, etc. Zepeda et al. (2013) stated that the consumer preferences for sustainability labels are influenced by label attributes (the source, the message, the design) and the consumer attributes (skepticism and trust, experience, familiarity and attitudes). The sustainability labels used in this study differ in their message as they focus on different sustainability aspects. The source describes the origin, credibility and reputation (Hoogland et al., 2007; Zepeda et al., 2013). The trust in the sustainability claim and the belief that the label is indicative of a sustainable product may depend on the source and its credibility and reputation and influences the food choice (Hanss and Böhm, 2012). Teisl et al. (2002) also report the credibility of the endorsing entity as an important factor for the trust in the label. The trust in the source and the belief in the meaning of the specific label might differ across the labels used in our study. Familiarity of the label is also influencing factor (Thøgersen, 2000) as consumers have the tendency to be skeptical about unfamiliar labels and may not trust the label (Sirieux et al., 2013). Also NCA (2008) reported that Organic certified coffee has the highest awareness in the US compared to any other sustainability label on coffee. In addition to familiarity and trust, other consumer characteristics influence their attitudes towards sustainability labels including past experiences, their concern towards sustainability, their knowledge and understanding of the meaning of the specific labels and their knowledge about sustainability issues in general (Grunert et al., 2014; Thøgersen, 2000; Zepeda et al., 2013).

Although we did not test this, these factors may be a plausible explanation why USDA Organic is the most and Carbon footprint to be the least valued. USDA Organic is based on a USDA regulation and USDA might be seen as a credible source of information. This may lead to more credibility of the label than labels based on 3rd party certifications such as Fair Trade, Rainforest Alliance and Carbon footprint. Carbon Footprint labeling is not present on the US market and thus they are less familiar with this, and may also not trust this label as compared to those they are more familiar with as compared to USDA organic, Fair trade and Rainforest Alliance. While USDA Organic is probably the

familiar sustainability label included in the study (NCA, 2008). The low WTP for Carbon Footprint might be due to the low familiarity with this label (Sirieix et al., 2013) and confusion about its meaning (Gadema and Oglethorpe, 2011; Hartikainen et al., 2014). We also estimated the WTP for the sustainability labels for the two largest segments [8]. As expected, S2, the sustainability and price conscious segment, is willing to pay a higher premium for sustainable certified coffee than the price-oriented segment (S3) (Table 5.7).

Table 5.7. Marginal WTP ($/12 oz or 340 g) for sustainability labels on coffee across segments

	Overall		Segment 2 Sustainability and price conscious		Segment 3 Price-oriented	
	n=81		n=47		n=26	
	Mean	(st. error)	Mean	(st. error)	Mean	(st. error)
USDA Organic	1.16 ***	(0.24)	1.41 ***	(0.32)	0.52	(0.56)
Rainforest Alliance	0.84 ***	(0.22)	0.99 ***	(0.27)	0.08	(0.55)
Fair Trade	0.68 ***	(0.21)	0.71 **	(0.30)	0.59	(0.55)
Carbon Footprint	0.27	(0.22)	0.51 *	(0.30)	0.04	(0.55)

***, **, * indicate significance at 1%, 5% and 10% level respectively

Based on a store check (Fayetteville, AR, 2013), retail prices for coffee packages (12 oz. or 340 g) ranged from $3/12 oz, to $9.99/12 oz. The actual price premium for coffee with a sustainability label ranges from $1.5 to $2.3/12 oz. when comparing coffee products with and without the label from the same brand. The actual price premiums for certified coffee in the market vary considerably since the premiums are not solely based on the certification scheme but rather on the quality of the beans, producer's reputation, origin, blend, brand, and outlet (Consumer International, 2005; FAO, 2009; Giovannucci et al., 2008) as well as on supply and demand. As such, it is very difficult to determine the premium in the market solely attributable to sustainability certification. Keeping other factors constant, the prices of Organic coffee are mostly higher than the prices of coffee certified as Rainforest Alliance and Fair Trade USA (FAO, 2009). This is consistent with our results since in each of our models, the premium for USDA Organic is higher than the premium for the other sustainability labels.

[8] Since the indifferent segment consists of only 8 participants, the WTP for this segment was not calculated

5.4.5 Effect of visual attention to sustainability labels on choice behavior for coffee

In this last part, we investigate whether a participant's degree of visual attention influences his or her preference and WTP for that particular attribute when having to make trade-offs with other attributes. This analysis allows us to determine if consumers who pay more attention to an attribute value it more. To do so, we estimated two additional models, Model 2 and Model 3 that incorporate visual attention in the utility function as interaction terms with the respective attribute.

In both models three out of the five interaction terms were statistically significant, namely those related to USDA Organic, Fair Trade and price (Table 5.6). The interaction terms of the labels with the visual attention for Fair Trade and USDA Organic attributes are significant and positive, confirming that a higher fixation count or fixation time is related to a higher utility for these attributes. This positive interaction term illustrates that the utility of a person who pays more visual attention to Fair Trade and USDA Organic label increases more when these sustainability labels are present on a coffee package. People who visually attend more to these labels are more likely to choose coffee carrying these labels. The interaction term for price and fixation count or fixation time are significant and negative suggesting that a consumer's utility decreases more for those who visually paid more attention to the price attribute. Thus a higher visual attention to price is associated with a higher price sensitivity (a more negative price coefficient). These models confirm that a higher fixation count or time for a sustainability attribute is related to a higher utility for that particular attribute; in contrast to the price attribute, for which a higher fixation count or time results, as expected, in a more negative utility. Overall, our results illustrate that eye-tracking measures reveal meaningful information about the value that consumers attach to the product attributes when making food choices. Consumers who spend more time and fixate more on attributes value them more.

The information criteria as well as the log-likelihood values can be used to discuss the relative fit of the various models. The log-likelihood is closer to zero and the information criteria are lower in Models 2 and 3 compared to Model 1, suggesting that the incorporation of visual attention information as covariates improves the fit of the choice models. Thus assessing consumer preferences for sustainability labels on food packages can be improved through accounting for heterogeneity due to visual attention.

Based on the Models 2 and 3, WTP premiums for the sustainability labels are calculated based on the average visual attention in terms of fixation count and time, respectively, for each of the sustainability labels and for price (Appendix I). The premiums at average visual attention are very similar to those

based on the overall sample (Table 5.7). The advantage of Models 2 and 3 is that they account for heterogeneity based on the visual attention. Based on the interaction terms in Models 2 and 3, we can also calculate the change in WTP for one extra fixation count (Model 2) and extra second fixation time (Model 3) for a certain sustainability label or for price. Results show that for every one unit (i.e. one count) increase in fixation count for price, WTP decreases by 2.3%, while for every one unit (i.e. one second) increase in fixation time for price, WTP decreases by 10.1%[9]. This result confirms that consumers with a higher visual attention to price are more price sensitive, which results in a reduction of the marginal WTP for sustainability labels.

Similarly, based on the interaction terms for the sustainability labels, differences in WTP premiums can be explained by the visual attention to these labels. For example, a unit increase in fixation count on a particular sustainability label results in a WTP premium increase of 5.9% for USDA Organic[10], 7.4% for Fair Trade, 2.1% for Rainforest Alliance and 9.0% for Carbon Footprint label. Similarly, a unit increase in fixation time results in a WTP premium increase of 22.9% for USDA Organic[11], and 23.6% for Fair Trade, 4.9% for Rainforest Alliance and 29.2% for Carbon Footprint label. This confirms that the higher the visual attention for a particular sustainability label, the higher is the WTP for coffee carrying this label.

5.5 Conclusions

This study provides insights into how consumers process sustainability information on coffee packages. Attention to sustainability labels on food products is a necessary precursor to processing the information leading to informed sustainable product choices. Instead of using self-reported use of sustainability labels during food choice, we used eye-tracking technology to measure visual attention to sustainability labels. Our study illustrates that visual attention to attributes including sustainability aspects, measured during food choice is related to the importance of these attributes and to the preferences towards the attributes. First, we found that visual attention relates to stated importance. Second, consumer segments with a higher stated importance attached to certain attributes also visually attended more to these attributes when making choices. Third, visual attention plays a role in explaining choice behavior for coffee. Specifically, spending more time and fixating more on

[9] -0.022/(0.908+0.022) based on Model 2 and -0.104/(0.919+0.104) based on Model 3
[10] 0.061/1.032 for Organic. For the other labels, the impact of one extra fixation count can be calculated in a similar way.
[11] 0.243/1.064 for Organic. For the other labels, the impact of one extra fixation second can be calculated in a similar way.

sustainability attributes relate to a higher preference for these attributes when making food choices, and relates to a higher WTP.

While we found a relationship between the value, importance, WTP for sustainability labels on the one hand and the visual attention given to these attributes during food choice on the other hand, the direction of the causality remains to be investigated.

First, higher motivation and higher valuation of the labels may lead to more visual attention as motivated consumers are actively searching for information. People who are more concerned about sustainability, are more motivated to make sustainable food choices and to use sustainability labels in their food choice (Grunert et al., 2014). Thus attaching a higher value to sustainability labels is likely to result in more attention for this information during food choice. By stimulating consumers' motivation to look for sustainability information on food packages and to value this information, they are more likely to use labels in their decision-making, spend time on searching for this information and make sustainable food choices. This is also supported by the stated degree of importance attached to sustainability attributes. The stated degree of importance attached to sustainability attributes as well as concerns for sustainability issues could be related to motivation. Specifically, higher motivation and involvement with respect to sustainability of food could result in a search for this specific information (Pieters and Wedel, 2004), which may explain the higher visual attention. The role of motivation has also been reflected in the eye-tracking studies on healthy food choices where health motivation in terms of nutrition importance and health consciousness stimulate consumers to attend to nutrition information when making a food choice (Visschers et al., 2010). While health-motivated consumers are likely to pay attention to and seek information about cues which assist in assessing the healthiness of foods (Hess et al., 2012), our study shows that sustainability-motivated consumers are also likely to seek information about sustainability aspects.

Second, also the reversed causality is possible: a higher visual attention may lead to higher valuation, similarly as the post purchase dissonance. Also the exposure effect, which states that attention has a causal effect on preference formation, may cause a higher visual attention for an attribute to result in a higher value and preference for that attribute. Thus it is possible that attracting attention to the labels and spending more visual attention to sustainability labels could in turn lead to a higher valuation for sustainability labels on food products. In this way, we could nudge people in valuing sustainability labels and in making sustainable food choices. Especially when involvement is low, and thus the information search is limited.

Overall, our study illustrates that accounting for the degree of visual attention when making food choices can reveal additional insights into the value that consumers attach to product attributes, such as sustainability labels. The findings of this study can be used as a guide by coffee and other food producers and marketers when making decisions related to sustainability labeling of food products. Higher attention given to sustainability labels is associated with higher valuation of these attributes.

Our study suggests several areas of future research. For instance, packaging plays an important role in attracting consumers' attention (Bialkova et al., 2013; Clement et al. 2013; Clement, 2007; Varela et al., 2014) and in communicating information about credence attributes at the point of purchase. Packages usually include not only sustainability labels and price but also other information cues (brand names, nutritional labels, ingredients lists, graphics, etc.) that are competing for the consumer's attention. Thus, further studies should include packages on which more information cues are presented in addition to sustainability labels in order to evaluate the visual attention to sustainability labels in a choice environment with more information (e.g., more attributes). This is likely to affect the attention as information density is a bottom-up factor that could influence attention (Bialkova et al., 2013). An example of an interesting study to conduct in the future is to include nutritional labels along with sustainability labels in a CE design with eye-tracking to test whether the results we obtained from the present study will hold.

This study also has some limitations. Firstly, extrapolation to other populations remains to be further validated and future studies should include larger and statistically representative sample and test the robustness of our findings using a sample in other locations (e.g., different region or country). Secondly, the use of a convenience sample limits the interpretation of the findings to its specific sampling frame. A third limitation pertains to the possible presence of hypothetical bias due to the reliance on stated rather than on revealed preferences. Future studies should also study food products other than coffee since the type of product is likely to have an influence on the visual attention behavior of consumers when making food choices. Future studies could also evaluate the beliefs, trust, credibility and knowledge related to the different sustainability labels used in this study. There are also limitations specifically to the use of eye-tracking which are discussed in detail in Chapter 7.

Chapter 6

Accounting for attribute non-attendance in food choice experiments using eye-tracking measures

This chapter is based on:

Van Loo, E.J., R. M. Nayga Jr., D. Campbell, H.-S. Seo, and W. Verbeke. 2016. Accounting for attribute non-attendance in food choice experiments using eye-tracking measures. Under review.

Abstract

The aim of our analysis is to investigate the incorporation of eye-tracking measures to account for attribute non-attendance (ANA) in choice experiments. We compared two definitions for detecting whether a specific attribute was ignored during a choice task. This is based on the visual attention (1) to the specific attribute in the choice set as a whole and (2) to the specific attribute in each of the alternatives within the choice set. In addition, we used two modelling methods to account for visual ANA, one at the choice set level (choice task visual ANA) and one at the respondent level (serial visual ANA) and two different fixation count requirements. This results in a total of six approaches to account for visual ANA. Using models with two coefficients for each attribute, one for visually attended and one for visually ignored, we tested whether the coefficients for the ignored attributes are zero and thus represent truly ignored attributes. Some attributes that were identified as 'visually non-attended' based on eye-tracking measures were truly ignored (since their coefficients were not significantly different from zero), so their coefficients in the utility function can be set to zero. However, for all approaches, price was not actually ignored in the decision-making process when identified as 'visually ignored'. This was also the case for USDA Organic and Rainforest Alliance in some approaches. Using our approaches, it is advisable to include two coefficients in the utility function for each attribute: one for visually ignored and one for visually attended. This suggests that the adequate approach for visual ANA might depend on the attribute itself and calls for more research on how to optimize the use of eye-tracking in the context of ANA into choice modelling.

RQ12: Were the attributes identified as ignored truly ignored?

RQ13: Does accounting for visual attendance influence the model estimates?

6.1 Introduction

A growing body of studies applies choice experiments (CEs) as a valuation method. In a CE, respondents are asked to select their preferred alternative from a given set (i.e., the choice set[12]) in which each alternative is described by attributes of varying levels. Respondents are asked to make selections from a series of choice sets. The analysis of CE data is based on the economic theory of consumer behavior (Lancaster, 1966; McFadden, 1974), which assumes continuous preferences and thus unlimited substitutability between the attributes employed (Ryan and Bate, 2001). This continuity axiom implies that respondents, when choosing their most preferred alternative, consider all the attributes presented to them as well as the trade-offs in terms of gains and losses between attributes (Hensher et al., 2005). However, a growing number of studies have questioned the assumption of compensatory behavior because respondents may ignore some of the described attributes while evaluating alternatives in a choice task (Campbell et al., 2008; 2011; Carlsson et al., 2010; Hensher, 2006; Hensher and Greene, 2010; Hensher et al., 2005; 2012; Hole, 2011; Kragt, 2013; Lancsar and Louviere, 2006; Scarpa, et al. 2009; 2010). For example, respondents may not make the assumed trade-offs between all the attributes presented due to attribute non-attendance (ANA), resulting in a violation of the continuity axiom. This decision heuristic has gained increased attention in the CE literature (Hensher, 2014). Not accounting for ANA has been found to affect coefficient estimates and model performance (Campbell et al., 2008, 2011; Carlsson et al., 2010; Hensher and Rose, 2009; Mariel et al., 2013; Scarpa et al., 2009; 2010). When an individual ignores an attribute, it suggests that there will be no trade-off between the ignored attribute and another attribute; hence, no marginal rate of substitution can be computed at the individual level (Campbell et al., 2008; Hoyos, 2010).

Two methods have been proposed to identify ANA in CEs. The first is to ask the respondents additional questions about which attributes they ignored (i.e., stated ANA). The second is to infer ANA based on observed choices (i.e., inferred ANA). Respondents can be asked whether an attribute was ignored while making a decision at the end of the entire choice task sequence (i.e., serial stated ANA) (Alemu et al., 2013; Carlsson et al., 2010; Hensher et al., 2005; Kehlbacher et al., 2013; Kragt, 2013; Scarpa et al., 2013). Alternatively, respondents can be asked about ignored attributes after each individual choice task (i.e., choice task stated ANA) (Meyerhoff and Liebe, 2009; Puckett and Hensher, 2008; 2009; Scarpa et al., 2010). The disadvantage of stated ANA is that these measures are self-reported, which raises concerns about reliability (Hensher and Rose, 2009). For example, responses may be

[12] In the CE literature, the set of alternatives which an individual must consider to arrive at his/her choice is called the choice set (Hensher et al., 2015). The choice task is used to refer to the action itself in which a respondent selects the preferred alternatives out of those alternatives presented in the choice set.

influenced by how the question is asked or how it is interpreted. It is also possible that respondents cannot recall how they made their choice, or they may not answer the attendance statement truthfully (Kragt, 2013; Scarpa et al., 2013). They may bias their answer in a socially desirable manner (Mørkbak et al., 2014). Additionally, when collecting this information at the end of the study (i.e., serial stated ANA), it may be difficult for respondents to answer because they may have applied different attribute processing strategies for each choice task (Hess and Hensher, 2010; Puckett and Hensher, 2009). Asking these questions at the end of each choice task allows the respondents to indicate different ANA behaviors for each choice task. However, a disadvantage of the choice task stated ANA approach is that respondents are informed about the researcher's interest in their attribute attendance, which may itself influence their information processing and thus their attribute attendance in later choice tasks. Another drawback is the additional cost in terms of survey time of repeatedly asking these supplementary questions.

Rather than relying on self-reported information on attendance, a second method infers ANA behavior using analytical models (Campbell et al., 2011; Hensher and Greene, 2010; Hensher et al., 2012; Hess and Hensher, 2010; Lagarde, 2013; Scarpa et al., 2009; 2010; 2013). The most popular inferred modelling approach uses equality constrained latent class models, which impose specific restrictions on the utility functions for each class by constraining some coefficients to zero for selected attributes in a certain class (Campbell et al., 2011; Caputo et al., 2013; Hensher and Greene, 2010; Kragt, 2013; Lagarde, 2013; Scarpa et al., 2009; 2013). Other inferred methods include a combined latent class mixed logit model that allows for ANA and continuous taste heterogeneity (Hess et al., 2013) and the use of a Bayesian approach to attribute selection (Scarpa et al., 2009; Balcombe et al., 2011). Another method of inferring ANA is the use of mixed logit models to derive respondent-specific coefficients. This method uses the coefficient of variation of individual-specific posterior means, which was suggested by Hess and Hensher (2010) and was applied by Scarpa et al. (2013) and Mørkbak et al. (2014).

The key question is "which of these approaches (or combination of approaches) best identifies ANA behavior"? Scarpa et al. (2013) compared the stated and inferred methods and concluded that it is not possible to identify which of the two approaches best accounts for ANA. Mariel et al. (2013) also showed that at the choice task level, analytical approaches to inferring ANA do not seem to correctly predict the true ANA, which was generated in hypothetical datasets.

In this study, we propose a third method based on visual ANA, defined as visually ignoring information about attribute levels (Balcombe et al., 2015). Visual attention is measured by eye-tracking equipment

while respondents are answering the CE questions. More specifically, eye-fixation counts are used as an indication of visual attention. Based on the fixation counts for a particular attribute, a discrete measure of visual attendance was created indicating whether a respondent visually attended an attribute.

Hence, instead of using the stated or inferred ANA measures discussed above, we use visual ANA to indicate whether the respondent visually attended to or ignored each attribute. The use of eye-tracking has been widely applied in the fields of marketing and psychology; however, it is a relatively new methodology in the field of economics. While some researchers, such as Scarpa et al. (2013), have suggested the use of improved methods, such as eye-tracking technology, to obtain information on ANA in CEs, only Balcombe et al. (2015) have done so. Following Balcombe et al. (2015), at least two fixations are required to consider an attribute visually 'attended to'. Hence, an attribute can be considered 'visually not attended to' if the fixation count is less than two. We follow the approach by Balcombe et al. (2015) but extend it in three ways. 1) For the ANA detection, we compare two definitions for identifying whether a specific attribute was ignored during a choice task. 2) Two methods for accounting for ANA in the model are applied by incorporating visual ANA at the respondent level (serial ANA) and at the choice set level (choice task ANA). 3) In addition to two fixation counts to be required, we also used one fixation count as the threshold to consider an attribute visually attended to.

Balcombe et al. (2015) identified an attribute as ignored in a particular choice task if fixation count for the attribute was less than two in the choice set as a whole. Thus the fixation count for one attribute was summated over the alternatives within one choice set. In addition to this method of ANA detection utilized by Balcombe et al. (2015), we use a second definition for identifying an attribute as being visually ignored. Rather than defining an attribute as ignored in a choice task based on the visual attention to the attribute summated over the alternatives in choice set, in this second definition the attribute is identified as ignored in the choice task when it was ignored in both alternatives in the choice set. Thus in the second definition, the visual attention to the attribute for each alternative is taken into account.

The modelling approach to account for visual ANA applied by Balcombe et al. (2015) was at the respondent level (serial ANA). They classified a respondent a 'non-attender' of a certain attribute of the whole CE (in all choice tasks) if the attribute was ignored during more than half of the choice tasks. While Balcombe et al. (2015) incorporated only serial visual ANA by classifying a person as either a non-attender or an attender of an attribute for the whole CE, we also study choice task visual ANA.

Several authors warned that respondents' processing strategies may change as they progress through a sequence of choice tasks, meaning that their tendency to ignore attributes may not be consistent throughout a panel of choices (Hess and Hensher, 2010; Meyerhoff and Liebe, 2009; Puckett and Hensher, 2009; Scarpa et al., 2010). Hence, it is important to allow varying ANA behavior between choice tasks. Thus, in addition to serial visual ANA, we incorporate choice task visual ANA which does not assume that respondents ignore the same attributes over an entire sequence of choice tasks but instead allows visual ANA to vary across choice tasks.

In our study, we advance the investigation of visual ANA by studying two definitions, and two modelling approaches for visual ANA. Two definitions for detecting whether a specific attribute was ignored during a choice task are based on the visual attention (1) to the specific attribute in the choice set as a whole and (2) to the specific attribute in each of the alternatives within the choice set. In addition, two modelling methods were used to account for visual ANA, one at the choice set level (choice task visual ANA) and one at the respondent level (serial visual ANA). This results in a total of four approaches to account for visual ANA. In addition to the threshold of two fixation counts as used by Balcombe et al. (2015), we also relax this to one fixation count. We then compare a CE model in which full attendance is assumed with the models in which visual ANA is addressed and investigate whether accounting for visual attendance influences the model estimates and willingness to pay (WTP) values.

6.2 Material and methods

6.2.1 Sustainability labels on coffee

Sustainability aspects of food are credence attributes and are thus unobservable unless explicitly labelled for consumers. However, consumers may be overwhelmed with information when making food choices in a shopping environment and therefore may not pay attention to all food labels (Grunert, 2011). Coffee was selected as it is one of the most popular sustainability-labelled food products. Many US coffee products carry sustainability labels such as Fair Trade (the specific US certification system is called Fair Trade USA), Rainforest Alliance, and USDA Organic, which are all included in our study. For more information on each of these sustainability labels on coffee, we refer to Van Loo et al. (2015). Coffee producers are often certified for more than one type of label. For example, in 2012, 73% of the Fair Trade certified producer organizations reported holding at least one additional certification (51% organic and 8% Rainforest Alliance) (Fairtrade International 2013, p 49). For coffee specifically, approximately 37% of Fair Trade coffee is also organic certified (Fairtrade International, 2013). Due to the proliferation of sustainability labels for coffee, coffee packages often carry several of these labels (Consumers International, 2005).

6.2.2 Experimental design of the choice experiment

Participants were recruited from a consumer profile database (N=6,500) *Name research centre (City, state*) (omitted for refereeing purposes only). The consumer database contains area residents, with the majority aged between 18 and 60 years. In total, 81 consumers who purchased coffee in the two months preceding the study (April 2013) and did not have any history of eye diseases or eye surgery participated in the study. Many previous eye-tracking studies recruited fewer respondents (e.g., 53 in Ares et al., 2013; 71 in Ares et al., 2014; 40 in Balcombe et al., 2015; 24 in Bialkova and van Trijp, 2010; 10 in Bialkova and van Trijp, 2011; 50 in Varela et al., 2014; 22 in van der Laan et al., 2015; 51 in Vidal et al., 2013; 32 in Visschers et al., 2010). Each participant was given a $20 gift card as a participation reward. Approximately half (53%) of the participants were female (Table 5.1). Each age and income category is represented. The sample is slightly biased towards participants with higher education.

All coffee products in the experiment were ground medium roast coffee, which is the most popular type of coffee in the US (Mintel, 2012). The coffee products were described using a combination of five attributes; the four sustainability labels and price. The attributes and the corresponding levels are shown in Table 6.1. For each of the sustainability labels, two levels were considered: present or not present. The four levels of the price attribute were chosen based on the actual prices of coffee during a store check in food stores in Fayetteville (Arkansas, USA) in April 2013.

The CE design followed Street and Burgess (2007). We used the orthogonal main effect plan (OMEP) to make profiles for the first alternative. The OMEP for four attributes with two levels and one attribute with four levels resulted in eight profiles for the first alternative. With the generator ([1 1 1 1 1]), the profiles for the second alternative were obtained (Burgess, 2007; Street and Burgess, 2007). This design of eight choice sets has an efficiency of 97.6%. To increase the similarity to a real shopping experience, a no-buy alternative was added to each choice set. Hence, in each choice set, participants were presented with two types of roasted ground coffee as well as a no-buy alternative (Figure 6.1). Due to the hypothetical nature of our CE, a cheap talk script was presented to respondents prior to the choice tasks. To avoid an order effect of the label location on the package, these locations (from left to right) were randomized in each of the eight choice sets. This randomization was repeated ten times, resulting in ten different surveys. Each respondent was randomly assigned to one of these ten surveys. Additionally, within each survey, the eight choice sets were randomly presented to avoid order effects.

Table 6.1. Attributes and levels used in the choice experiment

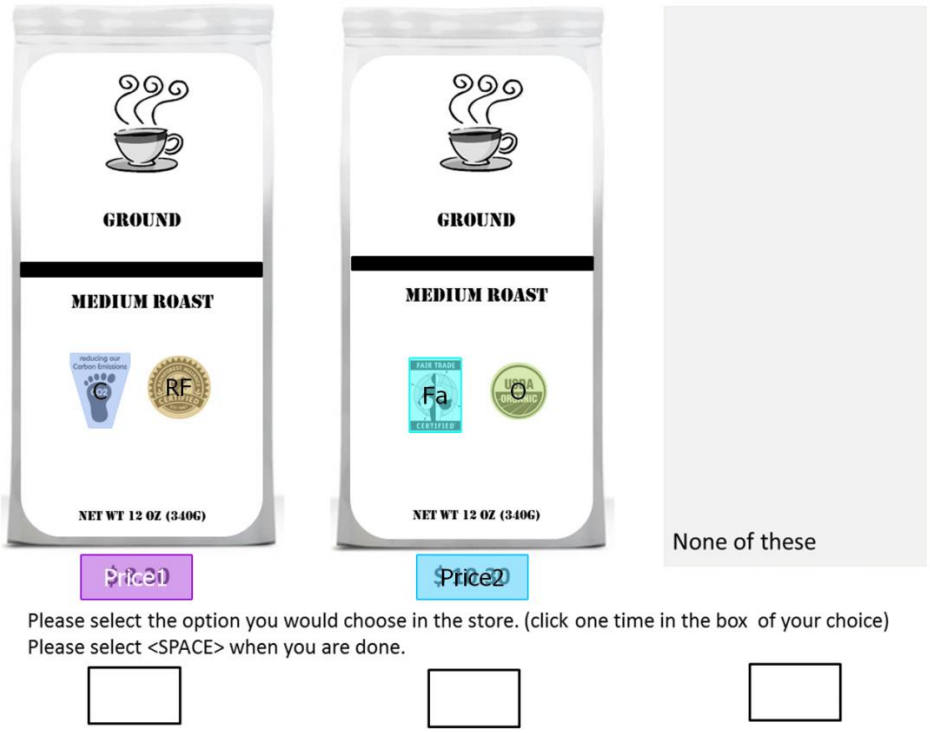
Attributes	Level
Fair Trade label USDA Organic label Rainforest Alliance label Carbon Footprint label	0 = Not present 1 = Present
Price (per 12 ounces)	$4.30, $6.30, $8.30, $10.30

6.2.3 Experimental procedure for the eye-tracking experiment

When answering the eight choice sets, the participants' visual attention was recorded using a contact-free eye-tracking device (model: RED, SensoMotoric Instruments GmbH, Teltow, Germany). The eye-tracking device was located in a panel beneath the 22" computer screen with physical dimensions of 474 mm by 297 mm and with a screen resolution of 1680 px by 1050 px. The approximate distance between the displaying monitor and the participant's head was 70 cm. The sampling rate and tracking resolution of the eye-tracking device were 120 Hz and 0.03°, respectively. Visual stimuli were randomly presented using stimulus presentation software (Experiment Suite 360°™, SensoMotoric Instruments, GmbH, Teltow, Germany).

Before the CE task, participants received instructions, and the eye-tracking device was individually calibrated using a five-point calibration method with a low tracking error (less than 0.4°). After successful calibration, two warm-up choice sets were presented to fully familiarize the respondents with the experimental procedures. As in Balcombe et al. (2015), participants knew that eye-tracking was applied; however, they were not aware of its purpose. As visual stimuli, pictures of coffee packages were presented. Participants were given time to look at the pictures of the coffee packages and choose the preferred alternative. After the two warm-up questions, they were randomly assigned to one of the ten surveys and then answered all eight choice set questions, which were randomly presented to them. Between the choice tasks (i.e., during the inter-stimulus interval), participants were asked to maintain their fixation on a central black cross against a white background for approximately 8 s. The duration of each task depended on the time the participant took to perform the choice task. Following Balcombe et al. (2015), the participants viewed each choice set as long as they wanted before indicating their choice. On average, the participants spent 73 s for all eight choice tasks combined (without the inter-stimulus intervals).

Figure 6.1 Example of choice set question with AOI. Frames indicating the AOI for Carbon Footprint label, Rainforest Alliance label, Fair Trade label, USDA Organic label and price



6.2.4 Eye-tracking measures

Areas of interest (AOI) were defined on the coffee packages (Figure 6.1) corresponding to the five attributes used in the study. Using the eye-tracking software (BeGaze™, ver. 3.0, SensoMotoric Instruments GmbH, Teltow, Germany), fixation counts were calculated for the five AOIs in each of the eight choice sets. The fixation count is the number of times the participant fixated his or her gaze on the AOI. More fixations are an indication that an area is more noticeable or more important to the viewer than other areas (Poole et al., 2005). The number of fixations within the AOI has been considered a reliable measure for the visual attention given to that AOI (Bialkova and van Trijp, 2011). The low speed event detection method (suggested for <200 Hz) was selected in BeGaze for the fixation detection. In this method, the fixation is the primary event and other events are derived from this. It uses two specific detection parameters: a minimum fixation duration of 80 ms and maximum dispersion of 100 px. The minimum fixation duration defines the minimum time window in which the gaze data is analyzed. Fixations smaller than the time window will not be caught. The low speed event detection method uses a dispersion-based algorithm. For details on this algorithm, we refer to the BeGaze Manual 3.6 (SMI, p 317). For each stimulus, the first fixation was excluded as the fixation position at stimulus onset has not been influenced by the stimulus content (Holmqvist et al., 2011).

6.2.5 Defining visual ANA

We recorded the visual attention to the information presented while the participants were making choices in the CE. More specifically, fixation counts were obtained for each AOI and are a measure for visual attention. However, going from fixation counts to incorporating visual ANA into the choice modelling requires several steps. In this study, three aspects are taken into account: 1) the cut-off point for the fixation count, 2) the definition for identifying an attribute as ignored in a choice task, and 3) the modeling approach for visual ANA.

1) Fixation count cut-off

Balcombe et al. (2015) reported at least two fixation counts to be required to consider an attribute 'attended to'; therefore, the cut-off point of two for fixation count was used. However, we also used a less strict cut-off, i.e., a fixation count of one.

2) Defining visual ANA

To define visual ANA, we use the fixation count as a measure of visual attention and create a discrete measure, namely visual ANA. This visual ANA indicates whether the attribute is identified as ignored or attended to an attribute in a particular choice task. For the visual ANA detection, we use two definitions to identify an attribute to be ignored in a particular choice task.[13]

- Based on visual attention to the specific attribute in the choice set as a whole (*Def A*)
  This definition was used by Balcombe et al. (2015) who considered an attribute to be ignored in a choice task if the fixation count for an attribute summated over the alternatives within one choice set was below the cut-off. Thus the fixation count for one attribute is calculated for the choice set as a whole and information on the level of the separated alternatives is ignored.
- Based on visual attention to the specific attribute in each of the alternatives within the choice set (*Def B*)
  An attribute is judged to be ignored in a given choice task if the attribute was ignored (fixation count less than cut-off) in both of the two alternatives (if attribute was present in both alternatives). Rather than defining an attribute as ignored in a choice task based on the choice set as a whole, this approach is based on visual attention to an attribute in each of the two alternatives within a choice set.

[13] We assume that respondents, by looking at one package, do not infer which labels the other package has

When using fixation count of one as cut-off, definition A and B are equal. A fixation count of less than one for the choice set as a whole, thus summating the fixation counts for both alternatives (*def A*) or fixation count of less than one in both alternatives separately (*def B*).

3) Modelling approaches for visual ANA

Two modelling methods were used to account for visual ANA, one at the choice set level (choice task visual ANA) and one at the respondent level (serial visual ANA). Serial ANA refers to classifying a respondent as an attender or non-attender for a particular attribute for the entire choice task sequence while choice task ANA allows for differences in attendance across choice tasks. Serial and choice task visual ANA are similar to serial and choice tasks stated ANA but instead of stated information, visual attendance is used.

- Serial visual ANA

  When a respondent visually ignored a given attribute in more than half of the choice tasks, this respondent is classified as a visual non-attender for this attribute over the whole sequence of choice tasks (Balcombe et al., 2015). In our specific case, with eight choice sets, a participant was classified as a visual non-attender for a given attribute for the whole sequence of choice tasks if the attribute was ignored in more than four choice tasks.
- Choice task visual ANA

  For the choice task visual ANA, ANA was allowed to vary across choice tasks. When a respondent visually ignored a given attribute in a choice task, this attribute was characterised as non-attended for that particular choice task. Therefore, for each choice set and for each attribute, a participant is classified as having attended or non-attended the attribute. This approach is distinct from the serial visual ANA approach, in which a respondent is either an attender or a non-attender for a particular attribute over the whole sequence of choice tasks.

For each of the two visual ANA definitions to identify ignored attributes (*Definition A* and *Definition B*), both modelling approaches, serial visual ANA (S) and choice task visual ANA (CT) were applied. This leads to four combinations: *defA-CT*, *defA-S*, *defB-CT* and *defB-S* (Table 6.2) when fixation count of two is applied as cut-off. For the cut-off fixation count of one, the definition A and B are the same and thus result in two additional approaches (*FC1-S* and *FC1-CT*). The approach in which definition A is combined with the serial ANA modelling method, with a fixation count of two as cut-off (*defA-S*) is the approach used by Balcombe et al. (2015).

Table 6.2. Overview of the six approaches based on the two modelling methods to account for visual ANA and based on the fixation count used as cut-off, the two definitions for detecting whether a specific attribute was ignored during a choice task.

Fixation count	FC 2				FC 1	
ANA modelling approach	Serial ANA		Choice task ANA		Serial ANA	Choice task ANA
Definition ignored attribute	Def. A Based on choice set	Def. B Based on alternatives	Def. A Based on choice set	Def. B Based on alternatives		
Abbreviation	*defA-S*	*defB-S*	*defA-CT*	*defB-CT*	*FC1-S*	*FC1-CT*

6.2.6 Discrete Choice Models

While the multinomial model (MNL) assumes homogeneity in consumer preferences, we assume that heterogeneity may be an issue in analysing consumer preferences for food labeling (Bonnet and Simioni, 2001; Van Loo et al., 2014). Therefore, a random parameter logit (RPL) model was estimated (with 500 Halton draws), allowing for random taste variation and accounts for the panel structure, given that each respondent made eight choices. This approach results in the estimation of mean and standard deviations for each of the random taste parameters. For simplicity, we assume price to be a fixed coefficient, which is a widely accepted and practiced specification in the field (Caputo et al., 2013; Layton and Brown, 2000; Lusk and Schroeder, 2004; Morey and Rossmann, 2003; Revelt and Train, 1998). This restriction allows the distribution of the WTP to be easily calculated from the non-price coefficients. We further assume that the coefficients of the four sustainability labels follow a normal distribution (Caputo et al., 2013; Lusk and Schroeder, 2004).

Two additional modelling issues are taken into account – the correlations across taste parameters and across utilities – to make the estimates more robust and consistent with consumer choice behavior (Barreiro-Hurle et al., 2010; Gracia et al., 2012; Gracia, 2014). In the standard RPL model, the taste parameters are assumed to be distributed independently from each other. However, to allow for dependence across tastes, no restrictions were applied to the correlations among the random parameters. Additionally, because the design consists of two designed alternatives and one no-buy alternative, correlations across utilities may exist (Scarpa et al., 2005). The no-buy alternative is truly experienced by participants, while the designed alternatives can only be imagined. Therefore, the utilities of the buying alternatives are likely to be more correlated among themselves than with the

no-buy alternative. To account for this correlation pattern, we employed an RPL model with error component (RPL-EC) (Scarpa et al., 2005; 2007). The two product alternatives share an extra error component, which is a zero-mean normally distributed random parameter.

Specifically, with our attributes, the utility that individual *n* obtains from alternative *j* at choice situation *t* takes the following form:

$U_{njt} = \beta_0 No\_Buy_{njt} + \beta_1 Organic_{njt} + \beta_2 Rainforest_{njt} + \beta_3 Fairtrade_{njt} + \beta_4 Carbonfootprint_{njt} + \beta_5 Price_{njt} + \eta_{ij} + \varepsilon_{ijt}$,

where *j* pertains to alternative A, B and C. No_Buy_{njt} is a dummy variable that takes the value of 1 when the no-buy alternative is chosen and 0 when either product profile A or B is selected. β_0 is an alternative-specific constant representing the no-buy alternative. Price is the price of a package of 12 ounces of coffee. η_{ij} is the zero-mean normal error term, or the error component term, which is only associated with alternatives that portray a purchase decision and is absent in the utility of the no purchase alternative. ε_{ijt} is the unobserved random error term.

The marginal WTP values are calculated as a negative ratio where the numerator is the estimated mean values of the coefficients associated with a particular sustainability label, and the denominator is the price coefficient. Data were analyzed using NLOGIT 5.0.

6.2.7 Accounting for ANA

The standard approach to account for stated ANA is to restrict the coefficient in the utility function to zero for the attributes that the respondents stated they ignored, which results in the removal of the respective attribute from the choice consideration (Hensher et al., 2005). This method has been incorporated into the NLOGIT 5.0 software by coding the attribute as -888 if not attended (Greene, 2012). This method assigns a zero to the attribute coefficients rather than to the attribute levels (Greene, 2012). This approach has been applied in several studies on stated ANA (Alemu et al., 2013; Hensher et al., 2005; Hensher and Rose, 2009; Kragt, 2013; Scarpa et al., 2013). In this study, we use the same approach but based on visual ANA instead of stated ANA. Thus, instead of using a dummy variable to denote whether the attribute was stated to be ignored (stated ANA), we now use a dummy variable to indicate whether the attribute was visually attended. For the choice task ANA this happens are the choice set level and for the serial ANA at the respondent level.

For each of our combinations (*defA-CT*, *defA-S*, *defB-CT*, *defB-S, FC1-S, FC1-CT*), we estimate a visual ANA model in which the coefficient of visually ignored attributes is restricted to zero. In addition, a full attendance model in which all attributes are assumed to be attended to is estimated. First MNL models

were estimated (Appendix J). Given that RPL-EC models are behaviorally more appreciate and outperform the MNL models in terms of model fit, we only discuss the results of the RPL-EC models.

6.2.8 Are the attributes identified as visually non-attended actually ignored?

We examine whether the attributes identified as visually non-attended are in fact also fully ignored when respondents are making the choice. We tested this in two ways.

1) Coefficient for ignored attribute

A first method is by no longer restricting the coefficients of the ignored attributes to zero (i.e., estimating it freely). In the stated ANA literature, some studies have indicated that people reporting to have ignored a certain attribute may have a marginal utility for that given attribute that differs from zero. Hence, respondents who stated that they ignored an attribute may have actually considered it (Carlsson et al., 2010). As a result, instead of restricting the coefficient of ignored attributes to zero, some stated ANA studies estimate two coefficients for each attribute: one for the group of respondents who stated that they attended the attribute, and one for the group of respondents who stated that they had not (Alemu et al., 2013; Campbell and Lorimer, 2009; Hess and Hensher, 2010; Scarpa et al., 2013). We also apply this approach and estimate models with two coefficients for each attribute: one for visually ignored attributes and one for visually attended attributes. If the visually non-attended attributes were truly ignored, the corresponding coefficient should not differ statistically from zero. MNL model estimations were used as RPL models with that many coefficients and our sample size were not possible.

2) Coefficient of variation of individual-specific coefficient distributions

This second method uses the coefficient of variation to check whether respondents identified as having ignored an attribute based on visual ANA truly ignored it. For each respondent identified as having ignored an attribute based on serial visual ANA, this allocation is compared based on this inferred method. This gives as an additional indication whether those identified as ignored (serial visual ANA) truly ignored the attribute based on the inferred method.

Following Hess and Hensher (2010), we attempt to infer whether a respondent ignored a particular attribute or not (thus inferred serial ANA) by analysis of the individual-specific coefficient distributions through conditioning on observed choices. For additional details, we refer to the NLOGIT reference guide section N29.8 (Greene, 2012). The mean and standard deviation for the conditional distribution were calculated for each of coefficients of the random parameters and for each of the 81 respondents

based on the RPL model in Table 6.4. These conditional estimates of the mean and standard deviations are also called the individual-specific estimates. Instead of than using the conditional mean to infer whether a respondent ignored an attribute or not, Hess and Hensher (2010, p 786) suggest using the coefficient of variation which they define as "the ratio between the standard deviation and the mean of the conditional distribution". This measure is used to incorporate uncertainty into the conditional distributions and "tells us when the conditional mean is indistinguishable from zero" Hess and Hensher (2010, p 786). Hess and Hensher (2010) report this to be a better approach then using the conditional mean as "a respondent may have a low sensitivity to an attribute without actually ignoring it". Only relying on a low mean to allocate a respondent into the ignored group might be incorrect and therefore using the coefficient of variation is suggested. Similarly as Hess and Hensher (2010), we allocate respondents with a coefficient of variation of two or above to the ignored group for that attribute. Subsequently, we evaluate whether respondents identified as ignored an attribute based on the serial visual ANA are allocated to the ignored group based on the coefficient of variation.

6.3 Results and Discussion

6.3.1 Visual attribute non-attendance frequency

For the serial visual ANA, only the choice sets of the respondents who ignored the attribute for more than half of the choice tasks are classified as non-attenders for that particular attribute. However, for the choice task visual ANA, respondents can be classified as non-attenders for an attribute for a particular choice task, meaning that ANA is defined at the choice set level. As a result, the approach for visual ANA, serial or choice task, has an influence on the frequency of ANA. Also the applied fixation count cut-off and the visual ANA definition have an influence. The proportions of ANA for each of the attributes and for the six different combinations are presented in Table 6.3.

When applying serial visual ANA, each respondent is classified as ignoring or attending to a certain attribute over the whole CE. Using a fixation count of two, the visual non-attenders for the sustainability labels range from 41% to 56% of the total number of participants for the serial ANA. For fixation count of one, the proportions of visual non-attenders of sustainability labels are lower ranging from 12 to 23%. For both fixation counts, is the number of respondents who ignore price lower than for sustainability labels. Of the 81 respondents, only 12% and 23% were classified as visual non-attenders for price using the ANA definition based on the choice set (definition A) and both alternatives (definition B) respectively. For fixation count of one, only 5% respondents are classified as ignoring price.

Table 6.3 Proportion (%) of choice task and serial visual ANA depending on the definition applied and fixation count (n=645)

	FC = 2				FC = 1	
	Serial ANA		Choice task ANA		Serial ANA	Choice task ANA
	Def A	Def B	Def A	Def B		
Fair Trade	40.7	40.7	52.2	52.2	12.3	28.1
USDA Organic	55.5	55.5	59.6	59.6	23.4	30.4
Rainforest Alliance	43.2	43.2	54.9	54.9	17.3	30.1
Carbon Footprint	40.7	40.7	52.9	52.9	16.0	28.1
Price	12.3	23.4	24.5	40.7	4.9	9.6

When applying choice task visual ANA, the number of choice tasks in which the sustainability labels were ignored ranges from 52 to 60% for fixation count two and 28 to 30% for fixation count one. Price was ignored in 25% or 41% of the choice tasks, depending on the ANA definition applied for fixation count two and in 10% of the choice tasks for fixation count of one as cut-off.

The visual attendance towards price depends on the definition applied because price was presented in each of the two buying alternatives. For the definition based on both alternatives (definition B), price is considered attended to in a choice task if in both alternatives, it has a fixation count of at least two as opposed to a fixation count of at least two for the prices presented in the choice set as a whole (definition A).

6.3.2 RPL-EC estimations

Similar to the standard approach in stated ANA, the models are estimated with the parameters for the visually ignored attributes being constrained to zero; i.e., one model using each of the four approaches for fixation count two: serial and choice task visual ANA based on definition A (*defA-CT*, *defA-S*), and based on definition B (*defB-CT* and *defB-S*) (Table 6.4). Two additional models, for fixation count one: choice task and serial modelling approaches (*FC1-S* and *FC1-CT*). The full attendance model (*full-AA*) pertains to the estimation assuming full attribute attendance and is included as a benchmark. To allow for heterogeneous preferences among the respondents and correlation across utilities, RPL-EC models were estimated for assuming full attendance and for each of the six approaches (Table 6.4). MNL models estimations are included in the Appendix J.

Table 6.4. RPL model with error component (RPL+EC) parameter estimates (n=645)

Fixation count		FC 2					FC 1	
ANA modelling		Full AA	Serial ANA		Choice task ANA		Serial ANA	Choice task ANA
Def. ignored attribute			Def. A	Def. B	Def. A	Def. B		
			defA-S	*defB-S*	*defA-CT*	*defB-CT*	*FC1-S*	*FC1-CT*
Fair Trade	Mean	0.63**	0.73**	0.75**	0.76***	0.81***	0.65**	0.65**
	St. Dev.	0.83***	0.79**	0.73**	0.65	0.54	0.58*	0.40
USDA Organic	Mean	1.02***	1.41***	1.35***	0.87***	0.84***	1.09***	0.77***
	St. Dev.	1.23***	0.85*	0.89	0.39	0.18	1.13**	0.84*
Rainforest Alliance	Mean	0.74***	0.73***	0.68***	0.60***	0.60***	0.75***	0.59***
	St. Dev.	0.58	0.45	0.33	0.42	0.15	0.55	0.36
Carbon Footprint	Mean	0.30	0.38	0.40	0.50**	0.58***	0.27	0.34
	St. Dev.	0.90*	0.72	0.71	0.39	0.39	0.62	0.39
Price		-0.85***	-0.81***	-0.84***	-0.61***	-0.54***	-0.77***	-0.68***
No_Buy		-8.76***	-8.91***	-9.13***	-7.35***	-6.75***	-8.01***	-7.61***
Err. Comp.	St. Dev.	2.71***	3.15***	3.63***	3.03***	3.51***	2.55***	2.63***
Log likelihood		-349	-354	-370	-404	-433	-357	-375
AIC		731.2	741.2	774.1	842.4	900.6	747.9	783.6
BIC		807.2	817.2	850.0	918.4	976.6	823.9	859.6

Note: *, ** and *** indicate statistical significance at 10%, 5% and 1% level, respectively

As expected, in all of the models, the coefficient of the no-buy alternative is negative and statistically significant, suggesting that participants increase their utility when choosing one of the proposed coffee product alternatives compared with the no-buy alternative. In all of the models, the hypothesis of correlation across utilities is verified because the standard deviation of the error component (ηij) for the purchase alternatives is statistically significant. Correlations across the random parameters were also allowed. The coefficients of the attributes have the expected signs. The price coefficient is negative and statistically significant at the 0.01 level, indicating that consumers' utility decreases with increasing price.

Under the *full-AA* model, all of the coefficients for sustainability labels (Organic, Rainforest Alliance and Fair Trade) are significant except for the Carbon Footprint label, implying that respondents' utility increases when one of the labels is present on a coffee package. The results show that USDA Organic is the highest valued attribute, resulting in the strongest utility increase. USDA Organic label is

preferred over Rainforest Alliance, and Fair Trade. The *full-AA* model has significant standard deviations of the random parameters (except for Rainforest Alliance), indicating the presence of considerable unobserved heterogeneity in taste preferences across the respondents.

Turning to the RPL-EC models in which the parameters of the visually ignored attributes are restricted to zero (*defA-CT*, *defA-S*, *defB-CT*, *defB-S*, *FC1-S* and *FC1-CT*), we find most of the parameters for the considered attributes to be significant at the 5% or 1% level. In all six models, the coefficient for USDA Organic is the largest. Carbon Footprint is not significant for all models except for the choice task modelling approach with fixation count of two as cut-off.

While the standard deviations of the random parameters Fair Trade and USDA Organic of the full attendance model were significant at 1%, this is no longer the case when accounting for visual ANA. For all six models, the standard deviations of the random parameters are no longer significant, except for Fair Trade in the serial ANA models for fixation count two (*defA-S* and *defB-S*) and for USDA Organic in one of the serial ANA model (*FC1-S*). While the full attendance model with significant standard deviations shows preference heterogeneity, accounting for visual ANA captures an important part of the heterogeneity across participants. This result illustrates that confounding between ANA and preference heterogeneity might be an issue and thus preference heterogeneity may be incorrectly interpreted when ANA is not addressed, which further illustrates its importance (Hess et al., 2013).

6.3.3 Are the attributes identified as visually non-attended actually ignored?

Coefficient for ignored attribute

We test whether the attributes identified as visually non-attended truly have coefficients equal to zero by estimating them freely, leading to separate parameters for visually non-attended and considered attributes. These models are referred to as *defA-S*2, *defB-S*2, *defA-CT2*, *defB-CT*2 and *FC1-S2* and *FC1-CT2* for fixation count two and one as cut-off, respectively. These model estimations with two coefficients for each attribute (considered and ignored) in which the ignored are not constrained to zero are reported in Table 6.5 and illustrate that most of the ignored coefficients are significantly different from zero (17 out of 30[14]). In the cases of the Rainforest Alliance, Fair Trade and Carbon Footprint labels, being identified as visually non-attended using one of the six approaches means that these attributes were truly ignored, except for Rainforest Alliance in the choice task ANA modelling approach with fixation count of two.

[14] Five parameters were estimated (USDA Organic, Rainforest Alliance, Fair Trade, Carbon Footprint and Price) for each of six approaches, resulting in a total of 30 parameter estimations.

Table 6.5. MNL parameter estimations with two coefficients (considered and ignored) (n=645)

Fixation count	FC 2				FC 1	
ANA modelling	Serial ANA		Choice task ANA		Serial ANA	Choice task ANA
Def. ignored attribute	Def A	Def B	Def A	Def B		
	defA-S2	*defB-S2*	*defA-CT2*	*defB-CT2*	*FC1-S2*	*FC1-CT2*
Considered						
Fair Trade	0.54***	0.55***	0.72***	0.72***	0.43***	0.46***
USDA Organic	1.46***	1.45***	1.11***	1.12***	0.99***	0.94***
Rainforest Alliance	0.86***	0.87***	0.93***	0.93***	0.72***	0.73***
Carbon Footprint	0.16	0.18	0.37**	0.38**	0.06	0.17
Price	-0.65***	-0.65***	-0.62***	-0.63***	-0.61***	-0.62***
Ignored						
Fair Trade	0.10	0.08	0.03	0.03	-0.41	-0.03
USDA Organic	0.39**	0.40**	0.81***	0.80***	0.35	0.69***
Rainforest Alliance	0.30	0.30	0.38**	0.38**	0.08	0.34
Carbon Footprint	-0.01	-0.04	-0.13	-0.14	0.11	-0.17
Price	-0.40***	-0.52***	-0.51***	-0.54***	-0.46***	-0.43***
No_Buy	-5.47***	-5.38***	-5.09***	-5.06***	-5.28***	-5.18***
Log likelihood	-376	-379	-386	-386	-388	-393
AIC	774.1	779.8	793.1	794.5	797.1	807.0
BIC	823.2	829.0	842.3	843.7	846.2	856.2

Note: *, ** and *** indicate statistical significance at 10%, 5% and 1% level, respectively.

For the serial ANA modelling approach with fixation count of one, also the ignored coefficient for USDA Organic is not significantly different from zero. For the serial ANA approach with fixation count of one, this result indicates that respondents identified as visually non-attenders for one of the four sustainability labels (Fair Trade, Carbon Footprint or Rainforest Alliance) truly ignored these attributes.

For the choice task ANA approach, choice tasks is which we considered Fair Trade, and Carbon Footprint (and Rainforest Alliance for fixation count one) as visually ignored were indeed truly ignored. These choice tasks were answered as if the visually ignored attribute was not present in the choice set.

For these attributes, restricting the coefficient to zero if it was visually ignored was appropriate and resulted in the removal of the attribute from the choice consideration.

However, 13 out of the 30 estimated ignored parameters are significantly different from zero and thus setting the coefficients of these parameters to zero may not be appropriate. In all six ANA models the coefficient of ignored price is significant at the 1% level. In all ANA models except *FC1-S2* the coefficient of ignored USDA Organic is also significant. When using fixation count two as cut-off, the choice task ANA model also has significant coefficients for the ignored Rainforest Alliance. Whereas assuming that visually ignored attributes are fully ignored is appropriate for the all sustainability labels in the serial ANA approach with fixation count one and for all sustainability labels except USDA Organic in the serial ANA approach with fixation count two, this is not the case for price. Therefore, it is inappropriate to constrain the coefficients of the visually ignored price and in some of the cases also the sustainability labels USDA Organic and Rainforest Alliance to zero. This finding is important because it indicates that some attributes that were classified as visually non-attended based on the ANA definitions and modelling approaches were not actually fully ignored.

The difference in coefficients between the two groups (ignored and not ignored), suggest some differences in behavior between the two groups. We now compare the ignored and the attended coefficients. For price, the coefficient for attended price is less negative than the coefficient for ignored price. This may indicate that being classified as visually ignored does not mean that the price attribute was fully ignored; it simply means that the respondents, on average, attached a less negative utility to it. While the ignored coefficient USDA organic is statically different from zero but 5 of the 6 models, it is smaller than the considered coefficients for USDA Organic. For the choice task ANA models with fixation count of two, also the Rainforest Alliance ignored coefficient is significantly different from zero but also lower than the coefficient for attended Rainforest Alliance. This indicates that classifying as visually ignored, on average, results in a lower utility for USDA Organic label (and Rainforest Alliance). This less negative (price) or positive (USDA Organic, Rainforest Alliance) coefficients for the attributes identified as ignored can be due to two possible reasons. First, Price, USDA Organic and Rainforest Alliance attributes that may be classified as visually non-attended may in fact not have been fully ignored when choosing the preferred alternative. Instead, respondents who paid less attention to these attributes received less negative (price) or positive (USDA Organic) utility from these attributes. Secondly, the smaller coefficient for the ignored subset might be a combination of truly ignored attributes (zeros) and attended attributes and therefore resulting in a lower average.

Balcombe et al. (2015) noted that people must look long enough at information for it to be processed. However, our results show that the time needed to visually attend to attributes may differ depending on the attribute itself. Price, USDA Organic (and in some cases Rainforest Alliance) are the attributes that were attended to when we identified them as being ignored may be due to the processing fluency of these attributes (i. e.. this can be related to familiarity as a greater familiarity to these labels will make it easier to process them). In addition to familiarity, the appearance of the attribute also influences the processing fluency. Price and USDA Organic might be less complex therefore easier to process. USDA Organic, for example, is not a complex label, only words are present and not illustration, while the other labels (Rainforest Alliance, Fair Trade and Caron Footprint) have both an illustration and text and may require more processing. This might explain why even when we defined them as visually non-attended, they were not actually ignored. In addition to familiarity, complexity and process fluency, also issues specifically related to the eye-tracking can be the reason why there are significant coefficient estimates for the ignored parameters such as USDA Organic (and Rainforest Alliance in some cases). While fixating on one attribute, another attribute might be viewed and interpreted without fixating at it. It is not because they did not fixate on an AOI that they may not be aware that it is there (Bergstrom and shall, 2014), since fixations only report visual attention taking place in our foveal vision and not in the parafoveal and peripheral vision. While our primary attention is focused on what we see in the foveal vision, we might still grasp information presented in other part of our visual field. Some authors (Henderson and Hollingworth, 1999; Henderson et al., 2003) report that a functional field of view can be 4 degrees, while others (Holmqvist et al., 2011) suggest to a margin of 1 to 1.5 degrees.

Coefficient of variation

In this second method, we evaluate whether respondents identified as ignored an attribute based on the serial visual ANA are allocated to the ignored group using the coefficient of variation method, an inferred method based on the observed choices (Table 6.6).

First, the rates of ignoring the different attributes between visual and inferred ANA are compared. The proportion of ignoring Fair Trade, USDA Organic, Rainforest Alliance and Carbon Footprint using this inferred method are 18.5, 14.8, 6.2, 35.8% respectively. The inferred method has much lower rates of ignorance compared to the visual ANA with fixation count 2, except for carbon footprint which is more similar. The proportions obtained by the inferred method are more in line with those obtained by visual ANA with fixation count 1 as cut-off, except for carbon footprint.

Table 6.6. Comparison of allocation of respondents between the serial visual ANA and inferred ANA (count)

	Inferred	Ignored based on serial visual ANA	
		FC 2	FC 1
Fair Trade	Not ignored	25	4
	Ignored	8	4
USDA Organic	Not ignored	35	13
	Ignored	10	6
Rainforest Alliance	Not ignored	32	13
	Ignored	3	1
Carbon Footprint	Not ignored	15	5
	Ignored	18	8

Aside from the actual rate of ignoring attributes, a comparison of the allocation of the respondents identified as visually ignoring an attribute is of interest and is presented in Table 6.6. A large portion of respondents identified as having ignored an attribute based on the visual ANA, are not identified as ignoring this attribute by the inferred method. This confirms that not some of the respondents identified as having ignored the attribute did ignore it, but a large portion did not ignore the attribute. However, it is not clear which method is the most accurate in identifying ignored attributes as also this inferred methods uses some assumptions. It is clear however, that there are differences in allocations into the ignoring group between the serial visual ANA and inferred ANA. Hess and Hensher (2010) who compared this inferred method (i.e. the coefficient of variation approach) with stated ANA found large differences or inconsistencies between the two approaches in terms of rates of ignoring and in allocation of respondents into the two groups. While the visual ANA approach has disadvantages, also this inferred approach has drawbacks. The use of the threshold value of a coefficient of variation of two is an arbitrary threshold (Hess and Hensher, 2010) and more research is needed to define a less arbitrary threshold in order to refine this coefficient of variation method. As mentioned by Hess and Hensher (2010), more work is needed on how to allocate respondents to the ignored group based on the coefficient of variation.

6.3.4 Model fit across estimations

When comparing the RPL model fits, restricting the coefficients of the ignored attributes to zero results in a decrease in model fit (a decrease in log likelihood and an increase in the AIC and BIC statistics)

compared with the full attendance model (Table 6.4). For both fixation cut-offs, serial ANA modelling approach results in a better model fit than choice task ANA modelling approach. For models with fixation count two, defining an ignored attribute based on the definition the whole choice set (definition A) results in a better model fit than defining it based on the alternatives (definition B).

Several studies on stated ANA report an improvement in model fit when constraining ignored coefficients to zero (Campbell et al., 2008; Hensher et al., 2005; Kragt, 2013). However, similar to our study, Alemu et al. (2013) reported a decrease in model fit when restricting coefficients to zero. This result could be attributed to the number of observations that are essentially excluded from contributing to the likelihood function (Alemu et al., 2013), which may also explain why we see a decrease in model fit when moving from serial to choice task ANA as the percentage of ignored attributes also increases (Table 6.3).

When estimating two separate coefficients (Table 6.5), the model fit improves compared with the model assuming full attendance (MNL Full-AA, see Appendix J). In the case of using two coefficients, the model fit does not appear to be different for the six approaches (Table 6.5). However the serial visual ANA results in a slightly better model fit.

6.3.5 WTP

We calculate the WTP values based on the RPL model mean coefficient estimates in which ANA has been accounted for (Table 6.7). If the attribute was identified as ignored, then we restrict the coefficient to zero, which removes that attribute from the choice set and thus treats it as if it was not present. Importantly, we cannot assume that the respondents did not look at the attribute because they did not care about it; we do not know the reason why they did not consider the attribute when making their choices. For instance, some people may have visually ignored an attribute because the task was too complex, while others may have ignored it because they do not derive utility from that attribute. In the first case (too complex), a person who ignored an attribute may have the same preferences as someone who attended to it and thus may also have the same WTP. In this case, the WTP based on the considered attributes would be applicable for everyone. In the second case, where respondents ignore an attribute because they do not derive any utility from it, the WTP for the ignored group is zero. Because we do not know the actual reasons for visually ignoring the attributes, we calculate the WTP based on the mean coefficient estimates and their standard errors from the ANA models and thus implicitly estimated using the considered attributes (Table 6.7).

For the mean estimates of the WTP distributions based on the RPL models, the USDA Organic has the highest WTP, while the Carbon Footprint has the lowest WTP in the full attendance model as well as the models accounting for visual ANA. For the full attendance model as well as the *FC1-S* model the Rainforest Alliance is the second-highest valued sustainability label, while in other cases Fair Trade label is. The resulting WTP values differ when accounting for visual ANA compared with the full attendance model. When comparing the WTP values for the six labels based on models accounting for visual ANA and the full attendance model, the results indicate that accounting for visual ANA produces higher WTP values compared with the benchmark model (except for USDA Organic in FC1-CT and Rainforest Alliance in the *defB-S and FC1-CT* model). This result suggests that accounting for visual ANA has important implications for WTP estimates. Moreover, our results also indicate that WTP values could differ depending on the fixation count cut-off, the definition of visual ANA and the modelling approach applied, which again illustrates that accounting for ANA makes a difference in terms of WTP estimates.

Table 6.7. Estimates of marginal mean WTP for sustainability labels on coffee using RPL-EC model estimates ($/12 ounces)

Fixation count		FC 2				FC 1	
ANA modelling	Full AA	Serial ANA		Choice task ANA		Serial ANA	Choice task ANA
Def. ignored attribute		Def A	Def B	Def A	Def B		
		defA-S	*defB-S*	*defA-CT*	*defB-CT*	*FC1-S*	*FC1-CT*
USDA Organic	1.20***	1.73***	1.60***	1.42***	1.56***	1.42***	1.13***
Rainforest Alliance	0.87***	0.90***	0.81***	0.98**	1.10***	0.98***	0.87***
Fair Trade	0.74**	0.90**	0.89**	1.24***	1.50***	0.85**	0.95**
Carbon Footprint	0.35	0.47	0.47	0.81**	1.08**	0.36	0.51

Note: ** and *** indicate WTP values statistically significant at 5% and 1% level, respectively.
For the ANA models (*defA-CT*, *defA-S*, *defB-CT* and *defB-S*), the WTP is the mean WTP based on attended sustainability labels and price

While coffee prices largely depend on the quality of the beans, their origin, the blend, and the brand, organic coffee prices are often higher than for coffee certified by the Rainforest Alliance or Fair Trade USA (FAO, 2009). Retail prices for coffee ranged from $3.00 to $9.99 per 12-ounce package (store check, *City, state*, 2013) (omitted for refereeing purposes only). Because the prices for both conventional and certified coffee vary considerably by the quality and origin as well as by the nature of the outlet and brand, it is very difficult to determine a premium that is solely attributable to a sustainability certification rather than these other factors (Consumers International, 2005; FAO, 2009). Based on a store check (Fayettevile, AR, US, 2013) (omitted for refereeing purposes only), the price premium for coffee with a sustainability label ranges from $1.50 to $2.30 per 12 ounces when comparing coffees with and without a label of the same brand. Our WTP estimates mirror these price premiums and the relative differences in premiums for different labels; in each of our models, the premium for USDA Organic is higher than for other sustainability labels.

6.4 Conclusion

ANA is an important methodological issue for researchers engaged in CEs. Researchers cannot assume that respondents have attended to all the attributes in a CE and have processed all of the information in a fully rational manner. Assuming that a person considered an attribute when he or she actually ignored it could result in a violation of the continuity axiom, which may then lead to biased and misleading parameter and WTP estimates. Given that CEs are commonly used to assess attribute valuation, there is an urgent need for and considerable research interest in finding methods to account for ANA.

As discussed previously, the two approaches that have emerged to address ANA are the stated and inferred approaches. The stated ANA approach relies on self-reported measures, while the inferred ANA approach relies on latent models or on derived respondent-specific coefficients. Thus, these approaches do not directly measure which attributes are actually being ignored in a CE. Additionally, evidence suggests that people do not consistently use the same attribute attendance rule throughout an entire sequence of choice tasks. As such, it is important to obtain ANA information at the choice task level, but obtaining such information is difficult with the stated approach because asking about ANA in one choice task may trigger changes in attribute attendance in subsequent choice tasks. Additionally, making the CE longer could induce non-attendance. The inferred ANA approach also assumes that respondents ignore an attribute throughout an entire CE. Therefore, there is an urgent need to study other ways to address respondents' true processing strategies and attendance at the choice task level.

We contribute to this research area by using eye-tracking measures to evaluate visual attendance to the attributes in a CE. This method does not rely on self-reported ANA behavior and does not attempt to infer ANA based on respondents' choice behavior. Instead, we track participants' information processing behavior and use their visual attention to specify whether they visually attended to the information presented to them. To the best of our knowledge, Balcombe et al. (2015) have conducted the only study thus far suggesting the use of visual ANA in CEs using eye-tracking technology. However, we extended it in three different ways. Balcombe et al. (2015) only examined serial ANA, which assumes that respondents consistently ignore the same attribute across choice tasks. We took this research one step further by allowing visual ANA to vary across choice tasks by modelling choice task ANA. Additionally, Balcombe et al. (2015) used only one definition to define an attribute as ignored in a particular choice task. Their definition was based on the visual attention to the attributes summated over the alternatives in the choice set. We added a second definition based on the visual attention to the attributes in each of the individual alternatives in the choice set. While Balcombe et al. (2015) used a fixation count of two as a cut-off to determine an attribute to be attended to; we also use a less strict cut-off point, a fixation count of one. Consequently, we used a total of six combinations to account for visual ANA, based on the two modelling approaches, the two definitions and two fixation count cut-offs.

Our study shows that different coefficient estimates and WTP values can emerge if one considers visual ANA vis-à-vis the full attendance model. Almost all of the WTP estimates based on all six visual ANA models are larger than those obtained by the full attendance model. For each combination of fixation cut-off, visual ANA definition and modelling approach we identified visually ignored attributes. This allowed us to properly assign a zero coefficient to ignored attributes in the models and intuitively obtain more reliable parameter as well as WTP estimates. We then tested whether these attributes classified as 'being ignored' were truly ignored based on the respondents' choices. Interestingly, we found that not all visually ignored attributes were fully ignored based on the respondents' choice behaviors (price and USDA Organic labels in most cases and Rainforest Alliance in some), i.e., the respondents paid some attention to them in their choice consideration. Hence, our results suggest that while our definitions of visual ANA are good indicators of ANA for the Fair Trade, Carbon Footprint and for most cases also Rainforest Alliance, the same does not hold for price and USDA Organic. This shows that the adequate way to account for visual ANA might differ depending on the attribute itself. For price and USDA Organic, likely people do not need to fixate their eyes on these attributes to the same extent as the other attributes. For example, it is possible that our respondents are very acquainted with price and USDA Organic as an attribute and may not need to fixate on it to absorb the information

presented. It is possible that for USDA Organic and price, they were aware to grasp the information presented from other parts of their visual field (parafoveal and peripheral vision) not covered by eye fixations.

Price, USDA Organic and Rainforest Alliance attributes that may be classified as visually non-attended were in fact not have been fully ignored when choosing the preferred alternative. The coefficients for price, USDA Organic and Rainforest Alliance when classified as visually ignored were lower than the considered coefficients. This might be due two reasons. Firstly, respondents who paid less attention to these attributes received less negative (price) or positive (USDA Organic, Rainforest Alliance) utility from these attributes. Secondly, the smaller coefficient for the ignored subset might be a combination of truly ignored attributes (zeros) and attended attributes and therefore resulting in a lower average. It is likely to be a combination of both as the method of the coefficient of variation indicated that a small portion of those classified as having ignored an attribute did indeed ignore it while a larger portion considered it. Given these results, we can conclude that it would be appropriate to constrain coefficients to zero in the cases when the attributes that were identified as visually ignored were truly ignored based on the respondents' choices. For the attributes that were classified as visually ignored but were not truly ignored, a separate coefficient should be estimated rather than constraining the coefficient to zero.

Our study indicates that using eye-tracking measures provides useful information regarding respondent behavior and can be used to attempt to identify ANA without relying on self-reported information or attempting to infer ANA behavior. Eye-tracking research can help us to understand attribute-processing strategies, to ascertain respondents' attribute attendance behavior and allows us to incorporate this information into choice modelling, which may produce estimates that are more reliable. However, similar as the other methods used to account for ANA in choice modelling, the use of visual ANA has challenges. Although eye-tracking technology is a promising tool to address ANA, further research is recommended to optimize the use of this technology in the context of choice, attention and ANA (Orquin and Loose, 2013). This study attempted to include a few different approaches to define and model visual ANA in choice behavior research. More research will be needed to fine-tune and standardize the different steps in the use of eye-tracking measures in choice modelling.

This study also has some limitations. Firstly, extrapolation to other populations remains to be further validated and future studies should include larger samples. Secondly, the use of a convenience sample limits the interpretation of the findings to its specific sampling frame. A third limitation pertains to the

possible presence of hypothetical bias due to the reliance on stated rather than on revealed preferences. There are also limitations specifically to the use of eye-tracking and suggestions for future studies on the use of eye-tracking to study ANA are discussed in detail in Chapter 7.

Chapter 7

General discussion and conclusion

Previous chapters have discussed the study-specific findings and implications in detail. This final chapter is divided into three sections and provides a general discussion with respect to the research questions (Section 7.1), provides a general conclusion (Section 7.2) and acknowledges the limitations of this doctoral research and proposes opportunities for further research (Section 7.3).

7.1 The research objectives and research questions revisited

The overall objective of this dissertation was to gain a better understanding of consumers' preferences for a range of sustainability labels on different food categories (yoghurt, meat and coffee). Visual attention for sustainability labels during food choice was investigated. Also their motivation (in terms of involvement) as well as their ability (in terms of knowledge) to use sustainability labeling were measured. Four studies were carried out to explore the five research objectives (Table 1.1 and 1.2). This included a cross-sectional quantitative online survey in four EU countries (UK, Germany, Belgium, and the Netherlands) (Study 1), two quantitative online surveys in Belgium (Study 2 and 3) and an experimental study involving eye-tracking and survey data in Fayetteville, AR, US (Study 4).

7.1.1 Research objective 1: Identify the involvement in sustainable eating

RQ1 How are sustainable diets perceived?

RQ2 Which consumer segments can be identified based on their involvement in healthy and sustainable eating?

RQ3 What determines involvement in sustainable eating?

The evaluation of (dis)similarities between 'a healthy diet', 'a sustainable diet' and 'a plant-based diet' as perceived by consumers illustrates the highly compatible image profiles of these three concepts. Each of the three concepts was most strongly associated with the attributes 'nutritious' and 'natural', whereas the concepts were the least associated with 'traditional'. This is in line with other research mentioning similar associations for both diets from a food consumer's point of view (Aschemann-Witzel, 2015). This finding suggests that food policies combining health and sustainability aspects into communication actions and guidelines may not be perceived as conflicting by consumers and may reinforce each other.

The second research question evaluates current consumer involvement to healthy and sustainable eating as this is an important motivator to make healthy and sustainable food choices. Consumers form a large heterogeneous group. However, they can be divided into smaller homogenous segments with distinct perceptions, behavior or characteristics. Respondents were grouped based on their involvement in health and sustainable eating in four distinct segments. The smallest segment (S1, 15%)

was neither involved in healthy nor sustainable eating. The largest segments were moderately (S2, 31%) respectively highly (S4, 32%) involved in both healthy and sustainable eating. Another segment (S3, 22%) was highly involved in healthy eating while moderately involved in sustainable eating. Hence more than half of consumers (54%) are highly involved in healthy eating and nearly one-third (32%) are also highly involved in sustainable eating. Thus, segments that are involved in sustainable eating are also involved in healthy eating, while the opposite is not necessarily true. The findings of this study also illustrate that health still matters more – and to more consumers - than sustainability.

Results indicate that concerns drive consumers' involvement in healthy and sustainable eating. Policy actions aiming at informing consumers about the consequences of their dietary choices for their personal health and the environment are recommended, as these may raise awareness, concern and involvement. Subsequently, when consumers are more concerned about these issues, attach more personal importance to it and are more involved in healthy and sustainable eating, it will motivate them to make sustainable food choices and use sustainability labels.

7.1.2 Research objective 2: Examine the consumers' preferences and WTP toward sustainability labeling (on yoghurt, meat and coffee)

RQ4 *What are the consumers' preferences and WTP for organic labels on yoghurt?*

RQ5 *How do people with a different buying behavior differ in terms of WTP premium for organic yoghurt?*

RQ6 *What are the consumers' preferences and WTP for sustainability labels on meat (including free range claims, organic labels (EU logo and Belgian Biogarantie), EU Animal welfare label, and Carbon Footprint label)?*

RQ7 *What are the consumers' preferences and WTP for sustainability labels on coffee (including Organic, Fair Trade, Rainforest Alliance and Carbon footprint labeling)?*

This research objective focuses on consumers' preferences and self-reported WTP for a range of sustainability labels on yoghurt (Study 2), meat (Study 3) and coffee (Study 4). In the study focused on yoghurt, most Flemings (89%) prefer organic over conventional yoghurt, and self-reported to be willing to pay €0.33 extra, on average, for a yoghurt priced at €1.5 (thus a 22% premium). However, this is clearly lower than the premiums in the Belgium market, being 37% in 2011 on average (VLAM, 2012). While most consumers report to be willing to pay a premium for organic yoghurt, high prices are barriers for organic yoghurt purchases, especially among the current non-users. Only the habitual yoghurt buyer is willing to pay a premium (40%) similar to the organic yoghurt premium on the Belgian market in 2011 (37%) (VLAM, 2012). The occasional buyer is willing to spend less than the current

market price (22% compared to 37%); however, the small differences between the WTP and the current market price reveal market potential. It suggests that a drop in market price (11%) can result in occasional buyers to become habitual buyers. This may also indicate some opportunities for compromise products (de Jonge et al., 2015) also referred to as conventional-plus products (Stolz et al. (2011) which go beyond the regulatory standards but are less strict and less expensive than the organic food production. However additional research would be needed to identify its market potential.

Consumers' preferences and WTP for four types of sustainability labels (organic meat, free range, animal welfare and carbon footprint) on chicken breast were investigated in Study 3. These claims empower consumers to make informed purchasing decisions that take environmental and ethical considerations into account. All three free range claims are preferred over the other included sustainability labels. The results show that nine in every ten Belgian consumers favor free range claims, which are also valued the most highly, attracting premiums ranging from 64% to 93% for high income consumers (43 to 63% for low income consumers). Vanhonacker et al. (2008) have reported that consumers find it important that poultry should exhibit natural behavior, have a lower stocking density, more available space, and outdoor access, all key aspects of free range production. This is also in line with previous studies which indicate that consumer concerns about animal welfare are mostly related to space (stocking density) and outdoor access (Bracke et al., 2005; de Jonge and Van Trijp, 2013b, Vanhonacker et al., 2009), two of the main foci of free range poultry farming. This study also shows that a vast majority of consumers (87%) would welcome the introduction of an EU level animal welfare label and willing to pay 39% premium (26% for low income consumers). Meat with free range claims or animal welfare label are preferred over organic meat, which supports the findings from de Jonge and van Trijp (2013a) and de Jonge et al. (2015) who mention the potential for conventional-plus products (or compromise products) in broiler production systems, with management practices between conventional and organic production system practices that focus on animal welfare aspects. The carbon footprint labels and the organic labels are less appealing to consumers, who have lower WTP for these labels. A carbon footprint label indicating a 30% CO_2 reduction resulted in a WTP of 36% for high income and 24% for low income consumers. For a 20% CO_2 reduction carbon footprint label a WTP of 27% for high income and 18% for low income consumers was found. Belgian consumers prefer the Belgian Biogarantie organic logo, certified by a private organization, to the newly-introduced EU organic food logo. This is also reflected in the WTP, 12-18% (for low and high income consumer respectively) for the EU organic logo while almost double (23-34%) for the Biogarantie organic logo.

In Study 4, the consumer preferences for sustainability labels on coffee, the pioneering industry for sustainability certification schemes were investigated and found that USDA Organic was preferred followed by Rainforest Alliance, Fair Trade and Carbon Footprint. When comparing the marginal WTPs for coffee among all these sustainability labels, the USDA Organic label has the highest WTP, resulting in a WTP premium of $1.16 for a package of 12 oz (340 g). This is followed by the Rainforest Alliance label and the Fair Trade label ($0.84 and $0.68, respectively). The presence of the Carbon Footprint label did not result in a significant premium. This is not surprising given the finding from NCA (2008) that Organic certified coffee has the highest awareness in the US compared to any other sustainability label on coffee. Zepeda et al. (2013) also reported that the USDA Organic label is preferred by US consumers over the Fair Trade label. The low WTP for Carbon Footprint might be due to the low familiarity with this label (Sirieix et al., 2013), confusion about its meaning (Gadema and Oglethorpe, 2011; Hartikainen et al., 2014) or a low interest and concern for this issue.

7.1.3 Research objective 3: Explore the consumers' awareness and knowledge of organic labels

RQ8 *Do consumers recognize organic labels (EU organic logo and the Belgian Biogarantie organic logo) and do they know what it stands for?*

RQ9 *Is there an association between consumer attitudes, objective knowledge about organic logos and organic yoghurt purchase frequency?*

This research objective focuses on the consumers' awareness of the EU organic logo and objective knowledge of organic food production which relates to the ability to make use of the labels (Grunert et al., 2014). The awareness of the EU organic logo is relatively poor (31%), since more than two thirds of the participants (69%) did not recognize the new European organic food logo. This is consistent with the results of the Eurobarometer study were only 24% of the EU respondents indicated to recognize the new EU organic food logo (EC, 2012c). The Eurobarometer results specifically for Belgium showed 20% awareness for the organic logo as compared to 54% for the Fairtrade label. A first requirement for a successful logo is that consumers recognize it. These findings suggest some major challenges for the EU organic food logo. The "Biogarantie" logo, a logo certified by a Belgian private organization, has a much higher recognition, with more than half of the respondents (54%) reporting to recognize this logo. The results revealed that some consumers would still orient themselves by using the existing logos instead of the new EU organic logo. In Germany, similar results are found as the consumer trust and awareness of the mandatory EU logo was much lower compared to the German governmental Bio-Siegel logo, which Janssen and Hamm (2014) attribute to the large promotional campaign of the Bio-Siegel logo after its introduction in 2001 while no large campaign for the EU logo was undertaken.

Two years after the introduction of the Bio-Siegel logo (2003), 67% of the Germans recognized it, while the EU logo in 2012 was only recognized by 33% of the Germans. Since the EU logo is now mandatory on organic food packages, its awareness is likely to increase in future (Janssen and Hamm, 2014). However, not only awareness but also knowledge in its meaning and trust in the inspection system are important (Janssen and Hamm, 2012a,b). This suggests a need for information campaigns and marketing actions to increase the awareness, trust and understanding of the meaning of the EU logo. The structural equations model reveals the positive association between knowledge, attitudes and the organic yoghurt purchasing frequency. With attitude being an important predictor, it is suggested for marketing strategies to also reinforce positive attitudes towards organic food.

7.1.4 Research objective 4: Examine the visual attention to sustainability labels and its relation with choice behavior

RQ10 How much visual attention is given to price and sustainability attributes during food choice and does it correlate with stated attribute importance?

RQ11 Does visual attention to sustainability labels and price for coffee contribute to explaining choice behavior?

The aim of this research objective is to explore how visual attention to sustainability information and price relates to preferences, attribute importance and food choice behavior. Positive correlations were found between visual attention and stated attribute importance. Those stating to attach more importance to price when purchasing coffee thus pay more visual attention to this attribute when making choices. Similarly for the sustainability labels, higher stated importance of Fair Trade, USDA Organic and Rainforest Alliance is positively correlated with the visual attention for the respective labels.

A higher fixation count or fixation time for Fair Trade and USDA Organic attributes is related to a higher utility for these attributes which illustrates that people who visually attend more to these labels are more likely to choose coffee carrying these labels and value these labels more. Thus spending more time and fixating more on sustainability attributes relates to a higher preference for these attributes when making food choices, and relates to a higher WTP and increase likelihood to choose coffee carrying these labels. While we found a relationship between the preference, importance, WTP for sustainability labels on the one hand and the visual attention given to these attributes during food choice on the other hand, the direction of the causality remains to be investigated. Eye-tracking measures reveal meaningful information about the value that consumers attach to the product attributes when making food choices and contributes to explaining choice behavior for coffee.

7.1.5 Research objective 5: Account for attribute non-attendance in food choice experiments using eye-tracking measures

RQ12 Were the attributes identified as ignored truly ignored?

RQ13 Does accounting for visual attendance influence the model estimates?

The aim of the last research objective is to investigate the incorporation of eye-tracking measures to account for attribute non-attendance (ANA) in choice experiments (CEs). Previous studies accounted for ANA by relying on self-reported ANA behavior (stated ANA) or by attempting to infer ANA based on respondents' choice behavior (inferred ANA). Instead, in this study, eye-tracking measures were used to evaluate visual ANA to the attributes in a CE.

Two definitions for detecting whether a specific attribute was ignored during a choice task are applied based on the visual attention. Two modelling methods to account for visual ANA (choice task visual ANA and serial visual ANA) and two fixation count cutoff points (fixation count of one and two) were used. This results in a total of six approaches to account for visual ANA. Results show that different coefficient estimates and WTP values can emerge if one considers visual ANA vis-à-vis the full attendance model.

Using models with two coefficients for each attribute, one for visually attended and one for visually ignored, we tested whether attributes classified as ignored represent truly ignored attributes. Some attributes that were identified as 'visually non-attended' based on eye-tracking measures were truly ignored, so their coefficients in the utility function can be set to zero. However, for all approaches, price and USDA Organic (and Rainforest Alliance in some approaches) were not ignored in the decision-making process when identified as 'visually ignored'. For price and USDA Organic, it is possible that people do not need to fixate their eyes on these attributes to the same extent as the other attributes, perhaps because price and USDA Organic are more familiar to them. This suggests that the adequate approach for visual ANA might depend on the attribute itself and calls for more research on how to optimize the use of eye-tracking in the context of ANA into choice modelling.

7.2 General conclusion

A primary challenge for twenty-first century food policy is the integration of public health nutrition and environmental sustainability goals. Given the inseparable environmental and health impact of dietary choices, integrating health and sustainability goals has become a highly topical issue in policy development and consumer communication with the potential to encourage consumers adopting

healthier and more sustainable eating behavior. Although the majority of interventions and food policy actions in the past have focused on achieving specific health goals (Capacci et al., 2012), some more recent policy initiatives initiated by national governments or at the European Union (EU) level started addressing explicitly healthy and sustainable food consumption and production (see Barling, 2011; Garnett et al., 2015; HCN, 2011) using different policy instruments, approaches and actions to foster healthy and sustainable food choice including communication or information provision tools, economic or fiscal tools, regulatory tools and behavioral tools. A priority action identified by the European Commission (EC, 2012a) is to encourage sustainable food patterns by instruments that support more informed choices. This includes information-oriented approaches educate, promote and empower consumers to make sustainable food choices, such as sustainability labeling, information, advertising and marketing campaigns, educational programs, printed materials and website and other awareness-raising tools (EC, 2012a; Garnett et al., 2015). While these tools empower them to take sustainability into account, they are also aimed at increasing the motivation to consume sustainability and to make sustainable food choices. Some dietary guidelines now incorporated sustainability in their dietary advice and suggest consumers to purchase food with sustainability labels (GCSD, 2013; SFA, 2015; WWF LiveWell, 2015).

This dissertation focuses on sustainability labeling as an information provision tool which allows for more informed food choices and encourages sustainable food choice. While many studies have evaluated the use of nutrition labels and its determinants, less research has focused on use of sustainability labels on food and its influence on food choice. More specifically, the following aspects are researched in this dissertation. Consumers' preferences towards and WTP for a wide range of sustainability labels, focusing on different facets of sustainability, on yoghurt, chicken and coffee are investigated. The involvement in sustainable diets and healthy diets are studied, which can be a motivation to use sustainability labels during the decision-making. The knowledge and awareness of organic labels are examined. This relates to the ability to use the information. Finally, visual attention to sustainability labels during food choice is investigated.

An increasing number of consumers are concerned about the way their food is produced, including ethical and environmental aspects. This has a significant impact on both the public and private sector. It has led to the growth of the number of voluntary sustainability labels. Additionally, some recent national dietary guidelines encourage the purchase of food with sustainability labels (GCSD, 2013; SFA, 2015). Hence, information on consumers' preferences for and valuation of sustainability labeling is important to the food industry (food producers and manufacturers, food marketers), policy makers

and governmental agencies. Consumers' preferences and WTP towards a wide range of sustainability labels, focusing on different facets of sustainability, on yoghurt, chicken and coffee are investigated and showed that consumers are willing to pay extra for products carrying sustainability labels. For organic yoghurt, only the habitual buyers are willing to pay the current market price. The high prices are barriers for organic yoghurt purchases, especially among the current non-users. For sustainability labels on meat this dissertation suggests that the free range claims are preferred, followed by an animal welfare label, carbon footprint label and, lastly, organic logos. This suggests potential for conventional-plus products (or compromise products) with management practices between conventional and organic production system practices that focus on animal welfare aspects (de Jonge and van Trijp, 2013a; de Jonge et al., 2015). Also adding a free range claim to organic meat products seems an attractive option. In contrast with the study on meat and dairy which was conducted in Belgium, the study on coffee was performed in the US. The USDA organic label was preferred over the Rainforest Alliance label, the Fair Trade label and the Carbon Footprint label. This is not surprising as USDA Organic has the highest awareness in the US compared to any other sustainability label on coffee (NCA, 2008).

Grunert et al. (2014) use motivation-opportunity-ability framework to explain the determinants of behavior with respect to the use of sustainability labels. Sustainability labels give the opportunity to take sustainability characteristics into account but do not imply they will be. There is a hierarchy of stages that the consumer should go through from sustainability labels exposure to decision-making in which consumers encounter several barriers (Grunert, 2011). This whole process of the use of sustainability labeling in the decision-making process is influenced by consumers' motivation and ability to use the information (Grunert et al., 2014). Motivation (involvement) and ability (knowledge) are studied as well as attention to sustainability labels. Attention to the label is a prerequisite for information processing. Instead of relying on self-reported measures, visual attention to sustainability labels is measured by eye-tracking.

The involvement in sustainable diets and healthy diets is studied and indicated that segments involved in sustainable eating are also involved in healthy eating, while the opposite is not necessarily true. Health still matters more – and to more consumers - than sustainability. Involvement in sustainable eating may be linked with the motivation to use sustainability labels. Highly involved consumers will likely more actively search for information and use more information before buying. Food-related health concerns and sustainability concerns were found to be the main drivers for consumers' involvement in healthy and sustainable eating, respectively. Policy actions aiming at informing

consumers about the consequences of their dietary choices for their personal health and the environment are recommended, as these may raise awareness, concern and involvement. Subsequently, when consumers are more concerned about these issues, attach more personal importance to it and are more involved in healthy and sustainable eating, they will also be more motivated to make sustainable food choices and thus to use sustainability labels.

Next to motivation, also the ability influences the use the sustainability labels. The knowledge and awareness of organic labels are examined. Specifically about the EU organic labeling, this dissertation flags a need to inform and educate European consumers more about the in 2010 introduced organic logo. Due to the low knowledge and recognition of the new logo, they prefer the Belgian organic food logo over the EU organic food logo. In order for the new EU organic food logo to be a success, consumers need to recognize it and know its meaning. One of the objectives of the EU organic food program is to have a harmonized EU organic food logo with a high recognition to increase consumer confidence and stimulate organic sales. However, this study indicates that more effective communication campaigns may be needed to achieve these goals. With the much higher recognition of the private organic certification logo compared to the EU organic label, it is likely that retailers and manufacturers will continue to include the voluntary private organic certification logos on their product in combination with the mandatory EU organic logo until consumers have a better awareness, knowledge and trust in this EU logo. Consistent use of only one label less will would free up some space on the package, and may lower the risk of information overload and ignorance among consumers.

From a methodological point of view, the doctoral dissertation studies the use of eye-tracking as a tool to evaluate visual attention and visual attribute non-attendance (ANA) which are incorporated in the choice modeling. Visual attention to sustainability labels is investigated. Attention is identified as one of the first steps in the consumer decision-making process as it is a prerequisite for information processing and use of sustainability labels. This study provides insights into how consumers attend to sustainability information (on coffee packages). A large body of literature employs self-reported use of sustainability labels (Grunert et al., 2014) or importance of sustainable food attributes when examining the effect of sustainability on food choices (Vanhonacker et al., 2013). This dissertation moves beyond the reliance on self-reported measures of sustainability label use during food choice, and instead uses eye-tracking measures to quantify the visual attention given to sustainability labels while making food choices. Attention to sustainability labels on food products is a necessary precursor to processing the information and may lead to informed sustainable food choices. The dissertation illustrates that visual attention plays a role in explaining choice behavior for coffee. People who visually

attend more to these labels are more likely to choose coffee carrying these labels and value these labels more. Spending more time and fixating more on sustainability labels relates to a higher preference for these attributes when making food choices, and relates to a higher WTP and increase likelihood to choose coffee carrying these labels. While we found a relationship between the value, importance, WTP for sustainability labels and on the one hand and the visual attention given to these attributes during food choice on the other hand, the direction of the causality remains to be investigated.

Firstly, higher motivation and involvement with respect to sustainability of food could result in a search for this specific information, also called top-down attention in the eye-tracking literature (Pieters and Wedel, 2004), which may explain the higher visual attention. The role of motivation has also been reflected in the eye-tracking studies on healthy food choices (Visschers et al., 2010). While health-motivated consumers are likely to pay attention to and seek information about cues which assist in assessing the healthiness of foods (Hess et al., 2012), similarly, sustainability-motivated consumers are also likely to seek information about sustainability aspects. Secondly, also the reversed causality is possible. A higher visual attention may lead to higher valuation, similarly as the post-purchase dissonance. This may be caused by the exposure effect, which states that attention has a causal effect on preference formation, and may cause a higher visual attention for an attribute to result in a higher value and preference for that attribute. To conclude, the use of eye-tracking reveals meaningful information about the attention to sustainability labels and relates to the value or importance attached to them and contributes to explaining choice behavior.

This dissertation also contributes to the research on ANA, an important methodological issue for researchers engaged in CEs. Researchers cannot assume that respondents have attended to all the attributes in a CE and have processed all of the information in a fully rational manner. Assuming that a person considered an attribute when he or she actually ignored it could result in a violation of the continuity axiom, which may then lead to biased and misleading parameter estimates and WTP values. Given that CEs are commonly used to assess attribute valuation, there is an urgent need for and considerable research interest in finding methods to account for ANA. I contribute to this research area by using eye-tracking measures to evaluate visual attendance to the attributes in a CE. This method does not rely on self-reported ANA behavior and does not attempt to infer non-attendance based on respondents' choice behavior. Instead, participants' visual attention is used to specify whether they visually attended to the information presented to them. This dissertation shows that different estimates and WTP values can emerge if one considers visual ANA vis-à-vis the full attendance

model. With the use of visual ANA, visually ignored attributes were identified. Interestingly, the research shows that not all attributes identified as visually ignored were fully ignored based on the respondents' choice behaviors. This suggests that the adequate approach for visual ANA might depend on the attribute itself and calls for more research on how to optimize the use of eye-tracking in the context of ANA into choice modelling.

While food labeling enables informed choices and aims to encourage certain food choices (in this case sustainable food choices), it is not certain whether it leads to behavioral changes and better (healthier/more sustainable) food choices. Most research on the effectiveness of food labeling to change behavior is on the topic of nutrition labeling which has been used in healthy promoting policies to foster behavioral change. Brambila-Macias et al. (2011), in a review, reported that it is not certain that nutritional labeling leads to healthier choices. Several researchers have identified the research gap on the impact of nutrition labeling on change in dietary behavior (Cappaci et al., 2012, Campos et al., 2011; Lachat and Tseng, 2013). Campos et al. (2011) conducted a systematic review of nutrition labels on pre-packaged food and found a link between the use of labeling information and healthier diets. However, the authors also clearly mention (p 1502) that "the causal nature of this association is likely bidirectional: nutrition labels may promote healthier eating, whereas individuals with healthier diets are more likely to seek out nutritional labels in the first place." Similarly Capacci et al. (2012) mentioned the limitation that people who indicate to use labels are also more health-oriented and thus a healthy diet might not be caused by the nutrition label. In addition, studies often utilize self-reported use of the label, which might differ from the actual use. For the impact of nutrition labeling, outcome variables as label use or acceptance are often used while there is a need for studies to include diet or health outcomes. The lack of health or diet related-outcomes is identified as a frequent research gap in nutrition labeling policy evaluation (Capacci et al., 2012). Due to these shortcomings in nutrition labeling research, Lachat and Tseng (2013, p 382) mentioned that "the current evidence on the effectiveness of nutrition labeling is inadequate" and call for real-life interventions with nutrition labels which measure outcome variables such as dietary intake, nutritional status and diet-related diseases.

These research gaps identified for the effectiveness of nutrition labeling on dietary changes are also present for the effectiveness of sustainability labeling. While labeling and other information provision tools on health and sustainability may increase awareness, empower consumers to take this issues into account, it remains uncertain that they lead to healthier and more sustainable food choices. The impact of sustainability labeling on dietary changes with respect to the healthiness and the sustainability of the diets remains a research challenge for future.

While this dissertation focuses on sustainability labels, it is important to mention that there are other policy tools to encourage sustainable food choices. Labeling is considered one of the so-called 'soft', non-intrusive approaches, i.e. approaches supporting informed choice such as public information campaigns, education and labeling. An EU wide review on policy interventions to promote healthy eating found that 'hard' approaches, i. e. policies targeting the market environment such as fiscal measures, regulations and mandatory standards, to be more effective to translate into action than the 'soft' approaches but also more intrusive (Brambila-Macias et al., 2011; Capacci et al., 2012). While the effectiveness of sustainability labeling for behavioral changes and dietary changes remains uncertain, sustainability labeling together with other 'soft' approaches play an important role in increasing consumer awareness, involvement in and concerns about sustainability issues (Garnett et al., 2015). "By creating consumer awareness and concern, they may 'soften up' the public, making them more likely to accept more robust forms of interventions such as regulation" (Garnett et al., 2015, p81). Similarly, EC (2012) reported awareness raising action to develop acceptability of future regulatory measures. An increased consumer involvement in health and sustainability aspects of food can in its turn encourage both policy makers and the food industry to take more radical actions to stimulate healthy and sustainable diets (Garnett et al., 2015). Thus, likely for policy approaches aiming at achieving integrated health and sustainability outcomes, 'soft' approaches are advised first to increase awareness, concern and engagement (Garnett et al., 2015). In a later stage, when consumers are more aware and concerned about these issues and more likely to accept more radical actions which target the market environment, a combination of different approaches is recommended (Garnett et al., 2015).

7.3 Limitations and future research

There are limitations associated with this doctoral research which need to be acknowledged and which also open up opportunities for further research.

7.3.1 Sampling

The methodologies used for sampling and data collection applied in this doctoral research imposed some limitations. In all four studies, a convenience sampling approach was adopted, which is vulnerable to a sampling bias because of subject self-selection. The use of a convenience sample limits the interpretation of the findings to its specific sampling frame. More specificity, Study 1 includes a large representative samples for age, gender and location in each of the four EU countries (UK, Germany, Belgium, and the Netherlands), with similar dietary patterns. However, future research could study consumers from other regions such as Northern European or Southern European countries

as dietary patterns are likely to have an impact on their involvement in sustainable and healthy eating. Study 2 and 3 were conducted in Flanders and thus pertains to its narrow geographic scope and there is sample bias towards younger and higher educated consumers. Study 4 was conducted with participants being recruited from one particular region (Northwest Arkansas). The data from Study 1, 2 and 3 were collected through an online survey. This excludes people who do not have access to Internet, but allowed the collection of a substantial amount of data in a relatively short time against relatively low costs. The use of a convenience sample limits the interpretation of the findings to its specific sampling frame. Extrapolation to other populations remains to be further validated and future studies should test the robustness of these findings using samples in other locations. Study 4 is based on a small sample and future studies with a larger and statistically representative samples are recommended in future.

7.3.2 Self-reported measures

All studies, except for the eye-tracking dataset in Study 4, rely on self-reported measures, which is very common in this field. Although these provide valuable insights, they likely suffer from social desirability bias and hence may deviate from actual behavior (Fisher, 1993). The studies do not control for social desirability, common method error bias and cognitive consistency. To overcome these limitations, more experimental and observational research is recommended studying actual behavior or revealed preferences. This has also implications for the WTP measures, which are of hypothetical nature as they rely on stated preference data. It is well-reported that hypothetical choices might suffer from hypothetical bias (Carlsson and Martinsson, 2001; Hensher, 2010) as subjects facing a hypothetical buying decision tend to behave differently than subjects in a real buying situation. Therefore, the absolute values of the WTP are likely biased and overestimated. However, comparing the WTP for the labels give an indication of the relative preferences. To overcome hypothetical bias, non-hypothetical or incentive compatible mechanisms can be applied. In future, more research on sustainability labels using non-hypothetical and incentive aligned methods are suggested and desirable such as experimental auctions, non-hypothetical CEs and field experiments to validate these findings in relation to WTP.

7.3.3 Factors influencing consumer decision-making

In the introduction, the theoretical framework was described based on Grunert (2011) and Grunert et al. (2014). Several phases of this framework are studied separately. Future studies are suggested focusing on the different relations in the framework.

With respect to the ability to use the label, this dissertation only measures the knowledge of the EU organic logo. While awareness and understanding are important, the ability to use the labels will also be influenced by whether the consumer deems the label as credible, trust it and feel that the information provided by the label assists him/her to make more sustainable food choices (Grunert, 2011). The trust in the sustainability label and the belief that the label is indicative of a sustainable product may depend on the source and its credibility and reputation (Hanss and Böhm, 2012). Teisl et al. (2002) also report the credibility of the endorsing entity as an important factor for the trust in the label. Future studies could thus also evaluate the trust, credibility, belief and knowledge related to the different sustainability labels used in this study.

These factors can also assist in explaining the differences in preferences and WTP for the different sustainability labels. Zepeda et al. (2013) mentioned that the consumer preferences for sustainability labels are influenced by label attributes (the source, the message, the design) and the consumer attributes (skepticism and trust, experience, familiarity and attitudes). The source describes the origin, credibility and reputation (Hoogland et al., 2007; Zepeda et al., 2013). Familiarity of the label is also influencing factor (Thøgersen, 2000) as consumers have the tendency to be skeptical about unfamiliar labels and may not trust the label (Sirieux et al., 2013). Future studies could try to explain the differences in preferences and WTP for the various sustainability labels by these possible reasons such as the credibility of the label, trust in the label, beliefs about the label, knowledge about the label, familiarity, etc. Study 2 illustrated the low recognition of the new EU organic logo; however, it is expected that the new EU organic food logo will gain awareness. Future studies can evaluate the evolution of awareness over time. Additionally, open-ended questions to measure knowledge can be included.

While the framework in this dissertation applied the motivation-opportunity-ability framework, it is important to acknowledge that there are a lot of factors that can influence the consumer decision-making process of sustainable products. Future research could include person-, product- and environmental-related factors. As mentioned by Kotler et al. (2013), there are four sets of consumer characteristics (i. e. personal-related factors) that influence the consumer decision-making process. These include personal (demographics, personality, lifestyle), psychological (knowledge, perceptions, motives, attitudes, involvement), cultural (social class), reference group) and social factors (family, reference groups). In addition to consumer characteristics, environmental factors (e.g. situational influences such as time and occasion), and product-related factors (e.g. product type, price, place, promotion, product attributes) may influence the process. Personal values (for example based on

Schwartz Portrait Values) are linked to sustainable food behavior (Grunert et al., 2014; Vermeir and Verbeke, 2006). While our study measured the perception of food attributes, importance of attributes is also importance as this relates to the motives for food choices (Onwezen et al., 2010). Additional, it is suggested to include measures for social norms or social pressure from peers to account for the willingness to comply with the opinion of others, as it may contribute to explaining intention to sustainable behavior (Vermeir and Verbeke, 2006). Future studies could include a range of different factors that influence the decision-making process such as personal-related factors, environmental factors (e.g. situation), and product-related factors (e.g. price, place, promotion, product-categories). More product-related factors are discussed in section 7.3.4.

7.3.4 Other food products, product attributes and sustainability labeling

While this dissertation included consumer preferences for sustainability labels on dairy (yoghurt, Study 2), meat (chicken breast, Study 3) and coffee (Study 4), it is suggested that future studies include other products such as fruit and vegetables, nuts, drinks, fish and seafood, and other meat products. With respect to Study 1, the consumer perception of health and sustainable diets were evaluated. As suggested by Verain et al. 2016), future should take differences in perceptions of healthfulness and sustainability across food categories into account when studying the relation or "match" between healthiness and sustainability perceptions.

The use of other product attributes to may influence the consumer decision-making process. In Study 2, 3 and 4, respondents are asked to make food choices solely based on sustainability attributes and price. However, in real life purchase situations additional information cues are used to derive to food choice and are competing with and trade-off against) sustainability labels such as brand, origin, taste, origin, convenience, health-related attributes such as nutrition information, nutrition and heathy-related claims as well as and other quality attributes. For future studies, the inclusion of other information cues is suggested. Brand as an important attribute when studying food choice and particularly in sustainability labeling. An increasing amount of retailers are expanding their private label (store brand) product assortment and even incorporate sustainability labeling into these store brand product categories (such as organic). Very few organic food studies have investigated the implications of this trend thus far (Perrini et al., 2009). Additionally, there is a lot of price variation for coffee based on other attributes than sustainability labels such as the blend, the type of beans and type of roast, country of origin, brand, that determine the price and that are when making a coffee purchase (Study 4). Thus future studies on coffee should include these information cues. With respect to Study 4, the attributes included will not only influence the food choice but it is also important when

measuring visual attention as more information cues on the package will compete for the consumer's attention. Therefore, also when studying visual attention, including additional attributes next to sustainability labels and price is recommended.

There are a lot of sustainability labels and future studies could investigate consumer preferences for other labels. While a hypothetical EU-level animal welfare label was included, other animal welfare labels could be included (e. g. Animal Welfare Approved, Certified Humane). In addition to carbon footprint (Carbon Trust carbon footprint) and Rainforest Alliance, other environmental label could be included such as food miles. Also research on a harmonized the EU ecolabel expressing the environmental impact of a food, as an extension of the current ecolabel would be interesting to investigate. The EC considered extending the voluntary EU ecolabel to food and drinks in 2011 and decided not to pursue this but mentions to revisit this in future (EC, 2016). For fish specifically, labels on sustainable fisheries and aquaculture (MSC, Marine Stewardship Council and ASC, Aquaculture Stewardship Council) could be studied. For coffee, in addition to organic, Fairtrade, Rainforest Alliance used in Study 4, UTZ certified, and Birdfriendly labels can be included.

7.3.5 Dietary changes

While this dissertation focuses on the use of sustainability labels and the food choices made, future studies should also look at the impact of sustainability labels on dietary changes in terms of healthiness and sustainability of the diet to address whether the labeling improves the dietary habits. Sustainability labels, if noticed, lead to informed choices but future research should look if it leads to better choices in terms of healthfulness and sustainability. Garnett et al. (2015) also suggest that the effect of interventions on both health and sustainability outcomes should be studied to investigate how to achieve behavioral changes.

7.3.6 The use of eye-tracking technology

While eye-tracking monitors consumers' visual attention, this technology has some limitations. First of all, it assumes that fixations are an indication of visual attention but eye-tracking only reveals what happens in an individual's foveal vision. While fixations take place in our foveal vision which is where our primary attention is focused (Bergstrom and Shall, 2014), eye-tracking does not allow to measure attention deployed in parafoveal and peripheral vision (Bergstrom and Shall, 2014; Orquin et al., 2016). It is not because they did not fixate on an AOI that they may not be aware that it is there (Bergstrom and shall, 2014), since fixations only report visual attention taking place in our foveal vision and not in the parafoveal and peripheral vision. While our primary vision is focused on what we see in the foveal

vision, we might still grasp what is present in other part of our visual field. While Bialkova and van Trijp (2011) reported eye fixations within certain AOI to be a reliable measure for visual attention for that AOI, we need to acknowledge that eye fixations do not necessarily represent everything that participants might have seen.

Secondly, AOI needs to be defined for which eye-tracking metrics (such as fixation count) are calculated. This method thus depends on how this area was defined, for which unfortunately there is no consensus in the decision-making research. As mentioned by Orquin et al. (2016, p 103), "this lack of standardization in AOI definition and reporting presents direct problems to the advancement of behavioral decision-making research". Thus there is a need to have a more standardized way to define AOIs.

A third limitation is that eye-tracking shows where participants fixate but not why; thus, the motivations and cognitions underlying these eye movements remain unknown (Graham et al., 2012). Familiarity might also influence how extensively information is examined (Pieters et al., 1996, 1999; Graham et al., 2012). Participants' fixations do not necessarily imply understanding and do not reveal anything about the higher-level processes of attention and comprehension. As suggested by Graham et al. (2012), conducting an interview after an eye-tracking task may provide more insight into what respondents were thinking during the task. While eye-tracking studies might be less prone to social desirability compared to studies that ask respondents directly about the information to which they attend (Graham et al., 2012), knowing that their eye movements will be monitored may also influence their behavior (Graham et al., 2012). Finally, eye-tracking is a relatively expensive and time-consuming method. Hence, considerations with respect to value-for-money as well as budget and time constraints are also important.

7.3.7 Visual attention

Chapter 5 on the visual attention to sustainability labels suggests several areas of future research. For instance, packaging plays an important role in attracting consumers' attention (Bialkova et al., 2013; Clement et al. 2013; Clement, 2007; Varela et al., 2014) and in communicating information about credence attributes at the point of purchase. Bottom-up factors with respect to the design of the sustainability label (format, color, representation, size) on the package and location on the package can be studied. While past studies looked at bottom-up factors that drive attention to nutrition information, such as the influence of packaging design features, label design, size, and context

(Bialkova and van Trijp, 2011), no other study has examined this issue with respect to sustainability labels in order to optimize the label design.

Information density is a bottom-up factor that could influence attention (Bialkova et al., 2013). Packages usually include not only sustainability labels and price but also other information cues (brand names, nutritional labels, ingredients lists, graphics, etc.) that are competing for the consumer's attention. Thus, further studies should include packages with more information cues in addition to sustainability labels and evaluate the visual attention to sustainability labels in a choice environment with more information (e.g., more attributes). While this research is focused on sustainability labels, more research is needed combining both health and sustainability information. Thus future research on visual attention could include both health- and nutrition- related information along with sustainability labels.

Future studies could evaluate the impact knowledge and familiarity related to the different sustainability labels and its relation to visual attention.

While the impact of hypothetical bias has been investigated in terms of WTP, no study has investigated hypothetical bias with respect to visual attention during food choice. This is a potential area for future research. Currently, many of the studies which apply eye-tracking with respect to food choice are hypothetical. People might behave differently, and thus also visually attend to information differently depending on whether their food choices have real economic commitments or not. Non-hypothetical studies on visual attention to sustainability labels are recommended.

7.3.8 Attribute-nonattendance (ANA) in CEs and eye-tracking

Chapter 6 focuses on the use of eye-tracking to help address ANA in CEs. Although eye-tracking technology could be a promising tool to address ANA, further research is recommended to optimize the use of this technology in the context of choice, attention and ANA (Orquin and Loose, 2013).

While we compared different visual ANA approaches, future studies is suggested to include all three types of ANA (visual, stated, and inferred) and evaluate which of these techniques or combinations of techniques is the most appropriate to account for ANA. Specifically for visual ANA, future research is suggested to improve and standardize how to apply visual ANA based on eye-tracking and remove arbitrary steps. Studies could for example test other fixation counts cut-offs and other visual ANA definitions. For example for serial ANA we used the approach of Balcombe et al. (2015) and identified a respondent as a non-attender for an attribute when they ignore an attribute in more than half of the choice tasks. However, "more than half" is an arbitrary approach and other approaches could be tested

to fine-tune the serial visual ANA method. Also other AOI sizes could be tested and more standardized approaches are needed on how to define AOI specifically for studying visual ANA. Results on these aspects can assist to optimize the use of eye-tracking to address ANA and can result in guidelines on how to incorporate visual ANA into choice modelling research.

In addition to incorporating ANA into choice models, future studies could use eye-tracking as a tool to research on how to optimize their experimental designs to discourage respondents from ignoring information and avoiding violation of the assumption of rational utility maximization in which it is assumed that the complete information presented is considered. We share the opinion of Balcombe et al. (2015), who suggested the use of eye-tracking to assist in the visual design and appearance of the CE instrument. Several eye-tracking studies have demonstrated that the bottom-up factors can trigger attention (Bialkova and van Trijp, 2011; Visschers et al., 2010). Bottom-up or stimulus-driven form of attention is caused by characteristics of the stimulus itself (color, size, location, saliency) and occurs without specifically searching for them (Wolfe, 1998). Insights on these bottom-up factors can help to design choice sets in which visual ANA is reduced. It can thus determine improvements to the visual design/lay-out of choice sets to limit ANA in CEs.

Appendices

Appendix A: Overview of measures used (Chapter 2)

Construct or measures	Items/statements	Scale	Cronbach's α
Meaning of sustainability[1]	To what extent do you think the following issues have something to do with sustainability? World food supply The use of pesticides in food production The environmental impact of food production The environmental impact of human use of land and water Food waste The amount of energy used when cooking food products Recyclable packaging Carbon emissions caused by food production Working conditions and wages for food producers Deforestation Using child labour in food production Prices paid by consumers for food products The healthiness of food and drinks Levels of unemployment The quality of public health services Food and drink safety The treatment of animals in food production Energy use when transporting food products The amount of packaging used on products	5-point scale from "Not at all" (1) to "Definitely" (5)	
Perceptions of healthy, sustainable and plant-based diets	In my opinion, a healthy diet is … In my opinion, a sustainable diet is … In my opinion, a plant-based diet is … not tasty/tasty	5-point semantic differential scale	NA

	expensive/cheap not easily available/easily available in the store I shop not natural/natural difficult/easy to prepare not for me/ perfect for me not traditional/ traditional not nutritious/ nutritious not filling /filling not healthy/healthy plant-based/animal-based not sustainable/ sustainable		
Self-reported healthy eating [2]	Please indicate to what extent the following statements apply to you personally in general? • "I eat a variety of foods originating mainly from plants, rather than animals" • "I eat bread, grains, pasta, rice or potatoes several times per day" • "I eat a variety of vegetables and fruits, at least 400g per day or 5 portions per day" • "I control my fat intake and replace most saturated fats with unsaturated vegetable oils or soft margarines" • "I replace fatty meat and meat products with beans, legumes, lentils, fish, poultry or lean meat" • "I use milk and dairy products (kefir, sour milk, yoghurt and cheese) or soy-based alternative to dairy products that are low in both fat and salt" • "I select foods that are low in sugar, limiting the frequency of intake of sugary drinks and sweets" • "I control my salt intake and limit adding salt to my meals".	5-point scale from "Does not apply to me at all" (1) to "Fully applies to me" (5)	0.83

Self-reported sustainable eating	Please indicate to what extent the following statements apply to you personally in general? • "I compost food waste at home"[3,4] • "I eat local products whenever possible" [3,4] • "I eat seasonal products" [3,4] • "I limit my meat consumption" [3,4] • "I regularly eat organic food products" [4] • "I limit the amount of food I waste" • "I regularly eat plant-based foods as an alternative to meat"	5-point scale from "Does not apply to me at all" (1) to "Fully applies to me" (5)	0.77
Subjective healthiness of the diet[5]	Please indicate to what extent you agree or disagree with each of the following statements. • "My eating behavior is as healthy as that of anyone I know of a similar age" • "My eating habits are excellent with respect to good health compared to those of other people of a similar age" • "I consider myself to be very health-conscious when it comes to food and eating habits".	5-point Likert scale	0.68
Subjective sustainability of the diet[5]	Please indicate to what extent you agree or disagree with each of the following statements. • "My eating behavior is as sustainable as that of anyone I know of a similar age" • "My eating habits are excellent with respect to good sustainability compared to those of other people of a similar age" • "I consider myself to be very sustainable-conscious when it comes to food and eating habits".	5-point Likert scale	0.65
Involvement in healthy eating[5]	Please indicate to what extent you agree or disagree with each of the following statements. • "Healthy eating is very important to me"	5-point Likert scale	0.91

	• "I care a lot about healthy eating" • "Healthy eating means a lot to me" • "I am very concerned about the health-related consequences of what I eat"		
Involvement in sustainable eating[5]	Please indicate to what extent you agree or disagree with each of the following statements. • "Sustainable eating is very important to me" • "I care a lot about sustainable eating" • "Sustainable eating means a lot to me" • "I am very concerned about the consequences of what I eat in terms of sustainability"	5-point Likert scale	0.94
Food-related health concerns	How worried are you personally about each of the following issues? • "The quality and freshness of my food" [6] • "Getting a diet-related disease such as diabetes or heart or liver problems"[6] • "Not having a healthy and balanced diet" [6] • "Putting on weight" [6] • "Having a diet low in vitamins and minerals" [7] • "Having a high-fat diet" [7] • "Having a diet rich in calories" [7] • "The amount and type of fat used when cooking food products" • "Having a diet low in plant-based foods"	5-point scale from "Not at all worried" (1) to "Extremely worried" (5)	0.92
Food-related sustainability concerns [1]	How worried are you personally about each of the following issues? • The use of pesticides used in food production • Environmental damage caused by human use of land and water for food production • The amount of food that is wasted • Using too much of the world's natural resources for food production	5-point scale from "Not at all worried" (1) to "Extremely worried" (5)	0.94

	• Packaging used for food products that is not recyclable • The amount of packaging used on food products • Carbon emissions caused by food production • The amount of energy used when transporting food products • The amount of energy used when cooking food products	
Consumption of plant-based foods	Based on the definition[8], what percentage of your diet consists of plant-based foods?	%
Attitudes towards plant-based diets	How would you describe your attitude towards plant-based diets?	10-point semantic differential scale from "extremely negative" (1) to "extremely positive" (10)

[1] Grunert et al. (2014)
[2] Based on WHO (2014)
[3] Whitmarch and O'Neill (2010)
[4] Vanhonacker et al. (2013)
[5] Adapted from Pieniak et al., 2010b
[6] Based on Eurobarometer (EC, 2010)
[7] Adapted from Roininen et al. (1999)
[8] Participants were given the following definition of plant-based diets (AICR, 2014): "A plant-based diet is defined as eating meals made up of 2/3 (or more) plant-based foods and 1/3 (or less) animal-based foods. While dairy products are animal-based (typically made from cows' milk), there are plant-based alternatives to dairy products which are made from plant-based ingredients without the addition of any animal-based ingredients. Examples are almond drinks, calcium-enriched soya drinks, and plant-based alternatives to yoghurt."

Appendix B: Comparison of country sample and population's socio-demographics (%) (Chapter 2)

		UK (n=714)		Belgium (n=684)		Germany (n=700)		The Netherlands (n=685)	
		Sample	Pop.	Sample	Pop.	Sample	Pop.	Sample	Pop.
Gender	Male	49	49	50	50	50	50	50	50
	Female	51	51	50	50	50	50	50	50
Age	18-24 years	14	15	13	13	11	12	14	14
	25-34 years	22	21	19	19	20	19	19	19
	35-44 years	21	21	21	21	21	20	21	21
	45-54 years	23	23	24	24	26	26	24	24
	55-65 years	19	20	23	23	22	23	22	22

Region BE	Sample	Pop.	Region NL	Sample	Pop.
Antwerp	15	16	Drenthe	3	3
Brussels	10	10	Flevoland	3	2
Eastern Flanders	13	13	Friesland	4	4
Hainaut	11	12	Gelderland	12	12
Liege	9	10	Groningen	4	4
Limbourg	9	8	Limburg	7	7
Luxembourg	3	3	Noord-Brabant	17	15
Namur	6	4	Noord-Holland	14	16
The Flemish Brabant	9	10	Overijssel	7	7
Walloon Brabant	3	4	Utrecht	7	7
Western Flanders	12	11	Zeeland	2	2
			Zuid-Holland	21	21
Region DE	Sample	Pop.	Region UK	Sample	Pop.
Baden-Wuerttemberg	12	13	East Midlands	7	6
Bavaria	17	15	East of England	9	10
Berlin	3	4	London	13	14
Brandenburg	3	3	North East	4	4
Bremen	1	1	North West	10	10
Hamburg	2	2	Northern Ireland	2	2
Hessen	8	7	Scotland	8	7
Mecklenburg-W. Pomerania	1	2	South East	15	15
Lower Saxony	9	10	South West	9	9
North Rhine-Westphalia	24	22	Wales	4	5
Rhineland-Palatinate	5	5	West Midlands	11	11
Saarland	1	1	Yorkshire/The Humber	7	7
Saxonia	5	5			
Saxonia-Anhalt	3	3			
Schleswig-Holstein	4	4			
Thuringia	2	3			

Appendix C: Effect sizes[a] and p-values of the comparison of characteristics across the segments (Chapter 2)

Involvement in healthy eating				**Involvement in sustainable eating**			
		r	p			r	p
S1	S4	0.81	<0.001	S1	S4	0.83	<0.001
S1	S2	0.47	<0.001	S1	S2	0.84	<0.001
S1	S3	0.85	<0.001	S1	S3	0.72	<0.001
S4	S2	0.87	<0.001	S4	S2	0.82	<0.001
S4	S3	0.23	<0.001	S4	S3	0.87	<0.001
S2	S3	0.86	<0.001	S2	S3	0.33	<0.001
Self-reported healthy eating				**Self-reported sustainable eating**			
		r	p			r	p
S1	S4	0.69	<0.001	S1	S4	0.71	<0.001
S1	S2	0.37	<0.001	S1	S2	0.42	<0.001
S1	S3	0.56	<0.001	S1	S3	0.47	<0.001
S4	S2	0.57	<0.001	S4	S2	0.55	<0.001
S4	S3	0.31	<0.001	S4	S3	0.48	<0.001
S2	S3	0.29	<0.001	S2	S3	0.06	0.0176
Subjective healthiness of the diet				**Subjective sustainability of the diet**			
		r	p			r	p
S1	S4	0.64	<0.001	S1	S4	0.67	<0.001
S1	S2	0.27	<0.001	S1	S2	0.38	<0.001
S1	S3	0.53	<0.001	S1	S3	0.41	<0.001
S4	S2	0.61	<0.001	S4	S2	0.56	<0.001
S4	S3	0.25	<0.001	S4	S3	0.47	<0.001
S2	S3	0.40	<0.001	S2	S3	0.07	0.008
Food-related health concerns				**Food-related sustainability concerns**			
		r	p			r	p
S1	S4	0.54	<0.001	S1	S4	0.64	<0.001
S1	S2	0.30	<0.001	S1	S2	0.36	<0.001
S1	S3	0.46	<0.001	S1	S3	0.39	<0.001
S4	S2	0.37	<0.001	S4	S2	0.50	<0.001
S4	S3	0.18	<0.001	S4	S3	0.45	<0.001
S2	S3	0.20	<0.001	S2	S3	0.04	0.117
Consumption of plant–based foods				**Attitude toward plant–based diets**			
		r	p			r	p
S1	S4	0.45	<0.001	S1	S4	0.58	<0.001
S1	S2	0.20	<0.001	S1	S2	0.30	<0.001
S1	S3	0.30	<0.001	S1	S3	0.43	<0.001
S4	S2	0.33	<0.001	S4	S2	0.44	<0.001
S4	S3	0.21	<0.001	S4	S3	0.28	<0.001
S2	S3	0.12	<0.001	S2	S3	0.17	<0.001

[a] Effect sizes are useful because they provide an objective measure of the importance (or size) of an effect. The approach by Field (2009, p 550) was followed to calculate the effect sizes based on the two-sample Wilcoxon rank sum. Field (2009) also mentions guidelines that can be useful as "rule of thumbs" to assess the importance of an effect (regardless of the significance of the test statistics) based on Cohen (1988, 1992):r=0.1, represents a small effect, r=0.30 a medium effect and 0.50 a large effect.

Appendix D: Questionnaire for study 2 (Chapter 3)

RECOGNITION EU ORGANIC LOGO)

Do you recognize this symbol? YES/NO

RECOGNITION BIOGARANTIE LOGO
Do you recognize this symbol? YES/NO

OBJECTIVE KNOWLEDGE
Please indicate if the following statements about the EU organic logo are true or false.

- At least 95% of the ingredients are organic
- At least 70% of the ingredients are organic
- This product can contain up to 20% of genetic modified materials
- The logo can be used for products derived from fishing
- and hunting wild life activities

PURCHASE FREQUENCY OF ORGANIC YOGHURT
Scale: 0 to 0 - 10 times
On 10 times that you buy yoghurt, how often do you choose one with an organic label?

PURCHASE INTENTION
7-point scale: (1) Very unlikely, (7) Very likely
Please indicate how likely is it that during the coming 7 days you expect, plan, desire to eat organic yoghurt, including today

- I expect to eat organic yoghurt in the coming 7 days
- I plan to eat organic yoghurt in the coming 7 days
- I desire to eat organic yoghurt in the coming 7 days

WTP

Suppose that you want to purchase 500 g yoghurt. The average price for 500 g regular yoghurt is €1.5. Please indicate how much you are willing to pay extra for a yoghurt with an organic label.

- €0.00
- €0.10
- €0.20
- €0.30
- €0.40
- €0.50
- €0.60
- €0.70
- €0.80
- €0.90
- €1.00
- €1.10
- €1.20
- €1.30
- €1.40
- €1.50
- I would buy a regular yoghurt independent on the price.

IMPORTANCE OF YOGHURT ATTRIBUTES

7-point importance scale: (1) Not at all important, (4) Neither Important nor Unimportant, (7) Extremely important

How important are the following product characteristics for you when making choices concerning yoghurt?

- Quality
- Taste
- Price
- Environmental friendliness
- Brand name
- Nutritional value
- Packaging
- Trustworthiness
- Availability
- Provided with an organic label

BELIEFS ABOUT ORGANIC YOGHURT

7-point scale: (1) Much worse, (4) the same, (7) Much better

How would you evaluate the following aspects when comparing organic yoghurt with conventional yoghurt?

"Organic yoghurt scores (worse/better) than conventional yoghurt."

- Taste
- Healthiness
- Price
- Environmental friendliness
- Safety
- Quality

- Availability
- Availability
- Trustworthiness
- Packaging

GENERAL ATTITUDES TOWARDS ORGANIC YOGHURT

7-point semantic differential scale

Please indicate which word best describes your feeling of organic yoghurt as compared to conventional yoghurt.

- Bad (1) – Good (7)
- Unpleasant (1) – Pleasant (7)
- Negative (1) – positive (7)

INVOLVEMENT IN ORGANIC FOOD

7-point Likert scale: (1) Strongly disagree, (4) Neither disagree nor agree, (7) Strongly agree

Please indicate how much you agree with each of the following statements.

- Organic food means a lot to me
- I care a lot about organic food
- Organic food is very important to me
- I appreciate organic food very much

Appendix E: Questionnaire Choice Experiment for study 3 (Chapter 4)

In the next part of this questionnaire you will be asked to choose between alternative products.

On the following pages, you will see descriptions of **two different types of chicken breast**.

The descriptions provide information about different characteristics of the chicken breast including organic certifications, animal welfare certification, environmental impact information such as the carbon footprint and the food miles and its price. Please assume that all other characteristics of the chicken breast are similar for all alternatives.

Some information about the different labels used:

Organic labels

- "European Organic food label" indicates that the product fulfills the EU requirements for organic food

- "Biogarantie label" is the Biogarantie ® is a private Belgian organic food label indicating the product fulfills to the Biogarantie requirements for organic food.

Different **free range claims**

"Free range"

- Stocking rate in the house is maximum 13 birds/m^2 and less than 27.5 kg liveweight/m^2
- Age of slaughter is 56 days or later
- During at least half their lifetime continuous daytime access to open-air runs comprising an area mainly covered by vegetation of not less than 1 m^2 per chicken
- The feed formula used in the fattening stage contains at least 70 % of cereals

Traditional free-range

- Stocking rate in the house is maximum 12 birds/m^2 and less than 25 kg liveweight/m^2
- Each poultry house contains no more than 4800 chickens
- Age of slaughter is 81 days or later
- Continuous daytime access to open-air at age of 6 weeks at an area of at least 2 m^2 per chicken
- The feed formula used in the fattening stage contains at least 70 % of cereals

Free range-total freedom

- Same as traditional free range except that the birds have continuous daytime access to open-air runs of unlimited area.

Carbon footprint label/Carbon reduction label

The Carbon Reduction Label is an on-pack label that indicates that the product you are buying are committed to reducing their carbon emissions. The carbon footprint has been measured in compliance with the Carbon Trust standards. The carbon footprint is the amount of greenhouse gas emissions associated with the product expressed as CO_2e. When calculating a carbon footprint, every stage in the product's lifecycle must be taken into account including the raw materials and packaging needed to produce it, through to manufacture, transportation, sale to the end user, use and disposal. Once the carbon footprint of the product has been measured and certified, the brand then has to commit to reducing the product's emissions.

European animal welfare protection label:

A harmonized EU-wide animal welfare labeling open for everyone to use if they meet the criteria. The certification system verifies this animal welfare standard which has requirements above existing legal standards on an EU level.

Studies have shown that people often respond to a survey in one way but act differently in real life. In studies where people are asked to indicate a product preference but do not have to pay for the product in question, they often state a higher willingness to pay than what they would actually be willing to pay in the store. One possible reason is that people do not really consider how large the impact of this extra cost would actually be on the available family budget. It is easy to be generous when you do not really have to pay for it. In a store, people might think differently: since the money spent on this good cannot be spent on other things. **We ask you to respond to each of the following preference questions exactly as you would if you were in a real store and had to pay for your choice.** Please keep this in mind when answering the survey questions.

Example of a choice set:

	Alternative A	Alternative B	Alternative C
Organic label	EU Organic food label	No label	Neither alternative A nor B is chosen
Animal welfare label	EU animal welfare label	No label	
Type of free-range farming claim	Traditional free range	Free range - total freedom	
Reduced carbon footprint label	No label	5.6 kg CO_2 compared to 7 kg CO_2	
Price	€20/kg	€25/kg	

	Alternative A	Alternative B	Alternative C
Organic label	Biogarantie label	EU Organic food label	Neither alternative A nor B is chosen
Animal welfare label	No label	EU animal welfare label	
Type of free-range farming claim	Free range	Traditional free range	
Reduced carbon footprint label	No label	5.6 kg CO_2 compared to 7 kg CO_2	
Price	€15/kg	€20/kg	

Appendix F: Cholesky matrix and correlation matrix from RPL-EC estimates (Chapter 4)

Table C1. Cholesky matrix from RPL-EC estimates

	Organic_EU	Organic_Belgium	AnimalWelfare	FreeRange	Trad_FreeRange	FreeRange_TotalFree	CO_2 minus 20%	CO_2 minus 30%	No_buy
Organic_EU	2.20***								
Organic_Belgium	1.33***	0.50***							
AnimalWelfare	-0.42**	-0.73***	0.18						
FreeRange	0.12	-0.51	-0.73***	0.02					
Trad_FreeRange	0.29	-0.48*	-0.36	0.18	0.12				
FreeRange_TotalFree	0.88***	-0.89***	-0.42	0.59*	0.05	0.16			
CO_2 minus 20%	0.95***	-0.67***	-0.13	0.27	-0.03	0.07	0.10		
CO_2 minus 30%	0.41*	-1.31***	0.30	0.42*	-0.09	0.16	0.26	0.29	
Err.Comp	-0.54	0.94*	0.22	-1.15***	-2.46***	1.19***	-0.05	3.13***	2.63***

Note: ***, **, * indicate parameters statistically significant at 1%, 5% and 10% level.

Table C2. Correlation matrix from RPL-EC estimates

	Organic_EU	Organic_Belgium	AnimalWelfare	FreeRange	Trad_FreeRange	FreeRange_TotalFree	CO_2 minus 20%	CO_2 minus 30%	No_buy
Organic_EU	1.00	0.94	-0.49	0.13	0.41	0.60	0.79	0.27	-0.10
Organic_Belgium	0.94	1.00	-0.75	-0.08	0.14	0.35	0.54	-0.05	-0.03
AnimalWelfare	-0.49	-0.75	1.00	0.24	0.28	0.17	0.06	0.64	-0.09
FreeRange	0.13	-0.08	0.24	1.00	0.87	0.67	0.51	0.36	-0.16
Trad_FreeRange	0.41	0.14	0.28	0.87	1.00	0.93	0.81	0.66	-0.33
FreeRange_TotalFree	0.60	0.35	0.17	0.67	0.93	1.00	0.94	0.75	-0.27
CO_2 minus 20%	0.79	0.54	0.06	0.51	0.81	0.94	1.00	0.75	-0.21
CO_2 minus 30%	0.27	-0.05	0.64	0.36	0.66	0.75	0.75	1.00	-0.07
Err.Comp	-0.10	-0.03	-0.09	-0.16	-0.33	-0.27	-0.21	-0.07	1.00

Appendix G: Predicted fraction of consumers with positive preferences towards both of the two mentioned labels simultaneously (Chapter 4)

	% Positive preferences
AnimalWelfare, Trad_FreeRange	84.7
AnimalWelfare, FreeRange	81.3
AnimalWelfare, FreeRange_TotalFree	80.1
Organic_Belgium, Trad_FreeRange	76.3
Trad_FreeRange, CO2 minus 30%	75.9
Trad_FreeRange, CO2 minus 20%	74.8
Organic_Belgium, FreeRange	73.0
FreeRange, CO2 minus 30%	72.7
Organic_Belgium, FreeRange_TotalFree	72.3
FreeRange_TotalFree, CO2 minus 30%	71.9
FreeRange, CO2 minus 20%	71.9
FreeRange_TotalFree, CO2 minus 20%	70.6
AnimalWelfare, Organic_Belgium	68.6
AnimalWelfare, CO2 minus 30%	68.0
AnimalWelfare, CO2 minus 20%	66.9
Organic_Belgium, CO2 minus 30%	61.5
Organic_Belgium, CO2 minus 20%	60.4
Organic_EU, Trad_FreeRange	54.1
Organic_EU, FreeRange	52.1
Organic_EU, FreeRange_TotalFree	51.4
AnimalWelfare, Organic_EU	48.7
Organic_EU, CO2 minus 30%	43.8
Organic_EU, Organic_Belgium	43.7
Organic_EU, CO2 minus 20%	42.7

Appendix H: Questionnaire for study 4 (Chapter 5)

Part A: Screening question:

Did you purchase ground coffee in the last 2 months?

- Yes
- No

Did you have any eye disease or eye surgery in the past?

- Yes
- No

Please select if you are:

- Right-handed
- Left-handed

Part B: Choice experiment instructions

You will be shown **two different coffee packs** next to each other. Both products are **12 ounce ground medium roast coffee**.

The packages show information about the coffee products including:

- USDA organic logo
- Rainforest Alliance logo,
- Fair Trade logo
- Carbon reduction label
- Price

Please assume that all other characteristics of the coffee packs are similar for all alternatives.

None of these

$ 4.30 $ 6.30

Please select the option you would choose in the store. (click one time in the box of your choice)
Please select <SPACE> when you are done.

☐ ☐ ☐

Please read this carefully.

Scientific studies have shown that people often respond in one way but act differently. In studies where people do not actually have to pay money for a product when indicating a particular preference, people state a higher willingness to pay than what one actually is willing to pay for the good in the store. A possible reason for this is that people do not really consider how large the impact of this extra cost actually is on the available family budget. It is easy to be generous when you do not really have to pay for it. In the store, people might think in a different way: the amount of money spent on this good cannot be spent to other things.

We ask you to respond to each of the following preference questions just exactly as you would if you were in a real store and had to pay for your choice.

Please keep this in mind when answering the following questions.

Part C: Choice experiment (8 choice sets)

Example of a choice set

1. Please indicate which option you would choose

2. Please indicate which option you would choose

Please select the option you would choose in the store. (click one time in the box of your choice)
Please select <SPACE> when you are done.

Part D: Survey

ATTRIBUTE IMPORTANCE AND ATTITUDE TOWARDS COFFEE

7-point importance scale: (1) Not at all important, (4) Neither Important nor Unimportant, (7) Extremely important

How important are the following attributes for you personally when you are purchasing coffee?

- Price
- Type of roast (light, medium, dark, etc)
- Brand
- Country-of-origin
- Fair trade certified
- Organic certified
- Flavor
- In-store promotion (whatever is on sale)
- Rainforest Alliance certified
- Size of packaging
- Appearance of packaging
- Caffeine content

GENERAL ATTITUDE TOWARDS COFFEE
7-point semantic differential scale

Please indicate which word best describes how you feel when you drink coffee .

- Bad (1) – Good (7)
- Unpleasant (1) – Pleasant (7)
- Unhappy (1) – Happy (7)
- Depressive (1) – Cheerful (7)
- Negative (1) – positive (7)
- Terrible (1) – delightful (7)

SUSTAINABILITY CONCERNS
7-point scale: (1)- only slightly concerned, (7) extremely concerned)

How concerned are you personally about each of the following issues?

- The use of child labor in food production
- Deforestation of the rain forest
- Starvation and malnutrition in the world population
- The use of pesticides used in food production
- Poor treatment of animals in food production
- Environmental damage caused by human use of land and water
- The amount of food that is wasted
- Using too much of the world's natural resources for food production
- Poor working conditions and wages for food producers
- Packaging that is not recyclable
- The amount of packaging used on products
- Carbon emissions caused by food production
- The amount of energy used when transporting food products
- The amount of energy used when cooking food products

Appendix I: Marginal WTP ($/12 oz) for sustainability labels on coffee for the mean fixation count (Model 2) and mean fixation time (Model 3) (n=81) (Chapter 5)

	Model 2		**Model 3**	
	Mean (st. error)		Mean (st. error)	
USDA Organic	1.14 ***	(0.21	1.16 ***	(0.21)
Rainforest Alliance	0.80 ***	(0.20)	0.83 ***	(0.19)
Fair Trade	0.66 ***	(0.19)	0.68 ***	(0.19)
Carbon Footprint	0.28	(0.20)	0.31	(0.20)

*** indicates significance at 1% level.

Appendix J: MNL parameter estimates (n=645) (Chapter 6)

Fixation count		FC = 2				FC = 1	
ANA modelling	Full AA	Serial ANA		Choice task ANA		Serial ANA	Choice task ANA
Def. ignored attribute		Def. A	Def. B	Def. A	Def. B		
		defA-S	*defB-S*	*defA-CT*	*defB-CT*	*FC1-S*	*FC1-CT*
Fair Trade	0.32**	0.61***	0.66***	0.76***	0.80***	0.49***	0.57***
USDA Organic	0.81***	1.26***	1.08***	0.80***	0.75***	0.89***	0.74***
Rainforest Alliance	0.57***	0.68***	0.58***	0.60***	0.57***	0.62***	0.53***
Carbon Footprint	0.05	0.26*	0.33**	0.52***	0.59***	0.14	0.28**
Price	-0.59***	-0.61***	-0.51***	-0.49***	-0.38***	-0.58***	-0.57***
No_Buy	-5.12***	-5.36***	-4.45***	-4.35***	-3.35***	-5.10***	-4.99***
Log likelihood	-401.4	-394	-429	-444	-479	-397	-411
AIC	814.8	800.5	870.0	899.7	969.4	805.8	833.4
BIC	841.7	827.3	896.8	926.5	996.2	832.6	860.2

Note: *, ** and *** indicate statistical significance at 10%, 5% and 1% level, respectively.

[1] With fixation count of one as cut-off, definition A and B are the same.

Summary

Public interest in sustainability issues has significantly increased in recent years due to heightening consumer concerns about the way their food is produced. While consumers care about the physical properties of their food, they also increasingly consider the ethical and environmental attributes in food, which are generally known as sustainability attributes. This has led to the growth of the number of voluntary sustainability labeling schemes used by food manufacturers to differentiate their products. Additionally, the incorporation of sustainability aspects in food policies is gaining importance and some dietary guidelines now advise consumers to purchase food with sustainability labels. Sustainable food choices can be encouraged by information-oriented approaches which educate, promote and empower consumers to make sustainable food choices, such as food labeling, marketing and advertising campaigns, and educational programs. This dissertation focuses on sustainability labeling as an information provision tool which allows for more informed food choices and encourages sustainable food choice.

Since the sustainability characteristics of foods are credence attributes, consumers need to be informed about these attributes to be able to make informed decisions. Sustainability labels are tools that give consumers the opportunity to take sustainability characteristics into account. Whether consumers will use these labels depends on their motivation and ability to use them. The influence of sustainability labeling on food choice and the consumer preferences towards a wide range sustainability labels are studied. The involvement in sustainable diets and healthy diets are investigated. Involvement can be a motivational factor to use sustainability labels during the decision-making process. The knowledge and awareness of organic labels are examined which relates to the ability to use the information. Finally, visual attention to sustainability labels during food choice and its relation to choice behavior are investigated.

From an empirical point of view, this dissertation contributes to a better understanding of consumer preferences towards and willingness-to-pay (WTP) for sustainability labels. A wide range of sustainability labels focusing on various aspects of sustainability are included: labels for Organic, Carbon footprint, Animal welfare, Free range, Fair trade and Rainforest alliance and these were applied in studies on three food categories: dairy (yoghurt), meat (chicken breast) and coffee. Dairy and meat were included as food categories as animal-based products are associated with a large environmental burden. The coffee industry is viewed as a pioneering industry for sustainability certification and coffee has the largest market share compared with other Fair Trade products. Due to the increasing proliferation of these sustainability certification schemes for coffee and the trend of using multiple certifications by producers, coffee packages commonly carry several sustainability labels. For this reason, coffee is used as a third food category in which the trade-offs between sustainability labels were studied. From a methodological point of view, this doctoral dissertation applied different stated

preference methods including payment card and choice experiments (CE). Furthermore, it used eye-tracking technology, an innovative approach especially in agricultural economic research, to measure respondents' visual attention and visual attribute non-attendance (ANA) of the food attributes. Based on the conceptual framework as well as the empirical and methodological applications, a total of five main research objectives were discerned.

The first objective was to explore how sustainable diets are perceived and study the consumers' involvement in sustainable and healthy eating. Consumers perceived the profiles of 'a healthy diet', 'a sustainable diet' and 'a plant-based diet' as highly compatible. This finding suggests that food policies that combine health and sustainability aspects into communication actions and guidelines may not be perceived as conflicting by consumers and may reinforce each other. Consumer involvement to healthy and sustainable eating is an important motivator to make healthy and sustainable food choices. Segments that are involved in sustainable eating are also involved in healthy eating, while the opposite is not necessarily true. This illustrates that health still matters more – and to more consumers - than sustainability. Policy actions aiming at informing consumers about the consequences of their dietary choices for their personal health and the environment are recommended, as these may raise awareness, concern, and involvement. Subsequently, when consumers are more concerned about these issues, attach more personal importance to it and are more involved in healthy and sustainable eating, it will motivate them to make sustainable food choices and use sustainability labels.

The second objective focused on consumers' preferences for sustainability labels on yoghurt, meat, and coffee. The results suggest that consumers are willing to pay a premium for food with sustainability labels. Belgian consumers prefer the Belgian Biogarantie organic logo, certified by a private organization, over the EU organic food logo which was introduced in 2010. Comparing consumers' preferences for four types of sustainability claims on meat related to organic meat, free range, animal welfare, and carbon footprint indicated that claims related to animal welfare and outdoor access are preferred. Nine in every ten Belgian consumers favor free range claims and a vast majority of consumers would welcome the introduction of an EU level animal welfare label. The consumer preferences for sustainability labels on coffee, the pioneering industry for sustainability certification schemes were investigated in the US and found that USDA Organic was preferred followed by Rainforest Alliance, Fair Trade, and Carbon Footprint. The studies in both Belgium and in the U.S. indicated that the Carbon footprint label is the least preferred. This might be due to the low familiarity and confusion about its meaning.

The third research objective was to explore the awareness and knowledge of organic labels which relates to the ability to use the labels. Results indicated the low awareness and recognition of the EU

organic logo compared to the Biogarantie logo. With the recognition of a label as an important prerequisite for its success, it suggests a need for more effective information campaigns and marketing actions on the EU organic logo. Not only awareness but knowledge in its meaning and trust in the label are also important.

The fourth research objective was to explore how visual attention to sustainability labels and to price relates to preferences and food choice. With an increasing number of sustainability labels on food, it is important to improve our understanding of consumers' visual attention to sustainability labels. Attention to sustainability labels is a precursor to processing the information and an indication of the use of sustainability labels. The use of sustainability leads to informed food choices and encourage sustainable food choice. While a large body of literature employs self-reported use of sustainability labels, this dissertation moved beyond the reliance on self-reported measures of sustainability label use during food choice, and instead used eye-tracking measures to quantify the visual attention given to sustainability labels while making food choices. This dissertation hereby provides a first study addressing this research gap by studying visual attention to sustainability labeling and its relation to choice behavior. The findings showed that people who visually attend more to sustainability labels value them more and are more likely to choose coffee carrying these labels. A relation was found between the preference, importance, WTP for sustainability labels on the one hand and visual attention given to these attributes during food choice on the other hand. Eye-tracking measures reveal meaningful information about the value that consumers attach to the product attributes when making food choices and contributes to explaining choice behavior.

The fifth and final research objective focused on the incorporation of visual ANA based on eye-tracking measures to account for ANA in CEs. Researchers cannot assume that respondents have attended to all the attributes in a CE and have processed all of the information in a fully rational manner. Given that CEs are commonly used to assess attribute valuation, there is an urgent need for methods to account for ANA. Previous studies accounted for ANA by relying on self-reported ANA behavior (stated ANA) or by attempting to infer ANA based on respondents' choice behavior (inferred ANA). Instead, in this study, eye-tracking measures were used to evaluate visual ANA to the attributes in a CE. Results show that different coefficient estimates and WTP values can emerge if one considers visual ANA vis-à-vis the full attendance model. However, not all attributes classified as ignored were truly ignored attributes. These results suggests that the adequate approach for visual ANA might depend on the attribute itself and calls for more research on how to optimize the use of eye-tracking in the context of ANA into choice modeling.

Samenvatting

De algemene belangstelling voor duurzaamheid is aanzienlijk toegenomen in de afgelopen jaren als gevolg van de toegenomen consumentenbezorgheden omtrent de manier waarop voedsel wordt geproduceerd. Consumenten houden rekening met de fysische eigenschappen van hun voeding maar houden ook steeds meer rekening met ethische en milieuaspecten, d. i. duurzaamheids-eigenschappen. Dit heeft geleid tot de groei van het aantal vrijwillige duurzaamheidslabels die door de voedselproducenten kunnen gebruikt worden om hun voedingsproducten te differentiëren. Bovendien is de integratie van duurzaamheidsaspecten in het voedselbeleid steeds belangrijker en sommige voedingsrichtlijnen adviseren consumenten om voedsel te kopen met duurzaamheidslabels. Duurzame voedingskeuzes kunnen aangemoedigd worden door informatie-georiënteerde benaderingen die consumenten onderwijzen, hen aanmoedigen en in staat om duurzaam voedingskeuzes te maken, zoals voedingsetikettering, marketing en reclame campagne, educatieve programma's. Dit proefschrift is gericht op als duurzaamheidslabels als informatievoorzieningstool om leiden tot meer geïnformeerde voedingskeuzes en om duurzame voedselkeuze te stimuleren.

Het signaleren van duurzaamheidseigenschappen van voeding is een grote uitdaging omdat dit geloofsattributen zijn, die alleen gekend zijn voor consumenten indien ze hierover geïnformeerd worden. Duurzaamheidslabels zijn instrumenten die consumenten de mogelijkheid geven om duurzaamheidseigenschappen in overweging te nemen. De motivatie en bekwaamheid van de consumenten zal beïnvloeden of ze deze labels gaan gebruiken bij het maken van keuzes. De invloed van duurzaamheidslabels op de voedingskeuze en de consumentenvoorkeuren voor een verscheidene duurzaamheidslabels werd bestudeerd. De betrokkenheid in duurzame voeding en gezonde voeding werden onderzocht, welke een motivatie kan zijn om duurzaamheidslabels te gebruiken bi het maken van voedingskeuzes. De kennis en het bewustzijn van biolabels werd onderzocht en dit is gerelateerd aan de bekwaamheid van het gebruik van duurzaamheidslabels. Tot slot werd ook de visuele aandacht voor duurzaamheidslabels tijdens voedselkeuze onderzocht.

Vanuit een empirisch oogpunt draagt dit proefschrift bij tot het verkrijgen van een beter inzicht in consumentenvoorkeuren en -waardering van duurzaamheidslabels. Een breed scala aan duurzaamheidslabels gericht op verschillende aspecten van duurzaamheid komen aan bod in dit proefschrift. Deze omvatten duurzaamheidslabels voor biologische productie, carbon footprint, dierenwelzijn, vrije uitloop, fair trade en rainforest alliance en werden bestudeerd in drie voedselcategorieën: zuivel (yoghurt), vlees (kip) en koffie. De voedselcategorieën zuivel en vlees werden gekozen omdat dierlijke producten geassocieerd worden met een grote milieubelasting. De koffie-industrie wordt aanzien als een baanbrekende industrie voor duurzaamheidscertificering en koffie heeft het grootste marktaandeel in vergelijking met andere Fair Trade producten. Door de toenemende toepassing van duurzaamheidslabels op koffieproducten en de producententrend om

gecertificeerd te zijn voor meerdere duurzaamsheidslabels, is het gebruikelijk om verschillende duurzaamheidslabels op koffieproducten terug te vinden. Bij gevolg werd koffie aangewend als een derde voedingscategorie waarvoor de consumentenafwegingen tussen duurzaamheidslabels werden bestudeerd. Vanuit een methodologisch oogpunt, past dit proefschrift verschillende "stated preference methods" toe, zoals payment cards en keuze-experimenten (CEs). Bovendien werd eye-tracking technologie toegepast in combinatie met CEs, een innovatieve aanpak, vooral in de landbouweconomie. Dit liet toe om de visuele aandacht en de visuele attribute non-attendance (ANA) voor bepaalde attributen van de respondenten te evalueren. Op basis van het conceptuele kader en de empirische en methodologische toepassingen werden vijf algemene onderzoeksdoelstellingen onderscheiden.

De eerste doelstelling was het onderzoeken hoe een duurzaam dieet gepercipieerd wordt en het bestuderen van de consumentenbetrokkenheid in een duurzame en gezonde voeding. Consumenten ervaarden de profielen van 'gezonde voeding', 'duurzame voeding' en 'een plantaardig dieet' als zeer compatibel. Deze bevinding suggereert dat het combineren van gezondheids- en duurzaamheidsaspecten in voedselbeleid niet als tegenstrijdig wordt ervaren door consumenten en elkaar kunnen versterken. Consumentenbetrokkenheid in gezonde en duurzame voeding is een motivatie zijn om gezonde en duurzame voedselkeuzes te maken. Segmenten die betrokken zijn in duurzaam eten, zijn ook betrokken in gezond eten, maar het omgekeerde is niet altijd waar. Dit illustreert dat gezondheid belangrijker wordt bevonden dan duurzaamheid. Beleidsmaatregelen die gericht zijn op het informeren van consumenten over de gevolgen van hun voedselkeuzes voor hun eigen gezondheid en het milieu worden aanbevolen. Deze kunnen bewustwording, bezorgdheid en betrokkenheid stimuleren. Vervolgens, wanneer consumenten meer bezorgd zijn over deze zaken, er meer persoonlijk belang aan hechten, zal het hen motiveren om duurzame voedingskeuzes te maken en duurzaamheidslabels te gebruiken.

De tweede doelstelling was gericht op de consumentenvoorkeuren van duurzaamheidslabels op verpakkingen van yoghurt, vlees en koffie. De resultaten suggereren dat consumenten bereid zijn om extra te betalen voor voeding met deze labels. De Belgische consumenten verkiezen het Belgische Biogarantie logo boven het Europees biologisch voedsel logo, dat geïntroduceerd werd in 2010. Belgische consumenten verkiezen labels met de vrije uitloop en dierenwelzijnlabels op vlees over biologische en carbon footprint labels. Negen op de tien Belgen heeft een voorkeur voor vrije uitloop claims en een overgrote meerderheid zou de invoering van een dierenwelzijnslabel op EU niveau verwelkomen. De consumentenvoorkeuren voor duurzaamheidslabels op koffie, de baanbrekende industrie voor duurzaamheidslabels, in de VS waren onderzocht en toonden aan dat USDA biologische label werd geprefereerd, gevolgd door Rainforest Alliance, Fair Trade en carbon footprint label. De

studies in zowel België als in de Verenigde Staten toonden aan dat een label voor carbon footprint het minst geopteerd wordt. Dit kan het gevolg zijn van de lage bekendheid alsook de verwarring over de betekenis van dit label.

De derde doelstelling was het onderzoeken van het bewustzijn en de kennis omtrent biologische labels. Dit is gerelateerd aan de bekwaamheid van het gebruik van het label. De resultaten toonden een lagere bewustzijn en herkenning van het EU biologisch logo ten opzichte van het Biogarantie logo. Met het oog op een succesvol geharmoniseerd EU biologisch logo met een hoge herkenning suggereert dit resultaat dat er behoefte is aan meer doeltreffende informatiecampagnes en marketing acties. Niet enkel de herkenning en het bewustizjn van het label zijn van belang met ook de kennis van de betekenis alsook het vertrouwen in het label.

De vierde doelstelling was het verkennen van de relatie tussen enerzijds de visuele aandacht voor duurzaamheidslabels en prijs en anderzijds de consumentenvoorkeuren en voedselkeuzes. Met een toenemend aantal duurzaamheidslabels op voeding, is het zinvol om de visuele aandacht voor duurzaamheidslabels te bestuderen. Aandacht voor het label is een voorwaarde voor het verwerken ervan en is een aanwijzing voor het gebruik. Het gebruik van duurzaamheidslabels leidt tot geïnformeerde voedingskeuzes en het stimuleren van duurzame voedselkeuzes. In plaats van zelfgerapporteerd gebruik van duurzaamheidslabels, wordt in dit proefschrift gebruik gemaakt van eye-trackingmetingen om de visuele aandacht voor duurzaamheidslabels te kwantificeren bij het maken van voedselkeuzes. Dit proefschrift is eerste studie die aandacht heeft voor de onderzoekskloof omtrent de visuele aandacht voor de duurzaamheidslabels en de relatie hiervan met keuzegedrag. De bevindingen toonden aan dat mensen die visueel meer aandacht geven aan duurzaamheidslabels deze labels meer waarderen en ook meer waarschijnlijk kiezen voor koffie met deze labels. Een relatie werd bevestigd tussen de voorkeur, belang, en prijspremium voor duurzaamheidslabels enerzijds en visuele aandacht voor deze eigenschappen tijdens voedselkeuzes anderzijds. Het gebruik van eye-tracking onthult zinvolle informatie over de consumentenwaardering van productattributen bij het maken van voedingskeuzes en draagt bij tot het verklaren van het keuzegedrag.

De vijfde en laatste doelstelling was gericht op de integratie van visuele ANA (“attribute non-attendance”) op basis van eye-tracking om ANA in CE te verhelpen. Onderzoekers kunnen er niet van uitgaan dat respondenten alle productkenmerken op een volledig rationele manier verwerken. Aangezien CEs een vaak gebruikte techniek is om attributenwaardering te onderzoeken is er een dringende behoefte aan methoden die rekening houden met ANA. Voorgaande studies hielden rekening met ANA door het gebruik van zelfgerapporteer ANA gedrag (“stated ANA”) of door ANA te proberen afleiden op basis van het keuzegedrag (“inferred ANA”). In plaats daarvan wordt in deze

studie gebruik gemaakt van eye-tracking om “visual ANA” te evalueren. Resultaten tonen aan dat rekening houden met visuele ANA de resultaten beïnvloedt. Niet alle attributen die werden geïdentificeerd als visueel genegeerd waren ook daadwerkelijk genegeerd. Deze resultaten suggereren dat de adequate aanpak voor visual ANA zou kunnen afhangen van het attribute zelf en dringt aan op meer onderzoek naar het gebruik van eye-tracking in de context van het incorperen van ANA in keuzemodelleren.

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Curriculum Vitae

Ellen J. Van Loo graduated in 2008 with a Master of Science degree in Bioscience Engineering at Ghent University. With a Fulbright scholarship and BAEF fellowship, she studied to University of Arkansas were she obtained a Master of Science degree in Food Science. In 2011, after working for an additional year at the Food Science Department at University of Arkansas, she returned to her home country, Belgium and joined the Department of Agricultural Economics at Ghent University as a teaching assistant. Ellen's research is in the field of food marketing and consumer behavior. Her expertise is related to consumers' food choices, food policy, food marketing, Behavioral eye-tracking research, Sustainable and healthy food choices, Consumer behavior and consumer decision-making. Ellen is author or co-author of various scientific publications in peer-reviewed journals and presented her results at several international conferences.

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Education

Sept 2011-Current	Agricultural Economics, PhD candidate Ghent University, Belgium
Aug 2008–May 2010	Master of Science, Food Science University of Arkansas, Fayetteville, US, GPA = 4.0
Sep 2005–Jun 2008	Master of Science, Bioscience Engineering University of Ghent, Belgium, Cum laude
Sep 2003–Jun 2005	Bachelor in Bioscience Engineering University of Ghent, Belgium, Magna cum laude

Training

September 2015	Using Eye-Tracking in Social Science Research Projects PhD course Instructors: Martin Meissner, Jella Pfeifer, Thies Pfeiffer, Jacob Orquin. Esbjerg, Denmark.
July 2015	Applying Behavioral and Experimental Economics to Food and Agri-Environmental Issues AAEA post-conference workshop San Francisco, US.

August 2014	Recent Trends in Experimental Economics EAAE pre-congress workshop Ljubljana, Slovenia.
April 2014	Discrete Choice Experiments StatUa and Department of Economics workshop Instructor: Roselinde Kessels University of Antwerp, Belgium.
January 2014	Logistic Regression Flanders Training Network for Methodology and Statistics (FLAMES) Ghent University, Belgium.
September 2012	Experimental Auctions: Theory and Applications in Food marketing and Consumer Preferences Analysis Instructors: R. M. Nayga, J. L. Lusk, A. Drichoutis. University of Bologna, Imola, Italy.
Fall 2011	Advanced Methods of Marketing Research Instructor: P. Van Kenhove Ghent University, Belgium.

Honors - Fellowships & Awards

2015	International mobility grant, Research Foundation Flanders (FWO) Scholarship for attending the workshop "Using eye-tracking in social science research projects", Esbjerg, Denmark.
2015	International mobility grant, Research Foundation Flanders (FWO) Scholarship for attending the Agricultural & Applied Economics Association (AAEA) Annual Meeting, San Francisco, US.
2014	International mobility grant, Research Foundation Flanders (FWO) Scholarship for attending the Agricultural & Applied Economics Association (AAEA) Annual Meeting, Minneapolis, US.
2014	International mobility grant, Research Foundation Flanders (FWO) EU Atlantis framework program in Rural Development and Agricultural Economics Scholarship to visit Korea University, Seoul, South-Korea.
2013	Faculty mobility grant, EU Atlantis framework program Scholarship to visit University of Florida, Gainesville, US and University of Arkansas, Fayetteville, US.
2012	Conference Scholarship for Young Assistants from Scientific Research Committee (CWO) Scholarship to present research at the 126th EAAE conference.
2012	Best Paper Award Finalist Wageningen International Conference on Chain and Network Science. WICaNeM 2012.
2008-2009	Belgian American Education Foundation (BAEF) Award and Fellowship Scholarship to study in US.
2008-2011	Fulbright Fellowship Scholarship to study in US.

2006 Scholarship for Renewable Resources and Clean Technology International Program
Scholarship for exchange to University of Arkansas, Fayetteville, AR, US.

Publications

International Peer-Reviewed Articles in Journals included in the ISI Web of Science

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Oral Presentations at Conferences

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Verbeke, W., and E. J. Van Loo. 2014. Food quality, food safety and certification strategies. 14th Congress of European Association of Agricultural Economists (EAAE): "Agri-Food and Rural Innovations for Healthier Societies". August 26-29, 2014, Ljubljana, Slovenia.

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Van Loo, E. J., V. Caputo, R. M. Nayga, and W. Verbeke. 2012. Consumers' valuation of sustainable food labels. 126th EAAE Seminar "New challenges for EU agricultural sector and rural areas. Which role for public policy?", June 27-29, 2012, Capri, Italy.

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Vanhonacker, F., E. J. Van Loo, X. Gellynck, and W. Verbeke. 2012. Belgian consumer attitudes towards more sustainable meat consumption patterns. 10th Wageningen International Conference on Chain and Network Management . May 23-25, 2012, Wageningen, The Netherlands.

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Invited Speaker

Van Loo, E.J. 2015. Consumers and sustainability. Summer School, Sustainability in the Agro-Food Chain, Program for students of Univ. of Arkansas. May 12, 2015, Ghent University, Ghent, Belgium.

Van Loo, E. J. 2014. Accounting for attribute non-attendance in food choice experiments using eye-tracking measures. Invited seminar. June 26, 2014, Department of Agricultural and Resource Economics, Korea University, Seoul, South Korea.

Van Loo, E. J. 2013. Consumer valuation of sustainability labels on meat. March 28, 2013, the Food and Resource Economics Department, University of Florida, Gainesville, FL, USA.

Van Loo, E. J. 2012. Consumentenwaardering voor duurzaamheidslabels op vlees. Annual BAMST meeting (Belgian Association for Meat Science and Technology). October 16, 2012, Merelbeke, Belgium.

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Zanoli, R., S. Mandolesi, S. Naspetti, T. Latvala, P.K. Nicholas, S. Padel, and E. J. Van Loo. 2015. D5.3: Assess the acceptability of novel production strategies.: Consumer survey results. Report for Project Sustainable Organic and Low Input Dairying (SOLID), 7th Framework Programme from European Commission. KBBE.2010.1.2-02.

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Professional Memberships

Agricultural and Applied Economics Association (AAEA), European Association of Agricultural Economists (EAAE), Belgian Association of Agricultural Economists (BVLE)

Journal Reviewer

Agricultural Economics, American Journal of Agricultural Economics, Appetite, British Food Journal, Ecological Economics, Food Policy, Food Quality and Preferences, Journal of Economic Psychology, Meat Science, Revista Internacional de Sociología (RIS), Sustainability.