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Consumers' Willingness to Pay for Safer, Cleaner and Animal Friendlier Beef

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Disposição dos consumidores a pagar por carne de bovino
com maiores níveis de segurança sanitária, bem-estar animal e proteção do ambiente

RESUMO

A variedade de produtos alimentares disponíveis nas prateleiras dos supermercados é interminável, satisfazendo necessidades que vão muito além da necessidade alimentar. Nesta perspetiva, há uma infinidade de produtos que podem ser valorizados pelos consumidores, mas que não estão disponíveis nos mercados. Paralelamente a este potencial, os consumidores têm aumentado os seus níveis de consciência e preocupação com a forma como os alimentos são produzidos, nomeadamente em relação a produtos alimentares de origem animal. Alguns segmentos de consumidores estão mesmo dispostos a pagar mais por produtos produzidos sob padrões que eles consideram atender às suas preocupações.

Neste contexto, o tema de investigação desta tese envolve a valoração económica de produtos de carne bovina, que são diferenciados pela presença de atributos relacionados com a segurança sanitária da carne, bem-estar animal e proteção ambiental.

Portanto, a questão central desta pesquisa é: estarão os consumidores dispostos a pagar por produtos de carne de bovino com atributos específicos, tais como a segurança sanitária, bem-estar animal ou normas ambientais, que vão além dos requisitos mínimos legalmente impostos? Esta pergunta foi respondida tendo em vista os seguintes objetivos específicos: a revisão das questões técnicas mais relevantes a serem resolvidas tendo em conta a sua relevância para os consumidores; a realização de grupos de discussão para avaliar quais as principais preocupações dos consumidores sobre bem-estar animal, segurança sanitária da carne e meio ambiente no contexto da produção de carne de bovino; a implementação de um estudo de experiências de escolha para permitir estimar (através da utilização de um modelo MNL) o quanto, em média, estão os consumidores dispostos a sacrificar dos seus orçamentos familiares, a fim de comprarem esta carne diferenciada.

Esta amostra de consumidores portugueses declarou estar disposta a pagar mais pela carne diferenciada. A elevada significância das estimativas MNL alcançada sugere a necessidade de valorar em conjunto atributos intimamente relacionados, nomeadamente devido à presença esperada de interações negativas muito significativas.

As conclusões incluem a sugestão de que algumas das preferências dos consumidores são na realidade preferências de cidadãos, o que pode advir da indiscutível natureza pública da segurança sanitária, bem-estar animal e meio ambiente.

Finalmente, do ponto de vista empresarial, esta pesquisa mostra algumas estratégias de diferenciação possíveis, que podem ser implementadas com base em atributos como a origem nacional e os sistemas de produção tradicionais.

PALAVRAS-CHAVE

Atributos acreditados; carne de bovino; disposição a pagar; experiências de escolha; grupos de discussão; multinomial logit; preferências declaradas; preferências do consumidor.

Consumers' Willingness to Pay for Safer, Cleaner and Animal Friendlier Beef

ABSTRACT

The variety of food products available in supermarkets shelves is endless, fulfilling necessities that go beyond the need for food. In such perspective, there are an infinite number of products that might be valued by consumers, but are not available in markets, i.e. non-market goods. Alongside these potential, consumers have increased levels of awareness and concern about the way food is produced, namely food products of animal origin. Some consumer segments are even willing to pay more for products produced under standards they consider to meet their concerns.

Within this framework, this thesis' research topic involves the economic valuation of beef products which are differentiated through the presence of attributes related with beef safety, animal welfare an environmental protection.

Therefore, the question central to this research is: Are consumers willing to pay for beef products with specific attributes such as food safety, animal welfare or environmental standards, going beyond legally imposed minimums? This question was answered having in mind the following specific goals: the review of the most relevant technical issues still to be solved and worth analyzing; the discussion during focus groups of consumers' main concerns regarding animal welfare, food safety and the environment related with beef production and beef products; the implementation of a choice-experiment survey to allow estimating how much, on average, are consumers' willing to sacrifice from their households' budgets in order to buy this differentiated beef product, through the use of a MNL model.

Our sample of Portuguese consumers stated they are willing to pay a premium for differentiated beef. A high significance for the MNL estimates was achieved and we found evidence of the need to jointly value closely related attributes namely due to the expected presence of very significant negative interactions.

Additional conclusions include the suggestion that some of the stated consumer preferences are in fact citizens' preferences, which may arise from the undisputable public nature of food safety, animal welfare and the environment.

Finally, from a corporate perspective, this research shows some potentially differentiating strategies that could be implemented based on attributes such as national origin and traditional production systems.

KEYWORDS

Beef; choice-experiments; consumer preferences; credence attributes; focus groups; multinomial logit; stated preferences; willingness to pay.

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List of Abbreviations and Symbols

AW	Animal welfare
BRC	British Retail Consortium
BSE	Bovine Spongiform Encephalopathy
CAP	Common agricultural policy
CCP	Critical control points
CE	Choice experiments
CP	Control points
CVM	Contingent valuation method
EDU	Economic Dimension Units
EFSA	European Food Safety Agency
EFSIS	European Food Safety Inspection Service
ENV	Environment
EU	European Union
EUREPGAP	Euro-Retails Produce Working Group
FAO	Food and Agriculture Organisation of the United Nations
FAWC	Farm Animal Welfare Council
FFP	Five Freedoms and Provisions
FS	Food safety
GAP	Good Agricultural Practice
GDP	Gross Domestic Product
GFSI	Global Food Safety Initiative
GLOBALG.A.P.	Global Good Agricultural Practice
GMO	Genetically Modified Organism
GPP	Gabinete de Planeamento e Políticas
GVA	Gross Value Added
HACCP	Hazard analysis and critical control point
IDRHa	Instituto de Desenvolvimento Rural e Hidráulica
IFS	International Food Standard
IIA	Independence from irrelevant alternatives
INE	Instituto Nacional de Estatística
ISO	International Organization for Standardization
MNL	Multinomial Logit Model
NOAA	National Oceanic and Atmospheric Administration
OIE	World Organisation for Animal Health
PDO	Protected designation of origin
PGI	Protected geographical indication
RP	Revealed preference
SP	Stated preference
UK	United Kingdom
USA	United States of America
WHO	World Health Organization
WTO	World Trade Organization
WTP	Willingness-to-pay

List of Publications

This thesis was based on the following manuscripts
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Viegas, I., Vieira, A., Stilwell, G., Santos, J.L., Aguiar Fontes, M. (2011) Is there a link between beef quality and animal welfare in traditional beef systems? ***New Medit***, 3/2001: 17-25.

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URL: http://ageconsearch.umn.edu/bitstream/115551/2/Viegas_Ines_60.pdf

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URL: http://www.fmv.utl.pt/spcv/PDF/pdf6_2012/91-100.pdf

Viegas, I., J.L.Santos, A.Barreto, M. Aguiar Fontes (2012) Meat Safety: A Brief Review on Concerns Common to Science and Consumers. ***International Journal of Sociology of Agriculture and Food***, 19(2): 275-288.

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Viegas, I., M. Aguiar Fontes, J.L.Santos. Beef Production in traditional silvopastoral systems - A second best for the environment? Submitted to the journal ***Ecosystem Services,*** April 2013.

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The research work also resulted in the following posters and oral presentations

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PART I

Part I is devoted to the Introduction and it includes a debate on societies, markets and food consumption, a review on the concepts related with food quality and an analysis of the methodologies that can be used to assess consumers' preferences and willingness to pay for food products.

Chapter 1 focuses on the evolution of the market environment, consumers' behaviours and preferences towards food, in an attempt to frame the relevance of this research.

Chapter 1
A debate on markets for beef products

1.1 Globalization, dynamic societies and changing consumers

"The sheer novelty and glamour of the Western diet, with its seventeen thousand new food products every year and the marketing power – thirty-two billion dollars a year – used to sell us those products, has overwhelmed the force of tradition and left us where we now find ourselves: relying on science and journalism and government and marketing to help us decide what to eat."
– Michael Pollan, in Defence of Food: An Eater's Manifesto, 2008.

The more classic approach to the economics of food consumption states that consumers' income and prices are among the most important determinants of food choice. As income rises, the weight of food expenditure in the total households' expenditure decreases. In Portugal, the share of expenditure on food products decreased from 18.7% of the total expenditure in 2000 to 13.3% in 2010/2011 (INE, 2012).

One of the consequences of this income rise is that with lower income restrictions, families get to diversify and broaden the bundle of food purchases (Blaylock, Smallwood, Kassel, Variyam, & Aldrich, 1999), and factors such as consumers' preferences, beliefs and concerns play a more dominant role. Meat, for example, is more frequently part of meals as incomes grow – as the impressive change in China's previously predominantly vegetarian diet shows (Delgado, 2003).

As such, the most fundamental concepts surrounding food consumption have been changing for a while now, and consumers are increasingly choosing their food taking into consideration physiologic, psychological or sociological factors (Blaylock, et al., 1999).

Some socio-demographic changes in today's societies are playing an important role. Western societies are getting older, families are becoming smaller, and women are working more. People (old and young) are increasingly sedentary and moving away from rural areas. A more positive perspective shows that societies in developed economies are becoming generically more educated, better informed and more diverse.

All these changes across societies have impacted food consumption in almost all the possible perspectives, namely the time dedicated to shopping, confection and eating. Time for these activities is very scarce for most segments of society, and convenience has become

a very important factor for shopping decisions. But if convenience is important, quality is a characteristic that consumers consider more and more indispensable and unquestionable as they get better off.

Consumers with higher incomes are more prone to buy premium products, and even for products that are typically seen as having a low degree of differentiation, like meat (and beef in particular), quality characteristics (in a broad sense of the word, as it will be discussed further ahead) are increasingly of interest.

Furthermore, consumers are also looking for new food indulgencies and discoveries, such as new flavours (or foreign flavours), new textures or new packages. Also, the aspects of food related to health are ever more relevant for consumers' choices, leading to concerns with nutritional, safety and functional aspects of food (see chapter 6 for a review on consumers' concerns related with meat safety and e.g. Verbeke, Frewer, Scholderer and De Brabander (2007) for work on consumers' behaviour with respect to food safety and risk information). Finally, altruistic interests related with the way food is produced also influence consumers' choices, namely those related with sustainability (see, e.g., Aldanondo-Ochoa and Almansa-Sáez (2009) for a discussion on consumer's interest for environmentally friendlier food products and Lusk and Norwood (2012) for a debate on altruistic concerns about farm animal welfare).

Easier access to information – namely since the ubiquitous internet phenomenon – allows consumers to search for all these food products with the characteristics they are looking for, and to verify whether (whatever sort of) allegations are true.

As a response to these eager necessities of today's societies – or on another perspective, as a motor to generate them (Caswell & Joseph, 2007) – food products are more and more differentiated, with more value-added features, trying to reach (and to be specific) a wider variety of consumer segments. As markets turn global and miles turn shorter, the competition increases. Driven by markets' competition and consumers' demand, new products' development keeps generating new goods[1], and in some cases price isn't a limitation (Grunert, Bredhal, & Brunso, 2004)[2].

Food companies and retailers strategies are now shaping products' prices and availability. Marketing strategies are in many cases carving consumers' needs, perceptions and motivations, thus changing shopping behaviours and consumption patterns. This marketing environment is also providing incentives for food producers to differentiate their products, even at the farm level.

So, food is changing from a production perspective too. For better or worse, the technological evolution has led food to a completely different place than where it was a few decades ago. As in many other aspects of society, the last fifty years have seen more change, than the fifty centuries before.

Food is now safer, that is indisputable. It's mostly sold under proper conditions so it is unlikely to find unsound food at supermarket shelves. It's better looking, easier to prepare and eat (consider, for example, boneless hake or cod), more accessible to different income

1 However, the failure rate for new food products is stated to be between 60 and 80% (Grunert & Valli, 2001).

2 Worth mentioning that the income constraint will always play a role in food choices, and that the economic crisis that many European countries are going through will most certainly have reflexes on food consumption habits and on many products' sales – specially those more differentiated and premium priced.

segments and in a wider location range (kiwis from New Zealand in the antipode Portugal are a very good example). But it is also unhealthy in many aspects (Silver & Bassett, 2008), as it is more processed, has more additives and preservatives.

Finally, food is increasingly less sustainable. The food chain is increasingly longer and produces more waste and disposable by-products. Producing food consumes more resources than ever (although the efficiency levels are indisputably higher than ever), namely water and energy. This is particularly significant if one considers the entire chain of harmful effects of the production of food products of animal origin, which is responsible for growing levels of air, water and soil pollution[3].

Many food production sectors are also responsible for rearing livestock under conditions that are debatable, to say the least. Often, the need to gain efficiency and reduce production costs has lead to inhumane rearing conditions for many farm animal species.

Still, as for all the other aspects, societies, markets and consumers evolved, producing, regulating and searching for food products that are safer and produced in environmentally and animal benign ways. Organic food, natural food, local products, free-range products are just examples of such food products that try to counteract these unsustainable and deleterious aspects of the food production, namely that of animal origin.

Nevertheless, there is evidence showing that supply and demand haven't completely ajust to safer, cleaner and animal friendlier food products, and it is this issue that has become central to this research.

1.2 A note on food production and public policies in the European Union

Not only because of the previously mentioned deleterious aspects of food production, public policies also had their say on the food sector. Public interventions have focused on establishing production standards (labour regulations, environmental and livestock protection standards, etc), food safety regulations and publicity control, just to name a few examples (Caswell, 1998).

For example, European Union (EU) food producers are subject to a demanding regulatory framework, as farmers have to comply with many standards to be eligible for Common Agricultural Policy (CAP) income support[4], to operate within the law and even to get

3 Chapter 8 includes a brief review on the environmental impact of livestock production. For an exhaustive and disturbing review consider Steinfeld et al. (2006).

4 "The cross compliance mechanism's objective is to contribute to the development of sustainable agriculture and making the CAP more compatible with the expectations of society at large. It was firstly introduced on a voluntary basis in the Agenda 2000 and was further developed in the 2003 CAP reform for all the Member States (art. 3-9, Council Regulation No 1782/2003, repealed by Council Regulation (EC) No 73/2009). Cross compliance creates a link between the full payment of support under the CAP's first pillar and under some rural development measures (CAP's second pillar). In order to get payments farmers shall be compliance with parts of 19 existing and already implemented regulations or directives (the so-called Statutory Management Requirements) which cover rules relating to agricultural productions, lands and activities in the three areas of the environment, the public, animal and plant health and the animal welfare. Furthermore, farmers must guarantee that their land is in Good Agricultural and Environmental Conditions, which concern the issues of soil erosion, soil organic matter, soil structure, minimum level of maintenance, protection and management of water and maintaining the total area of permanent pasture. http://ec.europa.eu/agriculture/envir/cross-compliance/index_en.htm

contracted by increasingly demanding retailers. Animal production farms are no exception to this. As all agricultural operations in the EU, they must comply with a set of regulations, which define minimums for food safety, the environment and animal welfare.

Either by direct regulation of price formation structures or by conditioning production costs, these regulations really influence production costs – namely in aspects related with food safety, animal welfare and the environment – and are hence part of the price formation system for food within the European market (Olynk & Ortega, 2013).

Considering the cases for which the EU market is more protected (namely as it is for beef, our case-study's object) higher costs due to regulation are usually transferred to consumers through higher prices. However, not all food products reach the market with the same production costs, once different economies are subject to different levels of regulation, wages, or any other relevant conditions.

If it is assumed the future will bring increased levels of world trade liberalization and consequently less protected markets in Europe for beef and other food items, production costs and the price formation mechanisms become even more relevant, as they may determine whether European food producers will be able to compete (through product differentiation or other possible ways) with imports coming from countries with lower regulatory levels[5].

It is thus clear that public regulations with consequences on food products can have effects on consumers' choices, either by influencing prices or by impacting food product's availability. Equally relevant is the influence such regulations have had on many dimensions of food products' quality[6].

5 Regulatory impositions related with food safety, animal welfare and the environment are increasingly considered as non-tariff barriers to trade by the World Trade Organization (WTO) as they are seen as means to hinder free trade. The trend will most likely be towards their end, i.e., countries with high regulatory levels will increasingly be forced to accept the import of products produced under lower levels of regulation (Blandford, 2006; Fraser, 2008).

6 A note should probably be made at this point on the differences between European and American consumers. Even if one considers only food consumption, there are obviously many differences between intra-European consumers, due to countless country-specific products, habits, preferences, etc. However, the difference between Europe and the United Stated of America (USA) is probably deeper and is reflected in the scientific literature. For example, in the USA it is possible to administer beef cattle with growth hormones, which is forbidden within the European Union. And whereas within the EU it is mandatory to include beef origin on labels, this is still an open discussion in the USA Accordingly, the evaluation of consumers' concerns related with beef safety need necessarily to be different. Another example can be found on the awareness about the environmental impact of beef production. Beef production in the USA is very different from the EU, which implies different consumers' and citizens' perceptions and concerns.
Therefore, most of the scientific literature here quoted involves research made in the EU and based on European consumers and should be interpreted within such geographical borders. The most frequent exceptions involve methodological issues, for which the research location has little impact.

Chapter 2 is devoted to the concepts related with food quality attributes and consumers' perceptions, namely those regarding beef quality attributes.

Chapter 2
Does it all fit in a beef?
Food quality attributes and consumers' perceptions

2.1 Food Quality Attributes

Along with the changes on the relationship between consumers' and food, there has been an evolution of the notion of food quality itself. As such, when it comes to food, society is ever more aware of issues other than simple availability, and the inferred quality dimensions of a product depend on consumers' experience, knowledge, and beliefs, which can vary significantly from one person to another (Alfnes, 2004).

Quality dimensions can thus be defined as "product-specific characterisations that consumers form based on a product's attributes and that they believe indicate the usefulness of the product in fulfilling purchase motives" (Bech, Grunert, Bredhal, Juhl, & Poulsen, 2001)[7]. If different characteristics of food production – such as the welfare of production animals – are considered food attributes as perceived and valued by consumers, then they will determine a product's quality (Grunert, 2005).

Also, according to Grunert (2005), it should always be taken into account that there are two different meanings for quality: objective quality (which regards the physical characteristics of a food product) and subjective quality (which is the quality as perceived by consumers). Objective quality must be translated into quality attributes that consumers' subjectively evaluate through different types of cues (Brunso, Bredhal, Grunert, & Scholderer, 2005; Grunert, 2005).

Food quality attributes can be classified under several different perspectives (Fontes, Seabra, & Lemos, 2011)[8]:

- Process or product attributes;
- Search, experience or credence attributes.

Product attributes are related with physical characteristics of the food products and with the way those characteristics are communicated to consumers. Process attributes are related to characteristics of the production process, like production with due concern for food safety, animal welfare and the environment, and they do not necessarily lead to a different final product (Caswell, Bredahl, & Hooker, 1998; Northen, 2000). Although they are not explicit within the product, they can influence the consumer's welfare if properly communicated.

A different perspective into food quality attributes classifies them as either search, experience or credence attributes. Search attributes can be ascertained at the time of purchase. Experience attributes are those which are only ascertainable after purchase and consumption. Finally, credence attributes are those which consumers can never ascertain by

7 This definition is very much related with Lancaster's Consumer Theory whose main concept was not to view the consumer as choosing between different goods but between different characteristics which the goods themselves provided (Lancaster, 1966). The relevance of Lancaster's Theory will be fully considered in chapters 3 and 12.

8 For a complete review on the main concepts and definitions related with food products' quality from the consumers' perspective see Fontes et al. (2011)

themselves, having to trust the quality judgement of others (Bech, et al., 2001; Nelson, 1970; Northen, 2000).

Many process-related quality dimensions, as well as some product-related ones, are credence dimensions (Bech, et al., 2001; Grunert, et al., 2004) and consumers must rely on quality cues, which in fact are search attributes (as first defined by Steenkamp (1990)) , in order to choose which product is expected to have the quality dimensions they wish to purchase. These search attributes, or cues, can also be distinguished as intrinsic and extrinsic. Intrinsic quality cues are part of the physical product such as colour or fat content, and cannot be altered without changing the characteristics of the product itself. Extrinsic quality cues deal with everything else that is product-related, such as price, brand or packaging (Bredhal, 2003; Olson & Jacoby, 1972).

Price effects as quality cues are ambiguous (Rao & Monroe, 1989; Zeithaml, 1988), but brands have undisputable effects on perceived quality[9] (Bredhal, 2003). Either way, they are used by consumers – together with many other possible cues – to make inferences about a food product's quality (Grunert, 2005)[10].

Concerning the beef attributes central to this research – i.e. food safety, animal welfare and the environment – there are some aspects worth debating, namely regarding their classification according to the aforementioned definitions. Such assortment has implications not only for the understanding of consumers' attitudes, but also in methodological discussions that will be held further ahead (chapters 3 and 12).

Food safety, animal welfare and the environment are credence attributes. There is no way for the consumer to verify whether production methods were animal friendly or environmentally sustainable. The only available option is to trust the information provided.

But food safety could be considered to be an experience attribute as well. If it is considered that a deleterious effect could be somewhat immediate after a food product's consumption (stomach flu would be an appropriate example) it can be argued that food safety is experienced after consumption. However, as there are many food safety hazards that would only be detectable in the long run, food safety is considered a credence attribute (Grunert, 2002). Consumers can only trust, and have no way to verify (at least on the short term) that their food is safe. It is worth mentioning that consumers' awareness degree is permanently shifting and is greatly influenced by close and recent food scares (Grunert, 2005).

In the perspective of the definition by Caswell et al. (1998), food safety also presents some degree of duality. It is a process-related attribute (as are animal welfare and the environment), but it is also a product attribute – through a health-related quality dimension (Grunert, 2005; Northen, 2000). Here lies a major difference between food safety and the other two attributes with consequences for this research. As food safety is a characteristic of the final product, it can be sold directly through the selling of food as a private good, and hence it has also a higher direct market-creation potential[11].

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9 "The ``perceived quality'' approach analyses product quality from the viewpoint of the consumer, making quality a subjective assessment dependent on perceptions, needs and goals of individuals" (Northen, 2000).

10 See chapters 9 and 10 for insights on Portuguese consumers about prices and brands associated with beef quality.

11 For a more elaborate discussion of the classification of food safety, animal welfare and the environment as private or public goods see chapter 3.

Nevertheless, meat is a food category where consumers face particular difficulties in forming quality judgements, especially because meat is mostly sold unbranded (Bredhal, 2003; Grunert & Valli, 2001). Moreover, it is worth mentioning that consumers have been known to make some inferences that may not be particularly reasonable and are indicative of the level of uncertainty that is faced while shopping for this kind of food (Verbeke, Frewer, Scholderer, & De Brabander, 2007). Thus, there are still many doubts about the existence of an indirect market for these attributes.

Therefore, once food safety, animal welfare and environmental protection are three concerns consumers have about modern food production systems (Madureira, Rambonilaza, & Karpinski, 2007; Napolitano, Girolami, & Braghieri, 2010), the question still to be answered is if it is possible to indirectly sell them through marketable food (e.g. differentiated beef)?

2.2 Consumers' perceptions of beef quality attributes – meat safety, animal welfare and the environment

Indisputably, consumers search for process-related quality dimensions has increased for the last decades (Grunert, et al., 2004; Olynk & Ortega, 2013; Verbeke, Wezemael, et al., 2010). Even more, Resurreccion (2003) claimed that the decline in the consumption of meat products in the UK was related to consumer concerns about food safety, animal welfare and the environmental effects of beef production.

There is thus a stimulus for food products differentiation, as increases in organic products' sales and other quality labels based on credence process attributes – like Protected Designation of Origin (PDO) – seem to confirm (Grunert, 2005; Pouta, Heikkilä, Forsman-Hugg, Isoniemi, & Mäkelä, 2010)[12].

There has been a somewhat constant research on what are the attributes that consumers consider to be relevant when shopping for beef and many attributes have been pointed out as influencing the quality perception of beef, as consumers consider meat to be an important part of their diets (Verbeke, Pérez-Cueto, De Barcellos, & Krystallis, 2010), and beef to be a particularly appreciated type of meat (Verbeke & Vackier, 2004).

There are many reports on consumers' expressed concerns relative to meat safety, the welfare of production animals and the environmental impact of food production, which can be summarized as ethical and altruistic concerns (Bernués, Olaizola, & Corcoran, 2003a; Brom, 2000; Harvey & Hubbard, 2013). Nevertheless, production related concerns are often more associated with inferences about the safety of food products (Bernués, et al., 2003a; Lusk & Norwood, 2012; Verbeke, Pérez-Cueto, et al., 2010)[13].

In this perspective, lack of naturalness in the production process, excessive preparation and manipulation are negative characteristics for consumers, due to the association with negative impacts for health (Angulo & Gil, 2007; Verbeke, Pérez-Cueto, et al., 2010).

There are also frequent concerns related with the presence of drug residues (Olynk &

12 See chapter 5 for some data on Portuguese market for differentiated beef products.

13 A more elaborate enunciation of this inference process can be found in chapter 12.

Ortega, 2013; Vanhonacker, Poucke, Tuyttens, & Verbeke, 2010), although often consumers don't have the ability to specify which substances they are concerned with[14].

The last two decades have been proliferous in meat related food scares, with increased public awareness (Fearne, Hornibrook, & Dedman, 2001; Wezemael, Verbeke, Kügler, de Barcellos, & Grunert, 2010)[15]. Beef products have sadly been associated with the probably most severe of these situations, Bovine Spongiform Encephalopathy (BSE). It is likely that safety related attributes in beef products have since then assumed a particular relevance (Grunert, 2002; Verbeke & Viaene, 1999), even if market shares have been slowly recovering across Europe (though still below the initial consumption levels).

The public intervention – namely within the EU – has also significantly increased subsequently (Knowles, Moody, & McEachern, 2007)[16] as have privately managed quality (and safety) assurance schemes (Fearne, et al., 2001; Verbeke, Pérez-Cueto, et al., 2010). However, the mandatory traceability information can have little value as a safety cue (Angulo & Gil, 2007; Verbeke & Roosen, 2009), contrasting with the expiration date that is used by many consumers as a proxy for freshness and safety (Angulo & Gil, 2007; Verbeke & Ward, 2006)[17].

Either way, beef safety is considered difficult to assess by many consumers and choosing a butcher as a source of trust and guaranteed safety is not unusual (Grunert & Valli, 2001; Wezemael, et al., 2010). About 50% of Portuguese consumers still made this choice in 2007 (Project AGRO 422, 2004-2007). Also worth mentioning is the fact that most consumers don't consider to have a relevant degree of responsibility for the safety of the beef they eat (and for any other food items, for all that matters) (Verbeke, et al., 2007; Wezemael, et al., 2010).

Another attribute that has been used by consumers, who consider it to be a cue for higher quality, is the place-of-origin (Bernués, Olaizola, & Corcoran, 2003b; Sepúlveda, Maza, & Mantecón, 2008; Verbeke & Roosen, 2009). There are several different possible origin denominations, related with regions or countries, and some are even subject to EU's regulations (namely the PDO and the Protected Geographical Indication – PGI)[18].

In many cases, origin (namely the country of origin) is an important cue for consumers to assess the safety of beef (Henson & Northen, 2000; Verbeke & Ward, 2006), and a national product is often considered safer[19]. Consumers also regard origin as a quality attribute due to strong association to the protection of local values and heritage (Acebrón & Dopico, 2000; Bernués, et al., 2003a).

In spite of all the described preoccupations and inferences related with beef safety, the fact is that consumers consider that if a given food product is available for purchase, it must

14 Chapter 6 discloses in detail the main concerns consumers seem to have about meat safety and points out some misconceptions behind those concerns.

15 For a comprehensive insight about the current debates about meat safety issues see chapter 6.

16 Chapter 6 also includes a review on the most relevant body of legislation impacting on food safety in general and meat safety in particular.

17 A more detailed analysis of what consumers use as cues for beef safety was achieved during the focus groups discussions held within this research framework. The qualitative results are presented in chapters 9 and 10.

18 The legal framework concerning PDO products is described in chapter 5.

19 This particular conception was very much patent during the focus groups discussion held within this research framework – see chapters 9 and 10.

be safe (Verbeke, Pérez-Cueto, et al., 2010; Wezemael, et al., 2010). This feeling moves away safety concerns during shopping decisions – with exception of the cases when a recent food scare occurred (Angulo & Gil, 2007; Verbeke, et al., 2007).

The same sort of dissociation between stated concerns and shopping decisions is also patent in the case of animal welfare and the environment. A well know and described phenomenon of voluntary ignorance allows consumers not to think about uncomfortable matters while making shopping decisions (Lagerkvist & Hess, 2011; Ngapo, et al., 2003; Vanhonacker, et al., 2010).

Still, it is very likely that most consumers are unaware of the true environmental consequences of livestock production (Vanhonacker, Van Loo, Gellynck, & Verbeke, 2013). Nevertheless, considerable consumer segments are increasingly concerned with this deleterious impact – and of bovine cattle production in particular – due to its contribution to climate change (Troy & Kerry, 2010) and thus some are willing to make environmentally friendlier choices.

Regarding the welfare of production animals, consumers are demanding that animals are reared, transported and slaughtered in humane conditions (Troy & Kerry, 2010; Vanhonacker, et al., 2010). In the case of beef, besides the ones previously mentioned, particular concerns relate with the wish to see animals grazing in good life conditions and low stocking densities, as opposed to industrial fattening operations[20].

Additionally, there are also references to consumers who associate higher welfare standards to an increased sensorial quality of beef (Vanhonacker, et al., 2010), which is to some extent supported by scientific evidence (Blokhuis, Keeling, Gavinelli, & Serratosa, 2008)[21]. If it is considered that experienced quality is one of the most important characteristics for most consumers in terms of repeating a purchase (Banovic, Grunert, Barreira, & Aguiar Fontes, 2010; Verbeke, Wezemael, et al., 2010)[22], animal welfare as a quality attribute gains increased relevance.

It should also be stressed that the organic denomination is a quality attribute from which consumers make many inferences (Grunert, 2002; Hughner, McDonagh, Prothero, Schultz II, & Stanton, 2007). Although some of those inferences are not scientifically supported, the fact is that many consumers regard organic meat as safer (namely due to lower levels of drug residues) and to be produced in more humane and environmentally friendlier way (Aldanondo-Ochoa & Almansa-Sáez, 2009; Hughner, et al., 2007).

Still, if there are all these cares and concerns about the environmental and animal impact of food production, the fact is that they aren't translated into higher market shares for differentiated products like organic ones.

20 Chapters 9 and 10 describe consumers' descriptions of what they consider animal welfare to be.

21 An up to date review of the relation between beef cattle welfare and the quality of beef products can be found in chapter 7.

22 For an extensive work on beef quality perception, namely related with experienced quality see the work of Banovic et al. (2010) and Banovic et al. (2009).

2.3 A duality between consumers and citizens

All these consumer stated concerns can sometimes be a mirror of their worries as citizens (Brom, 2000; Verbeke, Pérez-Cueto, et al., 2010). This duality explains why many consumers hold (sometimes strong) negative views about the way animals are produced and about the negative environmental impact of such products but still consume meat products (Mørkbak, Christensen, & Gyrd-Hansen, 2010; Napolitano, et al., 2010; Verbeke, Pérez-Cueto, et al., 2010). Moreover, when animal or eco friendlier products are available (but somewhat more expensive), many consumers are unwilling to purchase them, even if their ethical convictions as citizens are supportive of such sounder production methods (Vanhonacker, et al., 2010).

Public concerns about beef quality may therefore change depending whether they are assessing it on an everyday purchase context or on a production evaluation context, in what is translated into a paradox of incoherence in sayings-doings (Korzen & Lassen, 2010).

Furthermore, many consumers actually think that the responsibility for assuring that food is safe and that animals and the environment are properly protected belongs, in fact, to the Government (Verbeke, Pérez-Cueto, et al., 2010), which coincides with the reasoning that these process attributes are, at least to some extent, public goods (Harvey & Hubbard, 2013)[23].

The work here presented focuses mostly on presenting to consumers beef products (that are differentiated due to the presence of credence attributes) in a market setting. However, it would be likely that significantly different results would be obtained if the setting was one of a referendum. Such setting would lead consumers to act as citizens in a voting situation, rather than making a purchase decision (Korzen & Lassen, 2010; Olynk & Ortega, 2013). The final paragraphs of chapter 3 elaborate on some of the work undertaken in this direction, but that was abandoned early in this research.

Nevertheless, it is important to stress that the economic valuation tools that will be described subsequently would allow the distinction between these two different mind-sets and a very rich field of investigation lies on the comparison between what people want to pay as consumers and as citizens.

23 As previously noted, a more elaborate discussion on the classification of food safety, animal welfare and the environment as private or public goods can be found on chapter 3

Chapter 3 includes an essential characterization of the attributes under scrutiny as public or private goods and debates use and non-use values associated with them. Furthermore, non-market valuation methods are described in detail.

Chapter 3
Economic valuation of non-market goods

As it has been shown, there are many new food products with many new different attributes constantly becoming available for consumers, who may be willing to pay for them. Such willingness to pay represents the amount of money a person would be willing to sacrifice in order to receive a good, attribute or service[24]

In such a context, the search for new differentiated products with attributes valued by consumers (or at least by some consumer segments) is endless. Therefore, there are food attributes and food products that might be valued by consumers, but are not available in markets (at least yet), which fits the definition of non-market goods[25].

In private markets the more common transactions involve private goods which are routinely bought and sold in the marketplace and raise very few questions about the possibility of assigning them a monetary value. The possibility of a transaction actually occurring is influenced, among other things, by the good's attributes. However, for non-market goods there are doubts on whether it is possible to sell them or to capture their whole value through private markets.

Along this research it was intended to broaden this concept somewhat further by considering that the credence attributes involved in this research – i.e. food safety, animal welfare and the environment – can be considered non-market attributes of beef products (which are market goods)[26]. A considerable part of their relative unavailability in private markets is the public good character associated with the production of these three attributes.

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24 More precisely, and going beyond the strict context of food consumption, willingness to pay is the amount of money a person would be willing to sacrifice in order to receive a good, attribute or service, or to avoid something undesired (such as pollution, for example) and have their utility remain the same. Therefore, willingness to pay can be formulated by looking into the indirect utility function: $U = V(Y,S,Q)$, where U=utility, Y=income, S=demographic/economic variables, Q=level of provision of the goods/attributes/services.
The maximum willingness to pay (WTP) (or Compensating Variation; see Bateman et al. (2002) for a detailed explanation on the WTP and compensating variation concepts and other related issues), is denoted as C, ,and is defined as the value of C that ensures the following equality: $V(Y - C, S, Q_1) = V(Y,S,Q_0)$. Thus WTP is the amount of payment which, combined with the presence of the good, gives the person the same level of utility as would occur if there were no payment and no acquisition of the good.

25 For some research areas this definition may sound somewhat abusive. However, it's commonly accepted throughout the literature related with the valuation of environmental goods, which are usually not traded in markets. The use of the term applied along this thesis suggests that these non-market goods (goods not traded in markets) can be conveyed through their association with private goods, commonly traded in markets, and for which there is a market price. We believe that, for example, part of the value of an eco-friendly product comes from the product itself, but that some of the value comes from that non-market good that is being delivered through a private good.

26 The concept is far from new (see, e.g. Lusk, Nilsson and Foster (2007); Lusk et al. (2007) refer to "private goods with affiliated public good attributes" and has extensively analyzed the availability and transaction of such public attributes through private goods) , but may raise some argument in other research areas. For example, in public transport services, there is a concept of minimum public service obligation, which guarantees that the private good (a transport service) includes attributes (a minimum service and / or operating hours, for example) that fulfill public standards. Still, the underlying reasoning is the same: there is a need to fulfill the demand for desired attributes, whose provision is difficult to guarantee exclusively under pure market conditions.

3.1 Private goods with affiliated public good attributes

Pure public goods are characterized by the conditions of non-excludability (in that individuals cannot be effectively excluded from use) and of non-rivalry (where use by one individual does not reduce availability to others) (Samuelson & Nordhaus, 2009). These characteristics make it very difficult to capture their whole value through market transactions (namely due to free-riders, who benefit from the good without paying for it) and to fully compensate the public goods' producers (Lagerkvist & Hess, 2011)[27].

Focusing on livestock production practices and in goods with affiliated public-goods attributes (such as beef and the attributes under research), markets cannot or are unwilling to supply the levels desired by society of food safety, animal welfare or environmental protection, which justifies the need to regulate livestock production practices. Public intervention is thus necessary to guarantee the desired level of provision that matches societies' demand (Baldcock, Hart, & Scheele, 2011; Harvey & Hubbard, 2013).

However, sales of private goods with public goods' attributes have notably increased in recent years (Lusk, et al., 2007). In fact, Harvey and Hubbard (2013) point out that "the extent of consumers' willingness to pay for improved animal welfare products can indicate the extent of market failure", i.e. how much animal welfare is not being provided to fulfil societies' demand (Lusk & Norwood, 2012). The same reasoning can be extrapolated for the environment and food safety.

In fact, traditionally food safety has been thought of as a public good (e.g., BSE control regulations in the EU were governmentally imposed and the consequent food safety is non excludable). However, it has been described as an income-elastic (as income increases, demand for food safety is likely to rise) and price-inelastic good (consumers would be willing to pay premiums for safer products) (Swinbank, 1993). Market would therefore theoretically allow consumers to buy a product they consider safer (for example, organic meat) at a higher price. This would give food safety a more private character, as it would have rivalry and excludability characteristics.

Having these private characteristics – and because it has a direct and sometimes immediate repercussion on consumers' welfare and health – food safety is therefore, somewhat "easier to sell" than the other two attributes. Therefore, even if societies' demand can't be left entirely on the hands of market forces (Mørkbak, Christensen, & Gyrd-Hansen, 2010), by being easier to sell it is possible that real willingness to pay (WTP) for food safety will be easier to disclose through valuation methods[28] .

27 This leads to the definition of market failure, i.e. a situation where the allocation of goods and services by a free market is not efficient. Markets fail to provide an efficient allocation of resources in the presence of imperfect competition, information asymmetry or externalities. Relevant for our discussion are externalities, which arise when activities impose costs or bestow benefits that are not paid for in the marketplace. Governments may decide to step in and regulate these situations (Samuelson & Nordhaus, 2009).

28 This private versus public ambiguity may have helped to the existing variety of willingness to pay reports – see chapter 6.

Animal welfare and the environment – which have more moral and ethical considerations – are more prone to incomplete capture by market prices. Thus it is more a matter of indirectly selling a public good through a private good market. It will never be possible to capture the whole value of these goods, once there will always be expected free-riding (Lusk & Norwood, 2012). There will always exist beneficiaries of the provision of animal welfare and the environment who don't even buy the private good (vegetarians would be a good example for the case of beef).

However, even if without full production costs' recovery, it may be possible to finance at least part of these public goods through private markets (Lusk & Norwood, 2012). For example, it is recognized that organic meat has the potential to correct at least part of the market failure associated with the public nature of environmental externalities of agriculture (Aldanondo-Ochoa & Almansa-Sáez, 2009).

Resuming the discussion on non-market goods (private or public), if they have a positive influence to consumers' welfare, they have economic value and a monetary value can be determined. Economic valuation is the tool which allows the assignment of monetary values to these non-market goods (Bateman, et al., 2002).

In general, it is possible to determine the economic value of any of these non-market goods by one of two ways: revealed preference (RP) techniques and stated preference (SP) techniques. RP techniques value preferences through the analysis of real – revealed – market behaviours and seek to verify whether the demand for the non-market good under valuation has effects on associated goods' markets.

SP techniques ask people how much economic value they think the non-market good has (Bateman, et al., 2002), by asking them to declare how they would behave in an hypothetical situation.

3.2 A brief approach to revealed preferences and to non-use values

As outlined previously, RP techniques use information from markets that are associated with the good or service of interest and are based on the fact that decisions usually made on markets are reliable indicators of preferences (Bateman, et al., 2002; Madureira, Rambonilaza, & Karpinski, 2007). RP techniques include travel-cost method, hedonic price method and averting behaviour. Table 1 shows a brief explanation of each one of these methods.

Table 1: Revealed preferences methods (adapted from Madureira et al. (2007)).

Valuation method	Description
Travel cost method	Estimates the demand for sites using travel costs, which are considered to reveal the individuals' WTP for those sites. Time and money spent on visits leave trail of indirect evidence about the WTP for the services and amenities provided.
Hedonic price method	Estimates demand for non-market goods through demand and prices of multi-attribute market goods which include non-market goods as attributes versus others that don't include them (e.g.: Housing).
Averting behaviour	Estimates the monetary value of a public good by observing the demand (and associated costs) for goods and services that avoid the loss of that public good (e.g.: demand for water filters that ensure water safety).

A more profound discussion on RP methods is beyond this research's scope. It is however relevant to mention their limitations as a contribution to supporting the use of SP methods.

As credence quality attributes as those here analyzed are not often present in the markets beyond regulation-imposed levels, the use of RP methods to value them will necessarily face data availability problems.

Looking at complementary or substitute traded goods or services as a measure of the demand for a public good implies that there are only direct use motivations. However, non-use values (or passive-use values) are commonly associated with goods of public nature and cannot be captured by RP methods because there is no "meeting-point" between consumers and the good or service (Madureira, et al., 2007). Table 2 includes a brief description of the different types of non-use values.

Table 2: Non-use values (adapted from Mitchell and Carson (1989) and Lazo, McClelland and Schulze (1997)).

Non-use value	Description
Option value	The value placed on preserving a good or service even if there is little or no likelihood of ever using it, because of the otherwise uncertainty about future supply and also because of potential future demand (e.g.: preserving biodiversity due to the potential of discovery of new drugs).
Bequest value	The value that the current generation places on a given resource being available for future generations (e.g.: agricultural biodiversity).
Altruistic value	The value of knowing that animals are treated in humane way.
Existence value	The value of simply knowing that a particular good exists even if one never consumes it or takes direct benefit from its existence (e.g.: a particular autochthonous beef cattle breed).

Keeping these definitions present allows suggesting that the supply of public goods through their association with food products' attributes can represent the provision of non-use values. In other words, the demand for credence attributes will often be associated with consumers placing non-use values on food products' attributes. This can be considered a straightforward association for animal welfare and the environment, for which it is quite simple

to accept the existence of most kinds of non-use values.

Again, food safety will be the attribute that exhibits a somewhat different character, as it can be considered to have direct use value. If food safety is regarded as a product and an experience attribute (albeit its process and credence attribute character, as it was discussed along section 2.1), consumers possibly also place direct use motivations upon it.

It can also be advocated that there is a very close relationship between these non-use values' definitions and the aforementioned consumer-citizen duality, which leads to the recognition of the possible methodological difficulties associated with valuing consumers' preferences rather than assessing citizens' choices. Either way, a stated preference method would be the selected tool.

3.3 Stated preference methods

Stated-preference methods, such as contingent valuation[29], choice experiments and conjoint analysis, can elicit consumers' preferences for goods in constructed, not real markets. Through the use of proper hypothetical market-scenario design it becomes possible to circumvent the lack of available data by generating the required (hypothetical) data. They mostly constitute survey methods based on recognized axioms and rules of consumer choice for the derivation of monetary value assigned by respondents to attributes under consideration. Table 3 displays a brief description of the different SP methods available.

Table 3: Stated preference methods.

Valuation method	Description
Contingent valuation (CVM)	Uses hypothetical markets to ask individuals' WTP for changes in quality or quantity of goods and services. Uses a general verbal (sometimes graphical) scenario followed by a WTP question.
Choice experiments (CE)	Uses hypothetical markets to make individuals choose from a choice set comprising goods representing different combinations of the same attributes. One of the attributes is a price variable. The repeated choices of favoured goods in a set allow for indirect derivation of WTP.
Contingent ranking	Uses hypothetical markets to make individuals rank goods in a choice set comprising goods representing different combinations of the same attributes.
Contingent rating	Uses hypothetical markets to make individuals rate goods in a choice set comprising goods representing different combinations of the same attributes.
Conjoint analysis	More general designation for marketing research exercises, including some of the above methods (i.e. contingent rating and ranking).

29 The CVM should not be mentioned without a historical reference to the Exxon Valdez and the NOOA guidelines. The Exxon Valdez oil spill in Prince William Sound was the first time when the CVM was used in the assessment of the value of environmental damages. Making a long story short, after that legal action, and in response to criticisms, a panel of experts was convened by the National Oceanic and Atmospheric Administration (NOAA) in 1993. The consequent recommendations were that contingent valuation surveys should be carefully designed to address a series of shortcomings. For more on this subject see, e.g. Arrow, et al. (1993), Bateman, et al. (2008), Carson, et al. (1996), Carson, et al. (1995).

All of these SP methods have been extensively used for valuing each one of the attributes this research is dealing with[30]. Moreover, these methods can also be used to jointly value multiple attribute changes, which is (as argued in chapter 12) a crucial task for properly assessing real consumer WTP[31].

They are also very flexible methods to verify the value given by respondents to almost infinite combinations of attributes, allowing to assess the trade-offs consumers make among food safety, animal welfare and environmental quality. Even if these attributes are often closely jointly produced, there are cases where they are not, and the assessment of these trade-offs can be relevant for product and process design. When it is not, these trade-offs may still be of practical importance, as they deliver a better understanding of consumers' relative preferences for the three attributes, which can be used to improve the information about a beef product.

Within this research framework, the SP methods specifically under scrutiny were the contingent valuation method (CVM) and choice experiments (CE), which is the reason why the methodological descriptions will refer to them from this point on[32].[33]

3.4 Common grounds for the Contingent Valuation Method and Choice-Experiments

CVM and CE use surveys to elicit people's preferences and WTP (Mitchell & Carson, 1989). Both circumvent the absence of markets for the goods or attributes in question by presenting consumers with hypothetical markets where they have the opportunity to buy such goods (Mitchell & Carson, 1989). Through proper survey and sampling design, CVM and CE secure more complete estimates of economic values, including use as well as non-use values, when compared to other methods.

Depending on the purpose of the research, the hypothetical market can be a private market, or a political market (Mitchell & Carson, 1989). Therefore, these methods may elicit different responses for the same individuals, depending on whether the hypothetical scenario surveys them as citizens (vote in a referendum with an implied tax raise, or more expensive goods to all consumers due to general increased production costs) or as consumers.

However, that should not be regarded as a downside for these methods, once in real life

30 The literature review of the state-of-the art research on the valuation of these attributes is present in chapter 6 (food safety), chapter 7 (animal welfare) and chapter 8 (the environment).

31 The argument on the joint valuation of attributes that are jointly produced and are substitutes of each other – as it is the case of food safety, animal welfare and the environment – can be found in chapter 9 and with more detail in chapter 12.

32 Contingent rating and ranking were not assessed at any point of this research, but some information on this subject can be found in Mackenzie (1993) or Siikamaki and Layton (2007). Conjoint analysis was briefly studied due to its application in some work related with beef products, namely in Sawyer, Kerr and Hobbs (2008) and Schnettler, Vidal, Silva, Vallejos and Sepúlveda (2009). Also worth mentioning some references to inconsistencies of conjoint analysis (Louviere, Flynn, & Carson, 2010) and contingent rating and ranking (Hanley, Mourato, & Wright, 2001) with economic demand theory.

33 Although not part of the work or the literature review undertaken, a reference should be made to experimental auctions as a tool for eliciting consumers' WTP. This has been a popular tool within experimental economics in which participants submit sealed bids for one or more (improved) products. Real money is involved in the auctions which are considered incentive compatible. For more information on this method see, e.g. Grunert et al. (2009), or Lusk, Feldkamp and Schroeder (2004).

circumstances individuals do have different WTP for some goods depending on their behaviour as consumers or citizens (Vanhonacker, Verbeke, Van Poucke, & Tuyttens, 2007). For example, altruism can dictate the citizen WTP through taxes, but the same good can reveal a zero WTP for a price premium, once the consumer is not willing to pay for someone else's free-riding.

In such a context, a common concern related with stated preference methods is the fact that people tend to state they agree to pay for goods which reflect their ethical concerns and social norms[34]. Still, these overstated WTP values do indicate a support for the provision of the public goods under valuation and reflect societies values and demand (Harvey & Hubbard, 2013). What remains to be answered is how much the citizens would be willing to pay as tax payers or as consumers of goods generically more expensive due to increased production costs.

These differences in individuals' behaviour according to the "role" they are performing stress the need to carefully design the CVM or CE survey, which include choosing a scenario and a payment vehicle in order to elicit use and non-use values associated with the consumer or with the citizen preferences[35].

The hypothetical market should be constructed in detail and to be as plausible as possible, including the good to be valued, the baseline level of provision and the method of payment (Fischhoff & Furby, 1988; Mitchell & Carson, 1989)[36].

Regarding CVM, its most frequent use has been associated with the valuation of public goods and furthermore, with the aim of assessing public policies. Moreover, is has been extensively used on the field of valuation of environmental goods and services. For example, a CVM study could elicit the ex-ante value of a project for reducing air pollution by asking how much respondents' would be willing to pay for that reduction.

The simplest CVM format implies that the respondent is faced with a binary choice between the status quo or policy off option and the alternative policy. The changes introduced by the alternative policy, how it will be implemented and how much it will cost must be clearly specified. Implementing such policy will have some associated costs for people (citizens, consumers or users, depending on the case), and therefore the respondent is faced with a scenario of tax increase, higher prices associated with regulations or a user fee. Respondents thus face a choice of whether or not supporting the presented policy for a given value, which corresponds to the person's willingness to pay (Carson, 2000).

Nevertheless, CVM's results validity have been questioned in part due to hypothetical responses, i.e. there is little incentive for respondents to truthfully reveal their WTP (Grunert, et al., 2009). Possibly due to this disadvantage, a very much relevant body of literature on

34 Harvey and Hubbard (2013) present the reasons that can explain the overstated WTP and a profound discussion on animal welfare as a public good.

35 A further note related with this duality is of interest at this point. This research originally intended to analyze this subject and did develop a CE survey to determine citizens' WTP for animal welfare, food safety and environment in beef products. A more detailed explanation on this part of the work (which was abandoned) can be found in section 3.5. Nevertheless, most of the methodological specifications are applicable to both cases, with the fundamental differences being related with the choice context.

36 There are more specific details on construction of CVM surveys which are out of the scope of this research. The ones here included are common to CVM and CE. The work of Mitchell and Carson (1989) can be suggested as support for the design of a CVM survey.

valuation of private (food) goods with affiliated public good attributes makes use of CE[37].

Moreover, apart from this background, several characteristics of this research lead to the application of CE.

The CE method includes elements of the microeconomic theory of consumer behaviour (namely in what is related with the definition of rational choice theory[38]), but is more particularly a direct application of Lancaster's Consumer Theory (Louviere, Hensher, & Swait, 2000). Lancaster (Adamowicz, Louviere, & Swait, 1998) postulates that utility is derived from the characteristics the goods possess, rather than the goods *per se* (Lancaster, 1966)[39]. Lancaster's theory thus supports this research framework, as it is intended to estimate consumers' willingness to pay for beef attributes.

Also, CE methodology is consistent with utility maximization and demand theory, by allowing consumers to choose for their most preferred option (as long as there is a status quo option, as it will be explained further ahead) (Bateman, et al., 2002). Finally, when there is more than one attribute implicated, this methodology allows for the determination of an implicit ranking of attributes by comparing them in terms of their implicit prices (Bateman, et al., 2002) (which is not possible when CVM is applied).

Finally, given the good involved in this investigation (beef), CE allows for a more realistic and reasonable context in which respondents were supposed to make their choices. CE allows for the existence of several alternatives for respondents to choose from, which mimics more adequately the choice context of a food product.

Therefore, in the present research, CE was elected as the adequate tool for the task of eliciting consumers' willingness to pay for differentiated beef products with animal welfare, food safety and the environment as credence attributes.

3.5 Choice-experiments: methodological aspects and design

CE's econometric framework for explaining choice behaviour is based on random utility theory (RUT) (Hanley, Wright, & Adamowicz, 1998)[40], from which are derived the discrete-choice models available to researchers[41]. The most frequently used model is the Multinomial Logit (MNL) and the most common estimation criterion is maximum likelihood (Adamowicz,

37 This thesis has no intention of analyzing the advantages and disadvantages of CE over CVM. For an insight on this issue consider, e.g. Adamowicz et al.(1998)

38 Economic principle that assumes that individuals always make prudent and logical decisions that provide them with the greatest benefit or satisfaction and that are in their highest self-interest (Samuelson & Nordhaus, 2009).

39 This thesis includes a more elaborate discussion on the fundaments of Lancaster's theory and its relationship with this research on chapter 12.

40 Random utility theory has its roots on the work done by Thurstone almost 100 years ago, who modeled choices between pairs of stimuli (Thurstone, 1927). This work was later extended to multiple choices and comparisons by McFadden (McFadden, 1974), who established the grounds for the multinomial logit model.

41 Chapter 12 includes a detailed discussion on the econometric framework of choice-experiments.

Louviere, et al., 1998)[42].

CE are a survey based method in which respondents are requested to choose between different bundles of attributes or goods (Hanley, et al., 1998), and usually price is included. It is a very reliable method for generating data – as it results in multiple observations – as long as carefully designed choice procedures are applied (Louviere, et al., 2000).

The method's advantages, when compared to other stated preference methods, include the possibility of estimation of individual attributes' values and the identification of attributes' marginal values as well as avoiding the "yea-saying" problem frequently associated with CVM, as usually there is more than one alternative available apart from the status quo option (Adamowicz, Boxall, et al., 1998; Hanley, et al., 1998).

On the side of the challenges associated with CE is the difficulty of defining a choice context (Hoyos, 2010). It must be guaranteed that respondents' are understanding the context, the goods being presented and the attributes being valued properly (Fischhoff & Furby, 1988). However, the good being valued here (a beef product) was helpful in the sense that is usually purchased by consumers during day-to-day shopping situations, which facilitated the plausibility of the choice-situation. The payment vehicle (money, in this case €/kg of beef) represented no difficulty.

Still, the perception of a product's price is a very elaborate mental process, and not always a conscious one. Many consumers' – albeit the fact that they can manage their income restrictions – aren't consciously and permanently aware of the price of all the products they usually buy (Grunert, 2005).

Furthermore, it is clear that habitual purchasing is very relevant for food shopping, and many decisions are made by habit and repetition, and are not based on deliberate conscious choices (Grunert, 2005).

These two facts have implications for choice-experiments' results (or for any other stated choice method) and on the estimated WTP. First, the vast majority of products presented in choice-experiment surveys are not present in the usual shopping basket for most consumers and the choices made may therefore represent choices that would not be made on a day to day context, where consumers can simply ignore new food products. Second, the price information may be significantly more obvious than in shopping situations, which may lead to a price-processing situation that is inflated (Grunert, 2005).

With all these peculiarities associated with CE, it becomes clear that the scrupulous application of all the method's specifications is fundamental. A carefully designed CE thus includes a number of crucial decisions to be made along the entire process, from the characterization of the decision problem, through an appropriate survey design, to the analysis of generated data (Adamowicz, Louviere, et al., 1998; Hoyos, 2010). Table 4 briefly describes the stages of a CE design and includes some specification of the work undertaken along this research.

42 Stimulating future work will involve latent class models, to allow for preferences heterogeneity. Chapter 14 includes some more details on this.

Table 4: Stages of a CE design (adapted from Hanley, Mourato and Wright (2001))

Stage	Description
Selection of attributes	The good to be valued (a beef product) and the attributes under valuation (animal welfare, food safety and the environment) were chosen at the very early stages of the work[1]. A monetary cost (the good's price) should be included as an attribute to allow the estimation of WTP.
Assignment of levels	The attributes' levels should be feasible, realistic and plausible (Fischhoff & Furby, 1988). Literature reviews, focus groups and pilot surveys are fundamental in order to define adequate attribute levels. A baseline status quo level should be included for all the attributes, including price. The inclusion of a status-quo or reference alternative within all the choice sets is widely accepted (and recommended) across the CE literature. This alternative has the intention of framing the decision context, making it closer to reality, which should help respondents' answer in a meaningful way (Hoyos, 2010; Rose, Bliemer, Hensher, & Collins, 2008)[2].
Experimental design Construction of choice sets	Methods of statistical design theory are used to combine the chosen levels of the attributes into a number of alternative scenarios that will be presented to respondents. This is a crucial step as the entire generation of data is supported by a reliable experimental design. The design efficiency is an important feature, as it is a measure of the level of precision in which effects are estimated (Hoyos, 2010). For this research the choice was of an efficient experimental design that allowed the proper estimation of main effects and interaction effects between attributes[3]. All the experimental design parameters choice sets can be found in appendix 1. At this stage the number of choice situations that each respondent will be faced with, as well as the number of alternative per choice situation should be defined (and tested, if possible). The elected choice sets and its combinations are detailed in chapter 12.

1 Chapter 4 includes a detailed explanation of the motivations behind the choices of this good and its attributes, as well of the reasons behind the chosen methodological framework.

2 According to Hanley et al. (2001), one of the alternatives available for consumers to choose must be attainable. If a status quo alternative is not present, respondents would be forced to choose. The following estimates would not only be inaccurate but also not consistent with demand theory.

3 Professor Lívia Madureira (from Universidade de Trás-os-Montes e Alto Douro) delivered the finished choice sets for the survey, allowing that further theoretical specifications related with experimental design lie beyond this researches' framework. A brief yet detailed explanation of the experimental design process can be found in Hoyos (2010).

Regarding the CE implemented for this research, the literature reviews (chapter 6 (meat safety), chapter 7 (animal welfare) and chapter 8 (the environment)) and the focus groups discussions that were organized in order to accomplish the adequate definition of attributes and their levels – i.e. all the work done along the development of the survey's questionnaire – correspond to a large part of this thesis. This fact alone comes to demonstrate how important the first stages of CE are. Finally, all this information was gathered on a questionnaire, including the valuation questions as well as leaflets and tables that were used to inform respondents.

Apart from the valuation questions – to which these last paragraphs refer to – CE surveys typically include several sections which provide information about respondents' behaviours, attitudes, perceptions etc., on the issues related with the good being valued (Adamowicz, Louviere, et al., 1998). Also, a section related with socio-demographic characteristics of respondents is included[43]. A complete version of the questionnaire used in this research can

43 A comprehensive description of all the survey's sections is included in Chapters 11 and 12.

be found in appendix 2.

Reporting to the questionnaire administration, the first stage (a pre-test phase) involved 31 questionnaires administered by the candidate[44]. A convenience sample was chosen, as respondents needed only to be beef buyers and at least in part responsible for the households' shopping decisions. Apart from these criteria, it was intended that respondents in this phase were as varied as possible, in terms of education, income, occupations, etc.

The main goals were to assess whether respondents could easily understand the language, the survey's phrasing and the questions asked. Another objective was to verify if the scenarios presented were comprehensible and if respondents could easily perform the choice tasks. Finally, it was intended to verify whether respondents could deal with five choice situations, or if this was too much of a cognitive burden (which would require the use of a smaller number of choice situations per questionnaire).

The results from this first stage indicated that it was feasible to use five choice situations per questionnaire, and that respondents in general understood it and could perform well. The following work led to the implementation of the main survey, for which it was necessary to define the sampling.

An adequate sampling originates from the definition of the population of interest (Hoyos, 2010). Using an extreme example, inquiring only vegetarians would be of little interest to assess WTP for differentiated beef products. Even if these respondents have non-use values for the attributes at stake, they would certainly originate biased and inaccurate answers by not being consumers of the good elicited.

Therefore, the appropriate sampling for this research was defined according to the following criteria:

- Respondents had to be adult beef consumers (or buyers, at least);

- Only people responsible for the households' shopping decisions were of interest due to the need of awareness of the family's income restriction;

- Once differentiated beef is typically a premium priced product, a biased sample towards higher incomes was elected; as a consequence, the sample was also biased towards older and more educated people;

- Also due to the availability of differentiated beef products, which is more frequent and constant in large urban centres, the samples were selected in the two largest Portuguese cities, *Lisboa* and *Porto*.

All the questionnaires were administered by a professional survey company through face-to-face interviews. A pilot survey involved 100 respondents; a second phase involved 283 respondents and a final phase (which allowed for corrections of the sample) included 232 respondents. In total, the questionnaire was administered to 615 beef consumers.

A final comment should be included conserning to the often mentioned consumer-citizen duality and its implications for this research work. The initial stages of this research intended to assess the different roles people play when choosing a food product as beef. Therefore, the CE survey that was designed had two main versions for which the valuation

44 At this stage a version of the survey that intended to capture citizens' WTP was still applied. Nevertheless, as the entire survey was the same (see the final paragraphs of this chapter for a full explanation on this topic) the goals were the same and the conclusions applicable.

tasks slightly changed.

The product (differentiated beef), the attributes (animal welfare, food safety and the environment) and their levels (0 or 1), and even price levels were the same. Also, the experimental design was the same. The only difference resided on the definition of the market situation that was presented and on the question prior to the first choice task. The market in the "consumer" version was described as if beef producers had a choice of producing beef according to animal welfare, food safety and environmental standards above the legal minimums. This would therefore result in some beef products that would be available at higher prices.

For this version, the first choice task was preceded by the following: "We know that people often say they are willing to choose products that are more expensive than those they would actually be willing to buy. It is important that you respond as if it were a real situation, thinking that this money would not be available for other products. Based on the possible choices what steak would you choose?".

For the "citizen" version the market was presented by introducing new legal standards that would force all producers to deliver safer, cleaner and animal friendlier beef. This would result in an irreversible price increase situation that would be extended to all consumers.

In this case, the following text preceded the first choice task: "Should the Government adopt one of these new laws, these steaks were only available in the market at the highest price. The price increase would be irreversible and it would affect you and all consumers. Taking this into account, which legislation would you support in a referendum?".

As shown, the goal was to have two questionnaires that varied only on the way the valuation questions were asked and develop two surveys. The differences on the estimated WTP would therefore be attributable to the differences between consumers' and citizens' preferences. As the next chapter will clearly show, this part of the research had to be abandoned. Although some questionnaires were implemented (n=494), sampling issues (and a need to put a stop in field work and data analysis) led to the decision of postponing this promising field of research.

Chapter 4
Objectives, organisation and structure

4.1 Stimulus, choices and relevance

As noted along this introduction, the variety of food products that are available in supermarkets shelves is endless and food products fulfil necessities that are very much beyond the need for food.

Nevertheless, it is always possible to idealize a new product that doesn't exist on the market yet. It is also possible to sell an everyday product but with new attributes. And it is even possible to sell an everyday product with all its usual attributes, but from a new perspective, previously not valued by consumers. In such perspective, there are an infinite number of products that might be valued by consumers, but are not available in markets, ***i.e.*** non-market goods.

Alongside these potential, consumers have increased levels of awareness and concern about the way food is produced, namely food products of animal origin. Some consumer segments are even willing to pay more for products produced under regulations or standards they consider to meet their concerns and preferences.

This market environment was one of the main stimuli for this research, along with another one, associated with the CAP. The cross-compliance mechanism introduced a link between farmers' payments and regulations related with animal welfare, food safety and the environment in food production. Moreover, the new CAP is meant to promote production decisions that are more market driven.

However, the research on how much consumers are willing to pay for these attributes on their food products is not abundant particularly if we consider that they should be valued in a bundle.[44]

Finally, as these stimuli involved the valuation of non-market attributes in a food product, the methods to be applied – economic valuation using stated preference methods - were hardly more than a consequence.

Nevertheless, having chosen the research topic, the food product (beef) and its attributes (animal welfare, food safety and the environment), and having (broadly) chosen the research methods (economic valuation), several research routes were available. Although not completely incompatible, they corresponded, to say the least, to different mind frames.

Thus, choosing one of the possible approaches to the main problem was fundamental in order to direct the progress of the investigation, enlightening the work that needed to be done.

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44 There is actually very scarce research if not the consumers but the citizens willingness to pay is considered, which makes the postponed analysis of the second version of the survey an even more relevant work.

Dealing with the three beef attributes simply as differentiating tools would most likely have directed this research to the marketing and consumer behaviour field. However, the literature review carried out at an early stage did not reveal any significant research using beef products with such attributes. This absence would most likely represent future difficulties due to lack of relevance for consumers of the set composed by beef and food safety, animal welfare and the environment as attributes.

Furthermore, the research already initiated (namely undertaking the focus groups – see chapters 9 and 10) showed clearly that investigating the marketing potential of these attributes in beef products, though a relevant question, would probably be too narrow. Therefore, the thesis suggesting that beef productive systems could have an increased market potential simply through (privately) differentiating beef products with animal welfare, environment and food safety as quality attributes would most likely not prevail. At worst, the investigation could face the need to either replace the product or the attributes under research sometime along the way, with the obvious associated problems.

Another research field could be related with the CAP (remembering that the choice of attributes originally emerged from the cross-compliance system) and its impact on the Portuguese beef sector. More specifically, it would be possible to ground this research line on the difficulties this sector has been facing, trying to show that these differentiating attributes could be a route for competitiveness.

Such work would be somewhat unpromising, although it did justify the analysis of the available data regarding a characterization of the Portuguese beef sector, which was translated into a journal article. However, due to the diminished international relevance of this subject it would most likely become very difficult getting any results to be published.

A very promising and even exciting approach to our work would be to elaborate on the economic valuation techniques and to deepen the discussion surrounding the dichotomy consumer-citizen and the not so clear frontiers between public goods and private goods (as exposed on chapter 3). Still, although very inspiring future research perspectives are now available due to some recently acquired knowledge and tools, this line of research was not possible at that time.

After declining these prior approaches, we chose to look at the three quality attributes as research subjects per se, since for all of them there are technical issues to be solved, both from the production side, from the deliverance to consumers' perspective and from the consumers' point of view. The analysis of these unsolved questions should also allow shedding some light onto whether these attributes are better dealt with through public or private mechanisms.

This approach was considered appropriate, first of all, if it is remembered that the institution that hosts this research is a Veterinary faculty, thus allowing fully using the available expertise. Furthermore, it reinforced the applicability of the chosen methodologies (and it also allowed some advances around the economic valuation research line without focusing the entire investigation's goals on it).

4.2 Main goals

There is one question central to this entire research that must be put forward:

> *Are consumers willing to pay for beef products with specific attributes such as food safety, animal welfare or environmental standards, going beyond legally imposed minimums?*

Framing this question within the food quality framework, as quality deals with the "get" aspect of an exchange, and paying for it deals with the "give" aspect (Bech, Grunert, Bredhal, Juhl, & Poulsen, 2001), will consumers "give" more to "get" more of these attributes?

Regarding this global objective, the main specific goals of this research were threefold:

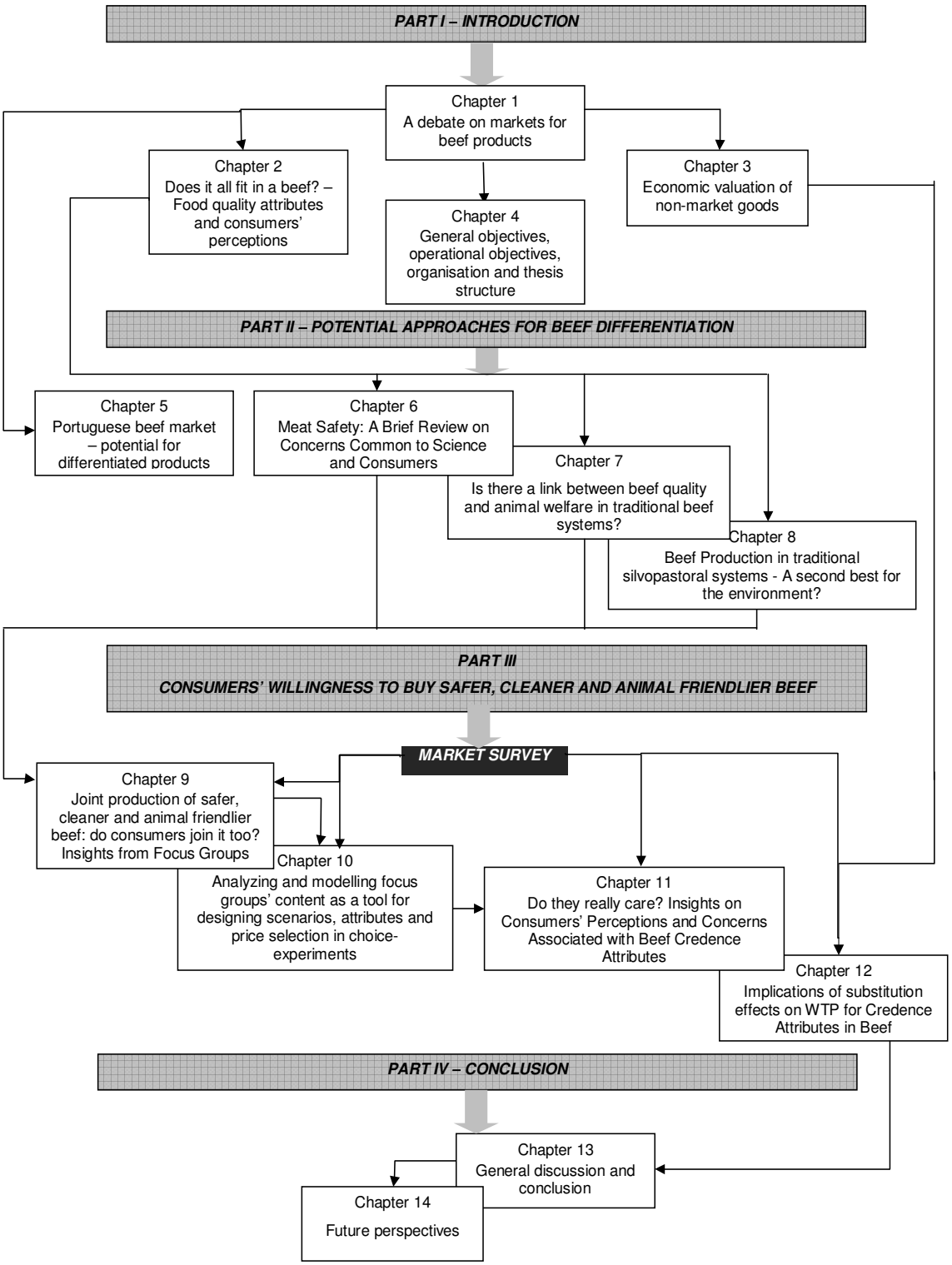
- The identification – through contact with stakeholders and an extensive literature review – for each of the three attributes, of the most relevant technical issues still to be solved and worth analyzing, with the underlying concern that the identified problems would have to be deemed possible at the production stage;
- The identification – through focus groups discussions – of consumers' main concerns regarding animal welfare, food safety and the environment related with beef production and beef products;
- The determination of consumers' WTP for safer, cleaner and animal friendlier beef – i.e. the estimation of how much, on average, are consumers' willing to sacrifice from their households' budgets in order to buy this differentiated beef product

These main goals can be more detailed into specific objectives associated with the thesis structure.

4.3 Organization and specific objectives

A more graphical presentation of the thesis structure (Figure 1) can help elucidate on the workflow undertaken during this research.

Figure 1: Thesis structure



The following paragraphs include a brief description of each of the thesis chapters and a small description of the corresponding objectives.

Part I is devoted to the ***Introduction*** and is divided in four chapters.

Chapter 1 includes a debate on markets for beef products, focusing on the changes operating within societies (particularly within the EU) that are leading to changes on consumers' behaviours and preferences towards food. The objectives are to frame the market environment and the evolution in societies that justify the need and pertinence of this research.

Chapter 2 reviews the concepts related with food quality attributes and consumers' perceptions and broadly analyses consumers' perceptions of beef quality attributes. This theoretical approach is necessary in order to frame the work ahead and to point out the concepts and definitions applied.

Chapter 3 introduces the concept of economic valuation of non-market goods and describes the methodology applied within this research. This is an essential chapter as it starts with the analysis of the attributes under scrutiny as public or private goods, evolving to the discussion about use and non-use values. The other objectives of this chapter were the categorization of non-market valuation methods and a more detailed description of CVM and CE.

Chapter 4 includes the objectives and the organization of this thesis.

Part II covers the basis for the questionnaire design and is divided in four chapters.

Chapter 5 analyses the Portuguese beef market and its potential for the success of differentiated beef products. This chapter had the specific objective of characterization of the Portuguese beef market, presenting a SWOT analysis in order to evaluate the potential for beef products, more specifically for differentiated beef products.

Chapters 6, 7 and 8 have the same objectives for each one of the attributes under research: to review the state of the art literature on the yet to be solved problems. The pointed issues would be put together with consumer's elicited concerns in order to elaborate CE scenarios. More specifically:

Chapter 6 reviews the scientific evidence related with meat safety and finds common grounds with consumers' concerns. The scientific scope has to be broadened from beef to meat as many of the hazards are not specific to one kind of meat.

Chapter 7 describes the Portuguese beef production systems, namely the more traditional ones, and points out features considered as positive in animal welfare terms by Portuguese consumers.

Chapter 8 characterizes the environmental impact of beef production and suggests that traditional silvopastoral systems may be a second best solution.

Part III includes the applied methodology divided into four chapters. The goals included the description of methodologies and the presentation of results.

Chapter 9 presents insights and a primary approach into focus groups' qualitative results.

Chapter 10 deepens the contents analysis of focus groups, reinforcing the findings from the previous chapter. More importantly, this chapter introduces a quantitative analysis approach for designing scenarios, attributes and price selection in CE.

Chapter 11 analyses the first two sections of the survey, bringing insights on consumers' perceptions and concerns related with beef consumption. The goal was the analysis of the first sections of the survey, which were primarily dedicated to consumers' behaviours and concerns with issues related with the attributes under research.

Chapter 12 examines the CE data, with particular emphasis on substitution effects and its impact on the WTP. The final goal was the elicitation of WTP, but also the analysis of the consequences of independent valuation of the attributes here analyzed. Also, the goal was to point out practical implications of the joint valuation of these attributes.

Part IV is dedicated to the Conclusion.

Chapter 13 presents the main conclusions and specific approaches to the innovative aspects and practical implications of this research.

Chapter 14 elaborates on future research perspectives.

PART II

Part II covers the market environment relevant for this thesis – the Portuguese beef market. It also includes thorough literature reviews of the state of the art regarding each one of the attributes under research. These part's contents therefore constitute the grounds for the stated preference questionnaire design.

Chapter 5 characterizes the Portuguese beef market and includes an evaluation of the potential for beef products, more specifically for differentiated beef products.

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Chapter 5
Portuguese beef market – potential for differentiated products

Today's competitive food markets have been showing a growing demand for differentiated products and beef is no exception to this tendency. This food product though mainly sold as unbranded, is often a target for differentiating strategies. In Portugal, differentiated beef products account for only a small share of the market, but nevertheless experience some growth. Furthermore, the sector has also been subject to changes due to the reforms of the Common Agricultural Policy (CAP). CAP reforms have led to new objectives for the agricultural sector, such as sustainability and competitiveness, increasing the linkage between producers and the market where strategies include differentiating quality approaches. It is therefore appropriate to analyze the Portuguese beef sector as well as the differentiating quality strategies available and their market behaviour, in order to help understand what is the real potential for differentiated beef in Portugal and to allow knowing the preferences of potential consumers willing to pay for quality differentiated beef products.

5.1 Introduction

In today's developed economies, the demand for differentiated food products is an important feature of competitive markets. Many consumers' behaviour and choices are no longer determined by food prices only. This means that competitiveness in food markets can be linked to the ability to develop innovative quality differentiated products, aiming at those consumer segments not only concerned with pure price based differentiation (Grunert, Bredhal, & Brunso, 2004).

In the particular case of beef products, the market and the producers have been following differentiation strategies, and the Portuguese reality is no exception to this trend. Recent past has been marked by changes both in the typical place of sale and in beef products differentiation. Large retail chains (supermarkets and hypermarkets) represent now the location for buying beef for almost 50% of Portuguese consumers (Project AGRO 422, 2004-2007), replacing the formerly dominant local butchers. Moreover, beef has evolved from being marketed as a completely undifferentiated product without a brand or label, to being available not only as a branded product, but also subject to several differentiating strategies.

These differentiated beef products, in spite of accounting for only a small proportion of beef production and consumption in Portugal, have had a significant growth. This positive

evolution is even more significant, if the undifferentiated beef market growth is considered.

Although some recent available data shows a somewhat stable annual *per capita* consumption of beef (with values around 16.8kg in 1999 and about 18.7kg in 2009) (INE, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012), the undifferentiated beef production[45] has been decreasing, and the country's beef imports have been rising at an annual average growth rate of 10% between 2001 and 2008 (INE, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012a). Some of this production decrease and imports increase can be explained by the country's structural characteristics, but the sector is also influenced by the evolution of the Common Agricultural Policy (CAP).

The last decade has been the stage of major CAP reforms, which shifted its main objectives from food security to sustainability and competitiveness. In order to do so, CAP support mechanisms have been deeply changed. Many of the existing supports to produces were decoupled, no longer influencing producers' decisions (including output levels), therefore promoting a stronger connection between producers and markets. Supports also became conditional on compliance with environmental, animal health and welfare as well as food safety rules. CAP reforms therefore became one of the most relevant issues to be considered when an agricultural sector, such as the beef sector, is analysed.

Beef differentiating quality strategies can be included within these CAP's objectives, as they seek to satisfy some markets' (and some consumers') demand. These objectives are clear in the new European Commission "Quality Package" adopted in December 10th, 2010. Furthermore, CAP reforms have moved towards increasing the linkage between producers and the market. Thus, although being a niche market, it can be relevant to evaluate the Portuguese differentiated beef sector, the differentiating quality strategies available and their market behaviour, as it can help delineating the best market strategies for this sector.

In order to do so, a comprehensive description of the Portuguese beef sector is needed, with particular incidence on the factors conditioning the sector's competitiveness and viability and keeping in mind not only national conditions and constraints, but also EU policies.

Included in a broader investigation about consumers' willingness to pay for differentiated beef products, this analysis of the Portuguese beef sector is justified in order to identify the existing baseline market trends needed to assess the market potential for new beef products. Hence, the present article has as main objectives:

- To analyze some of the implications the CAP and its reforms had on the beef sector;
- To describe and characterize the Portuguese beef sector in terms of supply, demand and trade.
- To describe the Portuguese differentiated beef sector and to unveil constraints on and opportunities for this sector.

45 Determined by the quantity of heads slaughtered and approved for consumption

5.2 Methods

In order to understand what has been the trend in beef production, trade, consumption and market prices, a descriptive analysis of the available information concerning this sector is needed. Although this kind of procedure doesn't represent a methodological step forward, it is, nevertheless, the appropriate approach when a detailed knowledge about any given sector is necessary. Therefore we will be looking at data on different variables (namely production figures, consumption, trade, amongst others) and estimating percentage changes, annual growth rates, anticipating underlying trends and, when possible, identifying potential threats and opportunities for the beef sector,

The available data was provided by several public organizations (such as the National Statistics Institute, the veterinarian official services, an agricultural research organism, among others, as well as the European Union institutions) and the gathered information was organized in order to allow establishing time series for different kinds of data.

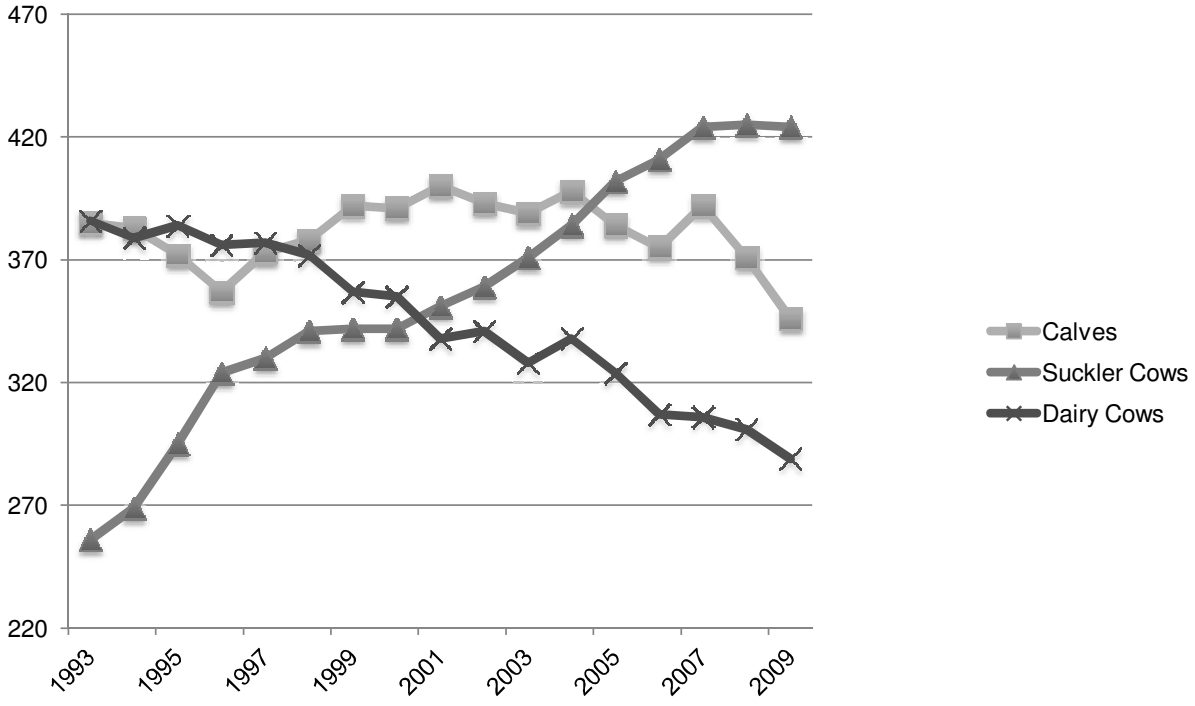
Hence, the impact of CAP reforms on the Portuguese beef sector and the beef sector's weight in the Portuguese agriculture are analyzed followed by a brief description of beef production and consumption trends for the last fifteen years. For this analysis the differentiated and the undifferentiated beef segments were considered separately, to allow for a comparative assessment aiming at describing trends and uncovering constraints, whilst trying to answer a main research question: what is the potential for emerging market niches and more sustainable beef production systems in Portugal?

5.3 The Common Agricultural Policy and the Portuguese beef sector

The 1992 CAP reform, enhanced by the Agenda 2000, represented the first step in a paradigm shift regarding support mechanisms, by cutting the link between subsidies and output levels, meaning farmers were no longer paid to just produce food. The direct price support measures were reduced and farmers started receiving direct income payments to help maintain income stability. This reform led to a partial compensation (from 1999 onwards) of farmers' income losses through direct payments linked to production. The direct aids were, for beef production, determined by the number of animals held (headage payments) (Swinbank, 1997).

However, the amount attributed per animal varied with the kind of animal grown. Therefore, these coupled support measures undoubtedly conditioned producers' decisions. In the Portuguese beef sector the existence of a suckler cow premium was appealing to many producers, which led to a significant increase in the suckler cow figures. In fact, as it can be seen in Graph 1, the number of suckler cows has come to be higher than any other kind of cattle, including dairy cows, representing about 30% of the total cattle in 2009 (INE, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012).

Graph 1: Evolution in calve, suckler cow and dairy cow herds (Unit – 1000 heads) (INE, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012)



Data also suggests that the Portuguese beef production sector has been strongly influenced by the 2003 CAP reform. One of the main features of this reform was the introduction of the single farm payment scheme and the decoupling of production-linked direct payments in many of the agricultural sectors in Europe, aiming at enhanced competitiveness and stronger market-orientation. There were, however, very different effects on different countries and agricultural systems, namely because each national Government could decide on which cultures and animal productions to decouple (within a predefined range of possibilities).

Some Portuguese agricultural sectors were therefore strongly affected. On the one hand, this decoupling had a strong impact in the Portuguese cereal sector. The few price support measures for cereals were even further decreased, once the sector was fully decoupled (due to a Government's option). Moreover, the suckler cow premium was maintained fully coupled therefore becoming very appealing for producers.

Furthermore, once the cereals were fully decoupled, extensification payment scheme (EPS) became much more attractive. It had been established as a direct support scheme implemented in the beef and veal sector with specific measures in the form of a reconversion programme of land used for arable crops towards extensive livestock production, and it was extended until 2005 (European Commission, 2003; *Evaluation of the extensification payment,* 2007).

This support measure combined with the coupled support measures for suckler cows strongly stimulated arable land conversion into pasture.

However, these pastures would need to be properly managed and improved, without

which many of them wouldn't be adequate for efficient beef fattening (due to low quality output which in turn determines low headage). The natural conditions in most of the country (marginal soils and intense water deficit in summer) do not favour intensive beef production, unless the pastures are well managed and the animals are properly supplemented with feedstuffs whenever it is needed. These improvements are expensive and unprofitable in most cases explaining why farmers didn't uptake this strategy.

Therefore, as the pastures and forage production are usually not appropriate for efficient fattening, the land conversion eventually led to a bigger suckler cow herd (once these animals are less dependent on high-quality forage, having thus much lower food costs in these conditions when compared to other cattle production).

On the other hand, due to potential social and environmental problems that activity abandonment could raise, some countries were allowed to maintain support payments in some sectors partially coupled to production. Portugal maintained the bovine sector partially coupled, decoupling the bovine adults slaughter premium to 40% but keeping the suckler cow and calve slaughter premiums still up to 100% coupled (European Commission, 2007, 2008; Tranter, et al., 2007). Moreover, the suckler cow premium was the highest one, among the coupling options determined by the EU, and Portugal significantly increased, as well, the number of suckler cow premium rights after 2003 (European Commission, 2007, 2008).

Hence, beef producers continued to opt for this production which has, however, reduced its profitability due to a low selling price for calves and a small number of calves sold per cow (European Commission, 2007).

Consequently, the existing beef production was (and in many cases still is) largely sustained by EU coupled support, which has helped maintaining producers whose potential lack of viability, in an unsupported market, could have lead to activity abandonment. The weight of coupled payments in the farm margin over variable costs is around 60% for Portuguese beef breeder farms (European Commission, 2007). Moreover, the European Commission has reported, in 2007, that Member States (MS) with higher reliance of farm income on coupled payments are more sensitive to any suppression of direct payments. In Portugal, specialist breeders switching to a negative economic margin in case of total decoupling own 19% of the suckler cows, showing the kind of social problem that decoupling could imply.

As it can be seen, after this continuous series of CAP reforms, most of the Portuguese beef sector has continuously increased its subsidy dependence, therefore loosing competitiveness. This is somewhat contrary to what should be one of the CAP's new directions, which is to promote and support market oriented production, leading producers to a closer linkage to markets and consumers' demand.

In order to analyze the national bovine herd evolution (somewhat shaped by CAP's reforms) in the Portuguese beef sector trends, regarding the national agriculture in particular, and economy in general, a detailed characterization of the sector follows in the next section.

5.4 Portuguese beef sector characterization

5.4.1 The beef sector within the Portuguese economy

In 2000, the Gross Value Added (GVA) of agriculture in Portugal accounted for 2.5% of the Gross Domestic Product (GDP), and in 2009 that value had decreased to 1.6% (basic prices) (GPP, 2011). These figures are in accordance with the natural development of an Economy. Considering employment data, the agro-forestry sector (including agriculture, forestry, hunting and fishing) represented 16.1% of the civil working population in 2000, whereas in 2009 it represented 14.7% (GPP, 2011). Thus, the employment evolution in this sector may show some activity abandonment (although it can also represent productivity increases in some cases).

Both these two trends are in accordance with the general tendency in the EU. EU-15 share of agriculture in the GDP has also decreased in the mentioned period as well as the civil working population in the agro-forestry sector (European Commission, 2010a).

Portuguese animal production sector has slowly grown, coming from representing 32.7% of agricultural production value in 1990 to 37.1% in 2010 (current prices, base 2000) (GPP, 2011). Although plant production still accounts for the highest proportion, animal production has increased its share on the gross value added of agriculture. In 2010 the beef sector value represented 6.9% of the animal production sector value (GPP, 2011).

The evolution of the sector in terms of economic dimension of the beef farms is also relevant. In 1997, beef farms classified as having a large economic dimension (definition based on farms' gross margin; expressed in Economic Dimension Units; 1EDU = €1200) represented 40% of the gross margin value generated by the total of the beef cattle farms, whereas in 2005, that percentage raised to 64%. In 1997, these economically larger farms represented 7% of the total number of beef cattle farms; in 2005 they represented 13% (INE, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012), reflecting that some farms are increasing in terms of economic dimension (and possibly economic efficiency as well), and are therefore more likely to cope with the sector's constraints. Nevertheless, these are still a minority (13%).

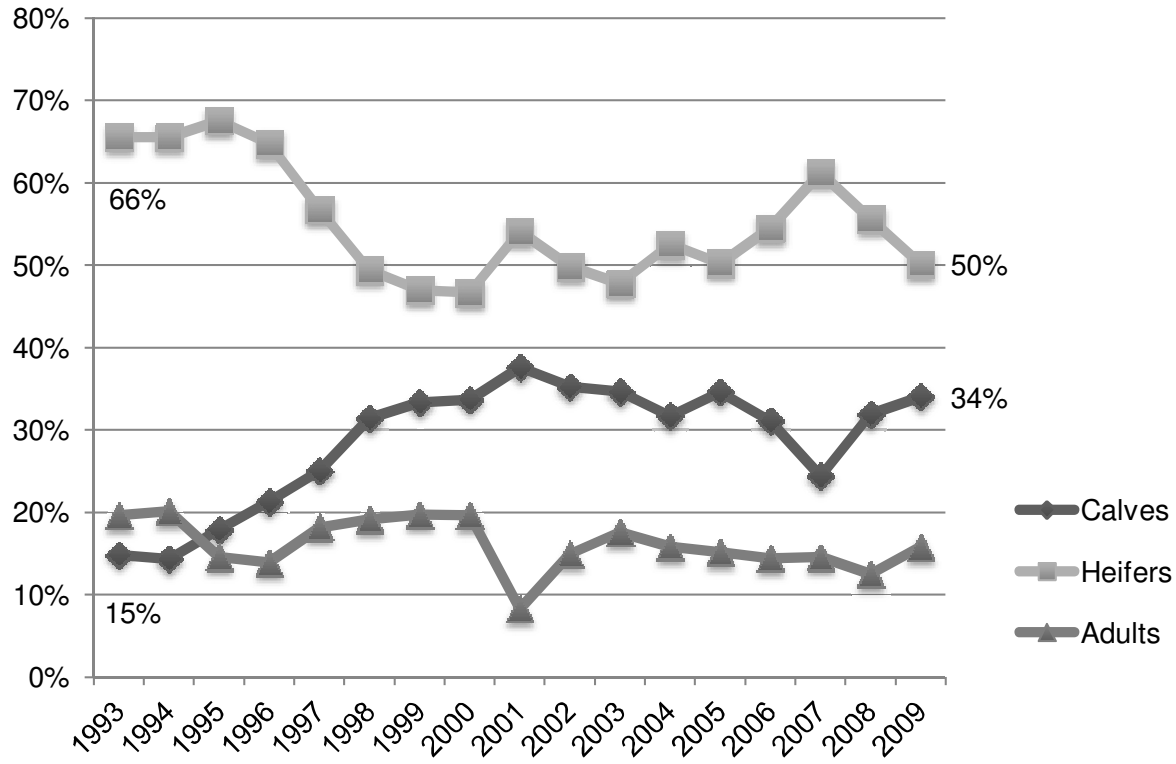
There are also signs that the undifferentiated beef production sector may have been experiencing some constraints, as the sector's production figures help to show.

5.4.2 Portuguese beef sector production

The beef production trend for the last decade is in many ways related to the CAP policy evolution with the consequences described previously, and also to natural and structural constraints inherent to the livestock production conditions in Portugal.

The suckler cow herd increase can be seen looking at the slaughtered animals between 1993 and 2009 (Graph 2). Calves have come from representing around 15% of the slaughtered animals in 1993 to around 34% in 2009. Heifers have dropped from 66% to 50% in the same period (INE, various issues).

Graph 2: Evolution in slaughtered calves, heifers and adult (INE, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012)



The tonnes of meat produced follow this trend: the quantity of beef from calves increased at an annual average growth rate of 6.7% between 1993 and 2009, whereas beef from heifers and adult cattle decreased around 1.9% and 1.6% during the same period. The total beef production growth was therefore negative for the period 1993-2009 (-0.7% average annual growth rate) (INE, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012).

These figures are the consequence of a much lower meat output per animal, when veal is considered. This can, to some degree, be explained by the high production costs associated with the fattening operation (which is mainly characterized by confinement productions and feeding throughout the animals' life), namely due to the feedstuff prices (where they can represent as much as 80% of total costs), among other factors (GPPAA, 2007). Notice namely the price spike that took place in 2008 for these products in world markets.

However, considering the smaller and more recent period from 2001 to 2009, the total beef production growth is positive (1.0% average annual growth rate) (INE, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012).

Also, beef sale values have grown from around 70 million Euros in 2001 to 106 million in 2007 (current prices) which means a growth from 70 million Euros to 98 million Euros in real prices (base year = 2002) (5.6% average annual growth rate) (INE, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012).

We will look now, in the following section, to what has been the trend in beef trade.

5.4.3 Portuguese beef trade

Portugal has had, at least since 1994, a self-sufficiency rate for beef and veal below 60% (except for the years 1996, 1997 and 2005) (GPPAA, 2004, 2005, 2006). These exceptions may be due to a reaction of Portuguese consumers to the BSE crisis, although the available data is insufficient to prove it (and thus justifying the need for further investigation).

Between 2001 and 2008, beef imports had an annual average growth rate of 10.4% in quantity, representing an annual increase of 12.4% in value (real prices) (INE, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012). The balance of trade for this period is clearly negative as expected by the low self-sufficiency rate and the imports growth.

Not surprisingly, in 2005, almost 95% of the imported beef had the EU as provenience, mostly from Spain (57%), the Netherlands (16%), and France (8%) (GPPAA, 2007). This means our competitors are obliged to the same production rules as Portuguese beef producers, and still manage to be competitive in the Portuguese beef market.

Beef imports from South America (Brazil, Uruguay and Argentina), although not yet representing a large proportion of total beef imports (around 8% in 2005), are growing (GPPAA, 2007). Once some remaining trade barriers (some related to food safety issues, but most related to tariff quotas) are removed, as part of future global trade negotiations, this growth can increase, introducing in the Portuguese markets new price-competitive products, and with potential quality differentiating strategies.

The growth potential for South American beef imports, as well as the considerable dominance of European beef imports over the Portuguese beef market can be considered significant threats to the Portuguese beef sector.

5.4.4 Beef consumption in Portugal

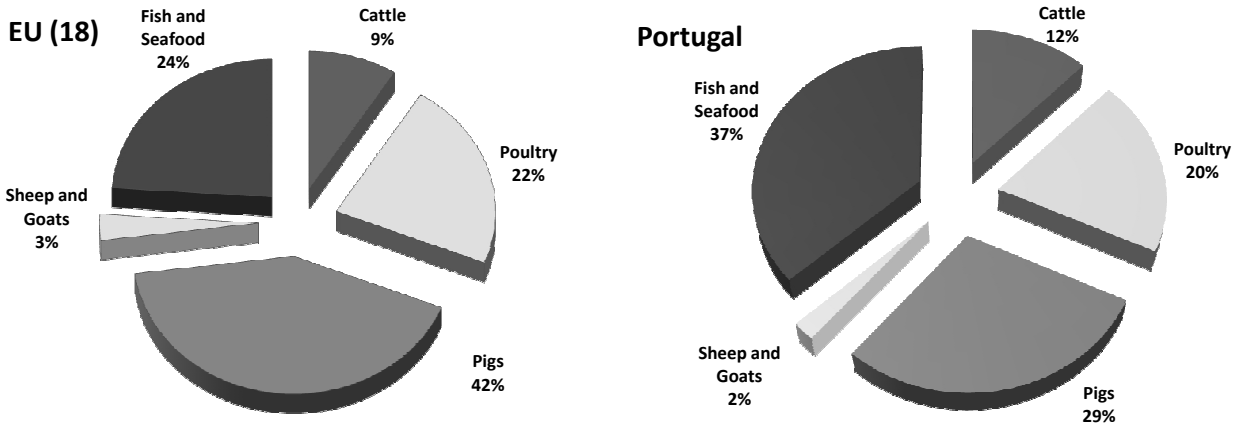
The Portuguese *per capita* beef consumption since 1995 hasn't varied much. The growth from 16.8kg in 1999 to 18.7kg in 2009 represents an average annual growth rate of around 1% (INE, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012). This small increase doesn't allow forecasting any significant growth in beef consumption, even because beef is one of the most expensive meat products available, which could impair its usage as a substitute for other kinds of meat. Between 1995 and 2000, beef and veal were the only meat group to decrease its share in Portuguese consumers' meat expenditure (Banovic, Barreira, & Fontes, 2006). Moreover, according to the same authors, Portuguese consumers' share of expenditures with food at home have been diminishing, with meat expenditures showing the highest decline in real terms, when compared with fish and other food products.

Besides expenditure changes, this may also reflect Portuguese consumers search for healthier food products (similar to many other European consumers) (Grunert, et al., 2004; Wezemael, Verbeke, De Barcellos, Scholderer, & Perez-Cueto, 2010)), which may impair some beef consumption. Beef may be considered an unhealthier meat product for several reasons. On the one hand, it may be associated with food safety issues, namely BSE. In the other hand, consumers may consider beef to have higher fat contents (Grunert, et al., 2004; Wezemael, et

al., 2010). In both cases, beef may be replaced for other meat products (namely poultry) or fish.

When comparing the Portuguese and the EU's meat consumption, the Portuguese beef gross human apparent consumption *per capita* in 2007 was of 18.6kg, and for the EU18 it was of 8.8kg (EUROSTAT, 2008). And, as it can be seen in Graph 3, beef represents in Portugal a higher percentage of animal protein intake, if compared with the EU's (EUROSTAT, 2008).

Graph 3: Percentage weight of animal food products in gross human apparent consumption *per capita* in EU18 and in Portugal (EUROSTAT, 2008)



Furthermore, Portugal has the highest *per capita* fish consumption in the EU (EUROSTAT, 2008), which is translated into a very high *per capita* animal protein intake. Altogether, this means the Portuguese beef sector as a whole can't expect much stimulus from an increase in demand.

However, there may be niche markets for beef relying not on an increasing demand in quantity terms, but on an increasing demand for quality differentiated products. As Antle (1999) reported, across Europe, consumers have been demanding, not more quantity, but more quality differentiated products. Here quality means very often not only a tastier or tenderer meat, but also healthier, safer, or animal and environmentally friendlier meat (Aguiar Fontes, et al., 2008; Bernués, Olaizola, & Corcoran, 2003; Resurreccion, 2003; Wezemael, et al., 2010). Portugal is no exception, as it can be foreseen in the growing demand for differentiated beef products, which will be analysed in the following section.

A SWOT analysis (S: Strengths; W: Weaknesses; O: Opportunities; T: Threats - Table 5) is now given as a result of what was discussed in the previous sections and some literature review.

Table 5: Beef sector SWOT analysis (Aguiar Fontes, et al., 2008; Banovic, et al., 2006; European Commission, 2007; GPPAA, 2004, 2005, 2006; IDRHa, 2001, 2002, 2003, 2004a, 2004b, 2005, 2006, 2007; INE, 2002, 2004, 2005, 2006, 2007, 2008a, 2008b, 2012; Progect AGRO 422, 2004-2006)

STRENGHTS

- Value of Portuguese animal production growth and increased share on agricultural GVA.
- Structural change, with the share of beef GVA coming from large producers increasing from 40% to 64%.
- Productivity increases and efficiency gains consistent with structural changes in production.
- Beef sales values growth from 70 million Euros to 98 million Euros (real values).
- Existence of some market differentiation: PDO beef production with consistent growth since 1997.
- Previous research concluded that in a sample of 800 Portuguese consumers, 80% claimed to like beef or like it a lot.
- Well established distribution channels, both in large and small retail, with solid market shares.
- Total beef production growth was positive between 2001 and 2009.

WEAKNESSES

- Agricultural sector employment data may show some activity abandonment and difficulty to attract new generations.
- Beef production still largely sustained by coupled support: producers' decisions still not completely market driven.
- Total beef production growth was negative between 1993 and 2009.
- Negative balance of trade and low self-sufficiency rate.
- Stable ***per capita*** consumption since 1995: no significant growth in beef consumption.
- Beef products are very expensive compared with other food products of animal origin.
- Beef and veal decreased its share in Portuguese meat expenditure.
- Main problems in beef marketing: lack of uniform supply, uneven quality, lack of promotional activities, high price.
- Differentiated products face some difficulties to get established in current distribution channels.

OPPORTUNITIES

- CAP reforms towards more market oriented farmers, more able to face competition.
- New dynamics in agricultural employment: younger and more qualified people, more competitive and directed to the market.
- Potential growth margin of domestic production in face of low self-sufficiency rate.
- Increased demand for quality differentiated products.
- Previous research showed that consumers trust national products, which can be used in marketing strategies.
- There are support policies aiming at extensification and environment, animal welfare, food safety, etc, which can be applied into quality differentiating possibilities.
- Market opportunities for premium priced products (substitution effects).

THREATS

- Imports from Argentina, Brazil and EU member states.
- High internal and external competition based on price.
- Fish is a quality product substitute; Pork and poultry are lower price substitutes.
- Expenditure away from home and on convenience foods increased.
- Future CAP reform and its consequences on the sector due to possible support cuts.
- Periods of economic recession: lower disposable income.
- Red meat is often considered a less healthy food product.

5.5 The Portuguese differentiated beef sector

The previous analysis has shown strengths, weaknesses, opportunities and threats associated with the Portuguese beef sector. There is, however, some differentiated beef production in Portugal that may be resisting to the described constraints and evolving more in line with the CAP's philosophy. The available data suggest viability for this subsector, as it is growing in terms of produced quantities, production values and market share (Graphs 4.1 and 4.2) (IDRHa, 2001, 2002, 2003, 2004a, 2004b, 2005, 2006, 2007). Therefore, the differentiated beef sector is worth looking further at.

The existing literature shows that in developed economies demand for food is increasingly influenced by factors other than price. In fact as Antle (1999) stated, consumers' concerns about food in developed economies have increasingly shifted from the availability of food to food quality. It must be kept in mind that the notion of quality changes along with changes in our life and in society and, when it comes to food, as income raises society is ever more aware of issues other than simple availability.

For beef products there are several differentiating strategies available for producers that allow exploring consumers' demand for quality. In Portugal, beef products with Protected Designation of Origin (PDO) and organic beef are two of the more consistently available in the market and are therefore worth analysing.

The PDO is a quality differentiated label regulated in the European Union since 1992 and it was established to encourage diverse agricultural production, protect product names from misuse and imitation and help consumers by giving them information concerning the specific character of the products (European Commission, 2010b). It is presently regulated by Council Regulation (EC) No 510/2006 of 20 March 2006 on the protection of geographical indications and designations of origin for agricultural products and foodstuffs.

Products aiming at a PDO label must have characteristics essentially due to its geographical environment (which includes factors such as climate, soil quality, local know how, local breeds, etc). Also, the entire production chain must be located within the geographical area associated with the PDO.

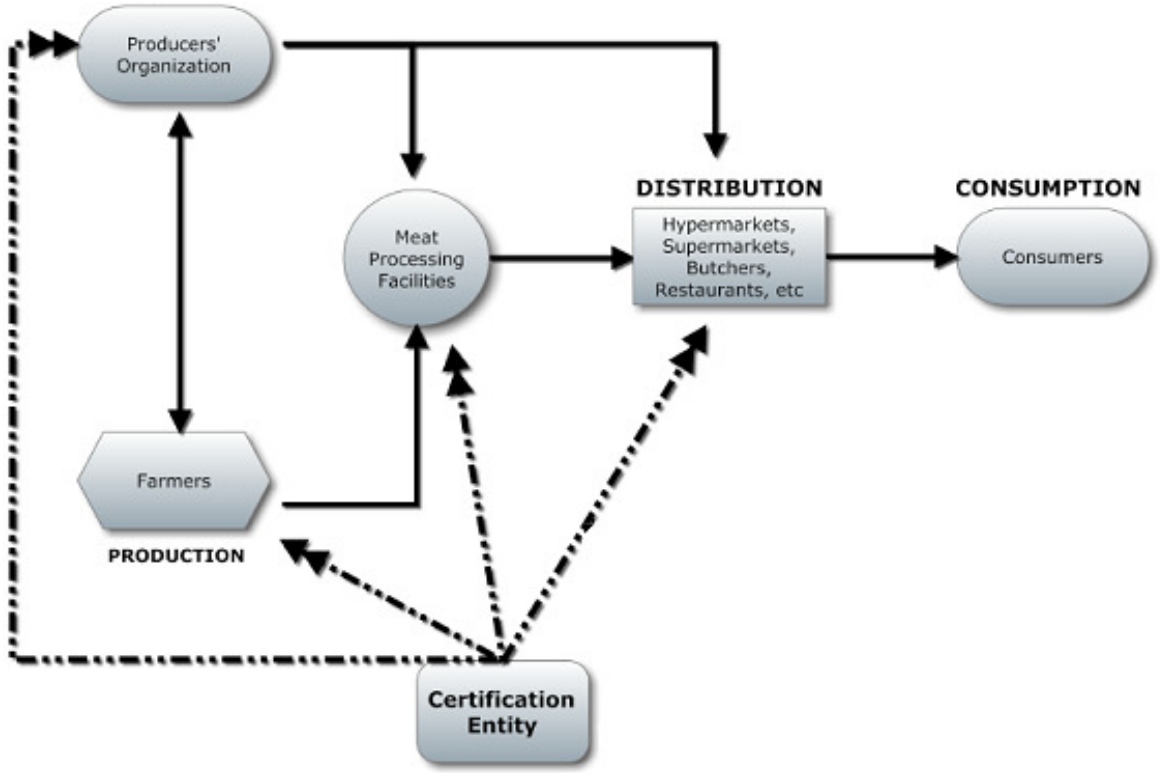
The PDO scheme can thus be applied to different kinds of agricultural products, and many of the procedures are not product specif. In the case of PDO beef, as it can be seen schematically in Figure 2, producers of a given breed included under a PDO registration are organized in producers' organisations. These are responsible for the definition of the production specifications needed for obtaining the PDO denomination, and also for the general production management (Barreira, Brandão, Lemos, & Fontes, 2009).

The PDO specific legislation requires that "an agricultural product or foodstuff bearing such a description should meet certain conditions set out in a specification" (Council Regulation (EC) No 510/2006). Thus, farmers comply with rearing, feeding, lodging and transportation rules included in the specification document and the animals must be registered as belonging to the specific pure bred involved in that designation. Very often production practices are established according to regional traditions (Barreira, et al., 2009).

Transportation, meat processing facilities and distribution channels are usually managed

by the producers' organisation. A third-party certification entity is responsible for verifying the compliance with the set specification throughout the whole chain (Barreira, et al., 2009). The beef produced is certified and thus labelled with the PDO European symbol and producers benefit from the exclusive right to use that PDO product name.

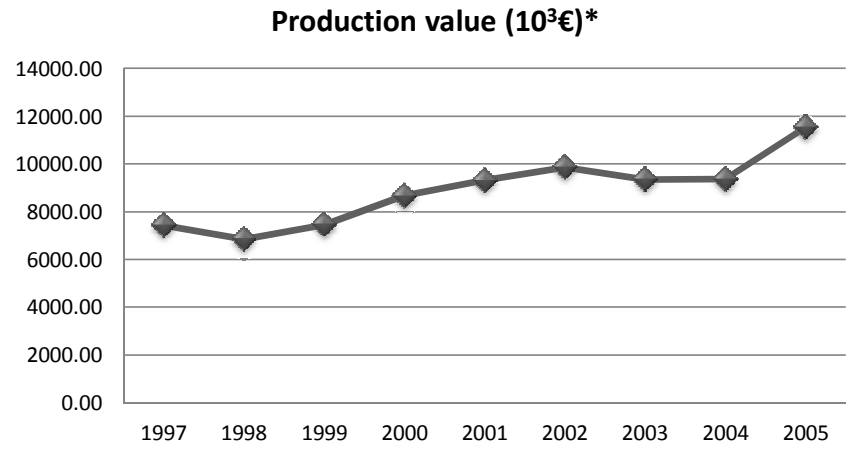
Figure 2: General organisational framework for a PDO beef production and distribution (adapted from Barreira et al. (2009))



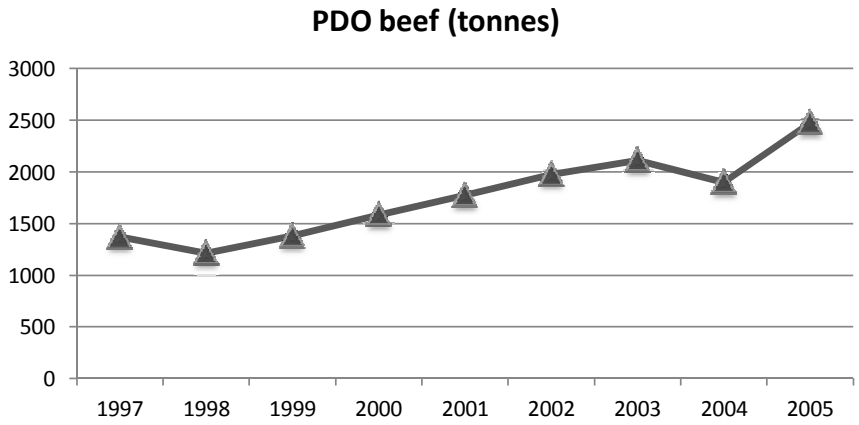
Considering now the PDO beef sector evolution, these niche productions have steadily increased at much higher rates than undifferentiated beef productions since they were introduced in the national market (when compared with undifferentiated beef).

PDO beef production began in Portugal in 1997 and, as shown in Graph 4 and Graph 5, it has been consistently growing. The production value had an average annual growth rate of 5.7% between 1997 and 2005 (real prices, base 2002 (INE, 2002)), and the produced quantities an average annual growth rate of 7.7% for the same period.

Graph 4: PDO beef production value in Portugal (real prices) (IDRHa, 2001, 2002, 2003, 2004a, 2004b, 2005, 2006, 2007; INE, 2002)



Graph 5: PDO beef production quantities in Portugal (tonnes) (IDRHa, 2001, 2002, 2003, 2004a, 2004b, 2005, 2006, 2007; INE, 2002)



Facing such values, and although PDO beef has never accounted for more than 2.5% of the heads slaughtered and approved for consumption (GPPAA, 2004, 2005, 2006; IDRHa, 2001, 2002, 2003, 2004a, 2004b, 2005, 2006, 2007), this market niche can't be ignored. As it was discussed in the previous sections, undifferentiated beef production will no longer have much of a growth margin, and competitiveness will probably continue to be lost. If there is some room for growth, it is for the differentiated market, which, though a niche market, can represent interesting opportunities for producers.

Moreover, the PDO beef sector has been growing, in spite of high certification costs, when compared to undifferentiated beef prices (GPPAA, 2004, 2005, 2006; IDRHa, 2001, 2002, 2003, 2004a, 2004b, 2005, 2006, 2007). High certification costs contribute to higher production costs, and most likely to higher consumer prices. It thus shows some consumers are willing to pay more for quality differentiated beef, helping support through their demand this production sector.

Moreover, previous studies have shown relevant consumer perceptions about PDO beef, such as associations with increased food safety and higher quality, product genuineness, and, perhaps more important, with increased juiciness and tenderness (Aguiar Fontes, et al., 2008; Progect AGRO 422, 2004-2006; Ribeiro, Vieira de Matos, & Fernandes, 2008).The same authors also found that consumers think of PDO products as a good way to promote regional development.

Nevertheless, the designation is still unknown to many beef consumers and many don't even know if they have already tasted PDO beef (Aguiar Fontes, et al., 2008; Progect AGRO 422, 2004-2006).

5.5.1 Other differentiated beef products in Portugal

Within the differentiated beef sector, there are also organic products. Although these products are not the main scope of this article, and data is very scarce, it is worth mentioning that the organic bovine livestock units have grown about 20% since 2005 (INE, various years). However, the organic beef production growth may be due not to market demand, but to EU subsidies (there was a 45% increase in the number of bovine animals under organic production systems supported by subsidies between 2004/05 and 2005/06 (IFADAP, 2005, 2006)). The CAP seems therefore to have worked as a major force for organic conversion.

Organic agriculture is included in the agri-environmental measures which support specifically designed farming practices going beyond the baseline level of good farming practice, which helps to protect the environment and maintain the countryside.

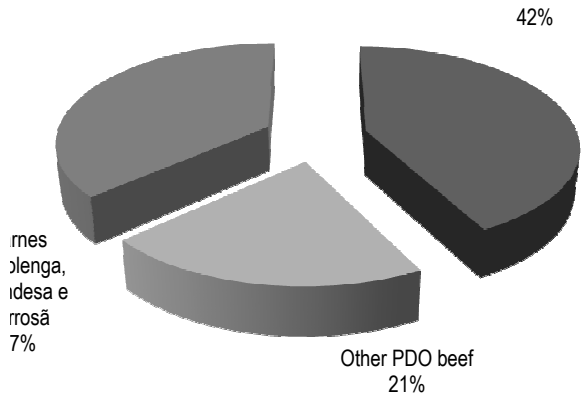
Moreover, a large proportion of organic production animals are held in Portuguese regions classified as Less Favoured Areas by the EU (Banovic, et al., 2007; European Commission, 2007; IFADAP, 2005, 2006), where breeding conditions for intensive fattening are poor, thus helping conversion to organic systems.

However, there is no data to support that there is a consistent production increase or a demand growth.

5.6 Constraints and perspectives for the differentiated beef sector

One of the major weaknesses of the Portuguese PDO sector is the large number of existing PDO registrations, some of which are not even effectively making use of it. By 2005 there were nine PDO beef registrations (and three Protected Geographical Indication (PGI) registrations). Of these nine, one PDO accounts for more than 42% of the quantities produced, and other three for more 36% (Graph 6). This means the other six represent very small productions (Fragata, Tibério, & Teixeira, 2007; IDRHa, 2001, 2002, 2003, 2004a, 2004b, 2005, 2006, 2007).

Graph 6: Production shares of PDO beef producers in Portugal, 2005 (IDRHa, 2001, 2002, 2003, 2004a, 2004b, 2005, 2006, 2007)



Although there has been an interesting contribution of national breeds (Banovic, et al., 2007), with production translated into PDO products, some breeds' production is fairly small, indicative of limiting factors, such as small livestock farm size, and inefficient production and commercial structures. Fragata et al. (2007) refer the diversity of resources, dynamic and capacities of the PDO management entities to differentiate and commercialize their products as one of the reasons for the low market shares. These productions are so small and uncompetitive that it is not possible to channel the majority of them into large retail operators, thus only being sold locally, and reaching only a small number of consumers. This might also contribute to the already mentioned lack of awareness of many consumers about this designation.

A study undertaken by Barreira et al. (2009), looking at PDO producers (and after performing a factor and a cluster analysis) identified three major groups. ***Optimistic*** producers (who believe PDO is the way to be in the market in order to achieve their goals), ***Pessimistic*** producers (who have more difficulties with market relations and price variability) and "***Flyers***." "***Flyers"*** are producers who can change their options very easily, meaning they place their productions in the differentiated market, or in the undifferentiated market, according to the best price, which is adverse to developing a successful marketing strategy.

It is important remembering there are costs associated with PDO products, such as increased production and certification costs, which sometimes may be high enough to diminish producers' margins in such a way that it is preferable to place their products as undifferentiated. Such behaviour can lead to the unavailability of PDO products for consumers, thus impairing the labels' success and it is incompatible with the development of a well known and properly established brand or quality sign. It is also contrary to large retailers' commercial strategies.

At first sight a considerable number of PDO products could represent an active sector, but it is not so. For such differentiated products to achieve successful market shares, the production, commercialisation and marketing structure should be integrated into a business solution, in order to aggregate and reduce business costs, gain economies of scale in both production and marketing and thus lead to a more efficient and competitive sector.

Some Portuguese PDO beef products have already caught on this philosophy, once

several producers (sometimes most of the producers in an entire region) all work under the same label (and certification schemes), channelling one single brand of quality product into the market (Banovic, et al., 2007). This allows having bigger productions, and lower certification and commercialization costs, increasing producer margins (Ribeiro, et al., 2008). It also favours selling their product in large retail supermarkets (Banovic, et al., 2007; IDRHa, 2001, 2002, 2003, 2004a, 2004b, 2005, 2006, 2007), which obviously leads to a much bigger number of consumers getting in touch with their products.

Hence, we can argue that other Portuguese PDO beef labels would largely benefit from some production concentration (although remembering the regional character of such productions). This concentration would help prevent the flyer behaviour, once production, certification and marketing costs would be contained due to economies of scale. The absence of ***Flyers***, and a generically bigger production for the existing labels would only help these products to enter the large retail supermarket operations. This would be an unquestionable advantage for these products, as supermarkets are one of Portuguese consumers' preferred food shopping locations (Gracia and Albisu (2001) report 59% of food sales in Portugal being made in hypermarkets and large supermarkets).

Nevertheless, the small retail distribution channel should not be disregarded. Another study shows that 54% of respondents from a sample of Portuguese consumers still prefer the local butcher as the location to buy meat (Aguiar Fontes, et al., 2008) (with the same kind of values being referred by Fragata et al. (2007)), namely because they trust them more. This trust in the butcher's advice could help overtake the lack of awareness and recognition many consumers assume to have regarding PDO labels (Aguiar Fontes, et al., 2008; Fragata, et al., 2007), possibly generating enough demand to compensate for higher distribution costs associated with product dispersion in smaller retail channels.

The possibility of reaching more consumers could also allow exploring one of the PDO beef characteristics: its national origin. Portuguese origin is valued by many Portuguese consumers (Aguiar Fontes, et al., 2008; Fragata, et al., 2007; Ribeiro, et al., 2008), thus representing by itself a quality dimension many are willing to pay for.

Additionally, the same authors report that PDO beef is considered safer, more genuine and of higher quality when compared to undifferentiated beef, by the respondents considered in the study. Once many consumers now search for healthier foods, (and may have thus diminished their consumption of what they consider to be unhealthy meat) this consumer perception about PDO beef should be explored.

For those consumers who really like beef but are nevertheless concerned about their health, this could be a quality option to be considered. As the quantities these people would consume would probably be relatively small, the premium prices could be accepted due to the healthiness perception.

In order to confirm or not these market opportunities, more information about the differentiated beef sector is therefore needed, namely concerning (consumer) prices for PDO and organic beef, number of slaughtered organic bovines, among others.

Additionally, and once this analysis is included in a broader investigation about consumers' willingness to pay for differentiated beef products, it would be relevant to know more

extensively what consumers want as quality characteristics. For example, still to be explored is to what extent consumers' have preferences for eco-sustainable production methods, which could also be a way to market PDO beef products.

5.7 Conclusions

The reported Portuguese beef sector analysis, aiming to establish the existing baseline market trends, allowed drawing some conclusions.

Although CAP reforms had as one of its main goals to promote agricultural production decisions more driven by market demand, some Portuguese agricultural sectors may not have been able to adapt to a more market driven agriculture. Some of the Portuguese policy options regarding implementation of the 2003 CAP reform led to a weakened undifferentiated beef production sector, with high subsidy dependence. Also, the country has high dependency on imports.

On the other hand, Portuguese consumers already have high meat *per capita* consumption, which means the Portuguese beef sector can't expect a significant increase in demand that could work as a stimulus. This stimulus must be looked for in other alternatives.

All these factors suggest the need to establish differentiated Portuguese beef products, who could be competitive not because of their prices, but other quality characteristics. Of course, price will still have a role to play and this is why this kind of differentiated products will remain a niche market.

In fact, and in spite of all the difficulties inherent to this sector, PDO beef has had a sustained growth which was above the undifferentiated beef production growth rate for the same period.

PDO beef production can thus be an alternative, but this niche is not consolidated. It is therefore important for this sector to invest in improving its organization, by concentrating certification and marketing costs, leading to increased producer margins. Additionally, higher concentration can help PDO beef to be marketed through larger retail supermarkets, thus reaching more consumers.

Concluding, PDO beef represents a niche market, aiming at a defined group of potential consumers that are willing to pay for quality differentiated beef products. Research should help define weather there are other demanded quality characteristics still to be fulfilled, or if the ones already supplied in the market are the only ones worth investing in.

Chapter 6 tries to find common concerns among meat consumers and scientific evidence related with meat safety. It also includes a review on the up-to-date legal framework regarding food (and meat) safety.

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Chapter 6
Meat Safety: a Brief Review on Concerns Common to Science and Consumers

Meat safety is a multidimensional concept, and there are reasons to believe there is an information asymmetry between consumers, producers and safety authorities along the supply chain. Within this framework, this article puts together consumers' concerns about meat safety, the current scientific evidence and the existing legal framework in the EU, trying to unveil possible fields for quality differentiating strategies. As such, this paper does not add new data to the food safety or consumer issues fields. Rather, it allows a new perspective by associating two different research areas.

Going through the reported consumers' concerns regarding meat, it is not possible to define one specific worry as more prevalent or frequent. Still, the presence of drug residues in meat is a concern often shared by consumers of several types of meat and in many different European countries. Interestingly, it is also an open scientific question.

Research on the association between the presence of antibacterials' residues in meat and microbial resistance is frequent. However, there is still no consensus on this subject. Still, even in the absence of such consensus, it is a relevant issue for meat production, public health and consumers' interests.

Regarding the EU legal framework, the food safety legislation has accompanied the scientific development, even acting preventively in questions without scientific consensus, as in the case of the use of antibacterials as a feed additive. Nevertheless, even if the use of antibacterials in food animals is covered by several legal documents, this is still a concern for consumers.

This suggests that some consumers may be interested in meat products that relieve their distrust. Therefore, there may be grounds for the development of a differention strategy aiming at segments willing to pay premiums for meat with increased guarantee of antibacterial residues' control.

6.1 Introduction

Over the last decades, within the European Union (EU) consumers' concerns about food have slowly shifted from food security to food safety. As food availability is no longer a concern within European borders, consumers became more interested and alert for the safety and other characteristics of their food. In this context, the last two decades have witnessed impressive changes in consumers' perceptions of food safety in general and meat safety in particular.

However, meat safety is a complex concept, as there are many hazards and challenges to be considered. Hazards include microbial pathogens, resistance to antibacterials[46], food additives and chemical residues and other possible contaminants, just to name a few (Knowles, Moody, & McEachern, 2007). Meat safety challenges involve traceability issues, pathogen and chemical residues detection problems, regulatory issues, addressing consumers' concerns, etc (Sofos, 2008). Moreover, meat safety must be regarded as an increasingly global matter due to the increase of meat consumption around the world, exposing higher numbers of consumers to potential hazards.

In view of such diversity of hazards and challenges there are reasons to believe there is an information asymmetry between consumers, producers and safety authorities along the supply chain (Loader & Hobbs, 1999). Producers, sellers and safety authorities have more and better information about the potential hazards and the dimension of risk associated with the consumption of a given food product. The asymmetry can be associated with the (intentional or not) unavailability of information for consumers, but also with differences between scientific evidence and consumers' perception (Miles, et al., 2004; Yeung & Morris, 2001b). This information asymmetry is even more relevant if meat safety is regarded not only as an individual, private matter (the guarantee that a piece of meat will not result in illness) but also a public health matter, as it is when one considers public health issues as those related with drug residues and resistance to antibacterials.

Even so, food poisoning in the sense that some food products will make one ill in an individual and immediate sense is no longer an immediate concern for most consumers. Most of the time, consumers trust their food will not make them ill, and do not even consider the possibility that food available for purchase can have deleterious effects for their health. Scientific developments in the food safety field together with the evolution of European food safety laws and enforcement as well as food safety communication, have surely played a role in consumers' ability to gain and maintain such trust.

Nevertheless, food safety concerns have assumed new proportions since the 1980s, as several food scares in Europe have taken unprecedented dimension, particularly when food products of animal origin are considered. One can remember cases like BSE, dioxin residues, *E.coli*, etc (Knowles, et al., 2007). This increased impact derives not only from (now global) media coverage, but also from the diffuse (and therefore frightening) hazardous effects associated with these issues. For most consumers the health consequences related with these food scares were most certainly hard to fully comprehend. However, regarding that some of these health conditions may be lethal they were always most likely perceived as very severe.

In such context, whatever the attitudes consumers have towards food safety they might have major influence over their consumption options. If food safety concerns are present at the shopping decision moment, consumers may choose to buy a substitute product, as it occurred during the BSE crisis (see, e.g., Loyd, McCorriston, Morgan and Rayner (2001), for data on the substitution of beef consumption for other meats). If such behaviour becomes generalized it will

46 It should also be noted that the reference to antibacterials includes antibiotics, sulphonamides and quinolones, and that this chosen definition is in accordance to the one used across the legal documents currently in force within the EU. It is also important to stress that, for the EU, the definition of residue includes not only substances with pharmacological effects, but also their metabolites or other substances transmitted to animal products which are likely to be harmful to human health.

have obvious consequences for the replaced product market share.

Moreover, consumers are known to make irrational choices and have irrational concerns and preferences, overestimating some risks that are unlikely to occur and underestimating others. And even when information and transparency are abundant, often consumers seem not to be able, or interested in, processing that information properly (Verbeke, Frewer, Scholderer, & De Brabander, 2007). It is therefore an objective of this article to go through the evolution of consumers concerns and perceptions regarding meat and meat products in recent years, and also whether concerns relating to meat consumption actually meet safety hazards mentioned in the scientific literature, or if they represent problems of information asymmetry between consumers and the scientific evidence.

In this perspective, an overview of recent literature about consumer concerns on meat safety enables the shedding of light on the issues that are more frequent and common throughout European consumers. It should be particularly interesting to verify whether there are concerns common to consumers in different countries, with different backgrounds and consumption habits. An exhaustive literature review was not the authors' objective, and there is no intention to entail any sort of meta-analysis of the research published around this issue. The focus is rather centered on trying to understand whether there are expressed consumer concerns on food safety that have links with the food safety issues addressed by the scientific literature and the existing EU legal framework.

Finally, this article also intends to make an association between consumers' perceptions and concerns about meat safety, the scientific evidence surrounding this food product and the existing legal framework, trying to unveil possible fields for quality differentiating strategies. As such, although this paper represents no new contribution or new research on either the food safety field and on consumer issues, it aims at putting together two research areas usually not combined. Therefore, the unquestionable speculative character assumed here is nevertheless compensated by the unveiling of the not commonly investigated connections between these two fields. In order to analyze such connections, this article is organized as follows: section 6.2 includes a review on European consumers' meat safety concerns; section 6.3 is dedicated to an analysis of the scientific evidence supporting consumers' concerns about antibacterials residues in meat; section 6.4 will then examine the EU's specific legal framework on antibacterial and other residues in meat; section 6.5 concludes by getting together consumers' concerns, the European legal framework and potential quality differentiating strategies.

6.2 European Consumers' Concerns about Meat Safety – a Brief Review

Within the EU, most of the times public policies have been able to act ahead in preventing food safety hazards (embracing EU's precautionary principle among other aspects) although there are known cases of reactive (as opposed to preventive) legal acts. BSE is probably the most noticeable example, as the establishing of new regulatory institutions and legislation were triggered by this food scare (Knowles, et al., 2007).

Still, in spite of the entire legislative body, and all the European institutions associated with its enforcement, meat safety has been described to be a concern to many European consumers. Many examples of such stated concerns can be found across the literature. Glitsch (2000) and Henson and Northen (2000) report concerns among German, Irish, Italian, Spanish, Swedish and British consumers related with beef, poultry and pork safety; McCarthy (2000) found that 55% of the surveyed Irish consumers were concerned about the safety of meat consumption; Yeung and Morris (2001a) describe concerns about poultry safety in the UK; Cicia and Colantuoni (2010), in a meta-analysis detected an increasing importance of meat attributes such as safety among European consumers; Angulo and Gil (2007) found loss of confidence in meat products in Spain, and that beef was considered the most risky food product among the surveyed consumers.

These reported concerns may be a problem for food markets in Europe (Angulo & Gil, 2007; de Jonge, et al., 2004; Savadori, et al., 2007), as purchase likelihood is strongly correlated with risk perception (de Jonge, et al., 2004; Yeung & Morris, 2001b). For example, the beef market instability caused by BSE was strong enough to actually be acknowledged by the EU in Regulation 1760/2000.

Yet, food safety is not a permanently present concern for many consumers, either during food purchasing or consumption. On the contrary, it seems that it is mostly taken for granted, as an inherent product attribute that most consider non-negotiable (Angulo & Gil, 2007; Verbeke, et al., 2007). However, regarding the type of research often done in this field, consumers' concerns usually emerge upon questioning. Therefore, they may not reflect ideas present while shopping, which can generate inconsistencies between research data and market data. The meat sector has faced periods of great pressure partly as a consequence of several food scares of recent years such as BSE in beef (Beaumond, Orenga, Sans, & Brugère, 2006; Gracia & Albisu, 2001), dioxins in poultry and pigs or Salmonella outbreaks in poultry (Knowles, et al., 2007). Additionally foot and mouth disease and avian influenza also had influence in European consumers buying behaviour although they pose no threat for human health (Knowles et al., 2007). One could therefore suspect that concerns about such issues would appear on top of the European consumers' rankings when asked about food safety risks and concerns.

However, more recent data seems somewhat conflicting, at least when BSE is considered. A Eurobarometer report (2006) mentions that 50% of consumers still express some concern about this disease. Similar values were obtained by O'Donovan and McCarthy (2002) in Ireland. On the other hand, there are results showing that the level of concern of BSE was no greater than other safety issues (Henson & Northen, 2000; Verbeke, Wezemael, de Barcellos, Kügler, & Grunert, 2009). It may be that as time goes by following a given food scare, more consumers tend to disregard such occurrence, progressively regaining some trust and recovering old consumption patterns (Knowles, et al., 2007).

As such, there are numerous other safety issues viewed by consumers as a concern. Whatever specific hazard is mentioned first depends on the meat product being considered, on the relevance food safety issues are having in society (and in media in particular) in that given period and also on demographic factors, previous experience and risk perception, among others (Angulo & Gil, 2007; Buzby, 2001; Gracia & Albisu, 2001; Sofos, 2008). Nevertheless,

apart from the already mentioned concerns about food hazards specifically related with recent scares, there are issues more commonly referred by consumers without being specific for a meat product or to a geographic region.

One such issue is the presence of drug residues in meat. Veterinary drug residues such as antibiotics in meat are frequently stated as central among the concerns about meat safety expressed for some segments of European consumers (Verbeke, et al., 2007)[47]. Several specific examples can be quoted from the literature. For example, Henson and Northen (2000) report high levels of concern among consumers from six European countries about antibiotic residues. Such concerns were often ranked second in several of those countries, right after concerns about hormone residues. O'Donovan and McCarthy (2002) found antibiotics to be among the top concerns of Irish meat consumers.

Verbeke and Vackier (2004) found several segments of Belgian consumers to be worried about antibiotics in fresh meat and that those concerns were ranked first when compared to other meat safety risks (namely dioxins, BSE and harmful bacteria). Miles et al. (2004) found more than 50% of the surveyed UK consumers to be extremely worried about the use of antibiotics in animal production. Krystallis and Arvanitoyannis (2006) describe a cluster of Greek consumers particularly concerned about meat chemical safety (i.e., its content in antibiotics and hormones).

Concerns about this specific chemical hazard are also mentioned in reports about consumer's perceptions about poultry meat (Glitsch, 2000; Yeung & Morris, 2001a) and pork meat (Glitsch, 2000). Mørkbak, Christensen and Gyrd-Hansen (2010) estimated a positive willingness to pay among Danish consumers for pork produced under tighter rules regarding the use of antibiotics. Finally, a European survey points out the same conclusion, stating that 68% of European consumers are "very worried" or "fairly worried" about "residues in meat like antibiotics or hormones" (Eurobarometer, 2006).

In Portugal, during the focus groups conducted in 2009 aiming at proper scenario design for a stated preference survey (Viegas, Santos, & Aguiar Fontes, 2011), antibiotic residues in meat were often spontaneously referred as a beef safety concern for many participants. The same reactions were also found in a series of focus group meetings in Spain (de Carlos, García, de Felipe, Briz, & Morais, 2005) and in research in the UK (Miles & Frewer, 2001).

As mentioned above, hormone residues are also a concern for some segments of European consumers (Eurobarometer, 2006; Knowles, et al., 2007; Miles, et al., 2004; O'Donovan & McCarthy, 2002; Tonsor, Schroeder, Fox, & Biere, 2005), which may seem contradictory considering that the use of substances with hormonal action in farm animals is prohibited within the EU (with legally defined exceptions, see Council Directive 96/22/EC) (Reig & F., 2008). These concerns about chemical hazards like the presence of antibiotics or hormones in meat may be justified by the "unknown" factor, i.e., consumers have less knowledge about such hazards and consider them to be more unnatural and unfamiliar to them, attributing them a higher risk (Miles, et al., 2004; Yeung & Morris, 2001a).

Another meat safety issue of concern to consumers is microbiological safety. More

47 In the context of consumers' concerns, the term antibiotic is more often applied, in opposition to antibacterial, which is probably more accurate in a scientific context. Nevertheless, the term antibiotic will be used whenever that is the term applied in the referred literature.

specific references are related to the presence of pathogenic micro-organisms like salmonella or *Escherichia coli* (namely VTEC O157:H7) (Beaumond, et al., 2006; Miles & Frewer, 2001; O'Donovan & McCarthy, 2002). These microbiological risks are more commonly associated with poultry meat, where in fact Salmonella and Campylobacter are the commonest food-borne bacteria (Glitsch, 2000; Yeung & Morris, 2001a), and with pork meat (Glitsch, 2000).

However, there seems to be a somewhat lower level of concern about microbiological risks, even if these are considered the main food hazards for the public among the scientific community (Miles, et al., 2004). Low concern about this issue may have several sources. First, there have been no recent widespread food scares related with microbiological hazards in meat. Furthermore, most meat poisoning situations due to pathogenic micro-organisms that do occur are localized (in the sense that they affect few people in given location) and somewhat benign, and do not reach the media as a problem for society in general.

Also emerging in the literature about food safety concerns are Genetically Modified Organisms (GMOs). There are several reports of a very strong mistrust from European consumers' about food products that include GMOs (Bredhal, 2003; Burton, Rigby, Young, & James, 2001; Costa-Font, Gil, & Traill, 2008; Dannenberg, 2009). However, this is not an issue arising very often when meat safety is considered. It is possible that feeding cattle with GMOs is something most consumers do not consider or even have much knowledge about.

Going through the reviewed information related to meat consumers' concerns, it is not possible to define one specific concern as absolutely more prevalent or frequent. The main concerns manifested by consumers depend, for example, on the type of meat under survey. Nevertheless, a safety issue that often emerges as one of the top worries for European consumers is the presence of drug residues such as antibiotics in meat. This particular hazard shows up as a concern shared by consumers of several types of meat and in many different European countries. Therefore, the following section analyses some of the scientific literature on why this issue is relevant in terms of meat production, public and animal health.

6.3 Are Antibacterials' Residues in Meat a Concern?

Meat safety faces uncountable challenges in today's globalized markets. Sofos (2008) and Nørrung and Buncic (2008) elect Campylobacter and Salmonella as the most common pathogens affecting meat safety. Besides these and other microbiological hazards, technological hazards (namely those related with genetic modification) or contaminant (as pesticides and drugs) related hazards (Knowles, et al., 2007; Yeung & Morris, 2001a) are widely described and debated in the literature concerning meat safety. Within this broad spectrum of hazards and challenges, it is only comprehensible that consumers are uncertain and concerned about meat safety.

Nevertheless, the presence of drug residues such as antibacterials in meat does emerge as a somewhat consistent and persistent concern in the literature on consumers' perceptions, being referred across different countries and regarding different types of meat. At the same time, research on antibacterials' residues in meat and meat products and microbial resistance is frequent when literature on food safety, veterinary medicine, environmental safety or public

health is reviewed. Moreover, as it will be seen further ahead, this issue has been subject to extensive legal regulation.

This problem is multifaceted not only in terms of its origin, but also concerning the consequences, as it has implications for public health, animal health, the environment, biodiversity, and also for global markets, societies and policy makers. As will be described, the emergence of bacterial resistance to antibacterials has great implications on the availability of efficient tools to fight human infections on a global level. Also, the environmental consequences go far beyond the local consequences due to animal production pollution. Finally, there are economic and social aspects to be considered, namely those related to livestock producers, the pharmaceutical industry, international trade and consumers. This means that whatever regulatory measures are taken (based or not in scientific evidence), there are many (and potentially conflicting) points of view to be considered.

An exhaustive description of antibacterial' residue occurrence, microbial resistance mechanisms or control measures is beyond this review's scope. The main focus will be on exposing why this issue is important in terms of meat production, public health and consumers' interests.

In livestock production antibacterials can be used for three purposes: therapeutics, prophylaxis and growth promotion (Azevedo, Maia, & Tavares, 2010; Doyle & Erickson, 2006; Phillips, et al., 2004; Sarmah, Meyer, & Boxall, 2006). Growth promotion effects are generally obtained through the application of sub-therapeutic doses of antibacterials as feed additives (Doyle & Erickson, 2006; Silbergeld, Graham, & Price, 2008) and it is more frequent in poultry and pig production, than in beef production. It can be said that the use of such antibacterials is beneficial as it improves conversion rate (among other possible effects), therefore improving profitability (Azevedo, et al., 2010).

Whatever the applications' purposes, antibacterial residues reach the environment. The most common paths include animal products' residues, waste disposal, soil, water and food crop contamination, etc. (Azevedo, et al., 2010; Sarmah, et al., 2006; Silbergeld, et al., 2008). Environmental contamination occurs mainly because animals excrete high proportions of active forms of the supplied antibacterials, which is an effect also present when sub-therapeutic doses are used (Acar & Moulin, 2006; Sarmah, et al., 2006; Silbergeld, et al., 2008). Finally, consumers can have direct contact with these residues either through environmental exposure or through the ingestion of contaminated food products (Azevedo, et al., 2010; Sarmah, et al., 2006; Silbergeld, et al., 2008). Exposure can translate into direct effects at an individual level, such as allergic reactions, carcinogenic effects, digestive problems, etc (Azevedo, et al., 2010; Reig & F., 2008).

Even more significant, however, are the indirect consequences of antibacterials' residues, which raise important public health issues. The World Health Organization (WHO) and the European Food Safety Agency (EFSA), as well as many research reports consider that microbial resistance to antibacterials is one of the more serious and emerging problems in public health, across the world (Azevedo, et al., 2010; Doyle & Erickson, 2006; Hugas & Liebana, 2009; Reig & F., 2008; Silbergeld, et al., 2008).

The most serious consequence of microbial resistance is the decrease in the useful life

of antibacterials for combating human or animal disease (Silbergeld, et al., 2008; Sofos, 2008). This can be verified through increased frequencies of treatment failures and increased severity of infections, as well as the occurrence of infections that would not have otherwise occurred (Angulo, Nargund, & Chiller, 2004). This becomes even more serious when it is remembered that no new molecules have been developed recently. There are therefore no new alternatives to those already subject to microbial resistance (Acar & Moulin, 2006; Azevedo, et al., 2010).

Resistances can be acquired through a well known phenomenon of intrinsic resistance, resulting from a long evolutionary process responding to environmental pressures, and that cannot be avoided (Azevedo, et al., 2010; Doyle & Erickson, 2006; Silbergeld, et al., 2008). Microbial agents can also develop cross-resistance mechanisms, meaning they can become resistant to several antibacterials (especially, but not only, if these agents have similar actions) (Acar & Moulin, 2006; Azevedo, et al., 2010).

However, besides the development of intrinsic resistances, there is a more concerning phenomenon of acquired resistances. These acquired resistance mechanisms are developed much faster than the intrinsic resistance phenomenon, and the exposure of bacteria to sub-lethal (or sub-therapeutic) concentrations of antibacterials is a particularly effective way of selecting resistant strains (Silbergeld, et al., 2008).

Several sources claim that the usage of antibacterials' in livestock is a major driving force for the selection of resistant microorganisms, as well as the transmission of zoonotic and commensal microbial agents from animal populations to humans (Acar & Moulin, 2006; Angulo, et al., 2004; Azevedo, et al., 2010; Reig, 2008; Silbergeld, et al., 2008). The livestock sector is the largest user of antibacterials worldwide (Doyle & Erickson, 2006; Sarmah, et al., 2006; Silbergeld, et al., 2008) potentiating the transmission of genes and mechanisms associated with resistance (Phillips, et al., 2004; Sarmah, et al., 2006).

Selective pressure often interacts in the environment, animal and Human populations, amplifying the resistance phenomenon and the spreading through different species, with the help of fast and efficient bacterial reproduction (Acar & Moulin, 2006; Azevedo, et al., 2010; Silbergeld, et al., 2008). It is not possible to measure the size of the impact of these selective mechanisms on resistant microbial species in Human populations, but there is undoubtedly a catalytic effect, potentiated by the intensity of livestock production and the consequent intensive use of antibacterials (Azevedo, et al., 2010; Silbergeld, et al., 2008).

Multiple research claims to have established a causal relationship between (sub-therapeutic or other) antibacterials' administration in livestock and the growing incidence of antibacterials' resistance in human medicine (Acar & Moulin, 2006; Angulo, et al., 2004). For example, Silbergeld, et al. (2008) refer consistent temporal relationships between the introduction of antibacterials into livestock production use and increases in the prevalence of resistant microorganisms, among other evidence.

However, other authors claim that insufficient evidence has been found to prove that relationship beyond doubt (Azevedo, et al., 2010; Doyle & Erickson, 2006; Phillips, et al., 2004; Presi, et al., 2009; Smith, Dushoff, & Morris, 2005). Similarly, some authors argue that meat and meat products can also act as vehicle for the spread of bacteria resistance to various antibacterials, besides spreading antibacterial residues (Phillips, et al., 2004; Sarmah, et al.,

2006), although there is also no consensus on this subject (Phillips, et al., 2004; Presi, et al., 2009). Finally it must also be remembered that incorrect use of antibacterials is as serious in human medicine as in livestock production, which cannot therefore be the only sector to blame for resistance emergence (Azevedo, et al., 2010; Sarmah, et al., 2006).

Measures such as a worldwide ban of non-therapeutic use of antibacterials (Silbergeld, et al., 2008), or the establishment of precise guidelines for the prudent use of antibacterials in veterinary medicine as defined by the World Organisation for Animal Health (OIE) (Acar & Moulin, 2006) have been suggested, but not without controversy (Smith, et al., 2005). The WHO also has a global strategy for the containment of antibacterial resistance (WHO, 2001). The application or evaluation of such measures and guidelines are nevertheless beyond this articles' scope. However, the specific regulatory measures that have been put to place to deal with this issue in the European Union are worth analysing. This will be done in the following section.

6.4 European Union Legal Framework on Antibacterial and Other Residues in Meat

Quality management systems for food safety are based in public legislation and in private standards, both having the *Codex Alimentarius*[48]as background. Although it is not this article's objective to thoroughly describe any of these private quality systems, a brief reference should be made.

Private quality management systems have been developed mostly by the food distribution sector and generally include the food safety legal requirements, while trying to complement them. Some examples within the EU include GLOBALG.A.P. (G.A.P. – Good Agricultural Practice; formerly EUREPGAP – Euro-Retails Produce Working Group), the BRC (British Retail Consortium), IFS (International Food Standard), EFSIS (European Food Safety Inspection Service) and GFSI (Global Food Safety Initiative). These systems are business-to-business management systems that can include one or several standards such as good agricultural practices, Hazard Analysis and Critical Control Point (HACCP), International Organization for Standardization (ISO), etc. Therefore, they are not directly visible to consumers.

Regarding the public legislation, the EU has an impressive body of legal documents that relate to food safety. In gross terms, there is general food safety legislation, applicable to all kinds of food, and there is more specific legislation directed towards specific products. Specific food and feed law covers (among many other subjects), food residues and contaminants.

To fully understand and explain the implications of such legal and institutional framework would be an overwhelming task. Thus, to make an exhaustive review of all the legal documents concerning this issue is not this article's goal. Moreover, no technical legal analysis is pretended, as it would exceed the authors' specific competences.

The objective is therefore to simply list the legal documents that regulate and control the

48 *Codex Alimentarius* is a code of practice based on scientific evidence, established by the Food and Agriculture Organisation of the United Nations (FAO) and the WHO. Its goals are protecting consumers and facilitating international trade. It has no mandatory aspects, but it does act as a basis for many legal standards, including European ones.

use of antibacterial drugs in meat production, as well as the presence of drug residues in meat products throughout the EU. This food safety issue was recognized by the EU, the WHO and *Codex Alimentarius* as a growing (but still non-consensual) concern, namely because of the possibility of existence of a link between antibacterials' residues in meat and the development of microbial resistance, therefore justifying the need for proper regulation.

The review aims not so much at technical legal aspects, but at trying to present an organized and summarized version of the most relevant legislation (Table 6). More importantly, this review intends to understand if there are links between these documents and consumers' confidence or concerns.

Table 6: Most relevant legislation regulating and controlling the use of antibacterial drugs in meat production, as well as the presence of drug residues in meat products throughout the EU

Legal Document	
Regulation (EC) No 470/2009	• Describes the procedures to evaluate the safety of residues of pharmacologically active substances in accordance with human safety requirements. • Establishes a maximum residue level (MRL) for pharmacologically active substances used in veterinary medicinal products for each relevant food product (eggs, meat, milk, etc) for each relevant species. • Annexes include all the pharmacologically active substances with marketing authorization used in veterinary medicinal products, according to their MRL status. • The administration of veterinary medicinal products containing pharmacologically active substances included in Annex IV (such as nitrofurans) to food producing animals is prohibited within the EU.
Council Directive 96/22/EC	• Prohibits the use of ß-agonists and other substances with hormonal or thyrostatic action in livestock farming, once it is acknowledged that their action may be dangerous for consumers and may also affect the quality of food-stuffs of animal origin. In no case can an animal to which one of these substances has been applied enter the food chain.
Council Directive 96/23/EC	• Establishes the measures that EU Member States should take to monitor substances and their residues in both live animals and animal products. • Defines measures to monitor the substances and groups of residues such as substances with anabolic effect and unauthorized substances, veterinary drugs and contaminants.
Directive 2001/82/EC	• Regulates the prescription and distribution of veterinary medicinal products intended for use in food-producing animals. • Defines the withdrawal period as the period necessary to protect public health, between the last administration of a veterinary medical product to animals and the production of foodstuffs from such animals.

It can be suggested that this link between consumers and the legal framework surrounding food products is intended by the EU, as the general food law (Regulation (EC) No 178/2002) establishes objectives for the protection of consumers' interests and tries to ensure that consumer confidence is secured. Therefore, it could be expected that the following legal documents go towards addressing consumers' worries.

Regarding this article's specific subject, it can also be said that food safety legislation has accompanied closely the scientific development in the food safety area. And even in

questions still not subject to scientific consensus, the EU has acted preventively, based on the precautionary principle, as in the case of the use of antibacterials as a feed additive.

Taking now the consumers point of view, the above described legal framework might also have been implemented in order to address public perceptions, concerns and fears. The control of the use of antibacterials and hormones in food animals is covered extensively by several legal documents. Moreover, this ensures complete transparency of all the implemented mechanisms and procedures.

However, as the review shows, this is still a very much a present concern for meat consumers across Europe. The difficulty inherent to an effective communication of such a complex technical issue may be a reason for such concerns to exist in spite of a seemingly transparent regulatory framework. Furthermore, the existence of asymmetric information implies that consumers have inferior knowledge than retailers, producers and authorities regarding the safety of the meat they are consuming. It can be suggested that the consumers' consciousness regarding this asymmetry is a reason for their stated concerns.

Hence, consumers may also face difficulties trusting the existing enforcement mechanisms in situations so distant from their daily livelihood. Also, as most consumers do not have contact with animal and food production, their natural ignorance may also be translated into distrust and legitimate concern.

This article's conclusions will therefore try to get together consumer concerns, scientific evidence and the European legal framework. The existence of such concerns in spite of all the legal and institutional mechanisms suggests that consumers may therefore be willing to choose meat products that relieve their distrust, thus representing a possibility for the development of the quality differentiating strategies that will also be suggested.

6.5 Conclusions

European consumers' beef safety concerns have been changing for the last two decades. Such changes are due not only to changes in Western societies in terms of food availability, ethical awareness and health concerns, but also more recently to some food scares of previously unseen proportions. The growing media coverage and globalization of food markets have influenced the dimension and impact of these scares.

Some of the major food scares that occurred in Europe since the 1980s were related to different types of meat, namely BSE in beef, dioxins in pig and poultry, etc. Consumers therefore express concerns about meat safety (such as BSE, antibacterials and hormones' residues, GMOs, etc.) although they are often discordant in subject and proportion with scientific evidence or legal impositions. For example, the concerns about the presence of hormone residues in meat seem somewhat disproportionate, as the use within the EU of substances with hormonal action is prohibited in farm animals. Also, the same legal criteria apply to products originating in third countries and there have been no scares related to this issue. It is therefore not easy to reason on the origin of consumers' concerns on this issue. But wherever they come from, they represent at least a miscommunication issue for the EU.

Moreover, although several sources argue that some of the most serious meat safety

issues involve microbial agents (such as *Campylobacter*, *Salmonella* spp. and verocytotoxigenic *E.coli* infections (see, for example, (Nørrung & Buncic, 2008), for a detailed review on this issue)), consumers do not seem to have the same perception (Miles & Frewer, 2001).

This different perception may emerge from several facts already described, namely the absence of significant or widespread food scares relating to meat and microbial agents. Moreover, the legal framework in place has no doubt a major role in guaranteeing as far as possible the microbiological safety of meat products throughout the entire chain, contributing to the absence of such outbreaks.

There is, however, an issue where evidence and worries expressed by the scientific community may be more closely related to consumers' concerns: antibacterial residues in meat. This potential hazard is mentioned by many consumers in several European countries as being part of their preoccupations about meat safety. Moreover, it is probably one of the few hazards mentioned in association with different types of meat, be it beef, poultry or pig.

It is consequently very interesting to verify that one of the concerns consumers state about meat safety is actually an open scientific question that the literature points out as a real problem, even if the real scientific reasoning and proof on this issue is beyond the knowledge or comprehension of most consumers. Also, the safety guarantees on antibacterial residues control may be a field where also the European legal and institutional framework has not met consumers' concerns, either by technical, legal or communicational reasons.

As such, antibacterial residues in meat seem to be an area where consumers' concerns, scientific evidence and legal framework seem to share common grounds in the need to establish new strategies. However, it can be suggested that the unsolved scientific questions around this issue will probably remain open for quite some time, as it represents quite a complex scientific issue, namely due to difficulties related with establishing causal relationships. Moreover, it can also be noted that the legal framework on meat production is already very extensive, and that new legislation on issues still to gather scientific consensus would probably raise many conflicts.

Within this context, a market strategy could be proposed, in the shape of a user-oriented quality differentiating strategy for meat aiming at consumer segments willing to pay premiums for meat with increased guarantees concerning antibacterial residues control. It is known that some consumers segments are already willing to pay for differentiated meat with characteristics associated with increased safety.

Preferences for beef with quality labels such as Protected Designation of Origin (PDO) or other guaranteed origin schemes are often mentioned as being related with a perception of increased meat safety (Gracia & Albisu, 2001; Verbeke, et al., 2007). This can also be verified for example in Portugal, where Aguiar Fontes et al. (2008) found that consumers seem to associate PDO beef to safer beef. Free-range or organic meat and other meat products with certified production methods are also associated with safety guarantees (Henson & Northen, 2000; Krystallis & Arvanitoyannis, 2006; O'Donovan & McCarthy, 2002; Yeung & Morris, 2001a) although there is no evidence that organic food is safer than conventional products (Sofos, 2008).

Quality strategies involving guaranteed traceability are also among those preferred by

consumers when it comes to additional safety guarantees (Krystallis & Arvanitoyannis, 2006; Verbeke, et al., 2007). Quality differentiating strategies may therefore be a potential route for assessing very specific consumer concerns (such as those manifested for antibacterial residues in meat) and thus explore new niche markets.

Therefore, efforts can be suggested in order to promote preventive health and animal welfare management in meat production systems. These should allow a more efficient and rational use of antibacterials, which is a characteristic consumers associate with safer and higher quality meat.

Technical specifications on such quality differentiating strategies are not part of this article's objectives and the limits to such differentiation strategy must be recognized. However, preventive plans applied together with certification schemes guaranteeing a sound usage of antibacterials could create a market niche for such meat products, providing producers with incentives to supply meat according to standards above those legally imposed by the EU.

There may be an attractive market for such meat products because they would supply an instrument to extract the implied value of food safety related with the control with antibacterial residues. However, it must be stressed that such certification schemes must be associated with higher production costs, which represents necessarily higher prices for consumers. These higher prices, together with well known income effects on demand often translate into small niche market shares.

As such, the expected produced and consumed quantities would always be small. From a public health perspective, the effect would therefore be negligible. Thus, if a global public health problem is to be assumed associated with the usage of antibacterials in meat production, it must also be assumed there are not sufficient incentives for the market to be a solution. This issue would most likely need to be considered a public affair and the competent authorities would need to take the matter into their own hands.

Nevertheless, there are already across Europe, certification schemes that include food safety specifications (namely those already related with HACCP), which already represent an increased benefit for producers and retailers. As some consumers may be willing to pay more for such meat products, they may provide some support to specific meat production sectors. Therefore, there may be market segments to be explored and opportunities to be seized in the meat market for different product variants associated with higher levels of food safety in what is related to antibacterial residues.

Chapter 7 thoroughly describes Portuguese beef production systems and their status in terms of animal welfare. Furthermore, this chapter tries to signal which features of such production systems can be valued by Portuguese consumers.

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Chapter 7
Is there a link between animal welfare in traditional beef systems and beef quality?

There has been a profound evolution concerning farm animal welfare perception in Europe. This together with growing evidence that animal welfare has an impact on food safety and quality led to new legislation for an animal friendlier production sector. Also, new support measures aid those who supply cost increased animal friendlier products with differentiated quality. This article unveils connections between traditional systems and animal welfare. Two beef production systems in Portugal are described. A descriptive analysis is relevant for understanding why local breeds are preferred by producers, and why "semi-extensive" systems are better adapted to the country. Portuguese beef systems are also described in terms of their animal welfare status and probable control points. A link between Portuguese native breeds and beef quality is proposed, namely through increased animal welfare that may be translated into beef intrinsic quality. Nevertheless, as animal welfare is a credence quality attribute, consumers must rely on information, that is, on quality cues, to infer upon it on the product. This might give marketeers the option to develop quality differentiated strategies based on that attribute, within their broader marketing strategies.

7.1 Introduction

Farm animal welfare is a growing concern for many consumers in Europe and is becoming increasingly recognised as an important attribute of food quality (Blandford, Bureau, Fulponi, & Henson, 2002; Blokhuis, Keeling, Gavinelli, & Serratosa, 2008; Quintili & Grifoni, 2004). In spite of different interpretations within different parties, there has been a profound evolution in animal welfare perception in Europe. Specifically considering beef products, Veissier, Beaumont, and Lévy (2007) report that consumers have relevant concern levels for animal welfare. In Portugal, Aguiar Fontes et al. (2008) in a study looking at consumers' attitudes and preferences towards beef, when analysing the level of agreement with a series of statements, and using a 5 point Likert Scale (1 = total disagreement, 5 = total agreement), found an average score of 3.78 for the statement "I don't mind paying more for beef that ensures animal welfare".

These concerns are in some cases strong enough for the market to respond by developing farm assurance schemes guarantying animal welfare friendly products, such as UK's so called "Freedom Food" (Burgess, Hutchinson, McCallion, & Scarpa, 2003). Nevertheless, it is important to remember that it may be possible that the consumption of animal friendlier products is motivated by the perceived link between the improvement of animal wellbeing and the quality of the food product, rather than concerns about the animal's quality of life (Harper & Makatouni, 2002).

This idea of consumers' motivations derives from the fact that food product's characteristics are its real attributes as perceived by consumers (Bech, Grunert, Bredhal, Juhl, & Poulsen, 2001). If attributes such as animal welfare are considered food attributes as perceived by consumers, then they will influence the product's quality.

Animal welfare should thus be included in the so called credence quality attributes, *i.e.*, a quality attribute that cannot be evaluated, under normal circumstances, by the average consumer, becoming a question of faith and trust in the information provided (Grunert, Bredhal, & Brunso, 2004).

All this means that the welfare quality of food products can be considered a relevant issue within the food chain, additionally supported by the growing evidence that animal welfare has direct and indirect impacts on food safety and quality (Blokhuis, et al., 2008; Wyss, Wechsler, Merminod, & Jemmi, 2004).

This evolution in society, together with pressure from different associations (Blandford, et al., 2002; Quintili & Grifoni, 2004; Wyss, et al., 2004) has had significant policy consequences, and once the food security issues were overcome in Europe, the Common Agricultural Policy (CAP) evolved through a series of reforms in this direction (Blandford, et al., 2002; Blokhuis, et al., 2008). These eventually led to considerable changes in the relationship between citizens and the agricultural sector, and also to new criteria for financial support to farm. Farmed animals are no longer viewed as just a means for food production, but also as an integrant piece of other social concerns such as food safety and quality, environmental protection and sustainability (Blokhuis, et al., 2008). It is in this context that animal welfare is now included in a concept of multi-functionality of farming, justifying new policies, regulations and support measures (Arfini, Cernicchiaro, & Mancini, 2006).

Within this environment, the White Paper on Food Safety, adopted by the European Commission in 2000 "makes proposals specifically designed to promote the health and welfare of animals, once it is recognized that animal welfare questions need to be integrated more fully with regard to food policy, in particular their impact on the quality and safety of products of animal origin intended for human consumption" (Blokhuis, et al., 2008; European Commission, 2000).

Current research shows that well-treated livestock free from distress and able to express their natural behaviour, is healthier (Horgan & Gavinelli, 2006), thus more productive, both in quantity and quality terms. However, as Webster (2001) states, even though farmers are responsible for providing animal welfare, there are costs associated with implementing higher animal welfare standards, such as those related with training the farm staff, and adapting farm activities to appropriate standards. Moreover, certification costs can be very high.

Even though there are support measures for farmers complying with standards above those legally imposed and quality differentiated products may be sold with premium prices (as is the case with some animal friendlier products), if consumers want more animal welfare, they must convert that expressed desire into effective demand for welfare friendly products (WFP). Then, the increased costs may be compensated (Schnettler, Vidal, Silva, Vallejos, & Sepúlveda, 2009) and welfare-based quality differentiated products may be able to find a market share large enough to compensate higher production costs (Vanhonacker, Verbeke,

Van Poucke, & Tuyttens, 2007).

Nevertheless, most consumers still show a tendency to buy the cheapest meat, thus not reflecting the attitude towards animal welfare in their buying behaviour (Vanhonacker, Verbeke, Poucke, & Tuyttens, 2008). This means that choices made by the majority of consumers may not match the demand expressed by society (Vanhonacker, et al., 2007; Webster, 2001), which provides grounds for proper investigation about consumers' preferences and willingness to pay for WFP.

Included in a broader research project investigating Portuguese consumers' willingness to pay for beef products with credence quality attributes related with safer, cleaner and animal friendlier production methods, this article's objectives are:

- To define the current status quo and legal framework for beef cattle welfare in the EU and in Portugal.
- To unveil connections between "semi-extensive" production systems and beef cattle welfare in Portugal.
- To analyse whether welfare friendly products can be included in quality differentiating strategies for the Portuguese beef market.

7.2 Animal welfare – definition and legislative framework

Probably, one of the major problems associated with farm animal welfare certification is the definition of welfare (Quintili & Grifoni, 2004). This definition problem starts with different interpretations from different parties (Blokhuis, et al., 2008; Quintili & Grifoni, 2004; Vanhonacker, et al., 2007), because conflicting aspects such as economics, feasibility and environmental concerns have to be considered (Wyss, et al., 2004). Farmers and consumers disagree on the perception of farm animal welfare current status (Vanhonacker, et al., 2008). Moreover, the later authors found that, although both farmers and consumers have some common ideas about animal welfare, consumers include additional values to it, such as freedom to move and fulfil natural behaviour.

With the globalization of information, consumers have also undertaken an active role in animal health and welfare. The requirements of European consumers, in addition to price, safety and quality, include the compliance with environmental and animal welfare norms. Requirements in niche markets (such as Protected Designation of Origin (PDO)[49] beef) include labelling and information on origin and production methods (Zjalic, Dimitriadou, & Rosati, 2006).

At the same time retailers and producers increasingly recognize that efforts to meet consumer concerns and requirements in the animal welfare area actually represent a business opportunity and may thereby be profitably incorporated in production strategies of any agri-food company or chain (Blokhuis, et al., 2008).

Moreover, there is a growing appreciation that conditions negatively affecting animal welfare can also damage other quality aspects, interfering with the products' intrinsic quality

49 The PDO is a quality differentiated label regulated in the European Union since 1992 and it was established to "encourage diverse agricultural production, protect product names from misuse and imitation and help consumers by giving them information concerning the specific character of the products". PDO products are certified and thus labelled with the PDO European symbol. Producers benefit from the exclusive right to use that PDO product name.

[(*i.e.* physical characteristics of the product that can be measured objectively, related to the product's technical specification (Grunert, et al., 2004)]. Indeed, improving an animal's welfare can positively affect numerous aspects of product quality (e.g. reducing the occurrence of tough or watery meat as well as the incidence of bruising, bone breakage and blood spots), and disease resistance (decreasing the immunosuppressive effect of chronic stress and the need for antibiotics). All these have direct relevance on food quality and safety (Blokhuis, et al., 2008), namely by diminishing potential for drug residues.

Increasingly research is being directed towards farmers' willingness to change to more welfare friendly practices and how this varies according to the cost of implementing these changes (Blokhuis, et al., 2008).

Farms are therefore exploring the application of animal friendly husbandry systems, management practices and breeding strategies, the implementation of monitoring and certification schemes and the communication of the associated information to the consumer (through branding and labelling, for example) (Blokhuis, et al., 2008).

From the scientific point of view, animal welfare, particularly farm animal welfare, emerged as a particular field of research in the 1960's. Since then there has been an increasing distinction between animal protection (what people do to animals) and animal welfare (the animal's own experience of its own situation) and it is now accepted that animal welfare science is about the animal.

The two most widely quoted definitions (Broom, 1996; Duncan, 1993) state that welfare is about an animal's ability to cope with its environment and, since the concept is only applied to sentient animals, animal welfare is about how animals feel. Thus basic research in this area usually reflects the need to get 'inside the head' of the animal (Blokhuis, et al., 2008).

Nowadays, one of the most widely recognized and most useful approaches to animal welfare is the definition of "The Five Freedoms and Provisions" (FFP), as defined by the Farm Animal Welfare Council (FAWC), for whom the welfare of an animal includes its physical and mental state. These freedoms identify the elements that determine the animals' own perception of their welfare state and define the provisions necessary to promote that state (Webster, 2001).

The guarantee of animal welfare according to these freedoms can only be accomplished by proper production practices, specific not only to the animal species, but also to production systems and husbandry, climatic and farming conditions, housing and management methods, feeding, etc. However, whatever specific conditions are present, animal welfare assessment should be a scientific procedure and should include health, physiology, performance and behaviour measures (European Commission, 2001).

Having in mind such animal welfare definitions, it is clear that the mindset of policy makers, producers and consumers has evolved from just preventing animal cruelty and suffering, to promoting their wellbeing and meeting their needs (Horgan & Gavinelli, 2006). The link between animal welfare, animal health and food safety has been highlighted since 1999 in the White Paper on Food Safety (European Commission, 2000), integrating animal welfare into the food chain policy. More recently, the new Animal Health Strategy 2007-2013 (European Commission, 2007) further stresses this link (Blokhuis, et al., 2008).

Although it is not this article's goal to exhaustively analyse and describe the European

and Portuguese legislation concerning animal welfare protection, an overview is relevant. The body of the European Union (EU) legislation has significantly changed and increased since 2000 (Schnettler, et al., 2009), and this trend is expected to go on, in light of growing evidence that animal welfare standards have both direct and indirect impacts on food safety and quality (Blokhuis, et al., 2008; Horgan & Gavinelli, 2006).

As it can be seen in Table 7 many of the legal documents concerning animal welfare protection are general, in the sense that they apply to all animal species, or at least to all farm animal species (Veissier, Butterworth, Bock, Bettina, & Roe, 2008). EU's recommendations lay down minimal requirements to guarantee that the animals' needs are fulfilled in matters of nutrition, health, freedom of movement, physical comfort, social contacts, normal behaviour and protection against physical and psychological stressors (Veissier, et al., 2008).

Table 7: Overview of animal welfare main legislative references within the European Union (adapted from Blandford et al. (2002), European Commission (2010) and Veissier et al. (2008)).

Legal Act	**Important features**
All Animals	
Treaty of Amsterdam, Protocol annexed on protection and welfare of animals (1997).	Recognition that animals are sentient beings and should be protected for this reason. In formulating and implementing the Community's agriculture, transport, internal market and research policies, the Community and the Member States shall pay full regard to the welfare requirements of animals
Farm Animals	
European Convention for the protection of animals kept for farming purposes (ratified by all member states, 1976) and Council Directive 98/58/EC of 20 July 1998 concerning the protection of animals kept for farming purposes	General principles for the keeping, caring and housing of animals, and in particular to animals in modern intensive stock-farming systems. Reflects the FFP.
Calves	
Council Directive 2008/119/EC of 18 December 2008, laying down minimum standards for the protection of calves	Calves should benefit from an environment corresponding to their needs as a herd-living species, so they should be reared in groups, with sufficient space for exercise, for contact with other cattle and for normal movements.
Protection of animals at the time of slaughter and killing, and during transportation	
European Convention for the Protection of Animals for Slaughter (1979) and Council Directive 93/119/EC of 22 December 1993 on the protection of animals at the time of slaughter or killing	Aiming at improving handling, lairage, restraint, stunning and slaughter conditions.
European Convention for the Protection of Animals during International Transport (1968) and Council Regulation 1/2005 of 22 December 2004 on the protection of animals during transport and related operations	Rules concerning duration of transport, loading and unloading conditions, animal handling and caring, and transport means conditions.

There is no specific EU legislation considering the welfare of cattle kept for beef production (Blandford, et al., 2002; European Commission, 2001). However, some animals' welfare, and some specific situations were considered sufficiently important to be subject of a specific legal document. In this sense, veal production has a been controversial welfare topic within Europe and led to the implementation first in 1991, and later in 2008, of legislation laying down minimum standards for calves' protection.

Also, animal transportation is a very relevant issue for animal welfare, not only because it can in fact be stressful and harmful for animals, but also because it is very much in the public eye, therefore being subject to specific legal requirements.

The current EU legislation should be considered as providing minimum standards for animal welfare in many European countries. It is unlikely to represent the final development of animal welfare legislation in Europe as a whole (Blandford, et al., 2002), as many of the European Food Safety Agency's documents suggest.

7.3 Beef production systems in Portugal – a descriptive analysis

Before describing the main Portuguese beef production systems, some very general data about EU's cattle herd and farms' evolution can be useful to act as a framework. The total bovine herd has been diminishing since 2001 in the EU15 at a -0.73% annual average growth rate. The dairy herd has followed the same trend, with a -1.43% annual average growth rate. However, the most striking figures concern the number of beef and dairy farms, which have had a -7.97% and a -12.90% annual average growth rates respectively since 2001, confirming that across Europe there is a trend for animal concentration in larger farms (Eurostat, 2009).

Considering the Portuguese reality, the main trends follow those of the EU. In 2008 there were 1439 thousand cattle, distributed by an area of 92072 km^2 (INE, 2009). By adding up the values in Table 8 corresponding to beef cattle (veal calves, males and non-reproductive females) the number of animals in beef farms is around 315 000 (although we have to assume that some of the males will be used for breeding instead). Alentejo is the region with more animals (in 2008 it accounted for 40% of the beef cattle) followed by the North region (23% of the beef cattle, in 2008). Another important feature is the growth in the number of beef cattle since 2001, while the number of dairy cows has been declining (Figure 3).

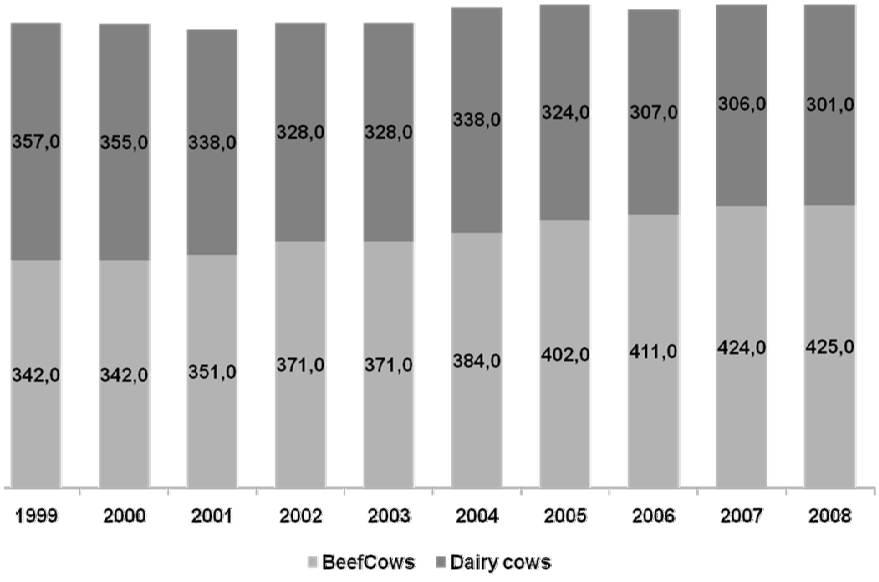
Table 8: Distribution of animals by the different portuguese geographical regions by NUTS II in 2008, (Unit - 1.000 heads) (adapted from INE (2009)).

Cattle	Total	Less than 1 year				Between 1 and 2 years		
		Total	Veal calves	Males	Females	Males	Reproductive Females	Other females
Portugal	1439	371	89	131	151	73	143	22
Continent	1191	304	76	109	118	62	114	18
North	332	92	42	19	31	17	34	5
Center	214	60	19	20	21	15	23	4
Lisbon	51	16	3	7	5	7	5	1
Alentejo	584	134	11	62	60	22	51	8
Algarve	10	3	2	1	1	1	1	*
Azores	242	65	12	21	31	11	29	3
Madeira	6	2	*	1	1	1	*	*

Cattle	2 years and more					
	Males	Heifers		Cows		
		For Breeding	Others	Total	Dairy	Other
Portugal	31	67	6	726	301	425
Continent	27	57	5	603	203	400
North	6	11	2	185	110	55
Center	3	14	1	94	59	34
Lisbon	1	5	*	16	9	7
Alentejo	16	27	2	325	24	301
Algarve	*	1	*	4	*	4
Azores	3	9	1	121	97	24
Madeira	*	*	*	2	1	1

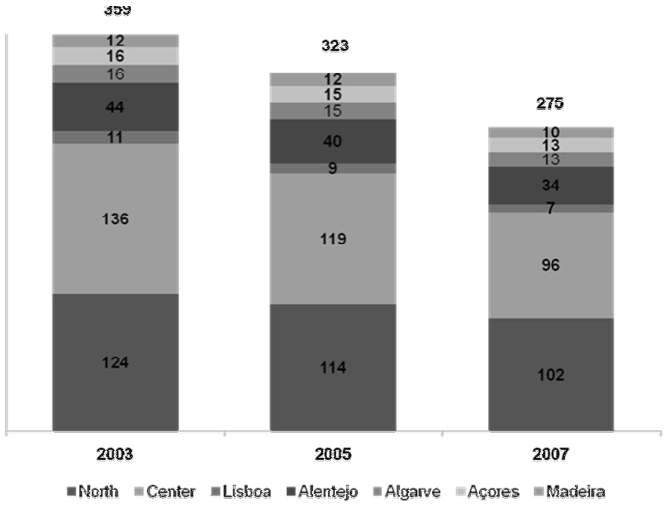
* Less than half of unit used NUTS - Nomenclature of Units for Territorial Statistics

Figure 3: Evolution of dairy cows and beef cattle (adapted from INE (2009))



The number of dairy farms has also declined (Figure 4), and in the mainland these farms are mainly present in the North, Center and Alentejo regions.

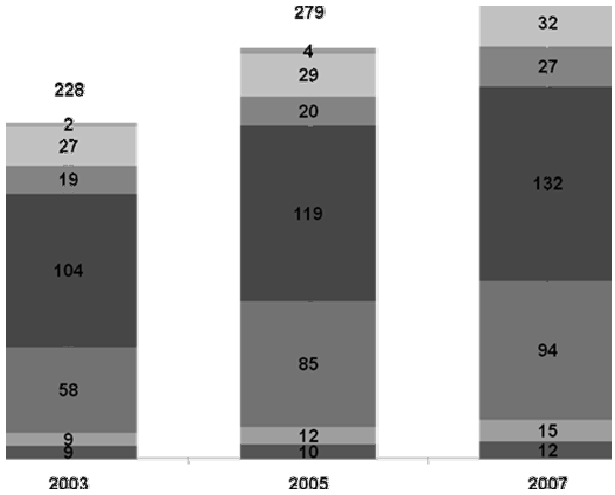
Figure 4: Evolution of the number of farms in the different portuguese regions, by NUTSII (adapted from INE (2009))



In 2005 Portugal had 10065 dairy farms, 10348 beef farms and 1041 classified as mixed dairy and beef (INE, 2006). The same report shows that the number of farms classified as beef grew 40% when compared with 1999 data.

The number of animals per farm has also been growing over the last years and in every region, mainly as a result of the above mentioned trends (Figure 5) (INE, 2009).

Figure 5: Evolution of the number of animals per farm by NUTSII (adapted from INE (INE, 2009))



The regions of Alentejo and the North (which have a higher number of farms) have a very distinct average number of animals per farm. This reflects the differences in beef production systems in the two regions and the differences in average farm size. In Alentejo (where farmers

are usually larger) there are more animals per farm (an average of 132 in 2007), than in the North (where there is an average of 12 animals per farm).

Nevertheless, in spite of the marked tendency towards concentration (shown by a 54% increase in the number of animals per farm in Portugal between 1999 and 2005), in the North there is still a majority of small farms. More than 36% of these farms have 1 or 2 animals and around 70% have less than 10 animals (INE, 2006).

Overall, these characteristics lead to significant differences in the regional production systems, which can be divided into two main groups: "semi-extensive" (which has different characteristics in the north and south of the country), and intensive.

7.3.1 "Semi-extensive" beef production system

Considering the data described in the previous section, we can identify two "semi-extensive" beef cattle production systems, found in the two main regions of the country with beef production. Table 9 summarizes the different characteristics accordingly to the geographical region described.

Table 9: Characteristics of the Portuguese "semi-extensive" Production Systems (adapted from Rodrigues, Pinto de Andrade, and Várzea Rodrigues (1998)).

Characteristics	**North/Center**	**South (Alentejo)**
Weather	Mediterranic with Continental and Atlantic influence	Mediterranic with Continental influence
Average temperature	15ºC	> 15ºC
Average rain	> 800mm	< 800mm
Soils		
• Granite and schistose sandy soils, low pH • Low levels of exchangeable bases	• Mountainous • Medium fertility and productivity • Medium hydric erosion • Low organic matter	• Essentially flat land • Low fertility and productivity • High hydric erosion • Very low organic matter
Production Systems		
Farm size	Small farms 3 ha	Large farms 300 ha
Average herd size (animals)	3	75
Activity characteristics	Diversified and family type	Entrepreneurship
Aptitude of indigenous breeds	Meat / Traction	Meat
Pasture	Natural irrigation + Dry land	Dry land
High digestibility and high forage production	April to July	March, April and May
High digestibility and low forage production	March and October	October and November
Null or low forage growth	August, September and November to February	June to September, December to February
Supplementary feeds	Hay, cereal straw, turnip, potatoes and fruits	Cereal straw, hay, grain and cereal culture residues
Calving	Along the year	Two periods (Summer and Winter)
Slaughter age	7 months	18 - 24 months

The Portuguese traditional "semi-extensive" production systems are considered sustainable and based on the use of local available resources (genetic basis of indigenous bovine breeds and spontaneous or seeded feedstuffs) (Rodrigues, et al., 1998).

In the small farms in the North and Center, farmers prefer to sell the animals at 4 to 8 months, instead of rearing them, avoiding additional feeding and housing needs. By selling the young animals, revenue indispensable for the family economy is obtained. In Alentejo the farm size allows an extensive livestock production system, which involves the late rearing of calves that are sold only at 18 to 24 months (Rodrigues, et al., 1998).

In addition to the sector's economic relevance, these extensive beef production systems play an important role in the protection and management of the environment (maintenance of countryside, control of weeds and bushes). Without this and other livestock production, many areas would suffer serious environmental degradation and desertification (Zjalic, et al., 2006).

A significant part of the "semi-extensive" beef cattle production systems is based on the use of animals with unique characteristics, different from region to region, with good maternal aptitude, high rusticity, slow growth performance (not very specialized in meat production) and exceptional adaptation to the environment where they live in and to the local naturally produced feed (Rodrigues, et al., 1998). Some of the animals belong to breeds associated with PDO beef, distributed along several Portuguese regions.

The differentiation trend can represent an important source of income to producers. Barreira, Brandão, Lemos, and Aguiar Fontes (2009) have shown that some PDO beef producers, namely in Alentejo region marketing "Carnalentejana" PDO, belong to a well established and very well organized producers association. These producers believe "this is the way to be in the market". The same authors also found that consumers think of PDO products as a good way to promote regional development.

7.3.2 Intensive beef production systems

There is no official record about the location of intensive feedlots in Portugal. The authors' experience suggests that these production units tend to be located near the large slaughterhouses. Traditionally they were located in the Center region. However, since November 2007 there have been severe restrictions in animal movements in Portugal because of a bluetongue outbreak. This scenario led to the rise of several feedlots in the South region, near the large farms that formerly produced animals in semi-extensive systems.

Still, in spite of the existence of these feedlots, and although there are no any official records on the average number of animals in this type of farm, the authors' experience suggests that Portugal is not a country where feedlots have a significant dimension or even tradition.

Also according to the authors' experience and through contact with many players in the sector, and given the current trends, there are mainly two types of feedlots in Portugal, classified here accordingly to the type of animal entering the feedlot. Table 10 summarizes the description of the beef intensive production system.

Table 10: Intensive production systems' characteristics in Portugal.

	Dairy calves	Suckler calves
Genetic resources (Rodrigues *et al.*, 1998)	Holstein-Frisian	Mainly crossbred: imported x indigenous breeds
Feed	Concentrate and straw (*ad libitum*). Sometimes maize silage. High energy and protein	
Produced quantity	Mass supply. Standardized product	
Demand[1]	More generalized	
Weaning age (months)	2-3	6-8
Slaughter age (months)	9-12	12-15
Initial weight (kg)	100-120	250-350
Final weight	350-400	500-550
Carcass weight	170-200	300-325

These production systems mainly produce and commercialize undifferentiated beef. Of course this has important implications, namely the need to compete mainly based on price facing tough competition in the market place.

Although there isn't any aggregated published data on this issue, our experience shows that many dairy calves that enter the intensive beef production systems come from Azores, an insular Portuguese region where dairy production is very important. There is a specific welfare problem related with the transportation of very young animals and the transfer conditions themselves. These often translate into very ill and weak animals upon arrival at the feedlot.

7.4 Portuguese beef production systems welfare status and possible control points

Within a framework that includes legislation, consumers' demands, producers' commitment and science, the FFP (Table 11) mentioned above can be taken as a starting point into the assessment of animal welfare's relation with the production system. Each freedom will then be decomposed into several control points and attributes.

Based on the Hazard Analysis and Critical Control Point (HACCP)[50] methodology, and following Noordhuizen, Cannas da Silva, Boersema, & Vieira (2008), we established control points for animal welfare assessment in Portuguese production systems as described below.

The critical control points (CCP) or control points (CP) are usually derived from the risk factors that have been identified during the strengths-and-weaknesses-assessment of a production system, representing points at different steps in the production process where risks should be controlled. They can be single points in the process, series of points, observations, procedures or test sites (adapted from Noordhuizen et al. (2008)).

50 The Hazard Analysis and Critical Control Point (HACCP) methodology is a preventive food safety control system, based on a systematic, documented and verifiable approach. It intends to identify specific hazards and establish preventive measures at all production stages.

A CCP has to meet several formal objective criteria before it can be considered as such. In living animals, due to biological variation, exact standards or absolute objective threshold values may not be available (as they are in physical processes). In such situations, if the critical control point is still considered of paramount importance, it must be defined as a control point (CP), which needs to be controlled, but is not objectively measurable (adapted from Noordhuizen et al. (2008)).

An exhaustive analysis of control points and attributes is not intended. However, there is a pressing need for credible on-farm assessment systems that help determining the animals' welfare status. Therefore, the attributes considered are already established as important by the existing body of science (e.g. DEFRA (2003), Blokhuis et al. (2008), Vanhonacker et al.(2008) or RSPCA (2010)).

Table 11: The Five Freedoms and Provisions (FAWC, 2010).

The Five Freedoms and Provisions (FFP)
1. **Freedom from Hunger and Thirst** - ready access to fresh water and a diet to maintain full health and vigour.
2. **Freedom from Discomfort** - provision of an appropriate environment including shelter and a comfortable resting area.
3. **Freedom from Pain, Injury or Disease** - prevention or rapid diagnosis and treatment.
4. **Freedom to Express Normal Behaviour** - provision of sufficient space, proper facilities and company of the animal's own kind.
5. **Freedom from Fear and Distress** - ensuring conditions and management which prevents mental suffering.

On-farm assessment systems should provide a standard way of converting science-based welfare-related measures into information that is conveyable to and easily understood by all the parties involved, namely the consumer, thereby addressing specific concerns and allowing for the clear marketing and product positioning (Blokhuis, et al., 2008). Information should also be properly understood by producers, as a guarantee of successful adherence.

This method will allow an easier evaluation of whether different beef production systems have intrinsic characteristics that allow them to fulfil the FFP. At the same time, it will be possible to identify probable control points that need to be implemented in each system. Nevertheless, this analysis is undertaken with the previously described Portuguese "semi-extensive" and intensive production systems in mind, and according to the authors' experience. Other production systems, present in another countries or regions, may not fit this analysis.

The following tables try to identify and summarize the CP according to each freedom (from the FFP framework).

Table 12: Freedom from Hunger and Thirst

Control Point	"Semi-extensive"	Intensive
Feeding and nutrition program appropriate to their age, weight, and behavioural and physiological needs. *Ad libitum* feed and water. Avoid sudden changes in the type and quantity of food. Adult cattle and calves must be provided with fiber to allow them to ruminate, which must be of such quality and length so as to help avoid acidosis. (RSPCA, 2010)	(+) Animals may not be dependent of hand feeding. (+) Amount of fiber is always guaranteed given the system's characteristics (-) Nutrition programs are more difficult to control as the animals are not observed as frequently and are dependent of local resources and flora. (-) Feed quality is dependent on the vegetative cycle and weather conditions.	(+) Concentrates have high energy and protein and most of the time constitute well designed feeding and nutrition programs. (-) Animals are dependent on the fiber that is provided with feed. (-) Animals are completely dependent on what is given to them, and feeding is completely controlled, which may prevent natural behaviour.
Drinking water with appropriate chemical and bacteriological quality	(-) Difficult to guarantee when water comes from natural sources	(+) Water quality is easier to control.
Feeding facilities and equipment cleaning and maintenance protocol	Non applicable	Depends on implemented procedures and protocols

Looking at the "freedom from hunger and thirst" criteria, it can be suggested that in intensive systems it is easier to guarantee food and water supply, and to guarantee proper animal nutrition (regarding proper measures to avoid imbalances such as acidosis are taken).

Table 13: Freedom from discomfort

Control Point	"Semi-extensive"	Intensive
Genetics	(+) Native breeds are usually more adapted to local conditions, such as temperatures and insulation, thus being less affected by such stress factors (-) Imported animals have more difficulty adapting to the new field conditions	(-) The production system does not make use of genetic characteristics for assuring increased comfort (-) Imported animals have more difficulty adapting to the new field conditions
Stocking density and available space (Vanhonacker et al., 2008)	(+) Easily guaranteed, given the system's characteristics	(-) Most farms tend to increase stocking density
Type of floor and bedding material (Vanhonacker et al., 2008); Comfortable resting area (DEFRA, 2003, Blokhuis et al., 2008)	Dependent on geographic conditions and soil characteristics in which the animals are kept	Dependent on facilities' characteristics and the kind of bedding used
Thermal comfort (Blokhuis et al., 2008, Vanhonacker et al., 2008)	(-) Difficult where no shelters are available. Heat stress can be one of the most important welfare problems in southern Europe	(+) Easily achieved in properly built farms
Air quality (Vanhonacker et al., 2008)	(+) Easily guaranteed, given the system's characteristics	(-) Noxious gas levels can be high
Animal waste and effluents (RSPCA, 2010)	(+) Fewer and more disperse environmental impacts	(-) Potentially bigger environmental impacts

Lighting (RSPCA, 2010)	(-) Difficult where no electrification is available	(+) Easily achieved in properly built farms

Regarding the freedom from discomfort, no clear distinctions can be made between the two systems. However, the environmental conditions may favour "semi-extensive" systems.

Table 14: Freedom from pain, injury and disease

Control Point	"Semi-extensive"	Intensive
Daily observation of the animals	(-) Difficult to guarantee as the animals are not observed as frequently	(+) Included in daily feedlot operation
Rapid diagnosis and treatment (DEFRA, 2003)	(-) Difficult to guarantee as the animals are not observed regularly	(+) Included in daily feedlot operation
Absence of injuries, disease and pain induced by management procedures (Blokhuis et al., 2008)	Depends on the implemented procedures and protocols	
Mutilations (castrating, dehorning and tail docking (RSPCA, 2010)	Depends on the implemented procedures and protocols	
Prophylactic and therapeutic protocols (RSPCA, 2010)	Depends on the implemented procedures and protocols	
Biosecurity measures and rodent control plans (DEFRA, 2003)	(-) More difficult to achieve, as the production system is more open to external factors	(+) More closed production system: biosecurity measures can be more easily implemented
Carcass disposal according to current legislation (RSPCA, 2010)	Depends on the implemented procedures and protocols Sometimes difficult to comply with legally imposed timings	Varying procedures and protocols that comply with legal requirements
Animal transport protocol	Varying procedures and protocols that comply with legal requirements	

The freedom from pain, injury and disease may be easier to assure in intensive systems, as long as proper handling and procedures are implemented, once animal monitoring is more frequent and easier. Nevertheless diseases like lameness, ruminal acidosis and respiratory disease are much more common in the latter system.

Table 15: Freedom to express normal behaviour

Control Point	"Semi-extensive"	Intensive
Facilities and equipment cleaning and maintenance protocol Characteristics of pens and equipments	Depends on the Implemented procedures and protocols (+) Only important when considering shelters	Depends on the Implemented procedures and protocols (-) Extremely important. Sometimes problems with ventilation

Expression of social behaviour. Animals should be allowed to express natural, non-harmful, social behaviour and natural behaviours, such as exploration and play (Blokhuis ***et al***., 2008) (Vanhonacker ***et al***., 2008)	(+) Naturally achieved	(-) Very difficult to achieve expression of natural behaviours. Expression of social behaviour, although always primary, can be enhanced by housing calves in group pens (Xiccato, Trocino, Queaque, Sartori & Carazzolo, 2002)
Ease of movement Foraging (Vanhonacker et al., 2008)	(+) Naturally achieved	(-) Ease of movement is impossible to achieve as the animals are permanently housed. Can be compensated by adequate stocking density (-) Foraging is very difficult to achieve, as animals usually do not pasture.

Table 16: Freedom from fear and distress

Control Point	**"Semi-extensive"**	**Intensive**
Trained personnel (RSPCA, 2010) Implementation of codes of practice	Depends on the Implemented procedures and protocols	
Good human - animal relationship. Absence of general fear, distress, frustration (Blokhuis et al., 2008) (Vanhonacker et al., 2008)	Depends on the Implemented procedures and protocols	
Boredom (Vanhonacker et al., 2008)	(+) As animal interacts more with its surroundings they tend not to be bored	(-) Associated with the intensive production
Mixing of animals Group size Stable groups (Vanhonacker et al., 2008)	(+) Uncommon. Groups are generally stable as they result from animals weaned at the same farm and at the same time	(-) Very common. One of the main factors leading to disease situations in feedlots.
Weaning	(-) At the farm, more often at 6 months age, usually represents a stressful event.	(+) Less stressful event as animals are younger. Dairy calves are less stressfully weaned
Transport protocols	Non applicable.	(-) The most stressful event after animal mixing
Handling facilities	Depends on the Implemented procedures and protocols	

Finally, when the freedom to express normal behaviour and the freedom from fear and distress are at stake, "semi-extensive" systems are clearly more animal friendlier, as beef cattle produced in such systems can be considered to have high quality of life, freedom to move and to fulfil natural behaviours, subjectively derived from above described objective criteria.

7.5 Portuguese beef cattle welfare – objective quality and user-oriented quality

An overall analysis does not allow for immediate identification of the animals' friendlier system. Looking at each freedom as a whole, it is not always clear which system is more prone to promote animal welfare. Moreover, proper management must always be assured, whatever system is considered.

Having analyzed beef cattle welfare in Portugal according to the FFP, some relationships between animal welfare and beef quality can be suggested, and, as discussed above, there are different ways of considering animal welfare in its relation to quality. Moreover, for consumers, concerns about animal welfare can also be multidimensional, once they often link it with the safety of the food product.

Whatever the reasoning behind consumers' motivations, beef producers should take advantage of them. In this sense, Portuguese "semi-extensive" production systems may offer animal welfare characteristics consumers are interested in.

Therefore, consumers may value animals enjoying ease of movement, and being able to express natural and social behaviour, as well as not being dependent on hand feeding or subject to high stocking densities. Consumers may also consider the lower environmental impact to be important. Finally, the use of local native breeds may be considered positive through associations with cultural heritage and landscape preservation.

The use of local breeds in Portuguese "semi-extensive" production systems has advantages besides consumers' preferences. These native breeds are usually more adapted to local conditions, being more resistant to extreme temperature and insulation conditions, as well as to variations in pastures quality and availability. Moreover, the animals are usually reared in stable groups, in cow-calf operations, and mixing of animals of different ages and sources is unusual. This characteristic alone avoids many stressful events and reduces contact with pathogenic agents.

With the growing appreciation that conditions negatively affecting animal welfare can also damage other quality aspects, the positive welfare aspects of such production systems can be considered important, once it can be argued that more intensively raised and handled animals can be more prone to stress. Current research shows that well-treated livestock, which is able to behave naturally, is healthier (Horgan & Gavinelli, 2006).

Therefore, beef cattle welfare shows a close relation to production systems, and improving an animal's welfare can positively affect numerous aspects of product quality (Blokhuis, et al., 2008). This welfare may be translated into beef intrinsic quality resulting in an increased experienced quality by consumers (*i.e.*, the quality dimension experienced by consumers during and after consumption (Grunert, et al., 2004)) (Fernandez, Monin, Culioli, Legrand, & Quilichini, 1996).

7.6 Conclusions

Regarding animal welfare, consumers' quality perceptions and expectations seem to interweave with the requirements of legislators and scientists. Consumer preferences have not been disregarded within EU and its policy, as European legal welfare requirements have been growing, together with evidence that animal welfare standards have both direct and indirect impacts on food safety and quality. Also, some support measures within the CAP favour producers who set higher standards for animal welfare.

Regarding the beef production systems here analyzed, it is not possible to clearly state that any of the two described systems is the animal friendlier one. Nevertheless, Portuguese "semi-extensive" beef production systems methods may have characteristics that, within the consumers' perspective, should be explored.

A user-oriented quality differentiating strategy for Portuguese beef should focus on features such as low stocking densities, natural animal behaviour and low environmental impact, incorporating credence quality attributes into the final beef product, including rural environment and ecosystem preservation and sustainability. Consumers relate these attributes with safer, more genuine and of higher quality beef.

Additionally, the animal rearing conditions in these systems reduce stressful events, which in turn can positively affect numerous intrinsic aspects of final product quality. This means there are potential intrinsic quality characteristics that can be translated into increased experience quality for consumers.

The market for such products is attractive because it provides a mechanism through which the implied value of animal welfare can be derived. Nevertheless, it cannot be ignored that animal friendly products very often have higher costs (namely because of certification), translating into higher prices for consumers. Moreover, it is not possible to minimize price and income effects on such products' demand and market, which will always be a niche market.

However there are already, in Portugal and across Europe, certification schemes that include objective animal welfare standards. Moreover, some certification strategies, although not specifically related with animal welfare, can be perceived as animal friendlier by consumers, translating into increased benefit for producers.

Keeping in mind that certification costs could represent higher consumer prices, when compared to undifferentiated beef prices, and that consumers income always plays a very important role in their willingness to pay for differentiated products, some consumers may be willing to pay more for quality beef, helping support through their demand specific production sectors.

That is the case of organic farming and PDO beef, which represents a small but consistent niche market in Portugal, representing interesting market opportunities for producers and considerable sustainability value for the regions where they are located. Still, differentiation through marketing of animal friendlier products may still be insufficiently explored.

Therefore, there may be business opportunities in the Portuguese beef market for different product variants associated with higher levels of animal welfare, such as products explicitly labelled as animal friendly, or products for which the consumer perceives this to be the case.

Chapter 8 is devoted to the review of the environmental impact of beef production. Moreover, it proposes a beef production intensity that may a second best solution for the environment, whilst it is positively valued by consumes.

This chapter has been submitted on Ecosystem Services as: I. Viegas, M. Aguiar Fontes, J.L.Santos, Beef Production in traditional silvopastoral systems - A second best for the environment?"

Chapter 8
Beef Production in traditional *Montados*
– A second best for the environment?

Some European silvopastoral productions like Portuguese Montados can be considered sustainable, with increased social, economic and environmental benefits. However, their abandonment is increasing. We identify this abandonment's main drivers and propose possible preservation solutions. A possible strategy is intensification, a damaging solution from the environmental perspective. A second strategy involves a systems engineering approach, which doesn't preserve cultural or heritage values. The most favourable strategy may be the preservation of cattle grazing systems, ensuring environmental and economic sustainability based on food products with expectable economic success. Such products should be included in eco-friendly or regional certification strategies, which together with agri-environmental payments, may compensate farmers' management efforts.

8.1 Introduction

Portuguese *Montados* (as well as other similar silvopastoral systems) are one of the European agricultural systems that can be considered as "semi-natural". These can be defined as sustainable land management operations, integrating agricultural and / or livestock production (predominantly sheep but also cattle and pigs) with forestry practices, with increased social, economic and environmental benefits for land users at all levels (Eichhorn, et al., 2006; Mosquera Losada, McAdam, Romero-Franco, Santiago-Freijanes, & Rigueiro-Rodríguez, 2009; Rigueiro-Rodríguez, Fernández-Núñez, González-Hernandéz, McAdam, & Mosquera Losada, 2009). In many European regions, such traditional systems are also an important part of the cultural heritage and are considered important recreational areas as well (Eichhorn, et al., 2006; Hadjigeorgiou, Osoro, Fragoso de Almeida, & Molle, 2005; McAdam, Burgess, Graves, Rigueiro-Rodríguez, & Mosquera Losada, 2009; Pinto-Correia & Vos, 2004; Rigueiro-Rodríguez, et al., 2009).

There are also use and non-use values to humans for preserving this cultural heritage very often associated with traditional livestock breeds. In addition, from the biological and production point of view, this genetic pool can be a source of characteristics associated with consumer preferences (Steinfeld, et al., 2006). Associated with these traditional production systems there has been an increase in high quality food production arising together with certification schemes (Hadjigeorgiou, et al., 2005; Rigueiro-Rodríguez, et al., 2009), such as

Protected Designation of Origin (PDO)[51].

It is therefore clear that there is an increasing interest in these systems as means of maintaining economic viability of rural populations, through agriculture but also through the diversification of economic activities (Milne, 2005).

However, many of the services (cultural, social, environmental, etc) aren't usually paid for, so only the land owners' private interests drive land use decisions. These positive externalities (consequences of economic activities that benefit unrelated third parties who do not participate in the market) can therefore be lost and, as a consequence, high costs can be imposed on society due to their disappearance.

Within such context, this article focuses its attention on the abandonment of systems like *Montados* and the main drivers leading to this situation (including climate change). Furthermore, the goal is to identify sustainable preservation solutions. It will be suggested that it is possible that the best way to guarantee the preservation of these traditional systems is to adopt a *second best* solution, by fomenting beef cattle production for *Montados*.

The proposed solution is recognized not to be the best in environmental terms (cattle isn't the ideal species to produce if the aim is to ensure the preservation of the ecosystem because of the heavy load it imposes on the soil), but it should prove itself to be the one that guarantees the preservation of cultural and landscape values, while maximizing economic viability. The production of beef cattle of indigenous breeds is the only one with prospects for market share so that there is sufficient economic viability.

As such, this second best solution to be proposed is based on a product with expected economic success, which nevertheless ensures environmental and sustainability measures that preserve the ecosystem. The maintenance of such systems associated with a desirable economic viability is probably the best way to prevent their abandonment.

As this article is included in a broader research on Portuguese consumers' preferences and willingness to pay for environmentally friendlier beef production, it should nevertheless be stressed that the environmental impact of livestock production isn't the authors' area of expertise or research and that this article has no intention of representing more than a speculative background review for the design of stated preference surveys' scenarios. As such, the goal is to present a sustainable silvopastoral production system that also meets consumer preferences while allowing economic viability.

Some of the recent literature on the mitigation of the environmental impacts of livestock production, namely Capper, Cady, and Bauman (2009) and Steinfeld et al. (2006) tends to suggest and support intensification (and confinement) as the best possible approach. However, as it will be shown, Europe's societies and agricultural policy trends are somewhat divergent from that perspective, fomenting more extensive and non-confined production systems.

More specifically the trend denoted for the agricultural policy at least partly tries to meet the expectations of many consumers who are increasingly concerned not only with health problems associated with animal products, but also with the environmental problems associated

51 The PDO is a quality differentiated label regulated in the European Union since 1992 and it was established to "encourage diverse agricultural production, protect product names from misuse and imitation and help consumers by giving them information concerning the specific character of the products". PDO products are certified and thus labelled with the PDO European symbol. Producers benefit from the exclusive right to use that PDO product name. It doesn't imply any environmental concern regarding the production methods.

with such productive sectors. Many consumers' choose to either reduce consumption levels, or to select certified products, looking very often for "green" or "eco-friendly" products (Steinfeld, et al., 2006). Across Europe, some of the above mentioned traditional silvopastoral production methods, which are considered sustainable and even environmentally friendly, would fit this demand, but many of them are lacking economic viability.

As such, the stimulus of environmentally friendly livestock production methods is much needed, either through market or policy-driven demand. It may therefore be relevant to analyze production methods that can result in food products which are considered quality products by consumers and are produced by environmentally, economically and socially sustainable methods.

This article's next section makes a brief overview of the characteristics of traditional silvopastoral systems in Mediterranean areas of Europe. The following sections (sections 8.2 to 8.4) include an overview of Portuguese traditional silvopastoral systems, namely *Montados,* and an analysis of the problems related with marginalisation, land abandonment and desertification of these territories. Section 8.5 proposes strategies to avoid land abandonment and promote the sustainable preservation of *Montados* and section 8.6 concludes by associating such strategies with high quality food production together with specific certification schemes.

8.2 Traditional silvopastoral systems in Mediterranean areas of Europe – a brief overview

There is a long tradition of silvopasture (as a practice of agroforestry) in Europe, in a wide variety of regions and climates, although during the 20th century its implementation has greatly declined, mainly due to agriculture's intensification and specialization (Mosquera Losada, et al., 2009). However, in today's Europe traditional grazing is believed to have positive effects in pastures biodiversity.

In the Mediterranean area some of these mature systems are considered to be high nature value ecosystems and one of the most biodiverse man-made landscapes, providing habitat for a large variety of flora and fauna, including insects and birds (Reidsma, Tekelenburg, van den Berg, & Alkemade, 2006). Vegetation and animal richness and variability is most likely the result of relations between high spatial and temporal diversity, soil and climate conditions, grazing by domestic and wild animals and other human management activities (Hadjigeorgiou, et al., 2005; Pinto-Correia & Vos, 2004; Proença, Queiroz, Araújo, & Pereira, 2009).

As it can be seen in Figure 6, the tree component of silvopastoral systems is responsible for the production of fruits, fodder and wood for fuel, litter or timber (Eichhorn, et al., 2006). Trees have also been responsible for many non-marketed products, such as recreation, hunting, watershed protection and carbon sequestration (Steinfeld *et al.*, 2006). Very often, trees themselves define the landscape, as they are often spread throughout fields with no planned pattern or density across the landscape (Eichhorn, et al., 2006).

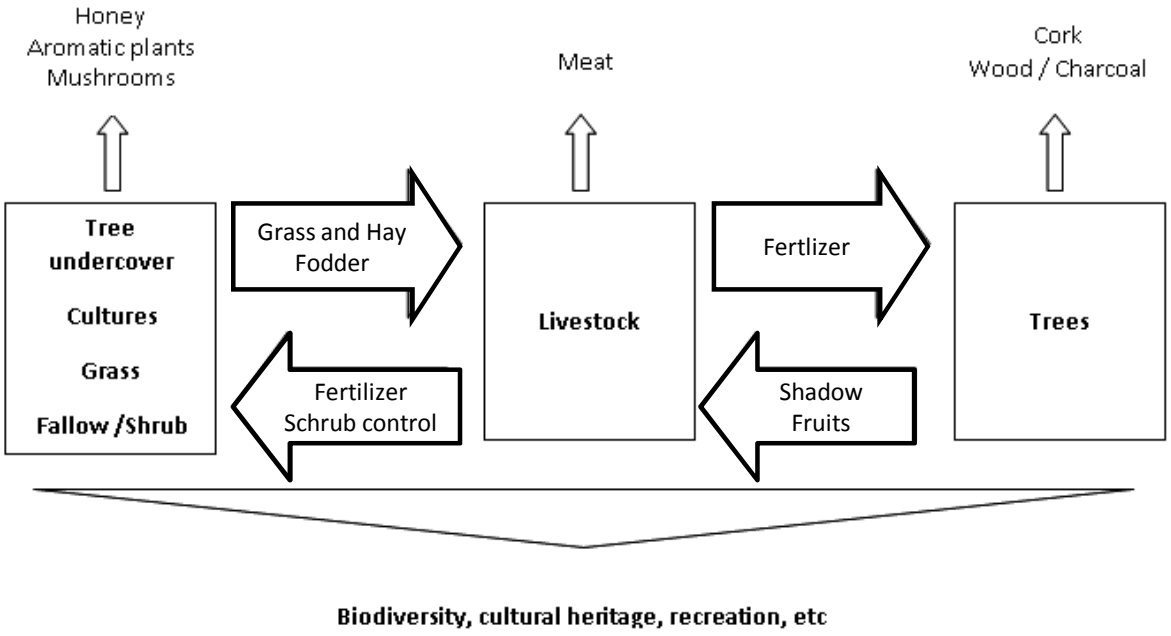
Trees also shade the pasture, which is particularly important in Mediterranean warm areas, not only for provision of shelter for animals, but also for higher persistence of the

herbaceous layer under trees at the end of spring, important for animal feeding (Eichhorn, et al., 2006; Pinto-Correia & Vos, 2004; Rigueiro-Rodríguez, et al., 2009). Finally, this component also promotes soil conservation, acts as windbreak and reduces evaporative water losses and nutrient leaching from the topsoil (Eichhorn, et al., 2006; Pereira, et al., 2004; Pinto-Correia & Mascarenhas, 1999).

Furthermore, pesticide and herbicide are used to a quite lower extent in agro-forestry systems, reducing soil and water contamination (Rigueiro-Rodríguez, et al., 2009). Positive mechanisms also include maintaining soil structure and heterogeneity (Steinfeld, et al., 2006). Fertilisers are also much less used, thus minimizing greenhouse gases' emissions. Finally, as low tree density promotes tree roots to reach deeper soil areas, carbon sequestration per tree is more efficient (Rigueiro-Rodríguez, et al., 2009) when compared with exclusive agrarian systems.

Regarding these systems' livestock component, the usual production output is meat. As long as the system's existing trees are large enough and animal density isn't high, cattle can be used (McAdam, et al., 2009). Positive effects of grazing include, besides soil fertilisation, the removal of much of the dry vegetation which can act as fuel, thus reducing the risk of wild fires (Castro, 2009; Hadjigeorgiou, et al., 2005; Pinto-Correia & Mascarenhas, 1999; Rigueiro-Rodríguez, et al., 2009).

Figure 6: Sylvopastoral systems' schematic representation (adapted from Pinto-Correia and Vos (2004))



In addition, animals are responsible for positive effects on biodiversity preservation due to the heterogeneity derived from animal presence at an appropriate stocking rate (Dumont, Rook, Coran, & Röver, 2007; Mosquera Losada, et al., 2009). Livestock can improve species composition by controlling shrub growth, by dispersing seeds through their hoofs and manure and by stimulating seed germination.

In fact, agriculture is recognized to play a very important role in biodiversity across Europe and it seems that the best conditions for maintaining biological and landscape diversity of European farmland are those created by extensive / traditional agricultural systems (EEA, 2006; Reidsma, et al., 2006).

Considering that livestock genetic diversity is considered to be threatened, and that many European breeds currently face high extinction risks (EEA, 2006), there are additional arguments in favour of strategies for conservation of livestock genetic resources in silvopastoral traditional systems, as domestic autochthonous animal breeds tend to be well adapted (Rigueiro-Rodríguez, et al., 2009). It is this genetic pool that potentially allows livestock to adapt to different environments and increasing environmental changes (Steinfeld, et al., 2006). Due to the predictable temperature increase in Mediterranean areas due to climate change, heat tolerant breeds should be preferred (European Commission, 2009), as are many Portuguese native cattle.

8.3 Portuguese traditional silvopastoral systems

Analyzing the Portuguese reality, several different agro-forestry systems were long ago established due to different biophysical and climatic conditions and for historical reasons. There are very different land use and ownership patterns, with smaller and scattered properties in the North and larger estates in the South (Castro, 2009). There are many types of land management, often determined by the tree and animal species used (Rosas, et al., 2009). Many of them have very high socio-cultural, historical and biodiversity values (Belo, et al., 2009; Proença, et al., 2009; Rosas, et al., 2009).

Most traditional agro-forestry systems include trees of the genus *Quercus*, often associated with animal grazing (Mosquera Losada, et al., 2009; Pinto-Correia & Vos, 2004). These autochthonous species are well adapted to irregular rainfall and long dry summers (Belo, et al., 2009).

One of the most important tree products in Portugal is cork (extracted from cork-oaks *Quercus suber)*, very often being produced in quite old systems. These systems generally consist of scattered trees (Belo, et al., 2009; Castro, 2009; McAdam, et al., 2009). Cork-oak *montados* are considered a sustainable system and have high economic value, as well as special cultural and ecological value (Belo, et al., 2009; Pereira, et al., 2004; Rebelo, Correia, Fonseca, Mathias, & Santos-Reis, 2009). Moreover, as cork is an insulating material, these trees are very resistant to fire (Belo, et al., 2009; Rebelo, et al., 2009).

Quercus ilex subsp. *rotundifolia* trees produce acorn, a very important feedstuff during autumn and winter. The system is often called holm-oak *montado* (Pinto-Correia & Mascarenhas,

1999). This system is considered better for livestock production, as its acorns are more nutritive and palatable than those of other *Quercus* (Pinto-Correia & Mascarenhas, 1999; Pinto-Correia & Vos, 2004).

Both holm and cork oaks can be found predominantly in the South of the country (Castro, 2009). Yet, other *Quercus* tree species are particularly found in the northeast of the country, and may be used for firewood and charcoal production, such as the oak *Quercus pyrenaica* (Castro, 2009). There are also small areas of *Q.pyrenaica montados* in the north-east of Alentejo, which are mostly grazed by cattle.

In addition, other tree species commonly found in agro-forestry systems in Portugal include *Castanea sativa* and *Olea europaea*. The first one is cultivated for timber and nut production, and it is an important landscape component in northern Portugal, often in silvopastoral systems called *lameiros* (Castro, 2009; Pinto-Correia & Vos, 2004). Nuts can be a valuable food resource for grazing animals (Castro, 2009). Olive trees can be found all over the Portuguese territory, and have a great economic and socio-cultural significance. Olive trees by-products, such as those resulting from pruning, are a useful foodstuff. Also, animals can eat left-over fruits from the soil (Castro, 2009).

The livestock component traditionally used in silvopastoral systems in Portugal includes native species of beef cattle, sheep, goats and pigs. The cattle have very specific characteristics, which vary from one region to the other. The existing breeds are the consequence of the great Portuguese biotype and ecosystems diversity (Belo, et al., 2009; Proença, et al., 2009).

The autochthonous breeds' characteristics include very good maternal aptitude, high rusticity and exceptional adaptability to the environment they live in and, especially to the food products locally and naturally available (meaning poor pastures, very often). They are therefore the best alternative in unfavoured areas such as many of the Portuguese interior ones (Pinto de Andrade, Várzea Rodrigues, & Rodrigues, 1999), even though their productivity levels may be inferior to commercial breeds under better conditions (INE, 2009b). However, many of these autochthonous breeds are at the risk of extinction (INE, 2009b).

It must however be stressed that traditionally the grazing of these systems depended mostly on sheep. As there has been a massive conversion from sheep to cows, during the last decades, there has been some biodiversity loss (reduced shrub patches and reduced spatial heterogeneity of the under-growth) as well as tree regeneration problems (Santos, et al., 2008). This conversion of sheep production systems into beef cattle systems isn't therefore the best possible solution for the ecosystem's management.

There are several possible reasons behind this change in the producers' productive options. On the one hand, the Common Agricultural Policy (CAP) supports have encouraged producers' to make such conversion for economical reasons. Even with the current decoupling rules for the beef sector, the incentives for producing beef have long been higher than the incentives for sheep production (Dýrmundsson, 2004; European Commission, 2006, 2009). Producers and landowners have thus opted for the more subsidized beef production.

On the other hand, the Portuguese meat sector (namely consumers' demand) also favours beef production. Regarding data since 1999, beef *per capita* consumption has been consistently at least five times superior to sheep *per capita* consumption (INE, 2004, 2005,

2006, 2007, 2008a, 2008b, 2009a, 2012). In 2009, beef *per capita* consumption was 18,7kg, while sheep *per capita* consumption was 2,5kg (INE, 2012).

Finally, sheep production requires much more manpower than beef production, which also favours the later if economic efficiency is considered. Sheep production often requires shepherds, which is a declining occupation, making it often very difficult to find people to work in this activity.

In addition, the number of animals needed to ensure economic viability is higher for sheep than for beef cattle. From this perspective, sheep production eventually entails several times more procedures (e.g. veterinary treatments, identification procedures, etc.) than a beef herd.

In spite of the economical advantages the usage of cattle in silvopastoral systems like *montados* may not come without problems, as mentioned above. Tree regeneration problems can be associated with high stocking densities and overgrazing. Excessive number of animals can result in soil compression and degradation and in the destruction of younger, more fragile trees (Santos, et al., 2008). Plieninger (2007) found that many of these systems' trees in Spain are quite old, showing the lack of holm oaks' regeneration and associating it with excessive animal grazing.

It must therefore be guaranteed that, especially if cattle is used, *montados'* management includes proper stocking density and probably the maintenance of some non-grazed areas, on a long-rotational basis, to allow tree regeneration (Plieninger, 2007), thus assuring the system's long term sustainability.

Having overviewed the characteristics of Portuguese traditional silvopastoral systems, this article now looks at the consequences of land abandonment, a specific environmental problem more commonly related with extensive agricultural and livestock production systems, especially in developed countries, particularly in upland or dry areas (where these systems usually are both more environmentally valuable and economically marginal). The next section will specifically address this issue.

8.4 Marginalisation, land abandonment and desertification of agricultural territories: environmental and societal problems

As the future of agricultural systems across the world will progressively face climate change impacts (IPCC, 2007), the expected effects on systems like *Montados* are the starting point for the analysis of some of the most serious threats they face.

Climate change effects will be noticed in agricultural yields through changes in temperature, rainfall, CO_2 concentration, ultra-violet radiation and pest distribution, as well as soil chemistry and composition changes. Extreme weather conditions and disease outbreaks can also be expected (European Commission, 2009; Parry, Rosenzweig, Iglesias, Livermore, & Fischer, 2004; Steinfeld, et al., 2006).

Although there may be expected positive effects in yields in some areas of the globe, the expected overall effect is a net reduction in agricultural production. Many negative social and economic consequences can therefore be expected in many parts of the world in a not very distant future (Parry, et al., 2004; Steinfeld, et al., 2006).

Considering livestock production, non-confined grazing systems are expected to be more easily damaged by climate changes, not only because of the mentioned impacts on crops and pasture, but also because diseases and parasites' distribution are expected to change and thus have stronger deleterious effects (Parry, et al., 2004; Steinfeld, et al., 2006).

In Europe, positive and negative impacts on agricultural activities can also be predicted, affecting volume, quality and stability of agricultural production (European Commission, 2009). Longer growing seasons and warmer temperatures may bring some benefits to some regions (AEA, 2007). However, changes in rainfall patterns may lead to drought situations, which in turn can lead to soil degradation. This alone is considered to be a major threat to Europe's land resources sustainability (AEA, 2007).

Mediterranean zones are particularly at risk (AEA, 2007; IPCC, 2007) and extreme situations, with degradation of agricultural ecosystems, can even lead to desertification processes (European Commission, 2009). Many of these sensitive Mediterranean areas are natural and semi natural grasslands which are important biodiversity and landscape resources. Nevertheless they are threatened by ongoing intensification and excessive stocking densities, or, more frequently, in many Portuguese locations, by "set-aside" practices and even land abandonment due to loss of economic viability of agricultural practices (Pereira, et al., 2004). Traditional silvopastoral systems have experienced gradual abandonment in many marginal areas, whereas in more productive soils, monocultures and intensive production systems have been taking place (Eichhorn, et al., 2006; MacDonald, et al., 2000).

Marginalisation of rural areas can occur as they become less attractive than core productive agricultural areas for people to work in. Lower agricultural productivity together with social, economic, political and environmental factors lead to a redistribution of agricultural activity and population across the territory. Increased labour costs, decreased agricultural prices, less economically viable farming activities in lower productivity areas, are very strong contributing factors, which can be joined by aging rural populations (EEA, 2004, 2006; MacDonald, et al., 2000; Pereira, et al., 2004). Land abandonment (partial or total abandonment of farms) is a common consequence of such marginalisation (EEA, 2004, 2006; MacDonald, et al., 2000).

In Portugal, for the last 50 years, there has been a very significant conversion of agricultural land into pastures, forests and unmanaged land (Domingos, et al., 2009; Rosas, et al., 2009). Today, land abandonment risk is very high in many Portuguese regions, especially in the hinterland. Factors strongly contributing to this risk include a high proportion (over 40%) of producers aged above 55 and a high proportion of farms (above 50%) with a low net value added per agricultural work unit (EEA, 2006; INE, 2009a; Pinto de Andrade, et al., 1999).

Portugal experienced, between 1989 and 2007, a very significant reduction of the arable land (to less than half of the original hectares). Permanent pastures increased 276% in the same period (INE, 2009b). These figures may mean there is a trend towards extensification, as 51% of the Portuguese agricultural surface was already occupied by permanent pastures in

2007 (although there are regional variations) (Domingos, et al., 2009; INE, 2009b; Rosas, et al., 2009). However, this extensification may not represent an environmental friendly conversion, as often this process is followed by land abandonment.

The available data also shows a strong decrease in the share of agricultural area managed by non-specialised farming (EEA, 2006). Specialization (the production of a single crop or livestock species) although not meaning intensification has its own environmental problems, as it usually represents the end of natural cycles for nutrients and organic matter. A common situation is the substitution of agricultural land by unmanaged (pine and eucalyptus) forests (Rosas, et al., 2009), often associated with abandonment (Pereira *et al.*, 2004). It can represent the loss of some quality agricultural habitats and landscapes associated with traditional non-specialised farms (Rosas, et al., 2009).

Abandoned land faces losses of landscape and biodiversity values and other environmental complications, such as increased soil erosion, resulting into further environmental and economic problems (MacDonald, et al., 2000; Steinfeld, et al., 2006). Wildfires are an example, which can occur over larger areas due to the existence of abandoned land.

Biodiversity losses are closely related with natural habitat fragmentation, which can happen when traditional agricultural land is abandoned (MacDonald, et al., 2000). In Portugal (which is part of one of the 25 world hotspots for biodiversity[52] (Pereira, et al., 2004)), many semi-natural agricultural habitats are dependent on the maintenance of appropriate management (INE, 2009b; MacDonald, et al., 2000).

Soil erosion is a severe consequence of land abandonment and rural fires. Both erosion and fires cause a net loss of carbon to the atmosphere (MacDonald, et al., 2000; Pitesky, Stackhouse, & Mitloehner, 2009). This is an acute situation in southern European countries (which experience long dry periods followed by heavy rainfall) (EEA, 2002, 2006) and it represents an important socio-economic and environmental problem *per se.* Moreover, erosion and fire problems are expected to worsen with rainfall and temperature alterations due to climate change (INE, 2009b; IPCC, 2007; Rigueiro-Rodríguez, et al., 2009).

Dry Mediterranean areas facing severe climate change impacts therefore face desertification, a process derived from irreversibly degraded soil, with permanent loss of vegetation and productivity (IPCC, 2007; MacDonald, et al., 2000). However, as it will be latter suggested, the appropriate management and maintenance of these areas can help reduce the consequences of climate change.

Abandoned or improperly managed land (including the above mentioned forests) faces a much more severe wildfire risk, as lack of maintenance facilitates the establishment of shrubs, generating fuel accumulation (especially in dry Mediterranean areas) (Belo, et al., 2009; Moreira, Rego, & Ferreira, 2001; Pereira, et al., 2004; Rebelo, et al., 2009; Rigueiro-Rodríguez, et al., 2009).

52 Hotspots for biodiversity are locations where biodiversity is very rich but also where the number of threatened species is high and threats are considered significant (Reid, 1998).

In Portugal, fire frequency has increased along the 20th century, accompanying rural exodus, agricultural land redistribution and abandonment and afforestation policies (Moreira, et al., 2001)[53]. The equivalent to 18% of national territory has been burnt between 1998 and 2007, which makes fire one of the most significant causes of habitat destruction in Portugal (Domingos, et al., 2009)[54].

It is thus clear this is a "circular problem", where land abandonment may contribute to environmental degradation and climate change (through greenhouse gas emissions due to fire, for example) and climate change consequences may increase land abandonment. All these land degradation causes and consequences can ultimately lead to desertification. According to MacDonald, et al. (2000), many Portuguese areas are classified as of high risk of desertification (many of which are located in southern regions where *Montados* are established).

Indeed, the Mediterranean region has been experiencing an increase in the extension of dry and arid lands, and in Portugal and Spain there are already minor areas so arid as to be considered pre-deserts (EEA, 2002). On the other hand, some Mediterranean areas have faced more frequent periods of severe precipitation (APA, 2009), which can also result in soil deterioration, especially if there are already erosion phenomena associated (EEA, 2002).

The Mediterranean region is considered a climate change hot spot, which means the probable changes occurring in this region are expected to be more severe than the global average (Belo, et al., 2009; Domingos, et al., 2009; IPCC, 2007). As climate changes, non-confined grazing systems will also be affected by increasing temperatures (expected general increase of 2-4ºC), lower precipitation and decreased forage production, further encouraging land abandonment (EEA, 2002; European Commission, 2009; IPCC, 2007). Fire risk cannot, obviously, be expected to decrease (Domingos, et al., 2009).

There is, however, a growing consciousness that grassland and silvopastoral ecosystems provide many services beyond livestock production, such as biodiversity conservation, climate change mitigation, desertification prevention and recreation. These can all be considered major issues, as important as food or animal products provision, and they are a key element of EU's subsidy policy (European Commission, 2009; McAdam, et al., 2009; Steinfeld, et al., 2006). The possible advantages of this kind of agricultural system considering the Portuguese reality will therefore be analysed in the following section.

53 It is worth mentioning that although livestock grazing is considered very important for the removal of the dry vegetation which can act as fuel, human activity linked to the livestock presence (shepherds and caretakers, for example) may often be responsible for (accidentally or out of negligence) lighting many of the fire occurrences in Portugal. Shepherds also ignite fires to maintain the ecosystem in the early succession stage of grassland, more favourable for animal feeding (Pereira, et al., 2004)

54 Another author (Pereira dos Santos, 2010; Pereira dos Santos, *pers.comm.*) nevertheless argues that wildfires in Portugal are a natural phenomenon and a consequence of the expansion of natural territories. Therefore, the major problem of fires from an environmental standpoint would be the net release of carbon into the atmosphere. Not questioning the obvious problem related with severe risks to human populations and property, from the biodiversity point of view fire itself is not a problem.

8.5 Strategies to avoid land abandonment and protect biodiversity in traditional agricultural systems

Stopping biodiversity loss has been a priority within the European Union for some time as it is clear by the large amount of legislation around this issue (the Biodiversity Action Plan, the Habitats Directive and the Conservation of Wild Birds Directive, just to name a few).

One of the main mechanisms for integrating environmental and biodiversity protection and agricultural practices is the CAP (Milne, 2005; Reidsma, et al., 2006). However, even if one of CAP's priority areas is the preservation and development of 'natural' farming and forestry systems (European Commission, 2012), there is also the need to guarantee (or at least encourage) food self-sufficiency and the economic stability of the agricultural sector and its actors.

In order to try to put together these goals within the Portuguese silvopastoral systems context, several solutions can be pointed out.

8.5.1 The intensification route

The intensification option as the solution that allows matching human demand for food on less land and thus helps saving land for natural ecosystem conservation and biodiversity promotion has been defended by many authors (see, e.g., Steinfeld et al. (2006) or Green, Cornell, Scharlemann, and Balmford (2005)). As such, the intensification option for a given agricultural system needs to be considered, and even more so when such system faces economical sustainability issues.

Therefore, it is possible to propose the intensification of beef production in traditional silvopastoral systems in Portugal based on autochthonous breeds taking advantage of already implemented certification schemes (e.g. PDO). This vision seeks only the highest economic return. It also assumes that the long-term environmental sustainability is not possible by not allowing the systems' natural regeneration. It would nevertheless allow increased beef outputs without increasing the area under beef cattle grazing. This would enable the preservation of larger land areas as natural habitats.

The unpreserved areas would nevertheless face severe environmental impacts. The degradation of overgrazed land often arises from excessive stocking rates, resulting in mechanical deterioration of soils and overgrazed vegetation. These have impacts associated with soil erosion, carbon release, loss of biodiversity and impaired water cycles (Steinfeld, et al., 2006).

Agricultural intensification (in terms of input intensity and overall productivity) tends to diminish local biodiversity, namely through excessive loads of fertilizers and pesticides, and is historically associated with habitat pollution and deterioration (Steinfeld, et al., 2006). Other negative consequences include increased soil erosion, ground water pollution, rivers eutrophication, among others (Steinfeld, et al., 2006).

Putting together the advantages and disadvantages of the intensification possibility,

and remembering that many of such traditional silvopastoral systems are also an important part of the cultural heritage, this may not be an advisable option. This solution does not guarantee long term environmental sustainability, and would therefore represent the loss of many non-use values associated with these systems.

8.5.2 Sown Biodiverse Permanent Pastures

The second proposed alternative ensures soil conservation and sustainability by completely replacing the current natural pastures for introduced species in systems engineering perspective. This kind of pasture is based on the introduction of different mixtures of improved and selected seeds of resilient species and it is much more productive than natural grasslands (Domingos, 2007).

These are considered permanent biodiverse pastures as they are self-maintained with up to 20 species or varieties (originally sown) during at least 10 years. Also, these pastures contribute more to carbon sequestration and higher animal stocking rates can be introduced (Teixeira, et al., 2008). Due to increased resilience of the selected species, sustainable growth of pasture can be ensured in different conditions (seasons, rainfall, etc.) (Domingos, 2007)[55].

Considering that feedstuff prices can represent as much as 80% of total costs in beef production (GPPAA, 2007), having access to productive pastures would certainly allow a more economically efficient production (Domingos, 2007). Moreover, as these pastures are more productive and resilient, the need for autochthonous breeds would not be justified. It would be possible to resort on more productive commercial breeds.

However, some critics can be pointed out to this solution. Despite being environmentally sustainable, this is not a traditional system and it does not represent any cultural and heritage values. In addition, there is little spontaneous biodiversity as most of it originates in introduced exotic species. Therefore, it does not necessarily promote the preservation of local autochthonous breeds and seeds, potentially contributing to the loss of this biological patrimony.

8.5.3 Preserving *Montados* together with beef cattle production

Montados are in many cases century-old land-use patterns for livestock production and long established ecosystems with very rich biodiversity (Pitesky et al., 2009), whose deterioration *per se* (due to abandonment) should not be overlooked.

Montados abandonment may be prevented by the maintenance of cattle grazed production systems, based on PDO breeds. The beef products' certification should include a sustainability guarantee. As suggested in the introduction, this would represent the second-best solution from the environmental perspective, but could nevertheless be the key for the preservation of such valuable systems while fomenting their economic viability.

Insisting in cattle production for a system when the potential deleterious effects derived from these animals' introduction is well known may seem senseless. However, if the consumption

55 For more detailed information on the characteristics of Sown Biodiverse Permanent Pastures: http://extensity.ist.utl.pt/

levels described previously are remembered, this proves to be the only economically viable production. The following reasoning justifies this affirmation. The PDO certified beef production that is suggested here as the best possible solution for *Montados* preservation would always represent a niche market. If the Portuguese beef *per capita* consumption has been consistently at least five times superior to sheep meat *per capita* consumption, sheep meat representing a niche market would correspond to insignificant quantities and values.

There are several incentives for the use of autochthonous breeds under PDO certification schemes. These local cattle breeds are more resistant to the climate conditions and better adapted to the feeding available in the *Montados*. Also, their production meets the efforts to preserve regional genetic and cultural patrimony. Finally, the beef products originating from these animals can be considered premium products by consumers who value not only the beef quality but also the heritage values associated with such breeds.

Nevertheless, the environmental impacts derived from the introduction of cattle in *Montados* can't be overlooked. Therefore, impact mitigation strategies should be suggested.

The probably best mitigation strategy that can be suggested involves both guaranteeing the appropriate stocking rate and the maintenance of fallow non grazed areas. The low stocking rate is the way to guarantee that the environmental impact of cattle grazing is nevertheless minimized. However, the only way to ensure the long-term regeneration of the tree and shrub component is to allow the existence of areas with no animals.

It should be recognized that the existence of areas with no animals grazing may be associated with an increased fire occurrence. However, as Pereira dos Santos (Pereira dos Santos, 2010) suggested, fires are a natural phenomenon in ecosystems such as *Montados* and can even be considered as favourable from the biodiversity point of view.

Finally, this solution would also imply the availability of production areas large enough to guarantee the maintenance of non grazed plots. As such unproductive land necessarily implies an opportunity cost for producers, the premiums derived from the certified beef products would need to be high enough to offset these additional production costs.

8.6 Conclusions

European sustainable silvopastoral systems (among which Portuguese *Montados* can be included) gather agriculture, forestry and livestock production with social, economic, cultural and environmental benefits. In the Mediterranean area, systems like *Montados* are considered to be high nature value ecosystems, with a very important function in biodiversity preservation. However, many of the values generated by this kind of agricultural system are often not paid for, generating potential losses for land owners, consumers and societies in general.

Regarding the Portuguese silvopastoral systems in particular, the main threats for their preservation are represented by either intensification or land abandonment processes. The later is somewhat more common in areas considered to be more marginal and less productive, leading to increased environmental, social and economic problems for the local populations.

Land abandonment is a strong degradation factor for soils, habitats and biodiversity. In addition, it can be considered a contributing factor for rural and forest wild fires. When

all these factors come together in a region already prone to marginalisation, desertification phenomena can emerge. Therefore, strategies which promote sustainable land occupation and preservation for silvopastoral systems are relevant.

A possible strategy to guarantee the preservation of natural land (which would remain unproductive) could be the intensification of some already existing production, thus promoting increased food productivity at the same time. This approach could be supported by the fact that the Portuguese meat market is not self sufficient, showing that there is room to accommodate additional national production to the existing demand. However, this solution proves not to be the most desirable one. From the environmental perspective, the intensification would without a doubt come with local environmental problems. Furthermore, by preserving land in natural unproductive condition, non-use values (such as those related with the cultural heritage) associated with silvopastoral systems would nevertheless most likely be lost.

A second possible strategy for avoiding land abandonment could involve a systems engineering approach, replacing natural pastures by more productive and resilient species. This approach would allow increased land productivity (both agricultural and pastoral) while avoiding the environmental impacts traditionally associated with intensification. Notwithstanding, this solution does not represent a preservation of any cultural and heritage values. Furthermore, questions can be raised regarding the lack of spontaneous biodiversity.

The most favourable strategy thus points out to the preservation of the existing extensive cattle grazing systems as a route for both ensuring environmental protection and guarantee economic viability. These systems can be seen not as purely productive systems, but mainly as systems which generate territorial occupation and management, representing possibly one of the best possible land-use option for these regions.

This would nevertheless represent a second-best option as it is recognized that cattle can be very damaging to these systems, particularly if high stocking densities and overgrazing are allowed. To avoid the problems these systems can represent, appropriate management must be kept. This means respecting the systems' main assets, the soil and the trees, and their equilibrium, by fulfilling appropriate stocking densities and allowing for some areas to remain un-grazed. However, this sort of management usually represents increased production costs.

In order to guarantee that the production costs are paid for and that the system has economic viability, these higher costs must be transferred to consumers through higher prices. Therefore, food products originating from such systems should be included in differentiation strategies, as their characteristics are often valued by consumers.

Promotion strategies can include certification programmes based on eco-friendly agricultural production or on the products regional genuine origin. Other strategies include taking advantage of recreational and touristic values associated with the typical landscape, cultural heritage, eco-tourism, etc. Together with public agri-environmental payments, these may all allow the payment for services provided by silvopastoral systems, therefore properly compensating farmers for their management efforts.

It would seem a contradiction to implement and enforce legislation and support programmes aiming at minimizing environmental impacts of agriculture and livestock production and, at the same time, not to give appropriate attention to traditional silvopastoral systems'

abandonment. Such systems are already close to sustainability from the ecological point of view. Their economic sustainability must therefore be stimulated, along some management constraints to allow for tree cover regeneration as well as spatial heterogeneity of the undergrowth, in order to avoid their loss and increase the ecosystem services they provide to society.

PART III

Part III is devoted to the description of the applied methodologies (focus groups and choice-experiment questionnaire) and to the results' analysis.

Chapter 9 presents a primary and descriptive approach into focus groups' qualitative results, showing some of the participants' opinions regarding beef safety animal welfare and the environment.

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Chapter 9
Joint production of safer, cleaner and animal friendlier beef: do consumers join it too?

Insights from Focus Groups

Consumers' motivations and behaviour towards food safety, animal welfare and the environment in beef production and beef products were discussed in several focus groups, within a broader research program aiming at determining Portuguese consumers' willingness to pay for safer, cleaner and animal friendlier beef.
Regarding the supply context, food safety, animal welfare and environmental protection are, to some extent, jointly produced within beef production systems. From the demand perspective there are also reasons to believe consumers aren't able to separately value each one of these outputs of beef production. Due to considerable difficulties in production costs allocation as well as willingness to pay valuation, there are reasons to jointly value them in a multi-dimensional package.
Six focus groups were used to elicit how respondents perceive and talk about these topics and to provide insights into their motivations towards beef. Results show that respondents often refer intrinsic attributes as determinants of beef quality. The main quality cues at the moment of purchase include appearance, expiration date and price.
Beef safety is generally taken for granted. However, concerns include hormones, antibiotics and slaughter hygiene. Environmental concerns are mainly linked with pollution and recycling. Animal welfare concerns include transportation, slaughtering and rearing conditions.
There are mixed reactions when it comes to willingness to pay premiums for any of the three given attributes. Participants refer preferences for products with bundles of these attributes, thus reinforcing the need to jointly value such complex and jointly produced attributes.

9.1 Introduction

Portuguese consumers' motivations and behaviour towards beef safety, beef cattle welfare and environmental protection were discussed in several focus groups. Focus groups are fundamental in valuation questionnaire development when complex goods and attributes are at stake. The qualitative aspects analysed show the kind of issues to be addressed in the future valuation survey included in this research's framework and will help defining choice scenarios.

Regarding this article's specific objectives, the focus groups intended to show if the consumers participating in the discussions make a joint valuation of these three complex

attributes, or if, on the other hand, they can separately assess them while considering their preferences for beef products.

More specifically, the discussions intended to determine whether, within a beef production and consumption context, there were common aspects among these subjects and underlying shopping decisions. Additionally, it was intended to verify if there are common associations or crossed references when each one of these three aspects is discussed in a common context.

Food safety, animal welfare and environmental protection are, to some extent, jointly produced within beef production systems. For example, less intensive systems are less aggressive to the environment, and also prone to guarantee higher standards of animal welfare. Both can be linked to safer food (de Passillé & Rushen, 2005; Harper & Henson, 2001; Kallas, Gómez-Limón, & Arriaza, 2007).

Apart from the joint production, there are also reasons to believe consumers themselves aren't often able to separately assess each one of these non-commodity outputs of beef production. For example, it is known that many consumers prefer environmentally friendly products for health reasons (inferring that such products are safer) rather than just for the sake of the environment itself (Lusk, Nilsson, & Foster, 2007).

Nevertheless, whatever the reasoning behind consumers' preferences for such goods, they are still relevant in many niche markets within developed economies. There are therefore reasons to assess the market potential for such differentiated beef products, in order to determine if it is possible to offset higher production costs.

However, the above mentioned joint production leads to considerable difficulties in production costs allocation. The joint assessment by consumers increases the complexity of willingness to pay determination. These facts are the grounds to try to jointly value these three non-commodity outputs in a multi-dimensional package (Kallas, et al., 2007; Randall, 2007; Santos, 2000).

Previous research shows additional theoretical reasons to jointly value these goods. The independent valuation of multiple non-commodity outputs of farming, such as food safety or the environment, followed by the adding-up of these independently assessed values was empirically shown to be prone to considerable measurement bias, because the different outputs typically behave as substitutes in valuation (Santos, 2000; Santos, 1998).

The joint production and the postulated joint valuation by consumers were therefore the basis for the broader research program with the main objective of determining Portuguese consumers' willingness to pay for safer, cleaner and animal friendlier beef. For this research framework a stated preference survey was elected as the proper method to help clarify the above mentioned doubts about consumers' true demand.

However, as the validity of stated preference surveys (as contingent valuation and choice experiments) depends, in part, on the absence of methodological misspecification (which means the researcher and the respondent must perceive the survey scenarios in the same way), it is necessary to previously use focus groups, as the ones included in this articles' contents (Mitchell & Carson, 1989).

9.2 Methods

Six focus groups were organized between July and September 2009, in Lisbon and Oporto, Portugal. The recruitment and invitation procedures were designed according to Krueger and Casey (2008). All participants had to be beef consumers and at least partially responsible for the household's meat shopping. No additional demographic characteristics were considered as a recruitment criterion. Beef consumption level, frequency and preferences were also not considered as a selection criteria, once variability was considered relevant for the discussions. In total, the six sessions included 35 participants (between 5 and 8 per group). Table 17 briefly describes the main demographic characteristics of the participants.

Table 17: Participants demographic characteristics

Sample characteristics		Percentage
Gender	Male	25.7
	Female	74.3
Age	26 to 35	40.0
	36 to 45	34.3
	46 to 55	14.3
	>56	11.4
Socio Economic Class	A	20.0
	B	45.7
	C+D+E	34.3
Marital Status	Single	20.0
	Married	68.6
	Divorced	11.4

A preliminary written questionnaire on beef shopping and consumption habits and preferences intended to help direct the attendants' mind frame towards the discussions' theme.

Regarding the questioning route, the first group of questions encouraged participants to introduce themselves and to describe their perceptions on beef quality and their concerns on beef shopping and consumption. The second group of questions introduced animal welfare, food safety and the environment in a beef production context. The next three question segments were dedicated to discussing food safety, animal welfare and the environment in beef production separately, in order to unveil participants' knowledge and concerns about these issues. Willingness to buy new differentiated beef products was also debated.

The sessions took around two hours and were all recorded, transcribed, and the contents subject to analysis according to Krueger and Casey (2008). Saturation was reached and new focus groups would not yield any new information.

9.3 Results

This first part of the group discussions intended to direct the conversation towards beef quality while eliciting the participants' spontaneous thoughts when asked about this issue. Therefore, participants were asked to define what they considered a high quality beef product. No specific references were made by the moderator about beef safety, animal welfare or the environment in beef production.

Most participants spontaneously mentioned tenderness and texture (the terms often replaced each other). Other reports already mentioned tenderness as one of the most important aspects of beef quality for consumers across the EU (Aguiar Fontes, et al., 2008; de Carlos, García, de Felipe, Briz, & Morais, 2005; Korzen & Lassen, 2010; Verbeke, Pérez-Cueto, De Barcellos, & Krystallis, 2010). Other mentioned aspects are included in Table 18.

These quality attributes seem to be somehow inferred from intrinsic quality cues, as good aspect and visible fat amount, which were often referred as features taken into account during shopping for beef products. The beef freshness (and therefore safety, as many pointed out) was said to be evaluated by many participants through judging the beef aspect and the expiration date.

Table 18: Attributes and cues regarding beef quality

Mentioned quality attributes	Mentioned quality cues
• Tenderness • Flavour • Freshness • Succulence • Colour • Texture • Court • Price	• Colour • Cut • Aspect • Amount of fat • Expiration date • Packing date • Price Value for money Buying less to buy more quality • National origin • Organic beef • Portuguese brands Portuguese PDO beef Portuguese organic beef

When such safety associations emerged, the moderator stimulated the discussion towards this issue. However, reactions often lead to the conclusion that food safety wasn't generally considered a concern, as minimum standards were perceived as guaranteed and satisfactory.

Furthermore, issues such as animal welfare and the environment were mostly mentioned only after a direct question, and although they were considered relevant and with influence in beef quality by many participants, most of them stated these aren't relevant concerns when shopping for beef products.

A very often mentioned quality cue is price. Although some participants referred finding good value for money as relevant for their shopping decisions, most consider that a higher priced beef is a sign of a better quality beef: "I don't buy a lot of beef, so I rather pay more for a high quality product".

Other relevant choice criteria were the origin (national origin is preferred) and the Protected Designation of Origin (PDO) label. Finally, organic beef, local beef products and certified beef were also referred as quality products.

When the discussion evolved towards specific beef safety issues (Table 19), most participants stressed this is not, at the present time, a big concern. Nevertheless, issues such as drugs (or antibiotics) residues, hormone administration, feed quality and slaughter hygiene were considered to be worrisome during the production stages.

Participants stressed their confidence in the existing legal framework, regulatory institutions and in the existing audits and inspections, considering that if any given beef product is available for shopping, then it must be safe. The European Union regulatory role was considered to be relevant for this confidence level. All these findings are similar to those found among consumers of several European countries (Angulo & Gil, 2007; Korzen & Lassen, 2010; Wezemael, Verbeke, Kügler, de Barcellos, & Grunert, 2010).

Table 19: Specific aspects regarding beef safety

Mentioned concerns	
	• Drug residues Hormone / antibiotics • Dioxins • Slaughter hygiene • Feedstuffs' hygiene • Expiration date • Pre-packaged beef
Beef safety cues	
	• Meat aspect • Fat and meat colour • National origin • Shopping at butcher
WTP for safer beef	
Yes	• Value for money • Buying less to buy more quality
No	• Pleased with current • Additional safety would have to be for all consumers
Don't know	• Trial Shopping • Only if certified

Some participants said they would be willing to pay a premium for beef with safety guarantees above the legally imposed ones, namely because they buy small quantities of beef products and are willing to pay for improved safety. Worth mentioning the fact that previous experience was often mentioned as influencing perceptions of beef safety.

Nevertheless, such decision was always said to be dependent on the premium amount, and the beef sensory quality would also need to be satisfactory.

Regarding the questions about the environmental impact of beef production and the participants' concerns about the environment (Table 20), participants considered it to be a minor problem when compared to food safety, not taken into account when shopping for beef (or even other products). Some participants even mentioned this to be more of an in vogue affair or a media concern, than a real issue.

However, most participants did state their environmental concerns, saying they try to do their share (namely through recycling), either because they are concerned about their health, or about future generations. Participants also mentioned grazing, extensive production and organic production as examples of environmentally friendly systems.

Table 20: Specific aspects regarding the environment

Mentioned concerns	
	• Health • Future generations • Not as important as beef safety • Lack of information • Just a fashionable media trend
Environmentally friendly beef	
	• Organic beef • Beef produced in grazing extensive systems • Not a concern while shopping
WTP for cleaner beef	
Yes	• Value for money • Buying less to buy more quality • Preference for "joint" products that include safety and environmental protection
No	• Green products are too expensive • Can't tell the difference
Don't know	• Trial Shopping

The association between organic products and environmentally friendlier products was spontaneous, and some participants were regular shoppers of organic beef. We can argue that organic beef, a method of production and a credence attribute, here was used as a sign of an environmentally friendlier beef. Also worth mentioning that, on average, this was not a concern while shopping. That is to say, at the point of purchase, consumers do not often think of environmental implications of beef production and of the beef they are purchasing.

For those participants willing to buy environmentally friendlier beef products, the stated reasons were the same as for safer beef products: buying less to buy better quality, but the size of the premium would again be considered relevant.

More interesting is, however, the preference for products that include safety and environmental protection, i.e., participants stressed that beef products certified for both

attributes would be more attractive.

When discussing animal welfare in beef production (Table 21), the focus groups participants considered this to be a rather emotional subject, and acknowledged the contradiction between eating beef and having concerns about cattle welfare. When asked to specify those concerns, most participants were able to specify them in quite precise terms, namely by describing transportation conditions and slaughtering techniques.

Intensive production was considered to be harmful for animal welfare, and issues like diminished space for movement and inability to fulfil natural behaviour were mentioned. Also, the lack of producers and caretakers training was also considered to be a concern for many attendants.

Finally, transportation and slaughtering conditions were also often mentioned as worrisome, and many participants actually said they rather not think about them.

Table 21: Specific aspects regarding animal welfare

Mentioned concerns	
	• Contradictory subject for meat eaters • Slaughter conditions • Animal transport conditions • Living conditions • Freedom to fulfil natural behaviour • Feeding • Caretakers formation
Animal friendlier beef	
	• Organic beef • Beef produced in grazing extensive systems • Not a concern while shopping
WTP for animal friendlier beef	
Yes	• Value for money • Buying less to buy more quality • Preference for "joint" products that include safety, environmental protection and animal welfare
No	• Consumers shouldn't be the ones to pay • Can't tell the difference • Distrust in certification
Don't know	• Trial Shopping

Thus, the willingness to buy animal friendlier beef was again a non consensual issue. Some attendants stressed it is not a concern during shopping, and, moreover, that it should not be the consumer responsibility to pay for the fulfilment of such animal welfare rules, although they are undoubtedly important rules.

However, as in the two previous issues, many participants said they would be willing to buy these products due to the small amount of beef they usually purchase, which allows them to make premium choices.

Finally, some participants spontaneously expressed interest in beef products with a bundle of these attributes, mentioning that if safety, animal welfare and the environment were all present in the same product they would be much more interested in buying it.

Such statements are consonant with what previous research has shown, i.e. the preference for these attribute bundles comes from the connection consumers make with increased product safety (Harper & Makatouni, 2002; Wezemael, et al., 2010). Moreover, such preferences even come in line with the above mentioned fact that food safety, animal welfare and environmental protection are, to some extent, jointly produced within beef production systems. For example, less intensive systems are less aggressive to the environment, and also prone to guarantee higher standards of animal welfare. Both can be linked to safer food (de Passillé & Rushen, 2005; Harper & Henson, 2001; Kallas, et al., 2007).

Table 22: Aspects debated regarding beef labels

Mentioned aspects	Negative reactions
• Food safety Expiration date Packing date National Origin Animal age ID number Organic production • Environment Recyclable package Green logos Organic production • Animal Welfare Grazing animals Organic production • Others European symbols (PDO, Organic, etc) Certification logos	• Unclear claims • Excess information • Difficult comprehension • Unreliable logos

After this somewhat more specific discussions the conversation was directed towards beef labels (Table 22). Some participants immediately referred not to notice anything besides price and expiration date, whatever beef they choose to buy. Moreover, a feeling about the excessive amount of information in all the labels emerged quite soon and was somewhat consensual.

When asked to elaborate further on their comments, many participants considered the labels to be difficult to understand, as they consider many of the present symbols and references to be unclear, and therefore somewhat unreliable. Furthermore, participants often considered elaborate labels as a way to increase prices without providing increased quality.

Nevertheless, European symbols were consensually considered to be a source of trust and a reliable certification. Moreover, PDO beef was consensually referred to as a high quality beef product, even among those who don't usually consume it. Consumers' perception that PDO beef is a higher quality product has been reported previously in the literature (Angulo & Gil, 2007; Banovic, Grunert, Barreira, & Aguiar Fontes, 2010; de Carlos, et al., 2005; Wezemael, et al., 2010).

Considering the associations that participants made between labels and beef safety,

the expiration date and the packing date were the most frequently mentioned items. However, many people also mentioned the reference to national origin as a safety guarantee. This result is similar to others found in the literature, which suggest higher trust in the own country or region (Banovic, et al., 2010; de Carlos, et al., 2005; Verbeke & Roosen, 2009; Wezemael, et al., 2010).

Regarding associations with the environment, some participants pointed out the organic symbol and stressed it as an environmentally friendly one.

Finally, associations with animal welfare were very scarce. Exceptions were mostly for associations with the organic symbol and the PDO symbol. Many participants considered that PDO beef is produced in countryside pastures, where animals have considerable available space and can enjoy quality of life.

9.4 Discussion and conclusions

One conclusion to be drawn is that for these consumers beef quality is much more a matter of sensory, intrinsic quality, not being so much influenced by non sensory credence attributes such as food safety or animal welfare. Reasons for this attitude can be suggested. Food products are mainly characterized by the experienced dimension. For a food product, and as expected, the satisfaction derived from consumption is mostly sensorial. This experienced quality is known to determine the probability of repeated purchases (Grunert, Bredhal, & Brunso, 2004). Therefore, it can be considered expectable that the attributes that lead to satisfaction and repeated consumption are those more often mentioned as determinants of beef quality.

Another often mentioned quality cue is price. Although some participants referred finding good value for money as relevant for their shopping decisions, most consider that a higher priced beef is a sign of a better quality beef: “I don’t buy a lot of beef, so I rather pay more for a high quality product”.

Issues such as animal welfare and the environment were mostly mentioned only after a direct question, and although they were considered relevant and with influence in beef quality by many participants, most of them stated these aren’t relevant concerns when shopping for beef products. Nevertheless, when facing such topics many participants did claim these were important issues for them.

Although beef safety is often considered a concern, the food safety legal framework and its enforcement are thought to be efficient. Therefore, for many participants beef safety is not an immediate concern during shopping.

Nonetheless, the potential presence of drug, antibiotic and hormone residues in beef is a widespread concern among participants.

Environmental concerns are mainly linked with pollution and recycling. Preferences go towards extensive beef production systems which are regarded as environmentally friendlier, even if participants aren’t able to specify the reasons why.

Animal welfare concerns include transportation, slaughtering and rearing conditions. Animal friendlier extensive pastures, which allow more space for movement and the ability to fulfil natural behaviour, were those preferred by participants.

The associations between beef production in extensive pastures and both animal welfare and the environment help show that consumers often consider these issues to be connected.

Furthermore, the immediate reference to organic products as safer, animal friendlier or environmentally friendlier also shows that for many consumers the provision of one attribute comes together with the provision of the other two.

There were mixed reactions when it comes to willingness to pay premiums for any of the three given attributes. However, there was a spontaneous stated interest in beef products that associate the three discussed credence quality attributes. Participants refer preferences for products with bundles of these attributes, probably considering the expectable price premium to be more attractive given the bundle of quality attributes they would be getting.

These consumers, even if not in the most conscious way, seem not to be able to embrace the separate supply of such attributes, making positive associations between them. In some cases, it may be possible for consumers to be aware of the joint production of food safety, animal welfare and environmental protection in beef production. This reinforces the need to jointly value such complex and jointly produced attributes.

Chapter 10 deepens the analysis of the focus groups' results thus starting with some of the tables presented in chapter 9. The approach to qualitative contents is renewed and a quantitative analysis of some choice exercises is proposed, in order to support the scenarios' designing, and the selection of attributes and prices for the choice-experiments.

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Chapter 10
Consumers` perceptions towards beef safety, animal welfare and environment:
getting insights and choice scenarios from focus groups

In European countries, food safety, animal welfare and the environment have become relevant consumers` concerns. The analysis of consumers' willingness-to-pay for food products, such as beef, with credence attributes namely with higher levels of safety, animal welfare and environmental performance can be done using stated preference (SP) methods. One of such methods is choice modelling. The validity of SP surveys is highly dependent upon the elicitation context and the scenario design, involving the above mentioned credence attributes. This article shows how possible scenarios to be used in choice-experiments can be obtained through focus groups using these three food attributes altogether. It was possible to get participants perceptions and concerns towards animal welfare, food safety and the environment in a beef product and a relevant price range. Furthermore this work contributes to the literature by enriching the framework for choice-experiments design.

10.1 Introduction

Societies and markets' evolution have dictated an increasing interest for food quality and for differentiated food products. The food quality concept has experienced major developments including the perspectives from all the actors in the food chain, from producers to consumers, retailers or policy makers.

From the consumers' perspective, a food product's quality can be derived from characteristics as diverse as taste, convenience, package, production method or even price. Which characteristics determine consumers' choices is a function of not only personal preferences, but also societies' concerns and values. In European countries, food safety, animal welfare and the environment are three concerns many consumers have about modern food production systems and food products of animal origin, such as beef (de Passillé & Rushen, 2005; Madureira, Rambonilaza, & Karpinski, 2007)[56]. Quite interestingly, across the literature we find references mentioning the gap between consumers' concerns and their actual demand for products normally with higher prices related to higher production standards (namely Brom (2000) and Carlsson, Frykblom, and Lagerkvist (2004)).

Consumption patterns are changing. New demands, preferences and attitudes have

56 Food safety, animal-welfare and the environment can be considered credence attributes. Credence quality attributes are in no way assessable by the average consumer (not even after consumption), and therefore depend on the faith and trust consumers have in the information provided (Grunert, Bredhal, & Brunso, 2004).

implications in consumption patterns. Looking in particular to beef consumption, it declined in Europe since the late nineties and consumers became, since then, particularly concerned with beef safety - of course highly related with the different consumer confidence crisis this sector underwent- and also with animal welfare and environmental issues. These last two mainly due to developments in scientific knowledge, legislation, and widespread access to knowledge and pressures from different publics. Reasons apart, the truth is that these are major concerns surrounding people minds and thoughts. But are they shaping consumers' willingness to pay (WTP) for beef products with such characteristics and is this translated in a different purchase and consumption behaviour?

Beef quality is influenced by different attributes and a multi-attribute approach can be used to analyse consumers` perceptions of beef quality as mentioned in Wezemael, Verbeke, Kügler, de Barcellos, and Grunert (2010). Indeed beef quality perceptions are determined based on consumer perceptions of search, experience and credence attributes. According to Steenkamp (Steenkamp, 1990), "quality cues are what the consumer observes, and quality attributes are what the consumer wants". Beef safety, animal welfare and environmental friendliness are mainly credence characteristics or attributes. This implies that the consumer cannot ascertain by himself the presence of such characteristics even after consuming the food product, in this case, after consuming the beef. The consumer has to rely on cues given and on third entities that ensure the presence of such characteristics.

Previous work undertaken shows that for some consumers major cues used for beef quality and safety are beef origin and expiry date (Bernués, Olaizola, & Corcoran, 2003), for others colour, freshness, visible fat, price, promotion, Protected Designation of Origin (PDO) and aspect are the most relevant ones (Acebrón & Dopico, 2000). Banovic, Grunert, Barreira, and Aguiar Fontes, (2009) looking at Portuguese consumers, concluded that information around the product, namely the brand, can influence consumers` perceptions towards intrinsic attributes such as fat content or colour. They also confirmed that for beef with quality designations (such as PDO), beef origin is an important attribute to infer beef quality (Aguiar Fontes, PInto, & Lemos, 2011).

The analysis of consumers true demand and willingness to pay for food products, such as beef, with credence attributes namely with higher levels of safety, animal welfare and environment can be done using stated preference (SP) methods. One of such methods is choice-experiments. The validity and the success of SP surveys is highly dependent upon the elicitation context and the scenario design, involving the above mentioned credence attributes, amongst other factors. When we are interested in assessing consumer perceptions towards beef credence attributes such as food safety (the subjective food safety and not the objective one), animal welfare and environmental performance, we need to know how consumers infer about such attributes. This paper tries to unveil consumer perceptions and attitudes towards these three attributes, how they evaluate them, and if in their purchase behaviour these attributes are taken into consideration and how. This is highly relevant for marketing and for policy. Furthermore, and because this study is integrated in a broader project whose main objective is to assess consumers` willingness-to-pay for a safer, cleaner and animal friendlier beef, insights from the work presented here will help in defining the price values (bids) and

other elements of the choice scenarios to be used, at a later stage, in the broader project, when Portuguese consumers' true demand and willingness to pay for safer, cleaner and animal friendlier beef is to be elicited by using a stated-preference approach[57].

With this underlying reasoning and being particularly interested in how consumers perceive and behave towards a safer, "cleaner" and animal friendlier beef, using, as a case study, the Portuguese consumer, we undertook some focus groups. Focus groups have recently been applied to unveil consumers' perception about beef quality in several European countries (Korzen & Lassen, 2010; Verbeke, et al., 2010). Attitudes towards food safety have also been evaluated within a focus group context (Behrens, et al., 2010; Korzen & Lassen, 2010; Wezemael, et al., 2010). Vanhonacker, Poucke, Tuyttens, and Verbeke (2010) have applied focus groups as a qualitative research tool to analyse the relevance of animal welfare in food shopping decisions and as a complementary source of information for a broader-scale survey. However, we haven't been able to find references to focus groups discussions involving these three food attributes altogether. Furthermore, though the use of focus groups is considered good practice in the choice-modelling/stated preference literature (Carson, 2000), the way we have used it here to obtain the bid levels is quite new. We consider this procedure a requirement to achieve a successful stated preference study.

Hence, and from what has been presented above, the main objectives of the present study are: (i) to unveil consumer perceptions and attitudes towards beef safety, animal welfare and the environment; (ii) to develop choice scenarios to be used in choice experiments (CE), and (iii) to get price bids (themselves part of scenarios referred to in (ii)) to be used in choice experiments. We will now move on to the methodology used.

10.2 Methodology

10.2.1 Focus Groups: participants, discussion guide, questionnaire and limitations

According to Kitzinger (1995), focus groups capitalize on group interaction to generate data particularly to explore participant`s knowledge and experience, thoughts and reasons. Six focus groups were conducted in Portugal - 3 in Lisbon and 3 in Oporto. These cities were selected because of their significant differentiated beef market consumption (Banovic, Grunert, Barreira, & Aguiar Fontes, 2010; Project AGRO 422, 2004-2007). Indeed differentiated food products are usually more available in urban contexts, and are generally sold at higher prices hence these cities ensured product availability and presence of higher income groups. In each city recruitment and invitation procedures were designed according to Krueger and Casey (2008). All participants had to be beef consumers and at least partially responsible for the household's meat shopping. No additional demographic characteristics were considered as a

57 More specifically, a choice – experiment (CE) survey was elected as the proper method for the research project above mentioned. However, within this articles scope, such specification is not needed, as most findings can be applicable to stated preference surveys in general. Whenever findings and conclusion apply specifically to CEs, it will be mentioned.

recruitment criterion. In total, the six sessions included 35 participants (between 5 and 8 per group). Summary of the participants profile is given in Table 23.

Table 23: Focus groups participants` profile

Sample characteristics		Percentage
Gender	Female	74.3
	Male	25.7
Age	26 to 35	40.0
	36 to 45	34.3
	46 to 55	14.3
	> 56	11.4
Households' disposable monthly Income (€)	<=1350	11.4
	]1350-2250]	40.0
	]2250-3150]	20.0
	]3150-4050]	14.3
	>4050	14.3
Literacy level	Elementary	11.4
	Secondary	14.3
	Bachelor or higher	74.3
Household size	< = 2	51.4
	3or 4	34.3
	>=5	14.3
Beef buying frequency	Once a week	14.3
	One to three times per month	60.0
	Less than once a month	25.7
Beef consumption frequency	More than 3× a week	2.9
	Twice to 3× a week	28.6
	Once a week	17.1
	Less than once a week	42.9
	Less than once a month	8.6

The participants were invited to discuss around beef quality perceptions particularly participants` attitudes, behaviour and thoughts towards beef safety, animal welfare and environment. The discussion was conducted by a moderator (a member of the research team) and followed the different sections specified in the discussion guide (given in Appendix 3), in accordance with the framework and objectives of the overall study. Notice that this guide includes a section on choice exercises which is worth a more detailed explanation.

As previously mentioned one of the objectives of these focus groups was to get insights and a framework to design choice experiments that would be used at a later stage of the broader research project. As so, these choices consisted of a set of exercises. Participants performed 5 exercises after section 6 of the discussion guide (Appendix 3). In such section, analysis and debate of four beef labels (relating to the same beef cut and where price was deleted previously) was undertaken: (i) organic beef; (ii) Protected Designation of Origin (PDO) beef; (iii) a supermarket brand labelled as "Sustainable", and (iv) an undifferentiated beef. After this debate, participants were asked to do 5 choice exercises, where they had to rank the four

packed beef products, using a preference scale (1 = least preferred to 4 = most preferred). In the first three choice exercises, participants were asked to rank the four types of beef in terms of their perceptions concerning beef safety (exercise 1), animal welfare (exercise 2) and environment (exercise 3), based on the available extrinsic cues: label, expiry date and package information (Figure 7).

Figure 7: Figure 1: Example of a choice exercise sheet

Name: _____

Please state your preference order according to the moderators' instructions

The last two exercises were slightly different: all the three attributes were evaluated at once and the price attribute was added. In exercise 4, the prices given were the real market prices at that time for the 4 types of beef while, in exercise 5, prices were allowed to differ but having as a reference the available market prices. Notice that for the undifferentiated beef the price used was the same in exercises 4 and 5 (Table 24). The objective of the last two choice exercises (exercises 4 and 5) was to assess if the preferences' order changed with price changes. We wanted to verify whether the price attribute outweighed the credence attributes.

Table 24: Price sets used in choice exercises 4 and 5

Beef Product	Price 1	Price 2
Undifferentiated beef	7.49€/Kg	7.49€/Kg
Organic beef	12.46€/Kg	10.95€/Kg
PDO beef	10.95€/Kg	12.95€/Kg
Supermarket beef brand	14.48€/Kg	11.49€/Kg

Prior to the beginning of the sessions, all the participants were asked to fill in a questionnaire, which included questions on socio-demographic characteristics and also on beef shopping and consumption habits and preferences, both for undifferentiated and differentiated beef. This questionnaire intended to help direct the attendants' mind frame towards the discussions' theme and to get some insights on the participants' familiarity with beef shopping and beef consumption frequency, but also to map participants' socio demographic characteristics. Notice that focus groups involve a small and not representative number of participants and the results here presented cannot be extrapolated to the entire population.

10.2.2 Data Analysis and limitations of the study

The sessions took around two hours and were all recorded, transcribed, and the contents subject to analysis according to Krueger and Casey (2008). A study of such nature is always exploratory and descriptive. The participants of the focus groups are not representative of the population but have characteristics similar to those that would be part of a sample to which the questionnaires and the stated preference method would be applied.

We were convinced that the preliminary information gathered with the focus groups, concerning consumers` perceptions, interests and behaviour towards beef safety, animal welfare and environment, would be a reliable one to be used in the questionnaire wording and construction. Furthermore, the choice exercises would give a trustworthy basis for the development of scenarios (including price levels) to be used at a later stage of the research. Of course, we cannot measure the relative importance of the perceptions and concerns, but they do give reliable preliminary information that can make all the difference in the success of questionnaire surveys based on choice-experiments.

10.3 Results

This section is divided in four sub-sections: (10.3.1) perceptions of beef safety; (10.3.2) perceptions of animal welfare; (10.3.3) perceptions of the environment, and (3.4) choice exercises results. These sub-sections reflect the different objectives of the present paper.

10.3.1 Perceptions of beef safety

Focus groups participants associated beef safety essentially with drug residues (hormone, antibiotics), dioxins, and slaughter and feedstuffs hygiene; all considered to be worrisome during the different production stages. They also associated it with regulations, control and previous experience. In essence, these were the mentioned concerns when asked about beef safety. Some major cues were given to infer about beef safety, and these were: beef aspect, colour and expiry date, origin, shop at the butcher (Table 25).

The majority of participants repeated this was not, at that time, a big concern. When the moderator stimulated the discussion towards this issue, reactions often lead to the conclusion that food safety wasn't generally considered a concern at the moment of shopping, as minimum standards were perceived as guaranteed and satisfactory. In general, these consumers consider that if a given beef is available at the shelf of the supermarket or at the butcher, then it is safe for consumption.

Most participants stressed their confidence in the existing legal framework, regulatory institutions and in the existing audits and inspections. The European Union (EU) regulatory role was considered to be relevant for this confidence level. All these findings are similar to those found in the literature concerning different European consumers (Korzen & Lassen, 2010; Verbeke, et al., 2010; Wezemael, et al., 2010).

Table 25: Beef safety perceptions, associations and concerns

Mentioned concerns		• Drug residues: hormone / antibiotics • Dioxins • Slaughter hygiene • Feedstuffs' hygiene • Regulations and control • Previous experience
Beef safety cues		• Meat aspect • Fat and meat colour • Expiry date • Pre-packed beef • National origin • Shopping at butcher
WTP for safer beef		
	Yes	• Value for money • Buying less to buy more quality
	No	• Pleased with current • Additional safety has to be for all consumers
	Don't know	• Trial shopping • Only if certified

The discussion around willingness to pay (WTP) for beef with food safety guarantees above the legally imposed ones was not consensual. However, about two thirds of the participants said they would be willing to pay a premium for such beef, namely those who buy small quantities of beef and therefore would be willing to pay for improved safety. Nevertheless, such decision was always said to be dependent on the premium amount, and the beef sensory quality (experience dimension) would also need to be satisfied. One third of the participants said they would be unwilling to pay for such beef, as they considered themselves satisfied with the current safety guarantees. Some of these participants even resented the perspective of premium food products being safer than others, as they consider safety must be a standard available to all consumers in every product, that is to say: it should only have the characteristics of a (non excludable) public good.

10.3.2 Perceptions of animal welfare

When discussing animal welfare in beef production, the focus groups participants considered this to be a rather emotional subject and acknowledged the contradiction between eating beef and having concerns about animal welfare. Very often respondents said they rather not think about animal welfare when shopping for meat. This voluntary avoidance of disturbing issues is a phenomenon very commonly mentioned in the literature (Blandford, Bureau, Fulponi, & Henson, 2002; Vanhonacker, et al., 2010).

Participants were able to specify quite precisely concerns about animal welfare, associating them with transport conditions and slaughtering techniques. Intensive production was considered to be harmful for animal welfare, and issues like diminished space for movement and inability to fulfil natural behaviour were mentioned. Also, the lack of producers and caretakers training was also considered to be a concern for many attendants (Table 26). Moreover, several participants even mentioned they were aware that animal stress is able to degrade beef sensory quality, namely its tenderness. However, no specific association between animal welfare and beef safety was made, contrary to what is commonly found across the literature (de Passillé & Rushen, 2005; Harper & Makatouni, 2002).

Table 26: Animal welfare perceptions, associations and concerns

Mentioned concerns		• Contradictory subject for meat eaters • Slaughter conditions • Animal transport conditions • Living conditions • Freedom to fulfil natural behaviour • Feeding • Caretakers training
Animal friendlier beef cues and attributes		• Organic beef • Beef produced in grazing extensive systems
WTP for animal friendlier beef		
	Yes	• Value for money • Buying less to buy more quality • Preference for "joint" products that include safety, environmental protection and animal welfare
	No	• Consumers shouldn't be the ones to pay • Can't tell the difference • Distrust in certification
	Don't know	• Trial shopping

The willingness to pay for animal friendlier beef was also a non-consensual issue. Some attendants stressed it is not a concern during shopping and, moreover, that it should not be the consumer responsibility to pay for the fulfilment of such animal welfare requirements. In these cases, the participants seemed to be stating their preferences as citizens[58]. This role, as well as the attribution of such responsibility to other actors, namely the government or beef producers has also been described by Harper and Henson (2001), Blandford et al. (2002) and Vanhonacker et al. (2010).

However, as for the previous topic, many participants said they would be willing to pay for beef with improved animal welfare due to the small amount of beef they usually purchase, allowing them to make premium choices. Some of the participants even mentioned this would be a beef they would be curious about, given the association they make between animal welfare and sensory quality.

10.3.3 Perceptions of the environment

When the discussion evolved towards the analysis of the environmental impact of beef production and concerns about the environment, most participants did state their environmental concerns, saying they try to do their share, namely through recycling, either due to their own health concerns, or due to concerns with future generations (Table 27).

58 This consideration was taken into account in the initial stages of the broader project. However it was assumed by the research team to investigate the consumer-citizen duality in future work. Nevertheless it was very interesting to capture this behavior during the focus groups discussions.

Table 27: Environmental perceptions, associations and concerns

Mentioned concerns		• Health • Future generations • Not as important as beef safety • Lack of information • Just a fashionable media trend
Environmentally friendly beef cues and attributes		• Organic beef • Beef produced in grazing extensive systems
WTP for "cleaner" beef		
	Yes	• Value for money • Buying less to buy more quality • Preference for "joint" products that include safety and environmental protection
	No	• Green products are too expensive • Can't tell the difference
	Don't know	• Trial shopping

Participants associated grazing, extensive and organic production as environmentally friendlier production systems. Nevertheless, they also considered that beef with such characteristics is fashionable and most of the time it is not possible to tell the difference, in sensory terms, between an organic beef and an undifferentiated one.

For a small number of participants the environmental impact of beef production was considered a secondary problem, when compared to food safety, and was not taken into account while shopping beef. Some participants even mentioned this to be more of an in vogue affair or a media concern, than a real issue. Most of them, however, considered themselves uninformed on the true impact of beef production, on the one hand, and on the availability of eco-friendly beef products, on the other.

For those participants willing to pay for environmentally friendlier beef, the stated reasons were the same as mentioned before: buying less to buy better quality, but the size of the premium would again be considered relevant. On the other hand, some participants said they would probably be unwilling to buy such beef as it, most likely, would be too expensive.

Finally, some participants spontaneously expressed interest in beef products with a bundle of these attributes, mentioning that if safety, animal welfare and the environment were all present in the same product they would be much more interested in buying it. Such statements are consonant with what previous research has shown, i.e. the preference for these attribute bundles comes from the association consumers make between such attributes and increased safety (Harper & Makatouni, 2002; Wezemael, et al., 2010). This raises some interesting research questions related with possible interactions in valuation across attributes. The authors have successfully explored such research questions at a later stage of their work which was to be published elsewhere (Viegas, Nunes, Madureira, Aguiar Fontes, & Santos, submitted).

10.3.4 Choice exercises results

The choice exercises allowed for obtaining a very important data set[59]. Indeed given that participants had to state their preference, faced always with an undifferentiated beef, the obtained data allowed setting a logistic regression model which included 4 independent variables: food safety, environment, animal welfare and price difference (price of differentiated beef versus the price of undifferentiated beef). The dependent variable depicts the choice of the differentiated beef. The logistic regression was chosen in order to help predict the price range to be used in the survey scenarios. Provided that no extrapolation is intended, and that the only objective is the determination of price range information, focus groups can produce some quantitative data, and some quantitative analysis methods can be applied (Stewart, Shamdasani, & Rook, 2007). It is important to reinforce that the intention here is not to estimate a representative WTP for differentiated beef, but merely to obtain a reliable price range for differentiated beef to be used at a later stage of the broader survey. For the development and analysis of this model the software SPSS Statistics 18.0 was used. Table 28 shows the estimated parameters.

Table 28: Logistic regression results

Variable Name	Coefficient	Standard Error	p-value
Food Safety	0,387	0,316	0,220
Environment	0,984	0,449	0,029
Animal Welfare	0,487	0,380	0,200
Price Difference	-0,653	0,185	0,000
Constant	2,110	1,277	0,098
Log-likelihood	104,935		
Pseudo R-Squared	0,261		

The parameters estimated by the model can be directly interpreted in terms of their significance and sign. As expected, the beef price negatively and significantly influences the consumers' choices. Considering the variables on the credence attributes only the ***environment*** variable is significant, influencing positively consumers' choices. However, a straightforward monetary interpretation isn't possible. It is necessary to combine different parameters in order to calculate an implicit price for each attribute (as explained in detail in Burton, Rigby, Young, and James (2001), James and Burton (2003) or Loureiro and Umberger (2007). More precisely, this implicit price can be calculated by dividing the coefficient of the attribute of interest by the negative coefficient of the payment attribute included in the model. The result corresponds to the respondents' mean willingness to pay for a unit increase in that attribute.

59 Each one of the two choice exercises involving prices can be seen as each participant having to make three choices coded as 1 = choice of differentiated beef and 0 = choice of undifferentiated beef. Consequently, although the number of individuals participating in the choice exercises was only 35, each one of them was involved in six observations concerning a choice of a differentiated meat versus the undifferentiated meat, producing a total of 210 observations.

$$Implicit\ price = -\frac{\beta attribute}{\beta price} \quad (1)$$

For the mean willingness to pay for each attribute calculation, two additional calculations were considered. As the constant was different from zero, it was included in the price range determination. Furthermore, in choice exercises 4 and 5 the three attributes were presented and evaluated at once and the participants ranked the order of preference. Only those ranked first in order of preference were considered (and given a value of 3). Therefore, the mean price was determined using the formula:

$$WTP = -\frac{3*\beta attribute}{\beta price} + \frac{\beta constant}{\beta price} \quad (2)$$

Table 29 shows the calculated prices for each attribute and for all the possible combinations.

Table 29: Attribute's mean WTP

One Attribute	**$_{mean}$WTP**	**Average**
Food Safety	5,00	
Environment	7,75	6,07
Animal Welfare	5,46	
Two Attributes		
Food Safety / Animal Welfare	10,46	
Food Safety / Environment	12,75	12,14
Animal Welfare / Environment	13,21	
Three Attributes		
Food Safety / Animal Welfare / Environment	18,21	18,21

For the sake of diminishing the number of prices available (and therefore, the number of different choice sets in the preliminary survey) only the average of the mean WTP for the attributes and its combinations was considered. For the price range calculation an approximation to the standard normal distribution was considered. Therefore, the standard deviation of our distribution was calculated by the formula:

$$Standard\ deviation = \left|\frac{1}{-\beta Price}\right| \quad (3)$$

where zz is the value for the standardized distribution associated with the chosen percentiles. In our case, these were 2.5%, 20%, 80% and 97.5%, as there are no recommended values

in the literature and we wanted to include both extreme and close to the mean values of the distribution.

The estimated price ranges are given by summing up the mean WTP value for one, two and three attributes, with the standard deviation value and the undifferentiated beef price as shown in Table 30.

Table 30: Price range values

Percentile	2.50%	20%	50%	80%	97.50%
One attribute	10.56	12.27	13.56	14.85	16.56
Two attributes	16.63	18.34	19.63	20.92	22.63
Three attributes	22.70	24.41	25.70	26.99	28.70

10.4 Conclusion and future work

The aim of this work was to get insights and a deeper understanding of consumer perceptions, concerns and attitudes towards beef safety, animal welfare and the environment. Furthermore it was also intended to get a reasonable price range to be used in choice-experiments at a later stage of a broader research. Finally we wanted to contribute to the literature by enriching the framework for choice-experiments design.

Overall these objectives were achieved.

We managed to get participants perceptions and concerns towards the different credence attributes considered. Indeed the results obtained lead us to consider as possible scenarios the ones presented in Table 31 which were used in the survey undertaken within the broader research project. Furthermore, the intensity of the guided discussions led to the elaboration of an accurate leaflet that was used as a support for the CE questionnaire. Consumers needed this additional information to be able to answer truthfully and meaningfully to the questionnaire of the SP survey. This procedure granted more confidence for the future survey to be undertaken which was confirmed with the results obtained (Viegas et al., submitted).

Table 31: Potential scenarios for choice experiments: beef attributes

	Scenarios Policy Off	Scenarios Policy On	Potential WTP
Food Safety	Maintenance of the current *status quo*	- Reducing the allowed level of antibiotic residues in beef; - Control of antibiotic use on farms - Control of antibiotic residues in meat	- Positive WTP for premium beef because the quantities bought are small. - Preference for products that include safety, environmental protection and animal welfare.
Environment		- Protection of local breeds - Avoid land abandonment - Preservation of national grazing production	
Animal Welfare		- Increased available space for each animal - Mandatory access to pasture - Increased caretakers' formation	

Inferences about the potential willingness to pay for a differentiated beef with the attributes under discussion in this article are difficult to make. The enthusiastic reactions for and against the possible availability of premium priced beef suggests the need of a cautious approach to the bids to be presented in the further survey, in order to avoid protest answers, reinforcing the pertinence of undertaking focus groups to determine a preliminary price range for the surveys' bids.

Worth mentioning the somewhat unexpected findings from these focus groups: the spontaneous stated interest in beef products that associate the three discussed credence quality attributes. Such attributes are, to some extent, jointly produced, and probably consumers very often have tangled preferences for them. This has been confirmed in Viegas ***et al***. (submitted).

Considering the article's objective of specifying the preliminary price range and respective bids to be used in the later SP survey, several considerations are relevant. All participants were able to consider the credence attribute under analysis in each one of the corresponding ranking exercises. Regarding the choice exercises with prices included, participants were able to rank their preference order. We might consider that price availability facilitates the choice process, as it makes the goods involved more familiar to participants. Regarding the estimated parameters, the lack of significance for some coefficients can be explained by the reduced number of observations. Nevertheless, direct interpretation of the coefficients signs can be suggestive of particular behaviours. The credence attributes coefficients positive sign is suggestive of these consumers' preferences for products with such characteristics. Significance of the *environment* coefficient, may suggest that participants are somewhat more familiar with eco-friendly products (more common in today's markets), compared with safer (taken for granted) or animal friendlier products. The *price* coefficient is significant and has a negative influence in participants' preferences as expected. Furthermore, its significance is quite relevant as

it provided some reassurance for the calculation of each attributes' implicit price, that is to say, the participants' mean willingness to pay for a unit increase in each attribute. A proper experimental design should nonetheless be used in order to guarantee that the calculated bids are adequately combined with the other attributes (and its different levels). Table 32 shows the bids to be included in the SP survey pre-test.

Table 32: Provisory price range and survey bids

	Price Range – Bids €/kg				
1 Attribute	10.56	12.27	13.56	14.85	16.56
Combinations of 2 Attributes	16.63	18.34	19.63	20.92	22.63
Combination of 3 Attributes	22.70	24.41	25.70	26.99	28.70

Keeping in mind that no extrapolation was intended for this process, the determined values serve the objective of determining the price range to be used in the SP survey design. Concluding, the mentioned participants' difficulties in specifying and elaborating on the debated issues showed that designing survey scenarios without the focus groups input would likely result in attribute misspecifications and invalid results. Furthermore, the spontaneous joint preferences for bundles of attributes show that the joint valuation in a SP survey may produce more reliable results. Finally, the price range obtained can be considered reasonable as they were somewhat within the premium priced beef cuts already existing in the Portuguese market.

We therefore confirm that focus groups are a valuable tool to depict consumers' impressions and knowledge of intricate subjects and to identify valid frameworks for SP surveys' scenarios, highlighting the interest of reporting focus groups results.

Chapter 11 begins the analysis of the survey's results namely those related with consumers' behaviours and concerns regarding food safety, animal welfare and the environment in general and in a context of beef production and consumption in particular.

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Chapter 11
Do they really care?
Insights on Consumers' Perceptions and Concerns Associated with Beef Credence Attributes

The willingness to purchase differentiated beef products is highly segmented and is often translated in small niche markets. There are still much to be explained concerning the gap between consumers' concerns and their actual demand for differentiated products based on higher production standards, which normally have higher prices. An analysis of consumers` concerns and perceptions related with animal welfare, food safety and the environment within the beef production chain and its links with beef consumption decisions confirms that the potential market for these differentiated beef products have characteristics of niche-markets. Finally, we want to understand if preferences, attitudes and concerns are translated in beef preferences and purchase intentions. There still exist a significant proportion of consumers not taking these credence attributes into consideration.

11.1 Introduction

The demand for differentiated food products is highly segmented and is often translated in niche markets. Beef products can be included in such reasoning, as suggested by the demand for organic (Fox et al., 2008) or PDO beef (Banovic et al., 2009).

Consumers may be willing to pay for differentiated beef and this willingness may arise from higher levels of awareness and concerns related with animal production conditions within modern food production systems (de Passillé and Rushen, 2005, Madureira et al., 2007). For example, Resurreccion (2003) claims that the decline in the consumption of meat products in the UK was related with consumer concerns about food safety, animal welfare and the environmental effects of beef production.

It is thus apparent that food products' differentiation often stems from process-related quality dimensions, which are related with characteristics of the production process, such as production with due concern for animal welfare and the environment (Bech et al., 2001). Though not necessarily leading to a different final product, these dimensions can influence consumer's welfare. It is accepted that consumers' search for process-related quality dimensions has increased for the last decades (Grunert et al., 2004).

Many process-related quality dimensions are credence dimensions, in the sense that their presence must be guaranteed by others, and consumers have no choice but to trust this information (Bech et al., 2001, Grunert et al., 2004). This available information is used to form quality expectations influencing the purchase decisions. This is the case with attributes like food safety, animal welfare and the environment, where consumers must rely on extrinsic

quality cues in order to choose the product that is expected to have the quality dimensions consumers are looking for.

However, in spite of these cues, consumers face information problems in choosing those types of food products that best match their preferences and perceptions of quality and that assure satisfaction (Poole et al., 2007). This raises some doubts about the effectiveness of using these attributes as a differentiating tool for some food products.

Additional doubts originate from the fact that altruistic concerns (as those related with animal welfare or the environment) may not be translated in real purchases (Webster, 2001, Lusk et al., 2007, Vanhonacker et al., 2007), as many consumers still opt for the cheapest meat. Furthermore, some consumers may not even care that much about such issues, especially in times of increased income restrictions. As such, failing to recognize that some product's attributes can only add value for some consumer's segments may have implications in demand estimation and in total revenue.

All this uncertainty is aggravated by the fact that beef usually has a considerable low degree of differentiation (Grunert et al., 2004). So there will be increased costs associated with producing, marketing and selling differentiated beef products, which may be large enough to make these goods unprofitable.

Nevertheless, in face of such incertitude and intricate motivations and behaviours, there are well established differentiated food products which ground their competitiveness in attributes like animal welfare (free-range eggs), environmental protection (organic products) or food safety (pesticide free fruit). Even taking into consideration income restrictions, there are small but profitable niche markets that may be worth exploring.

An analysis of consumers` concerns and perceptions related with animal welfare, food safety and the environment within the beef production chain will therefore shed some light into the true market potential for such differentiated beef products.

Faced with all that have been exposed we looked at Portuguese consumers` beef buying and consumption habits looking in particular to the relations between consumption habits and behaviours related with food safety, animal welfare, environment and altruism. This article also intends to explore Portuguese consumers' concerns related with the beef production chain. Finally, we want to understand if preferences, attitudes and concerns are translated in beef preferences and purchase intentions.

11.2 Methods

A cross sectional survey was implemented in order to assess Portuguese consumers' concerns about animal welfare, safety and environmental protection in beef production and in beef products and how these issues influenced consumer preferences and purchase intentions.

The questionnaire included five sections where the final one inquired about socio-demographic characteristics. The first section dealt with beef purchasing and consumption habits. The second with consumer's behaviours related with care and concern about animal welfare and the environment. Some additional questions were added to assess whether respondents cared for some more humane causes, like food banks or consumer protection.

The third section was specifically directed towards accessing the degree of concern about animal welfare, the environment or food safety in beef production. Emphasis was put on the fact that the subject of the question was the entire production chain. The questions here included also asked specifically which actors of the production chain did consumers' consider responsible for the problems. The fourth section asked respondents to rank four beef products in terms of their buying preferences, if the prices were the same. The four beef products were an animal friendlier beef, an environmentally friendlier beef, a safer beef and an undifferentiated beef.

Questionnaires were administered by a marketing company in the two Portuguese largest cities (Lisbon and Oporto). A valid sample of 613 respondents was obtained. Table 33 presents the summary statistics for demographic variables. The sample was not representative of the Portuguese population, namely in terms of age, income classes and number of children in the household. The sample bias towards higher income classes was a requirement since these are normally the consumer groups who typically purchase differentiated beef (Banovic et al., 2010).

Table 33: Summary statistics for demographic variables

Sample characteristics		**Percentage**
Gender	Male	46.0
	Female	54.0
Age	18 to 37	30.5
	38 to 57	34.6
	58 to 77	25.3
	>78	9.6
Literacy level	Elementary	33.6
	Secondary	15.8
	Bachelor or higher	50.6
Household size	<=2	49.6
	3 or 4	41.4
	>=5	9.0
Disposable monthly income (€)	<950€	5.5
	[951€-1900€]	28.1
	[1901€-2850€]	15.8
	[2851€-3800€]	34.6
	>3801€	16.0

Data were analyzed using SPSS 19.0. All the variables were categorical and therefore descriptive statistics were used to report frequencies. Cross-tabulations and non-parametric tests, such as X^2 statistics, were used to determine associations between variables.

11.3 Results

11.3.1 Beef buying and consumption habits

Table 34 presents the frequencies for the questions related with shopping habits, while Table 35 refers to the frequencies on consumption habits. Contrary to previous results (Aguiar Fontes et al., 2012) where purchases at the butcher were the preferred place to buy beef, these respondents stated they prefer to buy beef at the big multiples. Beef buying frequency and consumption frequency are positively related (X^2 (8, N = 613) = 419.877, p =0.000).

Table 34: Beef buying habits

	Percentage
Preferred beef shopping location	
Hypermarket / Supermarket	53.7
Butcher	45.5
Beef buying frequency	
At least once a week	33.6
One to three times per month	42.6
Less than once a month	23.8
Did you recently reduce your beef purchases?	
No	59.1
Do you buy certified or branded beef?	
No	94.5
Did you recently reduce the certified beef purchases?	
No	70.6

Notice that of those who buy certified beef (6% of the sample, and confirming the characteristics of a niche market) 92% didn't reduce either the beef purchases (X^2 (1, N = 613) = 21.511, p =0.000). In contrast, 59% of those who don't buy certified beef did reduce their undifferentiated beef purchases. The majority of certified beef shoppers are people with higher literacy levels.

Table 35: Beef consumption habits

		Percentage
Consumption frequency	Almost every day	2.4
	2 or 3 times per week	26.9
	Once a week	33.0
	1 to 3 times per month	24.0
	Rarely or never	13.7
Why do you consume beef rarely?	We don't like it	33.3
	It's too expensive	23.8
	It's not healthy	35.7
	Other	7.1

Regarding beef consumption habits, 58% of the respondents consume beef at least once a week. And for those who state they rarely do it, only about a quarter refers it is too expensive. Those who consume beef less frequently are those who have also reduced their beef purchases (X^2 (4, N = 613) = 32.784, p =0.000).

11.3.2 Behaviours related with animal welfare, environment and altruism

After the assessment of buying and consumption habits, the questionnaire included a group of eight questions about whether respondents' carry out some activities related with the environment or animals (wild or domestic). Two questions were included in order to verify if there was any kind of association between altruistic behaviours directed towards animals or the environment and altruistic behaviours directed towards people. Table 36 summarizes the results.

Table 36: Reported behaviours

Do you have any of the following behaviours?	Percentage
1. Read articles or watch television programs about animal welfare	30.2
2. Separate household waste for recycling	84.7
3. Buy (or regularly read) magazines on environmental protection or nature	4.7
4. Buy products specifically because they are environmentally friendly	30.3
5. Donate money (or volunteer) to animal protection associations or environmental protection	22.5
6. Actively participate in association activities or campaigns to protect animals or the environment	6.0
7. Belonging to associations for consumer protection	26.9
8. Deliver cash or goods such as clothing or food in institutions that help people in need	57.1
9. None of the above	7.7

The separation of domestic waste was by far the activity with more adherents, followed by item 8 and here we highlight the delivery of food items such as campaigns within the "Food Bank" Institution[60]. Item 1 shown in Table 4 was probably misinterpreted by many respondents, who probably considered that programmes about wild life were included. All the other options were chosen by a much smaller percentage of participants and items 3 and 6 are those that gather fewer respondents.

60 The "Food Bank" Institution ("Banco Alimentar contra a Fome", www.bancoalimentar.pt) is a very popular organization in Portugal, and this high participation percentage may be related with the several national campaigns that are undertaken every year, and more than once a year, in supermarkets and hypermarkets.

11.3.3 Concerns related with the beef production chain

The three following questions in the questionnaire were related with specific concerns about food safety, animal welfare and the environment in beef production and who do consumers' consider to be responsible for those aspects (from now on designated as "worrisome aspects"). Table 37 summarizes the results.

Table 37: Concerns and responsibilities related with the beef production chain

Does the beef production chain have worrisome aspects regarding...?	**Beef Safety**	**Animal Welfare**	**Environment**
Yes	48.5	59.4	40.3
No	51.5	40.6	59.7
If yes, due to...?			
Not enough legislation	13.1	11.0	19.4
Not enough control	74.4	58.8	78.5
Beef producers	55.9	57.4	44.5
Transportation and abattoirs	N.A.	56.3	N.A.
Supermarkets and butchers	31.6	17.3	19.0
Consumers	9.1	1.9	9.3

About half the sample stated that they don't have concerns about beef safety. Only a low percentage of respondents consider that there isn't enough legislation to ensure beef safety along the production chain. For these respondents the problem seems to lay on the lack of efficient and effective control of the existing legislation. The responsibility for the worrisome aspects regarding the environment has a similar distribution.

Almost 60% of respondents consider that the beef production chain doesn't have worrisome aspects regarding the environment. Moreover, a significant relationship was found between those who declare not to buy eco-friendlier products and those who don't have concerns about the environment (X^2 (1, N = 613) = 46.458, p =0.000).

On the contrary, almost 60% of the sample does consider that animal welfare may not be ideal along the production chain. These concerns seem to be more meaningful among consumers with higher literacy levels (X^2 (2, N = 613) = 8.155, p =0.017) and among younger and middle aged consumers (66% of those stating having concerns about animal welfare).

There is also a significant association between the declared concerns regarding these three issues X^2 (1, N = 613) = 138.127, p =0.000). In other words, those who don't report concerns about animal welfare, normally have no concerns with beef safety and environmental protection. Those who do state concerns about one of the variables have propensity to worry about the others.

Only 24% respondents have reported concerns about the three issues, whilst 36.8% declared not to have concerns about any of these issues within the beef production chain. Other socio-demographic variables seem not to have significant influence in these reported concerns.

11.3.4 Preferences for differentiated beef

Finally, the questionnaire aimed at determining if the declared concerns would be translatable into willingness to consume. Therefore, respondents were asked to rank four beef products in terms of their buying preferences if the prices were the same. Table 38 presents the rankings made by respondents when asked to order their choices if prices were the same for all the available beef products.

Table 38: Differentiated beef ranking

	Animal friendlier beef	Environmentally friendlier beef	Safer beef	Undifferentiated beef	No option
1st choice	21.7%	9.5%	54.5%	4.4%	10.0%
2nd choice	48.6%	19.7%	19.9%	4.0%	7.8%
3rd choice	18.9%	59.3%	17.3%	1.6%	2.9%
4th choice	2.4%	4.9%	0.8%	91.5%	0.4%

Answer to question *"Assuming that the prices did not rise, how would you order your choices?"* Indifference was allowed but only after significant indecision.

A "safer beef" was the first chosen beef by 54% of respondents, whilst 22% of respondents chose first an "animal friendlier beef". An "environmentally friendlier beef" was chosen first 10% of the times.

"Animal friendlier beef" tends to be a second choice, and the "environmentally friendlier beef" is often the third choice. Not surprisingly, as prices were all the same, the "undifferentiated beef" was the last choice by more than 90% of consumers.

Notice that though only 10% of the sample has "no option" at all as first choice, this proportion is basically the same as those choosing the "environmentally friendlier beef". Approximately 18% of the sample (n=109) did not have an option, that is to say, were completely indifferent between the four types of beef.

It is worth mentioning the fact that 4% of respondents opt for "undifferentiated beef" as their first choice. If to this we add those respondents that make "no option" at all (that is to say, are completely indifferent between available options) then we can consider that 14% of the sample does not care at all with these specific attributes – food safety, animal welfare and the environment – since the prices were all the same.

Regarding the relations between these rankings and the other groups of questions, those who buy certified beef tend to choose "environmentally friendlier beef" first X^2 (4, N = 613) = 44.970, p =0.000).

The consumers who declared to have concerns regarding beef safety tend to choose "safer beef" as their first option X^2 (4, N = 613) = 16.630, p =0.002). Also, "animal friendlier beef" was more often the first option for those concerned about animal welfare X^2 (4, N = 613) = 27.640, p =0.000). Consumers with higher literacy levels choose, as their first option, mainly a "safer beef". The other demographic variables do not seem to influence consumers' choices in this situation, as all classes prefer to buy a "safer beef".

11.4 Discussion and conclusion

This analysis of beef buying and consumption habits of Portuguese consumers, together with the scrutiny of concerns and perceptions related with animal welfare, food safety and the environment within the beef production chain has helped unveiling some interesting points.

Considering first the group of questions related with buying frequencies, it is interesting that the percentage of consumers buying beef in the butcher corresponds to about half the respondents, which is a smaller percentage than the 58% reported by Aguiar Fontes, Banovic, Lemos, & Barreira (2012). This may be related with the opportunity cost of time and the increasing importance of the attribute convenience. Moreover, in Portugal, differentiated beef is mainly sold in hypermarkets, so those who do buy certified beef will most likely purchase it in this kind of location.

Also worth mentioning is the small percentage of beef buyers who buy certified beef (6% of the sample and confirming the need to have a sample biased towards higher income classes). This strongly confirms that differentiated beef products represent niche markets, probably appealing only to those with higher available incomes. In line with this conclusion is the fact that the vast majority of people who consume certified beef did not reduce its consumption, in spite of the premium prices associated with these products and the Portuguese economic crisis.

Looking at beef consumption habits, although beef is often considered a premium meat per se (as it is normally more expensive that other possible substitutes like chicken and pork), a high percentage of the sample consumes beef at least once a week. It can be suggested that the true beef appreciators try to maintain their consumption levels.

Taking into consideration the group of questions related with altruistic behaviours, we can suggest that behaviours towards helping or being informed about animal welfare or the environment are not among our sample's habits. Moreover, the 30% of respondents declaring to buy products specifically because they are environmentally friendly (and the 22% declaring to donate money to animal welfare campaigns) should be interpreted with caution. It is well know that respondents' tend not to be completely faithful to their true behaviours and concerns in surveys, for the most varied reasons. As such, the percentages here presented are most-likely overrated, as eco-friendly products probably don't achieve such market shares in Portugal, and as the 2€ of per capita consumption of organic products in Portugal in 2010 seem to suggest (FIBL, 2012)

Not surprisingly, this revealed low interest is also apparent in the small levels of concerns about beef safety, animal welfare and the environment. These aspects may support the argument that these are truly niche markets, and that this kind of quality attribute interests only some consumers.

The high percentage of consumers stating that they don't have concerns about beef safety may be due to the fact that food safety is usually not a big concern in daily decision, except in cases when food scare occurred in recent times. These findings are in line with the findings of Grunert (2005) and Wezemael, Verbeke, Kügler, de Barcellos, and Grunert (2010). According to Viegas, Santos, and Aguiar Fontes (2011), consumers seem to have confidence

in the existing legal framework, which is concordant with our findings.

The percentage of respondents not particularly concerned with the environment is concordant with the fact that often consumers don't have a realistic idea of the environmental impact of livestock production (Vanhonacker et al., 2013).

However, when animal welfare is taken into consideration, consumers seem to have a more precise notion of the existing problems, as the percentage of concerned respondents seems to confirm. Moreover, the responsibility is much more divided along the chain, suggesting a more clear idea of the production process.

Rather interesting, although not surprising, is the lack of responsibility consumers' attribute to themselves. This detachment may be due to the indisputable public nature of these attributes. Also, it may be associated with voluntary ignorance (Harper and Henson, 2001, Ngapo et al., 2003). The fact that concerns are more significant among younger and middle aged respondents, and with higher literacy levels, can be interpreted in combination with the finding that these concerns are often combined in a pack of three. Altogether, this supports the fact that lack of awareness and knowledge about the beef production process helps consumers to keep detached and not worry about (and spend money on) issues they don't care that much about and consider not to be able to fix. For those consumers that are more informed, the concerns are probably related with the three issues.

Some comments on the preferences' ranking are also pertinent. The small percentage of respondents preferring an "environmentally friendlier beef" helps support the interpretation that the 30% of respondents declaring to buy eco-friendly products may not be answering truthfully. Furthermore, the fact that the "eco-friendlier beef" is only the chosen product at the third choice could have an additional interpretation. If the attribute that consumers' really care about is safety then, when faced with the same prices, food safety is the need they require in first place. Animal welfare may raise the need to fulfil some altruistic demand but the environment seems not to represent a significant preference in any perspective. All these findings come to support the proposed argument that beef product differentiation based on any of these attributes constitutes mainly a niche market, particularly in countries where organic products, namely organic beef constitute mainly niche markets.

Due to the aforementioned sample bias, however, the results can only be interpreted within the sample's characteristics and the generalization to the overall population is not possible. Moreover, the lack of association with most socio-economic variables hampers the possibility of proposing consumer segments at this point.

Future work will most likely involve correspondence analysis and cluster analysis in order to suggest which groups of consumers would be potential buyers for beef products differentiated on the basis of the credence attributes here covered.

It is possible that beef safety, animal welfare and environmental protection have the potential to be included in marketable beef products. The future focus must be on whether the willingness to pay exceeds the corresponding production costs, on the effectiveness of the information about these credence attributes, and on the transaction costs related to information itself. If these obstacles are surpassed, these niche-marketed food products might offer incentives for producers to differentiate their product, in spite of the greater economic risk

Chapter 12 analyzes specifically the CE data. It places a very deep attention on substitution effects and context dependency. Finally, this chapter not only includes the estimation of consumers' willingness to pay, but it also points out the possible consequences of the independent valuation closely related attributes

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Chapter 12
Beef Credence Attributes:
Implications of Substitution Effects on Consumers` WTP

Consumers' choices for food are influenced by a wide variety of attributes, namely credence attributes, but the food industry faces problems assessing whether the price premiums that consumers are willing to pay for these attributes will be sufficient to offset higher production costs. In such context, consumers' willingness to pay for safer, cleaner and animal friendlier beef was investigated through the application of a choice experiment. The relative importance of these attributes' WTP shows that consumers place higher values for food safety, followed by animal welfare and finally for environmental protection. The combination of the three attributes, due to substitution relationships, has effects in the estimated WTP. Moreover, some suggestions for the relations between these attributes can be proposed through an after-survey analytical solution. Finally, this research also improves the advisory framework for corporate or political decisions. The potential error of separately estimating closely related attributes can potentially jeopardize the success of a differentiation strategy.

12.1 Introduction

As societies become richer and more complex, consumers' choices for food products are influenced by an increasingly wider variety of food's characteristics or attributes. Food attributes can therefore shape consumers' utility and consequently, consumers' preferences and choices (Lancaster, 1966), and process attributes – attributes related to characteristics of the production process and that do not necessarily lead to a different final product (Caswell, 1998) – are no exception. Emphasising one or a combination of several of these process attributes in a food product may thus increase the probability of it being selected by consumers.

On another perspective, the way food is produced (namely food safety, the welfare of production animals and the environmental impact of food production) has often been mentioned as a concern for many consumers (Olynk & Ortega, 2013; Pouta, Heikkilä, Forsman-Hugg, Isoniemi, & Mäkelä, 2010; Ubilava, Foster, Lusk, & Nilsson, 2010), which has lead the food industry to regard consumers' concerns as a tool for achieving a competitive advantage. Pesticide-free fruits or free-range eggs are well known examples of differentiations driven by consumers' preferences.

Taking into consideration the production point of view, food safety, animal welfare and environmental protection are, to some extent, often jointly offered. For example, less intensive systems are less aggressive to the environment, and also prone to guarantee higher standards of animal welfare, which in both cases can be linked to safer food (de Passillé & Rushen,

2005; Kallas, Gómez-Limón, & Arriaza, 2007; Lusk & Norwood, 2012). Not surprisingly, these production standards are often accompanied by higher production costs, and therefore higher product prices (Nocella, Hubbard, & Scarpa, 2010). If consumers are ready to spend more money on food products with such attributes, it is possible that the premium obtained is sufficient to offset these higher production costs.

However, the food industry often faces problems assessing whether the price premiums that consumers are willing to pay will be sufficient to offset such higher production costs, once the price-quantity relation for this kind of credence attributes[61] may not be straightforward or continuous (Frank, 2006). Consequently, there are many examples of research on consumers' valuation of food products with credence attributes related with the production processes.

Focusing on more recent research involving products from animal origin, a brief literature review shows several studies on the estimation of consumers' willingness to pay (WTP) for animal welfare, food safety or environmental protection as food attributes.

Considering examples of WTP estimation for food safety-related attributes, Tonsor Schroeder, Pennings, and Mintert (2009) found statistically significant and positive values for safety enhancements in beef in four countries, which is in line with the findings of Angulo and Gil (2007). Traceability and information about hormones or antibiotics were associated with positive WTP (Dickinson, Hobbs, & Bailey, 2003; Lusk, Roosen, & Fox, 2001) as well as BSE-tested and traceability-enabled beef (Lim, Hu, Maynard, & Goddard, 2013). A meta-analysis by Cicia and Calantouni (2010) concluded that consumers are willing to pay 22% above the base price for food safety attributes. The same study also concluded that European citizens have a marginal WTP of 14% for animal welfare attributes.

A recent UK-based stated preference survey produced concordant findings for meat with increased animal welfare attributes (Kehlbacher, Bennett, & Balcombe, 2012). A meta-analysis by Lagerkvist and Hess (2011) suggests that European consumers may consider paying rather high values for the premiums associated with animal friendly products, revealing an interesting market potential. In line with these results are those from a cross-national survey in five European countries, which reports positive WTP for animal friendly products for some consumer segments, in spite of cross-cultural differences (Nocella, et al., 2010).

Finally, considering environment-related attributes, Hurley, Miller, and Kliebenstein (2006) found that 62% of participants in their study had a positive WTP for "environmentally friendly" pork meat. Travisi and Nijkamp (2008) have found that Italian consumers are willing to pay more for agricultural foodstuffs produced in environmentally benign ways, leading also to human health improvements. Similar results were found in Spain, where consumers stated positive WTP for healthier and environmentally friendlier milk, although their valuation was higher for the health attributes (Aldanondo-Ochoa & Almansa-Sáez, 2009).

This example shows an association between environment-related attributes and health and allows suggesting that these attributes often come together in consumers' preferences and expectations (Ubilava, et al., 2010). It also raises the question on what are the needs that these three attributes satisfy. For example, the demand for animal friendlier or environmentally friendlier products often comes from the belief that these products are safer, in spite of all other

61 Credence attributes are attributes that cannot be verified by consumers even after the product is purchased and consumed and whose presence must be guaranteed by others (Grunert, Bredhal, & Brunso, 2004).

altruistic motives (Lusk & Norwood, 2012; Verbeke, Pérez-Cueto, De Barcellos, & Krystallis, 2010). The estimation of consumers' WTP for different combinations of food safety, animal welfare and environmental protection as a bundle in one single food product of animal origin is therefore of interest.

Furthermore, within Lancaster's framework (1966), substitution (or complementarity) effects may lead the value of one attribute to be reduced (increased) by the available amount of other attribute. Therefore, changes in the supply (or price) of one of these attributes may change the way consumers' value the others, which can be analysed in terms of substitution relationships between attributes (Dachary-Bernard & Rambonilaza, 2012; Ubilava, et al., 2010).

However, research on joint valuation of the three above mentioned attributes is not so common. Two different choice experiments valued three attributes for pork meat: free of antibiotics, environmentally certified and animal-friendlier production. In a Finnish study, a 30% premium was elicited for environmentally certified pork chops, as well as a 30 to 45% premium for the other two attributes, depending on the social status of respondents (Ubilava, et al., 2010). Lusk Nilsson, and Foster (2007) found positive mean WTP for all three attributes. Certification for no antibiotics had the highest WTP, followed by certification for animal well being and by environmental certification.

US consumers' WTP for dairy products and pork chops with verified production processes claiming pasture access (***i.e.*** animal welfare) and control of antibiotic or hormone use (***i.e.*** food safety) was also found to be positive and significant (Olynk & Ortega, 2013; Olynk, Tonsor, & Wolf, 2010). Pozo, Tonsor, and Schroeder (2012) and Tonsor (2011) both found positive WTP for pork production with animal welfare and food-safety related attributes in pork meat.

Still, most of the research involving combinations of these attributes does not take into consideration the predictable interactions between them and the consequent substitution effects that arise within consumers' theory framework, disregarding the consequences for the WTP estimates.

As there are reported reasons to believe that consumers themselves do not separately value each one of these attributes (Ubilava, et al., 2010), the omission of other utility-relevant food attributes may generate bias in WTP values due to the improper specification of the valuation context (Korzen, Sandøe, & Lassen, 2011). Indeed, this is not different from what could be expected based on demand theory alone.

Because demand relationships across attributes are significant, there are thus practical reasons that support the need to jointly determine consumer's WTP for safer, animal and environmentally friendlier beef. Within environmental and landscape valuation, the independent valuation of different attributes, followed by their adding-up has been shown to be prone to considerable measurement bias, because different attributes typically behave as substitutes in valuation (Santos, 1998). Independent valuation and summation (IVS) is therefore considered an invalid procedure because of this bias (Hoehn, 1991; Randall, 2002).

Most of the literature on consumer's preferences for these food credence attributes has valued WTP for some attributes either independently of the other (related) attributes or not taking interactions into consideration. To the authors' knowledge, little scientific evidence exists

regarding substitution effects and context-dependency that may exist between animal welfare, food-safety and environmental protection as food attributes in one single product.

A choice experiment was elected as the appropriate method as one of its greatest advantages is the identification of trade-offs between attributes and the possibility of determining WTP for different combinations of non-price attributes (Mørkbak, Christensen, & Gyrd-Hansen, 2012). We hypothesised that WTP for each one of these attributes is conditional on the presence of the others (substitution effects). We suggest that the three attributes should be valued together and that the interactions between attributes will help estimate more reliable WTP values for different combinations of these attributes.

Consequently, and considering that the main findings of this research are related with a more accurate estimation of consumers' WTP for safer, "cleaner" and animal-friendlier beef – by avoiding IVS bias – the main objectives of this paper are: (i) to establish which substitution effects exist between food safety, animal welfare and the environment as beef credence attributes, and to estimate the influence those substitution effects have on WTP; (ii) to suggest possible interpretations of consumers' reasoning that leads to substitution effects, and (iii) to estimate the possible dimension of potential bias when WTP estimates are used in marketing or policy advising.

12.2 Methods

12.2.1 Choice modelling

Choice experiments (CE) is a particular method within stated preference methods with roots in Lancaster's theory of consumer choice, according to which consumers derive utility from a good's attributes and not from the good itself (Lancaster, 1966). Different goods are represented as different bundles of attributes. A consumer (subject to a budget constraint) will therefore choose across goods by selecting the bundle of attributes that maximizes his/her utility.

This method is intended to represent a real shopping situation, as consumers select a product with some given characteristics (attributes) within a finite and discrete set of options. These attributes usually assume several different levels, and one of the attributes is usually price. It is therefore possible to evaluate tradeoffs among product attributes and to identify their marginal values (Hanley, Wright, & Adamowicz, 1998).

The economic foundation of this method is the random utility theory whereby a choice is made by a decision maker in order to maximize a utility function that has a random component. It is therefore assumed that this random utility function is constructed as a combination of known explanatory variables, the systematic component of utility, and a random component which is unknown but assumed to have a zero expected value (Hanley, et al., 1998; Hensher, Rose, & Greene, 2007).

$$U_{in} = V_{in} + \varepsilon_{in} \quad (4)$$

V_{in} represents the systematic part of utility given by the decision maker n to alternative i and is generally considered as a linear-in-parameters expression that can be written as the sum of the utilities derived from each of the K attributes $(k = 1,2 \ldots, K)\ X_{ki}$.

$$V_{in} = \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_K X_{Ki} \quad (5)$$

The βK parameter represents the unique weight that accounts for that attribute's marginal utility across decision-makers (Hensher, et al., 2007; Mørkbak, Christensen, & Gyrd-Hansen, 2011).

$\mathcal{E}_{in}$ represents the error between the systematic part of utility and the true utility given by the decision maker n to alternative i, and it can be viewed as the part of the utility which is unknown to the analyst (Hensher, et al., 2007).

Alternative i will be chosen over some other alternative j within a choice set iff $U_i > U_j$, and the probability that individual n will choose option i over any other option j in the choice set is given by

$$\text{Prob}(i|C) = \text{Prob}\{V_{in} + \varepsilon_{in} > V_{jn} + \varepsilon_{jn}, \text{all } j \in C\} \quad (6)$$

where C is the complete choice set. The error terms are typically assumed to be independent across alternatives and identically distributed with an extreme-value (Gumbel) distribution (Bateman, et al., 2002).

The consequent multinomial logit model (MNL) is given by equation 7.

$$P_{in} = \frac{\exp\,(V_{in})}{\sum_{j=1}^{J} exp - (V_{jn})} \quad (7)$$

Assuming that choices are consistent with the Independence of Irrelevant Alternatives (IIA) assumption (Bateman, et al., 2002; Louviere, Hensher, & Swait, 2000), the MNL can be estimated by maximum likelihood as shown in equation 8 (Bateman, et al., 2002), where y_{ij} is an indicator variable that takes the value of one if respondent n chooses option i, and zero if not.

$$\log L = \sum_{i=1}^{N} \sum_{j=1}^{J} y_{ij} \log[\exp\,(V_{ij}) / \sum_{j=1}^{J} \exp\,(V_{ij})] \quad (8)$$

In the MNL, the coefficients represent the marginal utility of the attributes, and it is possible to quantify the marginal rate of substitution between non-price attributes and the price attribute. Therefore, the marginal WTP for any attribute ***X*** can be determined by the negative of the ratio between the marginal utility of the attribute and the marginal utility of money (***i.e.***, the price attribute) (Burton, Rigby, Young, & James, 2001):

$$WTP = -\frac{\beta_X}{\beta_{price}} \quad (9)$$

12.2.2 Survey design

A CE design should include a precise definition of the attributes, including their levels and ranges (Hanley, et al., 1998). For our choice experiment the attribute levels available for respondents in the questionnaire were therefore defined based on a multi-tier approach which included literature review, the available production possibilities and insights from focus groups discussions.

These discussions have shown that beef safety, the environmental impact of livestock production and the welfare of production animals are not well known topics amongst consumers. As a consequence, the attribute levels were formulated as simply as possible, with only two levels: the current legally imposed minimums (Legal Standards) and an improved level (Certified Additional Levels). Moreover, a symbol was adopted for each attribute in order to facilitate respondents' recognition of the attributes' levels (Froehlich, Carlberg, & Ward, 2009).

Table 39 presents (as it was shown to respondents) the description of the attributes' levels, as well as the symbols used to indicate the presence of a given attribute at the improved level in the choice experiments. As attributes and their levels could represent a significant cognitive burden on respondents, an additional small leaflet was presented, containing clear sentences and visual aids relative to the status quo and the improved levels for all three attributes (Appendix 4).

Table 39: Beef credence attributes

	Legal Standards		Certified Additional Levels	
Beef Safety	Quantity of antibiotic residues present in beef is defined by current legislation	FULFILLS LEGAL STANDARDS GUARANTEED	Reduction of the allowed quantity of antibiotic residues in beef	BEEF SAFETY CERTIFICATION
	In farm control of antibiotic usage is defined by current legislation		Stronger in farm control of antibiotic usage	
	Presence of antibiotic residues in beef is controlled as defined by current legislation		Tighter control of the presence of antibiotic residues in beef	
Animal Welfare	Allowed animal density is defined by legislation	FULFILLS LEGAL STANDARDS GUARANTEED	Decreased of the allowed animal density	CERTIFICATION ANIMAL WELFARE
	Animal caretakers' formation is mandatory		Increased animal caretakers' formation	
			Mandatory pasture access	
Environmental Protection	Air, water and soil pollution control	FULFILLS LEGAL STANDARDS GUARANTEED	Air, water and soil pollution reduction	CERTIFICATION ENVIRONMENTAL PROTECTION
			Local breeds' preservation	
			Land abandonment and fire prevention	

Price was offered at 9.98€/kg for the status quo beef plus five different premium levels (12.98€/kg; 15.98€/kg; 18.98€/kg; 21.98€/kg; 24.98€/kg) based on current market prices and values determined through focus groups choice exercises (Viegas, Santos and Aguiar Fontes, submitted). In fact, through these choice exercises it was also possible to generate priors to be used in the experimental design.

A pilot study showed that five choice tasks, each including three alternatives, were easily performed by respondents, who did not show signs of survey fatigue.

A D-efficient experimental design was employed to select choice scenarios. Each choice situation included two hypothetical differentiated beef products (varying in the three credence attributes and a varying premium price) and an undifferentiated beef product (with the three credence attributes at the minimum legal levels and the status quo price) (Appendix 5). Before the first choice set was presented, respondents' instructions included a "cheap talk" with the objective of reducing hypothetical bias (Lusk, 2003).

The final choice design resulted in twenty choice sets, which were blocked into four

groups of five. Each participant was randomly presented with one of the four different types of questionnaires.

In addition to the choice experiments, respondents were asked a group of questions regarding beef shopping and consumption habits and preferences, a group of questions about their attitudes and concerns regarding beef production, environmental and societal issues, and a group of questions related with socio-demographic characteristics[62]. The survey was administered by a market research company through face-to-face home interviews with an adult responsible for the household food shopping.

12.3 Results

A total of 613 questionnaires were completed by respondents in the two Portuguese largest cities, *Lisboa* and *Porto*. Table 40 presents the summary statistics for demographic variables. The sample was not representative of the Portuguese population, namely in terms of income classes (sample bias towards higher purchasing power) since these are normally the consumer groups who typically purchase differentiated beef (Banovic, Grunert, Barreira, & Aguiar Fontes, 2010).

Table 40: Summary statistics for demographic variables

Sample characteristics		**Percentage**
Gender	Male	46.0
	Female	54.0
Age	18 to 37	30.5
	38 to 57	34.6
	58 to 77	25.3
	>78	9.6
Literacy level	Elementary	33.6
	Secondary	15.8
	Bachelor or higher	50.6
Household size	<=2	49.6
	3 or 4	41.4
	>=5	9.0
Disposable monthly income (€)	<950€	5.5
	[951€-1900€]	28.1
	[1901€-2850€]	15.8
	[2851€-3800€]	34.6
	>3801€	16.0

Table 41 displays the estimated parameters in the main effects MNL model estimated with NLOGIT 4.0. Table 42 displays the MNL including two attribute interactions (between animal welfare and food safety, and between environment and food safety). The remaining interaction (between animal welfare and the environment) was not included since it was not

62 Some of the work related with the non-valuation and the socio-demographic questions of the questionnaire can be found in (Viegas, Santos, & Aguiar Fontes, 2013).

statistically significant.

The mean WTP and the confidence intervals for all attributes were calculated using Wald procedure to apply the Delta Method (Hole, 2007).

In both models all the variables are highly significant, including the interaction variables (which are negative, indicating significant pair-wise substitution effects for these attribute combinations). Price has always a negative coefficient, as expected. All the variables representing the attributes' marginal utility when separately valued have positive coefficients.

Table 41: Main effect multinomial logit estimation

Variable	Coefficient	SE	*Mean* WTP (€/kg)	95%CI (Wald procedure)
AW	0.3371	0.0578	7.62	[5.06;10.18]
ENV	0.1978	0.0509	4.47	[2.21;6.72]
FS	0.3248	0.0530	7.34	[5.00;9.69]
Price	-0.0442	0.0699		
Log-likelihood	-3337.942			
Number of observations	3065			

AW – Animal welfare; ENV – Environmental protection; FS – Food safety
All variables are significant at p<0.001

Table 42: Multinomial logit estimation with attribute interaction

Variable	Coefficient	SE	*Mean* WTP (€/kg)	95%CI (Wald procedure)
AW	0.5088	0.0759	9.56	[6.80;12.33]
ENV	0.2736	0.0723	5.14	[3.02;7.26]
FS	0.7332	0.1031	13.78	[10.17;17.40]
Price	-0.0531	0.0074		
Interaction AW-FS	-0.4402	0.1125		
Interaction ENV-FS	-0.3462	0.1037		
Log-likelihood	-3326.437			
Number of observations	3065			

AW – Animal welfare; ENV – Environmental protection; FS – Food safety
All variables are significant at p<0.001

In Table 42 the marginal mean WTP are calculated for cases in which the attributes are zero. However, due to the existence of interaction between the attributes, the marginal WTP of each attribute in fact depends on the values of other attributes. Therefore, it is relevant to present the WTP for different sequences of attributes' inclusion.

Table 43 suggests six possible inclusion sequences for the three attributes, assembled after the model estimation. The notation WTP(AW|(0,0,0)) should be read as " WTP for animal welfare conditional to the presence of...", regarding the code 0=absence and 1=presence, in the following order: (AW, ENV, FS). The mean WTP is followed by the 95% confidence interval.

Table 43: Inclusion sequences

Sequence 1 – AW-FS-ENV		
WTP(AW|(0,0,0))	WTP(FS|(1,0,0))	WTP(ENV|(1,0,1))
9.56 [6.80;12.33]	**5.51** [-2.74;13.76]	**-1.37** [-7.06;4.33]
Sequence 2 – AW-ENV-FS		
WTP(AW|(0,0,0))	WTP(ENV|(1,0,0))	WTP(FS|(1,1,0))
9.56 [6.80;12.33]	**5.14** [3.02;7.26]	**-1.00** [-12.82;10.82]
Sequence 3 – ENV-FS-AW		
WTP(ENV|(0,0,0))	WTP(FS|(0,1,0))	WTP(AW|(0,1,1))
5.14 [3.02;7.26]	**7.27** [-0.09;14.46]	**1.29** [-6.11;8.69]
Sequence 4 – ENV-AW-FS		
WTP(ENV|(0,0,0))	WTP(AW|(0,1,0))	WTP(FS|(1,0,1))
5.14 [3.02;7.26]	**9.56** [6.80;12.33]	**-1.00** [-12.82;10.82]
Sequence 5 – FS-AW-ENV		
WTP(FS|(0,0,0))	WTP(AW|(0,0,1))	WTP(ENV|(1,0,1))
13.78 [10.17;17.40]	**1.29** [-6.11;8.69]	**-1.37** [-7.06;4.33]
Sequence 6 – FS-ENV-AW		
WTP(FS|(0,0,0))	WTP(ENV|(0,0,1))	WTP(AW|(0,1,1))
13.78 [10.17;17.40]	**-1.37** [-7.06;4.33]	**1.29** [-6.11;8.69]

Logically, the final added WTP (13.71€/kg [-2.99;30.41]) is the same for all the inclusion sequences. However, they all reach zero WTP values for the second or third attribute to be added, except for sequence 3 – EVN-FS-AW.

The most negative WTP values are reached by aggregating ENV to sequences where food safety has been added already, which is due to the strength of the substitution effect between these two attributes being larger than the isolated environment attribute. The maximum WTP is obtained be aggregating FS and AW (15.07€/kg [4.06;26.08]).

The inclusion sequences can be seen from a different perspective, more elucidative of the effects on the presence or absence of FS in the WTP for the other two attributes. Table 44 shows such WTP for AW and Table 45 for ENV.

Table 44: WTP for animal welfare

Given FS = 0	**9.56** [6.80;12.33]
Given FS = 1	**1.29** [-6.11;8.69]

Table 45: WTP for the environment

Given FS = 0	**5.14** [3.02;7.26]
Given FS = 1	**-1.37** [-7.06;4.33]

These results confirm that in presence of FS the WTP for both AW and the ENV isn't statistically different from 0.

Finally, it is also interesting to present the results for WTP for FS in the presence or absence of the other two attributes, as shown in Table 46. As it can be seen WTP for FS is negative in the presence of the other two attributes.

Table 46: WTP for food safety

Given AW = 0; ENV = 0	**13.78** [10.17;17.40]
Given AW = 1; ENV = 0	**5.51** [-2.74;13.76]
Given AW = 0; ENV = 1	**7.27** [-0.09;14.46]
Given AW = 1; ENV = 1	**-1.00** [-12.82;10.82]

12.4 Discussion

The most straightforward interpretation of these results is the contribution for the current knowledge about consumers' WTP for credence attributes in food products. This issue has increasingly received attention, as food policy and consumer welfare become ever more complex and global.

In such a context, the relative importance of the ranking of these attributes' WTP values seems to be clear, with the consumers' strata surveyed placing higher WTP for food safety, followed by animal welfare and finally for environmental protection. Lusk et al. (2007) found a similar order for these attributes' marginal values, translated into higher mean WTP for the food safety attribute, followed by the animal welfare attribute and finally by the environmental protection attribute.

The fact that AW has a stronger effect compared with ENV on consumers' stated preferences may be due to consumers' lack of awareness about the true environmental impact of livestock production (Viegas, Santos, & Aguiar Fontes, 2011), which is supported by the fact that consumers' rarely change their meat consumption habits due to environmental concerns (Vanhonacker, Van Loo, Gellynck, & Verbeke, 2013).

12.4.1 Substitution effects

Our findings also suggest that the combination of the three attributes, due to substitution relationships, has effects in estimated WTP. Such substitution effects were expected and predicable – in light of Consumer Theory (Lancaster, 1966) – and the questions that needed answers were related with the magnitude of such effects and with the motivations underlying consumer's choices. In other words, what is necessary is a proper analysis of the existing substitution relationships between these related attributes.

Even though it is recognized that consumer's choices are influenced by the presence of (related) attributes within choice experiments (Gao & Schroeder, 2009), we haven't been able

to find an analysis of these substitution effects. As most research is focused on econometric models, the fundaments of consumer theory often haven't been applied to the analysis of choice experiments' results, possibly leading to a less than optimum applicability of the obtained results.

The MNL results clearly show the possibly deceiving effects of not taking interactions into consideration when estimating and interpreting consumers' WTP. If only a main effects model was considered, the coefficients (and thus the estimated WTP) for all the three isolated attributes would be smaller than the ones presented in table 3. Main effects models (that don't include specific variables for the determination of interactions) result in estimates that in fact include the isolated effects and also the interactions between the attributes. If there are substitution effects between them (as those in our model), these combined effect results in smaller coefficients. Therefore, the coefficients and the WTP for the isolated attributes are larger than in the case when the interactions between them are included in the model. Moreover, if any two attributes are combined the aggregated WTP is smaller than their simple adding up, confirming that there are substitution effects between them. This finding supports that these attributes should be valued together in order to avoid any IVS bias.

The substitution relationship between AW and ENV could not be determined due to lack of statistical significance of the interaction between the two attributes. This may be due to a non-attendance phenomenon of one of the attributes, when both are present. We can suggest that AW and ENV are very closely related in consumers' perceptions, fulfilling almost completely the same needs, which would lead some consumers' to disregard one of the two attributes, when in presence of both.

12.5 Concluding remarks

Apart from the suggested resemblance between AW and ENV, our findings encourage some inferences and additional explanations for the negative interactions. A more elaborate interpretation of this research's output is thus in an argument concerning context dependency and its' effect on consumers' preferences and choices. Moreover, some practical applications of these results should also be put forward.

12.5.1 Context dependency and other possible explanations for negative interactions

Context dependency can be considered an universal and inevitable phenomenon. Looking only to consumption behaviour, a consumer will always be influenced by the decision context, may it be informational context, shopping context, the presence of substitute or complementary goods, the socio-demographic context, etc. This sort of influence in decisions and also in the answers given in surveys is known, acceptable, and to some extent inevitable and incontrollable.

But in another point of view, context dependency can also be regarded as a path

dependency problem on the determination of the optimum bundle of attributes. Theoretically, it should be possible to describe and have consumers state their preferences for continuous attributes. If that were the case, the determination of the optimum production basket for animal welfare, food safety and environmental protection in beef would be a point in a tri-dimensional space were the marginal benefits (given by consumers' marginal WTP) meet marginal production costs.

However, for this particular research this became a methodological problem. The three attributes included in this valuation are generally present as very marginal concerns in consumers' minds, as it was clearly shown by focus groups results (Viegas, et al., 2011). Moreover, the gains (or improvements) in the levels of the attributes are not only multidimensional, but mostly discontinuous in terms of scientific and technological aspects (for an encouraging advance on animal welfare as a continuous attribute see Kelbacher et al. (2012)). It would therefore be very complicated to define a continuous path for each attribute improvement and its results would be very vulnerable to errors, both of description of real circumstances and of their perception by the interviewees.

Besides this inevitable context dependency, other possible theoretical explanations for negative interactions should be introduced. On the one hand, consumers most certainly make inferences on the available cues (Steenkamp, 1990), not only based on the information intentionally supplied by the choice-experiments, but also unconsciously (which is uncontrollable by the researcher).

On the other hand, it is not possible to control the a-priori information that respondents hold. Those better informed about animal production may in fact have some knowledge about the attributes' joint production, and thus regard an environmentally friendlier system as an animal friendlier one, for example.

Either way, it is not possible to control such inferences on a choice-experiment context, and it would only be possible to properly investigate and clarify them in a post-questionnaire focus group context (Powe, Garrod, & McMahon, 2005). Therefore, the following suggestions for the relations between AW, ENV and FS can be proposed – keeping in mind the inclusion sequences shown in table 4 – but they are merely speculative and based on the authors' experience derived from focus groups and pilot surveys.

Animal welfare and environment are probably acting as cues for food safety, in what can be suggested as a pure inference situation. The marginal WTP for FS when interactions with AW and ENV are present decreases to values close to zero, which can be more easily visualized by comparing sequences 2 and 4 to sequences 5 and 6 where food safety is included as the first attribute. It may be that consumers' can get all the food safety they want derived from animal welfare and environment.

The aforementioned consumers' lack of awareness about the environmental impact of livestock production finds support in the close to zero WTP values reached by ENV to sequences 1, 5 and 6. It can be proposed that for these cases consumers' already got what they value most, food safety. As ENV may only act as a cue for food safety, once the later is already present, consumers depreciate environment related attributes. AW, on the other hand, seems to have some value of its own, as the positive WTP values, even after the introduction

of FS, seem to imply.

The only sequence which never reaches negative WTP values is sequence 3 – ENV-FS-AW. Regarding the proposed relationships between these three attributes, it seems that in this case ENV could act as a cue for food safety, having thus some value for consumers. FS could still have some additional value for consumers, as ENV did not exhaust consumers' demand for food safety. Finally, consumers would still have some WTP for AW. This positive valuation, even with the satisfaction of the demand for FS and ENV, may arise from true altruistic values.

It can be argued that the aggregated WTP values for the different bundles of the three attributes are overstated. This can be associated with the undisputable public good nature of these attributes, which may lead consumers to state a higher WTP, in order to achieve some degree of moral satisfaction. Hypothetical bias and other discrepancies between consumers stated WTP and their actual purchase behaviour are well known, and can be related to the inconsequential character of stated preference methods (Harvey & Hubbard, 2013).

Finally, making amend for these speculative suggestions, it should be noted that they have no influence on the practical applications of the MNL's findings.

12.5.2 Practical applications of joint valuation

The discussion surrounding the proposed inclusion sequences must not be seen as if dealing with sequential choice experiments. It was an after-survey analytical solution proposed in order to allow exposing this article's most relevant findings, in a perspective of advising decision-makers. Whatever the reasoning chosen to explain the MNL's results, there are no changes in the estimates, which thus always lead to the same advisory framework.

It is undisputable that there is an improvement in the estimation of the attributes' WTP when the interactions are included in the model, with advantages that go beyond the simple theoretical interpretation of the MNL's results. The aggregated WTP value for the main effects model is 19.43€/kg, whilst for the interaction model the equivalent is 13.71€/kg, i.e a 30% smaller WTP. Facing such results, a much larger bias would be predictable if the valuations were independent and the WTPs were simply added up in the end.

Taking the perspective suggested here, it is clear that the advice given – within a corporate or political decision making framework – would be more accurate. Moreover, taking products that already include one of the attributes, the decision of differentiation based in one of the other two would be better informed and less risky. Reporting back to the discussion around the discontinuous character of the attributes' improvements, it becomes clear that when deciding to differentiate a beef product, the choice of which attribute to include is not irrelevant.

Once it is only possible to decide to add (or not to add) an attribute (and impossible to decide to add just a portion of an attribute), the inclusion sequence should be carefully decided. Particularly if it is taken into account that there are situations when the inclusion of an attribute leads to an additional benefit whose positive value may not be relevant, the additional benefits of adding an attribute may not be sufficient to overcome the additional production costs.

It is in such cases that this methodology reveals its keynote relevance. Facing production decisions on whether to include or not an additional differentiating (discontinuous) attribute, it would be an advantage to have information on whether there are additional benefits taking into account the already present attributes. In fact, the error that may arise from the separate estimation of closely related attributes would potentially jeopardize the success of a differentiation strategy.

Taking an example from the inclusion sequences shown in Table 43 it is possible to illustrate a situation for which a differentiation strategy could possibly be too risky. For a beef product that already is differentiated regarding food safety attributes (sequences 5 and 6), embracing a differentiation strategy based on environment related attributes would probably not be a good strategy, as the addition of ENV represents a benefit that isn't statistically different from zero. However, if the decision was based in the main effects model, the minimum expected additional benefit would be of 3€/kg (the lower bound of the confidence interval). The rational decision would thus support a differentiation strategy based on this attribute, which could result in a failure.

It should nevertheless be clear that in the case of an undifferentiated beef product, for which none of these attributes is included, the decision maker would face an indetermination. In such situations there is no ideal advice for an inclusion sequence due to the discontinuous character of the attributes.

This has both business and policy implications. From the business point of view, our results suggest that it may not be worth it developing beef products with attributes like environmental protection if consumers' demand for food safety is already fulfilled, for example. The beef attributes should therefore be carefully chosen and keeping in mind the beef products (and their credence attributes) already available.

From a policy perspective, it is also relevant to understand that Portuguese consumers' true preferences may be more related with safety, and not so much with animal welfare or even less with the environmental impact of beef production.

We also suggest that this joint valuation of attributes that are not only jointly produced but also hard to separate by consumers may have lead to WTP values that are not so prone to such a hypothetical bias. The stated WTP values for differentiated beef with these three attributes is well within market values for premium beef products in Portugal, which seems to support this conclusion. It would be interesting to confirm this by computing the previous estimates found in the literature and summing them. This would also help determining the magnitude of the IVS bias in this case.

The positive and significant WTP values for all the attributes and for several combinations of them should nevertheless be considered with some caution. Income restrictions always play a role in consumer's choices and markets for differentiated food products are often niche markets. As the econometric framework used in this paper assumes homogenous preferences, the WTP estimates can only be related to the average consumer in the sample.

As such, future research is needed in order to allow for heterogeneous preferences and to identify segmentation variables and the correspondent consumers segments, as it is likely that there are niche markets for different combinations of these attributes. This segmentation

(based also on the socio-demographic profiles that were collected with the questionnaires) can help capitalize on consumers' heterogeneous preferences, by showing new market opportunities for beef differentiation.

This research has managed to define and value the three attributes as a bundle, and to translate them into consumers' willingness to pay. It has also been possible to suggest some inclusion sequences, given the discontinuous levels of the attributes. A very rich field of future research can therefore focus in the specification of the gaps between the status quo and improved levels of animal welfare, food safety and environmental protection in beef, with the aim of defining continuous attributes.

PART IV

Part IV is devoted to the conclusions and it also includes an analysis of the innovative aspects and practical implications of this research. Some future research perspectives are also included.

Chapter 13
General discussion and conclusion

Education is a progressive discovery of our own ignorance
(Will Durant, 1885-1981)

Relevant and imposing conclusions related with all the work developed along this research have been presented in this thesis. It is useful, however, that those conclusions be subject to a joint reflection: only a comprehensive and global analysis of the parcels of this research will allow checking how far the previously established goals have been achieved.

Moreover, some focus onto new perspectives obtained in this research path is recommended. Therefore, the next two chapters will elaborate on theoretical and methodological repercussions, innovation and applications, and on subsequent work to come.

13.1 Main theoretical and methodological results

Recalling the central question to this entire research – *Are consumers willing to pay for beef products with specific attributes such as food safety, animal welfare or environmental standards, going beyond legally imposed minimums?* – it is possible to provide more than a simple yes or no answer.

As shown in chapter 12, our sample of Portuguese consumers stated they are willing to pay a premium for beef products differentiated with the specific credence attributes under research. However, this is a somewhat simplistic analysis of the results, and a more elaborate perspective should be put forward. A richer and possibly more interesting way of presenting such perspective is to go through the different specific objectives presented in chapter 4, highlighting the more relevant findings.

The main goals for part II were focused on unveiling the relevant technical challenges that could serve a twofold purpose for each one of the three attributes under research – to be an unsolved issue but not technically unsolvable one[63] and to be deemed relevant by consumers. Such goals were achieved mainly through extensive literature review, after which very rich collaboration was undertaken with different stakeholders for the three areas. This works' effective results are exposed in chapters 6, 7 and 8 and they led to the elaboration of scenarios presented in the choice experiment (CE). What is more relevant in this thesis' conclusion from a methodological point of view is the fact that the high significance achieved for the MNL estimates is certainly not independent of the effort undertaken in order to guarantee the elaboration of appropriate scenarios from the technical point of view.

These estimates' significance cannot be considered independent of the focus groups' results. In fact, it was the conjugation of the discussions' contents with the technical challenges disclosed for the three attributes that allowed a very accurate design of the scenarios to be

63 For example, the quest for absolute beef safety would be an unsolved technical issue, and also an unsolvable one, as from the technical point of view such result is not achievable (Buchanan & Deroever, 1993).

presented in the CE.

Another goal achieved with the support of the focus groups was the elicitation of the proper price range to be applied in the CE's price attribute. Again, the MNL results support this conclusion. If the price range estimated and used in the CE was not the appropriate one, the estimates would most likely lose significance and the model would not behave properly. Moreover, this work in fact represented a scientific innovation that will be discussed below.

The remaining main conclusion that needs to be put forward is related to the successful implementation of the CE's survey itself. Some limitations will be presented further ahead, but results are nevertheless encouraging.

Most of the relevant estimates are significant, and for those that are not it is possible to present explanations (as shown in chapter 12) that are not related with misconceptions of the questionnaire. Furthermore, the questionnaire included an appropriate experimental design that guaranteed that the presented choice sets were adequate[64].

Moving onto some more specific results of the different parts of the thesis, some aggregate conclusions can be presented.

It was concluded in chapter 6 that a possible meeting point between consumers concerns related with beef safety and the scientific evidence of work still to be done relates with the presence of antibiotics' residues in meat. Much of the use of antibiotics is related with intensive animal production, whereas extensive animal production does not need to resort so much to such drugs.

Extensive beef cattle production is also at the junction between consumers' preferences and their concerns regarding animal welfare, and the kind of production that does fulfil the five freedoms considered mandatory in order to assure proper animal rearing conditions, as exposed in chapter 7.

The same sort of extensive production is also suggested to be the solution for guaranteeing an acceptable level of environmental sustainability (as shown is chapter 8) while still ensuring the economic viability and the protection of cultural and heritage values.

So these three chapters point towards a beef production method that is widely accepted by consumers in terms of its food safety guarantees and its animal and environmental conditions. What becomes more interesting is the interpretation of these results combined with the data and conclusions presented in chapter 5.

As mentioned in that part of the thesis, production of Protected Designation of Origin (PDO)[65] beef in Portugal is based mostly in extensive production systems considered in many cases to be environmentally sustainable and associated with strong cultural roots to the production regions. In the context of this research, this production system becomes relevant for several reasons.

First, the scenarios presented are to some extent familiar to respondents due to the knowledge of the beef production systems which most likely helped them answer truthfully and meaningfully, with positive impacts on the estimates. Second, the PDO beef products were also discussed with the focus groups and were associated with some of consumers' preferred

64 In the case of this research, this task had the support of Professor Lívia Madureira (UTAD). All the data concerning the experimental design can be found in Annex 1.

65 All the information relative to PDO products can be found in chapter 5.

attributes, namely safety, quality and national origin, as presented in detail in chapters 9 and 10. Finally, the PDO market share is consistent with the results presented in chapter 11 for the percentage of differentiated beef buyers[66].

Therefore, all the chapters included in Part II show that the path followed in order to undertake the focus groups discussions and implement the CE's survey was adequately chosen and lead to consistent results, as presented in Part III of this thesis. Still, as for Part I, some conclusions can be put forward if the chapters and their results are looked at in a combined perspective.

One of the first possible conclusions that a combined reading of the results allows is associated with the "consumer versus citizen" duality. The focus groups discussions showed some unintentional approaches to the citizens' preferences (which were there to talk about their preferences as consumers), namely when it was time for participants to describe their willingness to buy safer beef products. As shown in chapters 9 and 10, some participants had very strong negative feelings to the idea of the simple availability of safer and more expensive products. This reaction comes to show the undisputable public nature of food safety, at least to some extent, and shows that consumers are not able to completely separate their roles, as expected.

The same combined interpretation of Part III also allows for an interesting conclusion regarding the need to jointly value the three attributes. Chapter 12 includes a long discussion on the joint valuation of the attributes, namely due to the expected presence of very significant interaction between those attributes. However, what must be noted is that the joint valuation of attributes was already somewhat present – and most importantly in a spontaneous way – during focus groups discussions. Chapters 9 and 10 include the data showing that consumers soon showed preferences for bundles of these three attributes, namely because in their perceptions those attributes are associated in the production process. The spontaneous reactions even included the idea of value for money associated with these "attributes' packages", which is reflected in the existence of negative interactions between the attributes, as those estimated in chapter 12. For consumers adding up the attributes cannot imply a linear price increase due to the existence of substitution relationships between the attributes.

Finally, and possibly the most relevant consequence of this research work is that the findings obtained, namely the conclusions regarding the different roles consumers may assume and the need to jointly value closely related attributes, can find some practical application beyond the academic perspective.

13.2 Practical applications

Possibly, the most promising practical application of the research undertaken arises from the joint valuation of the three credence attributes. As argued in chapter 12, for companies making production decisions, or in a political setting, this process of joint valuation seems to result in more accurate estimates of willingness to pay (WTP) values. Such increased accuracy

66 These results all come together also to confirm Project's Agro 422 (2004-2007) conclusions, namely in terms of the PDO beef market share and the associations that consumers make between PDO beef and quality and safety attributes.

arises mostly from the acknowledgement and quantification of substitution effects in the valuation of food process attributes.

Considering that the markets for beef products are increasingly competitive, such information would support a decision on whether to include a differentiating attribute, particularly because, as exposed in the conclusions of chapter 12, the choice of which attribute to include is not irrelevant[67].

Considering beef products specifically, some suggestions to the sector can be put forward, based on this research's results. On the one hand, differentiated beef products will most likely never represent more than niche markets. This market's dimension is probably even narrower if the context of economic crisis during which the questionnaires were made is considered. On the other hand, differentiating strategies may produce positive results given that the right attributes are included in the beef product of interest. The positive WTP results shown in chapter 12 seem to support this idea, even if the potential bias is considered. As the results presented are for an average WTP, it is likely that there are segments of Portuguese beef consumers willing to pay for this type of credence attributes[68].

Putting together the results of the choice-experiment (chapter 12), and of the focus groups (chapter 10) and the Portuguese beef sector analysis (chapter 5) also allows for additional practical implications. A negative balance of trade and a low self-sufficiency rate[69] may be suggestive of some growth capacity for national beef production[70]. This research has shown that Portuguese beef consumers have preferences for national beef, which in many cases they even consider to be safer and of higher quality (chapter 10).

Furthermore, some traditional beef production systems meet many consumers' preferences regarding the welfare of production animals (chapter 7) and may also be considered environmentally sustainable (chapter 8).

Therefore, in a corporate perspective, this research shows some potentially differentiating strategies that could be implemented based on attributes such as national origin and traditional production systems. Figure 8 presents a very simple differentiation cycle that can suggest how the proper strategy might help provide private incentives for beef differentiation.

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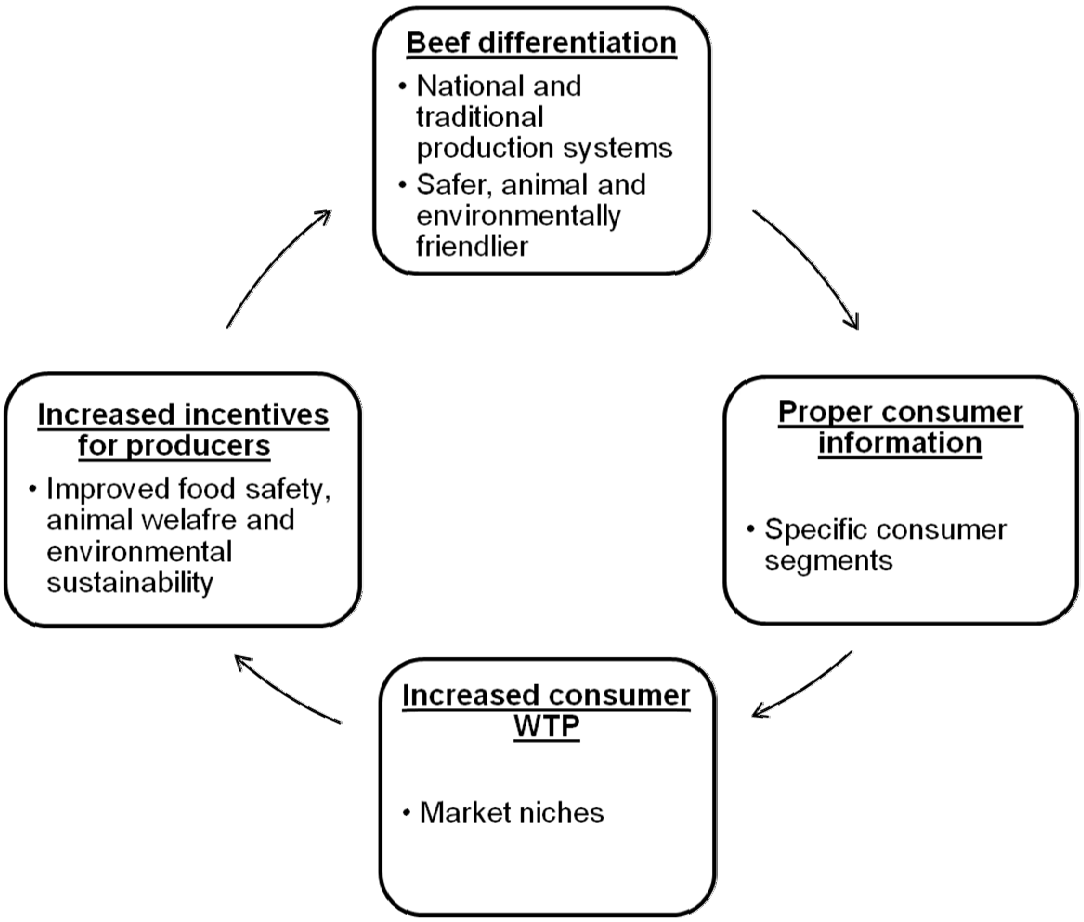
67 Beyond the specific advisory applications of this work regarding beef other potential applications for food companies can be foreseen if the separate estimation of closely related attributes of any product is considered. This could be the case of a mercury free salmon from sustainable capture, for example. It can be suggested that for many consumers these two attributes would be partly substitutes. For additional information on fish credence attributes consider Grolleau and Caswell (2007).

68 Some detail on the research ahead trying to identify these consumer segments and their specific preferences is present on chapter 14.

69 Updated values report a 53.3 self- sufficiency ratio for 2011 (INE, 2012).

70 A clear reference should be made to the fact that the Portuguese beef production is very much dependent on animal feed imports. Therefore, a significant growth on beef production would most likely imply an increased deficit on the balance of trade and potentially unbearable production costs. The suggested production increase is based on traditional production systems, which are not as dependent on food produce as they are based on grazing for many production stages. Still, these production systems could never guarantee the production of the quantities required to increase significantly the self sufficiency ratio.

Figure 8: Beef differentiation cycle based on traditional beef production systems (adapted from Napolitano, Girolami, & Braghieri (2010))



From a policy perspective, the practical implications of this research are not less relevant. Although the "consumer versus citizen" duality hasn't been completely explored (as explained in detail in chapters 2 and 3), the results achieved during this research do bring some information on concerns related with food safety, animal welfare and the environment.

Assuming the potential bias in the published results[71], it can be argued that some of these concerns – translated into a positive stated WTP – are at least partly related with citizens' preoccupations. Although this positive WTP supports the reasoning that there are consumers willing to pay for beef products with affiliated public goods characteristics, it is also reasonable to think that it will always be necessary some degree of regulatory intervention, namely due to the existence of imperfect information (Frank, 2006).

As the survey respondents only faced a market scenario, it is possible that their answers incorporate some degree of desire for public intervention. This hypothesis gains relevance if the percentage of respondents who claim that the worrisome aspects within the beef production chain are due to lack of legal control is considered (chapter 11).

Looking at each one of the specific attributes, some focus groups' results need to be included in this reasoning. The resented reactions to premium food products safer than others as pointed out in chapter 10, also shows that at least for some consumers, food safety should

71 A more detailed analysis of the potential bias involved in choice experiments was presented in section 13.3.

only have the characteristics of a public good.

Combining the same sources of information to look into animal welfare as a beef attribute allows the idea that the stated WTP may include some degree of altruistic demand. Still, focus groups' results clearly show the voluntary ignorance phenomenon, and if this issue upsets consumers as they say it does, it may be that there are preferences for a public (i.e. regulatory) rather than a market solution, though this remains to be proved.

Finally, environmental protection as a beef attribute does not seem to collect many significant preferences: if chapters 11 and 12's conclusions are put together, the conclusion is that Portuguese beef consumers don't have a great concern about the environment, at least in the framework of beef production.

This is also the attribute with the lowest WTP, and the one that is more strongly affected by substitution effects. Focus groups discussions already pointed out this trend, as this was the attribute for which most participants stated not to be willing to pay a premium. Needless to say that the public sector intervention may therefore be justified.

Notwithstanding, this discussion around public or market solutions to guarantee the socially demanded levels of food safety, animal welfare and environmental protection was not this research's goal, nor is the produced data sufficient to allow for firm conclusions.

As such, these final conclusions represent a research path with a significant amount of work still to be done, but also with more results in perspective, as chapter 14 will show. However, before this thesis can move towards that direction, some limitations to the results and conclusions presented must be put forward.

13.3 Limitations of the research work and the results presented

The first limitation to this work is the final sample for the CE's survey. That sample was not representative of the Portuguese population, being biased towards higher income segments (and thus likely biased towards higher education levels). This bias was conscious and justified by the fact that these are normally the consumer groups who typically purchase differentiated beef (Banovic, Grunert, Barreira, & Aguiar Fontes, 2010).

As it was shown in chapter 12, even with this bias the percentage of certified beef buyers was only 6%. Therefore, if this research had included a representative sample of the population, it could become very difficult for that sample to include a significant number of differentiated beef consumers. Their absence would possibly result in lack of significance of some of the findings presented on chapter 11, and, more importantly, in lack of significance of the WTP estimates presented on chapter 12.

However, the most constraining aspect of this bias were the difficulties felt in the work that lead to chapter 11. For almost all the conclusions taken it was not possible to find significant relations with socio-demographic characteristics, which may be attributable to our sample's

bias. As such, sometimes these conclusions felt somewhat fragile, and this is a limitation that must be acknowledged.

Furthermore, this choice of sampling will most possibly lead to some difficulties on work ahead. Chapter 14 will present a myriad of exciting and promising new work on the available untreated data that resulted from our CE surveys. Still, a word of caution should be put forward due to possible difficulties that cluster analysis and latent class models may face.

Apart from the sample limitations, there are a few impairments associated with the CE methodology itself. Such impairments are well reported and although this research may not be affected by these limitations, they should still be analysed.

One of the most commonly mentioned difficulties associated with CE is the appropriate definition of attributes and their levels, and the complex nature of the experimental design (Hanley, Wright, & Adamowicz, 1998). The more attributes are included in the CE, and the more levels each attribute has, the more complicated will the experimental design be (Louviere, Street, & Burgess, 2004). Furthermore, respondents will also face an increasingly difficult task, which can lead to inconsistent and insignificant estimates (Louviere, Hensher, & Swait, 2000; Louviere, et al., 2004).

Regarding the attributes' definitions, the exhaustive literature review and the focus groups discussions held lead us to believe that this has been addressed quite adequately in this research. The fact that only a status quo level and an additional level were used probably helped the respondents to answer meaningfully and truthfully to the choice experiments.

The existence of only two levels per attribute also helped simplify the design task. The results reported in chapter 12 namely those relating with the high significance of the attributes and their interactions' coefficients suggest that there were no problems surrounding the experimental design.

Another controversial aspect of CE (and all stated preference methods) is related to the hypothetical nature of the experiments. Several attempts were made to reduce the influence of this hypothetical bias (Carlsson, Frykblom, & Lagerkvist, 2005). This uncertainty associated with the provided answers has a particular focus on how much can respondents be trusted to give the truthful answer, or to put it another way, how much will they try to manipulate the survey's results by some type of strategic behaviour (Bateman, et al., 2002).

There is extensive literature on how this sort of behaviour may be averted, namely by making efforts to guarantee that the choice situations and questions are incentive compatible – i.e. all of the participants do best when they truthfully reveal their preferences (Lusk & Schroeder, 2004)[72]. Hensher (2010) suggests several measures to assure incentive compatibility (namely by including "a well-scripted presentation (including cheap-talk scripts[73]), explaining the objectives of the choice experiment (…) and pivoting the attribute levels of a choice experiment

72 For a comprehensive analysis of the concept of incentive compatibility and its evolution see, e.g. Chen (2008).

73 Cheap talk scripts are an attempt to reduce the hypothetical bias by thoroughly describing and discussing in the questionnaire itself the propensity of respondents to exaggerate stated WTP (Carlsson, et al., 2005; Lusk, 2003; Lusk & Schroeder, 2004). An example of a cheap talk script can be: "The experience from previous similar surveys is that people often respond in one way but act differently. It is particular common that one states a higher WTP than what one actually is willing to pay for the good in the store. We believe this is due to the fact that one does not really consider how big an impact an extra cost actually has to the family budget. It is easy to be generous when one does not really need to make the choices in a store. If you have another idea or comment on what this behavior depends on, please write this down on the last page of the questionnaire"(Carlsson, et al., 2005).

around a reference alternative that has been experienced, and/or there is substantial awareness of") although recognizing that there are challenges for on-going research.

The possible existence of some degree of hypothetical bias must be acknowledged, particularly if chapters' 11 and 12 results are read together. If the self-reported low degree of attachment and concern with beef safety, animal welfare and the environment reported in chapter 11 is confronted with the WTP of 13.71 €/kg of differentiated beef, it doesn't add up.

However, this may be a simplistic approach, particularly if it is remembered that these are average WTP values and that there are (even if low) percentages of consumers concerned with, and interested in, the attributes under research. Chapter 14 will build on the possibility of characterization of such consumers.

Finally, an additional issue surrounding CE is the difficulty to determine the results' external validity, i.e. the extent to which they can be generalized to other situations and to other people (Hanley, et al., 1998). For goods and attributes that are very unfamiliar for consumers, this may be a very difficult task, if not an impossible one.

In this research's context, such validation could be partly achieved by verifying if similar beef products are sold (and bought by consumers) in the market at prices similar to those elicited through the CE. In fact, as noted in chapter 12, the estimated WTP values for differentiated beef with the three attributes under research is well within market values for premium beef products in Portugal.

Reporting now a research limitation with no solution at this time, and according to the alert by Louviere et al. (2004), there is a high proportion of respondents "who either never choose an option (16.2%) or always choose an option" (55.8%). This limitation must be acknowledged, as WTP estimates may suffer from this response pattern. It is suggested by some authors that the underlying econometric models may need rethinking about this issue (Jordan Louviere, et al., 2004), but such task goes very much beyond this thesis' goals.

Concluding on this research's limitations, a note must be made on the absence of references to certification schemes and their potential on the effective communication of credence attributes such as the ones involved in this research. This absence may be noticed namely due to the increasing engagement of food retail chains on certification schemes that specify food production conditions (Codron, Giraud-Héraud, & Soler, 2005; Henson & Reardon, 2005)[74].

Furthermore, any future practical implementation of our findings on the beef market would necessarily imply a certification scheme, in order to convey to consumers the information about the provided credence attributes and the associated guarantees of their presence.

A small inroad to consumers' perception of certification was made during the focus groups discussions, although with no specific intention of evaluating the role of such certification. Some interesting comments were made on some of the presented labels that were included in certification schemes. For example, many of the participants were reluctant to accept the claims of "sustainable quality" that were present on a beef product label[75]. On the contrary,

74 An approach to certification schemes as drivers of agri-food systems can also be found, e.g. in Hatanaka, Bain, & Busch (2005) or Jahn, Schramm, & Spiller (2005).

75 Gouin and Coudrier (2001) also found some problems related with one of the certification schemes they included in their research. Interestingly, it is the same retail chain that lead to negative reactions along our focus groups discussions.

many consumers acknowledged a PDO label as a quality label, supporting the fact that these are effective certification schemes.

Thus, it would have been interesting to pursue these claims, and to include some questions on the recognition and valuation of beef certification schemes in the questionnaire. It is therefore clear that focus groups discussions represented a massive input of qualitative data for this research and can be suggested to be the ground for some methodological innovation.

13.4 Scientific innovation

Focus groups are a well documented methodology (Krueger & Casey, 2008; Morgan, 1996) and its use for the development of stated preference (SP) questionnaires is widely recommended since the NOOA panel (Arrow, et al., 1993; Carson, et al., 1996). As comprehensively exposed in chapters 9 and 10, the success of SP surveys depends very much of focus groups, which generate the information needed for the proper definition of an elicitation context and the choice scenarios. This is the case for many other fields of research that make use of SP methods.

However, this research may have taken focus groups somewhat further in their ability of generating useful information for SP questionnaires, by introducing choice exercises during the discussions as a tool for defining a relevant price range to be used in the CE.

To our knowledge, there is no previous research in consumers' preferences for food products' attributes making use of focus groups with such goal. We obviously cannot exclude the existence of such application of the focus groups methodology in other fields of research. Focus groups results are often not the object of a specific publication during a research work, and are more commonly mentioned during the methods section of research papers. Therefore, it must be accepted that this may not be a completely novel application of the focus groups methodology. Still, it is certainly not a very common one.

Chapter 10 has the details on the process used in order to obtain the data set and the applied regression technique by which it was possible to calculate the implicit price of each one of the attributes. Again, as stressed in that chapter, no extrapolation was intended nor was there an attempt to estimate a representative WTP for differentiated beef.

The price range obtained with the focus groups was considered appropriate, as it was compatible with the premium priced beef cuts that existed in the Portuguese market. Therefore, it was in fact possible to obtain a reliable price range to be used on the CE that was included in the proper experimental design. This fact is confirmed by the accuracy of the price levels used on the pretest, for which there was no need of correction for the main survey.

Consequently, this research has not only confirmed the advantage of using focus groups as a preliminary tool for the development of SP questionnaires, but supplied some support for novel applications of this method, suggesting an interesting new field of research.

Chapter 14
Future research perspectives

Societies demand for animal welfare, environmental protection and food safety may still not be completely fulfilled, as all the reports of positive WTP for these goods seem to suggest[75]. According to some authors, such insufficient supply can configure a situation of market failure (Harvey & Hubbard, 2013). Defining the better solution to deal with those potential market failures is a discussion that goes very much beyond the facts and figures, as it includes ethical and moral points of view that are not part of this thesis' goals.

Although a contribution to this discussion was given in the chapters above – by valuing these goods through the valuation of a private good with affiliated public good characteristics in a market setting – an additional input was intended, as exposed in chapters 2 and 3.

Thus, the work set aside now becomes a future research path due to the still unexplored data set generated by the referendum version of the survey. As discussed in the final paragraphs of chapter 13, the market setting survey raises some questions about the existence of some bias associated with consumers answering valuation questions in a citizen's perspective. Therefore, it will be very interesting to verify whether there are significant differences in the estimated WTP and on the remaining sections of the survey that allow the distinction between consumers' and citizens' preferences.

A different promising field of research relates to clearing up the doubts that were raised by the confrontation of chapters' 11 and 12 results (as pointed out in chapter 13). Such effort implies the treatment of the sample's heterogeneity which should lead to the definition of consumer segments and the estimation of their specific WTP for these differentiated beef products.

For the definition of consumer segments an exploratory correspondence analysis (due to the fact that most of the data is categorical) and a cluster analysis will probably be the chosen methodologies. It is possible that the data set is large enough for the estimation of WTP for the different consumer segments applying a MNL model (as the one presented in chapter 12).

Latent class models will probably be considered for the estimation of WTP for different consumer segments as well[76]. This estimation method does not assign cases to classes. Instead, it estimates for each case a probability of membership to each class. Therefore, an interesting perspective will be trying to compare if the estimated WTP for consumer segments generated by the two different methods – cluster analysis and latent class models – is significantly similar.

Last but not least, the methodology used in this research can be applied to other animal

75 Chapters 6, 7 and 8 include several examples of such reports.

76 Some very recent work on understanding preferences for beef attributes that applies a latent class model is presented in Koistinen et al. (2013).

products (e.g. pork, eggs or milk), including specific scenario definition. The obtained estimates could therefore be compared to understand how consumers value differently animal welfare, the environment or food safety when different animal species and different food products are at stake.

> *"Success is not final, failure is not fatal: it is the courage to continue that counts."*
> - Winston Churchill

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Appendix 1

Experimental design

MNL efficiency measures

D error – 0.139211

A error – 0.422541

B estimate – 65,853,907

S estimate – 3,469,261

Prior	b1	b2	b3	b4
Fixed prior value	1.23	0.83	0.73	-0.2
Sp estimates	168,942	2,973,581	3,469,261	0.993521
Sp t-ratios	1,507,951	1,136,622	1,052,295	1,966,381

Design									
Choice situation	AW	ENV	FS	BID	AW	ENV	FS	BID	QnN
1	1	0	1	12	0	1	1	3	3
2	0	1	1	15	1	0	1	15	4
3	1	1	0	6	0	1	1	3	2
4	0	1	1	6	1	0	0	3	1
5	1	0	1	3	0	1	1	12	3
6	1	0	1	15	0	1	0	6	2
7	1	0	1	9	1	1	1	15	1
8	1	0	0	3	1	1	0	12	4
9	0	1	1	9	1	1	0	12	4
10	1	0	0	12	0	1	0	12	3
11	1	1	0	12	0	1	1	3	2
12	1	1	1	12	0	1	1	6	4
13	0	1	0	3	1	1	1	9	2
14	0	1	1	15	0	1	0	9	1
15	0	1	0	3	0	0	1	3	4
16	0	1	1	6	1	1	0	9	2
17	0	1	0	9	1	0	1	15	3
18	1	0	0	9	0	0	1	15	1
19	0	1	0	6	1	1	1	12	1
20	1	0	1	15	1	1	0	6	3

AW – Animal welfare; ENV – Environmental protection; FS – Food safety

QnN – Questionnaire number

All the BID values were added the status quo level bid, i.e. 9.98€/kg to become the final price.

Appendix 2

Example of a questionnaire

Instrução – Abordagem do inquirido

Bom dia, o meu nome é XXX. No âmbito de um trabalho de doutoramento na Faculdade de Medicina Veterinária estou a entrevistar consumidores de carne de bovino. Ficaria muito grato se me respondesse a algumas questões.

Instrução – Após aceitação, leia o texto seguinte ao inquirido

Pode estar seguro de que aquilo que me disser é estritamente confidencial. Não vai ser necessário dizer-me o seu nome ou morada. O questionário não é difícil. Não se trata de um teste aos seus conhecimentos. Não há respostas certas ou erradas. O que é importante para nós é a sua opinião. Vamos então começar

Instrução – Leia cada uma das questões e opções de resposta disponíveis. Repita a leitura das opções caso seja necessário

1. Qual a sua frequência normal de compra de carne de bovino?	
a. Pelo menos uma vez por semana	
b. Uma a três vezes por mês	
c. Raramente (menos de uma vez por mês)	

2. Onde compra geralmente a carne de bovino?	
a. Hipermercado	
b. Talho	
c. Outros Locais	

3. Compra algum tipo de carne de bovino de uma marca específica ou certificada?	
a. Sim. Qual? (Preencha caso o inquirido diga qual) _____	
b. Não. Compro apenas carne corrente, indiferenciada	

	Sim	**Não**
4. Com a actual crise económica reduziu a compra de carne de bovino em geral?		

Instrução – Ler a questão 5 apenas se a resposta em 3 tiver sido afirmativa.

	Sim	**Não**
5. Com a actual crise económica reduziu a compra de carne de bovino de marca específica ou certificada?		

6. Qual a frequência de consumo de carne de bovino em sua casa?	
a. Quase todos os dias	

b. 2 ou 3 vezes por semana	
c. 1 vez por semana	
d. 1 a 3 vezes por mês	
e. Raramente ou nunca porque	
e1. Não gostamos	
e2. É muito cara	
e3. É pouco saudável	
e4. Outra. Qual? _____	

7. Quando apareceu a BSE (doença das vacas loucas) reduziu o seu consumo de carne de bovino?	
a. Sim	
b. Não	
c. Não sei / não me lembro	

Instrução - Entregue ao inquirido o cartão com as opções disponíveis (CARTÃO 1). Pode ser seleccionada mais do que uma opção

8. Costuma ter (ou alguém do seu agregado familiar) algum dos seguintes comportamentos? (Costuma equivale a "Pelo menos uma vez por mês")	
a. Ler artigos ou seguir na rádio ou televisão programas sobre bem-estar animal	
b. Separar lixo doméstico para reciclagem	
c. Comprar (ou ler regularmente) revistas sobre protecção do ambiente ou natureza	
d. Comprar produtos especificamente porque são amigos do ambiente	
e. Doar dinheiro (ou trabalho voluntário) a associações de protecção dos animais ou de protecção do ambiente	
f. Participar activamente em campanhas ou actividades associativas de protecção dos animais ou do ambiente	
g. Pertencer a associações de defesa do consumidor	
h. Entregar dinheiro ou bens como roupa ou comida em instituições que ajudam pessoas em dificuldades, como o Banco Alimentar Contra a Fome	
i. Nenhuma das anteriores	

Instrução – Entregue ao inquirido o cartão com as opções disponíveis (CARTÃO 2) e anote as respostas dadas. Não é preciso indicar A mais importante.

9. Quais os três temas sociais que para si são mais importantes atualmente no nosso país? Leia todas as opções antes de responder.	
a. Desemprego	
b. Bem-estar animal	
c. Reciclagem	
d. Saúde	
e. Segurança sanitária dos alimentos	

f. Ensino	
g. Incêndios florestais	

10. Vamos agora focar a nossa atenção na produção da carne de bovino. A carne de bovino segue uma cadeia desde a criação dos animais até à prateleira da loja. Para si, esta cadeia tem aspetos preocupantes em termos de:		
	Sim	**Não**
a. Ambiente		
b. Segurança dos alimentos		
c. Bem-Estar Animal		
d. Outro. Qual? _____		

Instrução - Entregue ao inquirido o cartão com as opções disponíveis (CARTÃO 3) para os casos em que a resposta em 11 foi SIM. Pode ser selecionada mais do que uma opção

11. Lembrando que estamos apenas a falar no contexto da produção da carne de bovino, para si, os problemas ao nível do **ambiente** devem-se sobretudo a qual ou quais destes intervenientes na cadeia:	
a. Falta de regulamentação do Estado	
b. Falta de fiscalização do Estado	
c. Os criadores de gado nem sempre são cumpridores	
d. As cadeias de supermercados, os talhos, etc., nem sempre são cumpridores	
e. Alguns consumidores cometem erros	

12. Lembrando que estamos apenas a falar no contexto da produção da carne de bovino, para si, os problemas ao nível do **segurança dos alimentos** devem-se sobretudo a qual ou quais destes intervenientes na cadeia:	
a. Falta de regulamentação do Estado	
b. Falta de fiscalização do Estado	
c. Os criadores de gado nem sempre são cumpridores	
d. As cadeias de supermercados, os talhos, etc., nem sempre são cumpridoras	
e. Alguns consumidores cometem erros	

13. Lembrando que estamos apenas a falar no contexto da produção da carne de bovino, para si, os problemas ao nível do **bem-estar animal** devem-se sobretudo a qual ou quais destes intervenientes na cadeia:	
a. Falta de regulamentação do Estado	
b. Falta de fiscalização do Estado	
c. Os criadores de gado nem sempre são cumpridores	
d. O transporte e o abate dos animais nem sempre são bem feitos	
e. As cadeias de supermercados, os talhos, etc., nem sempre são cumpridoras	
f. Alguns consumidores cometem erros	

Instrução – Leia o texto seguinte ao inquirido

A legislação em vigor para a produção de carne de bovino estabelece mínimos legais de:

- Higiene e segurança dos alimentos;
- Bem-estar animal; e
- Proteção do ambiente.

Contudo, os criadores de gado podem optar por produzir uma carne certificada, que vai além destes mínimos, e que pode ser vendida a um preço mais alto.

Instrução – Apresente ao inquirido o FOLHETO. Dê ao inquirido tempo suficiente para analisar o folheto. Esclareça que não é necessário fazer nenhum comentário e que o folheto é apenas informativo.

Instrução – Apresente ao inquirido o QUADRO A e leia a frase seguinte. Explique o quadro e pergunte ao inquirido se tem dúvidas. Dê ao inquirido tempo suficiente para analisar o quadro. Caso sim, explique o quadro novamente. Caso não, prossiga.

No quadro seguinte estão detalhadas as informações acerca dos assuntos específicos com que estamos a lidar. Mais concretamente, estão resumidos alguns mínimos legais e os níveis adicionais certificados que podem passar a ser produzidos. Gostaria que olhasse para essas informações mais atentamente, e também que desse atenção aos símbolos que lhe estão associados.

Instrução – Entregue ao inquirido o cartão com as opções disponíveis (CARTÃO 4). Não leia a opção e) ao inquirido. Só permita essa opção se o inquirido estiver muito hesitante

14. Supondo que os preços eram iguais em todos estes casos que lhe vou apresentar, e pensando num bife, por que ordem faria as suas escolhas?	
 **a.** Um bife com mais bem-estar animal	
 **b.** Um bife com mais protecção do ambiente	
 **c.** Um bife com mais segurança	

 **d.** Um bife corrente que cumpra os mínimos actuais	

e. Indiferente / Não responde		

Instrução – Entregue ao inquirido O CARTÃO 5.4A com as opções disponíveis. Leia a questão, explique o quadro e pergunte ao inquirido se tem dúvidas. Caso sim, explique o quadro novamente. Caso não, prossiga.

15. Sabemos que as pessoas muitas vezes dizem que estão dispostas a escolher produtos mais caros do que realmente estão. É importante que nos responda como se estivesse numa situação real pensando que esse dinheiro deixaria de estar disponível para outros produtos. Com base nas escolhas possíveis, que bife escolheria?	
a. Bife certificado 1 (Passe para 17)	
b. Bife certificado 2 (Passe para 17)	
c. Bife corrente (Passe para 16)	

Instrução – Entregue ao inquirido o cartão com as opções disponíveis (CARTÃO 6A). Pode ser selecionada mais do que uma opção

16. Porquê?	
a. Eu não poderia pagar estes bifes mais caros	
b. Porque os bifes certificados não valem estes preços	
c. Sinto-me satisfeito e seguro com os mínimos legais	
d. Cabe ao Estado e aos criadores de gado garantir estes assuntos	
e. Não me cabe a mim pagar estes custos	
f. Outro motivo. Qual?	

Instrução – Passe para 18

Instrução - Entregue ao inquirido o cartão com as opções disponíveis (CARTÃO 7A). Pode ser selecionada mais do que uma opção

17. Suponha que o consumo médio de bife por pessoa por mês em Portugal é de 1 kg. A sua resposta tem repercussões no seu rendimento disponível e portanto teria de comprar menos de outras coisas. Tendo isto em conta, manteria a sua resposta?	
a. Sim. Porquê?	
1. Porque consumo pouca carne de bovino e a diferença não seria muito grande	
2. Porque considero que estes aspectos são importantes para a nossa saúde	
3. Porque acho que a melhor qualidade da carne vale a diferença de preço	

4. Porque isto é um inquérito, e não teria mesmo de pagar	
5. Porque consumiria menos carne mas de melhor qualidade	
6. Outro motivo. Qual?	
b. Não. Porquê?	
1. Porque isso afinal representava muito no meu orçamento face ao que preciso para outras despesas	
2. Porque para mim o ganho de qualidade não vale o que o preço aumenta	
3. Outro motivo. Qual?	

Instrução – Leia ao inquirido a frase seguinte

> Vamos agora repetir o mesmo processo de escolha mas tendo em conta bifes diferentes dos anteriores.

Instrução – Entregue ao inquirido O CARTÃO 5.7A com as opções disponíveis. Leia a questão, explique o quadro e pergunte ao inquirido se tem dúvidas. Caso sim, explique o quadro novamente. Caso não, prossiga.

19. Mais uma vez, é importante que nos responda como se estivesse numa situação real pensando que esse dinheiro deixaria de estar disponível para outros produtos. Com base nas escolhas possíveis, que bife escolheria?	
a. Bife certificado 1	
b. Bife certificado 2	
c. Bife corrente	

Instrução – Leia ao inquirido a frase seguinte

> Vamos agora repetir mais uma vez o processo de escolha mas tendo em conta bifes diferentes dos anteriores.

Instrução – Entregue ao inquirido O CARTÃO 5.14A com as opções disponíveis. Leia a questão, explique o quadro e pergunte ao inquirido se tem dúvidas. Caso sim, explique o quadro novamente. Caso não, prossiga.

20. Mais uma vez, é importante que nos responda como se estivesse numa situação real pensando que esse dinheiro deixaria de estar disponível para outros produtos. Com base nas escolhas possíveis, que bife escolheria?	
a. Bife certificado 1	
b. Bife certificado 2	
c. Bife corrente	

Instrução – Leia ao inquirido a frase seguinte

> Vamos agora repetir novamente o processo de escolha mas tendo em conta bifes diferentes

dos anteriores.

Instrução – Entregue ao inquirido O CARTÃO 5.18A com as opções disponíveis. Leia a questão, explique o quadro e pergunte ao inquirido se tem dúvidas. Caso sim, explique o quadro novamente. Caso não, prossiga.

21. Mais uma vez, é importante que nos responda como se estivesse numa situação real pensando que esse dinheiro deixaria de estar disponível para outros produtos. Com base nas escolhas possíveis, que bife escolheria?	
a. Bife certificado 1	
b. Bife certificado 2	
c. Bife corrente	

Instrução – Leia ao inquirido a frase seguinte

Vamos repetir uma última vez o processo de escolha tendo em conta bifes diferentes dos anteriores.

Instrução – Entregue ao inquirido O CARTÃO 5.19A com as opções disponíveis. Leia a questão, explique o quadro e pergunte ao inquirido se tem dúvidas. Caso sim, explique o quadro novamente. Caso não, prossiga.

22. Novamente, é importante que nos responda como se estivesse numa situação real pensando que esse dinheiro deixaria de estar disponível para outros produtos. Com base nas escolhas possíveis, que bife escolheria?	
a. Bife certificado 1	
b. Bife certificado 2	
c. Bife corrente	

Instrução – Leia cada uma das questões e opções de resposta disponíveis.

23. Qual é a sua idade?	
a. Menos de 18	
b. 18 a 27	
c. 28 a 37	
d. 38 a 47	
e. 48 a 57	
f. 58 a 67	
g. 68 a 77	
h. 78 ou mais	

24. Sexo	
a. Feminino	

b. Masculino	
25. Qual o seu nível de escolaridade?	
a. Nenhum	
b. Básico 1º ciclo (ou 4ª classe)	
c. Básico 2º ciclo (ou 6º ano)	
d. Básico 3º ciclo (ou 9º ano)	
e. Secundário ou técnico-profissional (12º ano)	
f. Bacharelato ou licenciatura	
g. Mestrado ou doutoramento	

26. Qual a sua situação profissional?	
a. Representantes do poder legislativo e órgãos executivos, dirigentes e directores e gestores executivos	
b. Especialistas de profissões intelectuais e científicas	
c. Técnicos e profissionais de nível intermédio	
d. Pessoal administrativo e similares	
e. Pessoal dos serviços e vendedores	
f. Agricultores e trabalhadores qualificados da agricultura e pescas	
g. Trabalhadores qualificados da indústria, construção e artífices	
h. Operadores de instalações e máquinas e trabalhadores de montagem	
i. Trabalhadores não qualificados	
j. Membros das forças armadas	
l. Reformado	
m. Desempregado	

27. Composição do agregado familiar	
a. Número de adultos e crianças maiores de 12 anos	
b. Número de crianças até 12 anos	

Instrução – Entregue ao inquirido o cartão com as opções disponíveis (CARTÃO 7)

28. Qual o grupo de rendimento líquido mensal do seu agregado familiar?	
a. ≤950	
b.] 950€ – 1425€]	
c.] 1425€ – 1900€]	
d.] 1900€ – 2375€]	
e.] 2375€ – 2850€]	
f.] 2850€ – 3325€]	
g.] 3325€ – 3800€]	
h.] 3800€ – 4275€]	
i.] 4275€ – 4750€]	
j. >4750€	

Detalhes da entrevista (a preencher pelo entrevistador)

29 Data da entrevista	

30. Condições de realização da entrevista	
a. Só com o inquirido	
b. Com outras pessoas presentes	
c. Com a intervenção de outros membros da família	

1 – muito fraca a 5 – muito boa	
31. Manutenção da atenção do inquirido durante a entrevista	
32. Compreensão geral dos cenários apresentados	

Appendix 3

Discussion guide for the focus group

Section	Content
Introduction	Moderator's introduction; Explanations about session's progression.
Section 1	Participants' introduction; Perceptions on beef quality and concerns on beef shopping and consumption.
Section 2	Conversation about animal welfare, food safety and the environment in a beef production context.
Section 3	Discussion about beef safety in order to unveil participants' knowledge and concerns; Debate on willingness to buy new safer beef products.
Section 4	Discussion about animal welfare in order to unveil participants' knowledge and concerns; Debate on willingness to buy new animal friendlier beef products.
Section 5	Discussion about the environment in order to unveil participants' knowledge and concerns; Debate on willingness to buy new environmentally friendlier beef products.
Section 6	Analysis and debate of four beef labels: Organic beef, Protected Designation of Origin (PDO) beef, a supermarket brand labelled as "Sustainable" and an undifferentiated beef.
Recess	
Section 7	Choice Exercises.
Section 8	Conversation regarding the desire for more and better information on differentiated beef; Final remarks on what a high quality beef is.

O BEM-ESTAR DOS BOVINOS ESTÁ MUITO RELACIONADO COM AS CONDIÇÕES EM QUE OS ANIMAIS SÃO CRIADOS E A FORMA COMO SÃO TRATADOS.

LEGISLAÇÃO ACTUAL

Está definido um espaço mínimo para cada animal.

Os animais nem sempre têm acesso ao pasto.

É obrigatória a formação dos tratadores.

ONDE SE PODE IR MAIS ALÉM

É possível fornecer incentivos à criação de bovinos em sistemas extensivos onde é maior o espaço disponível para cada animal.

Nestas explorações os animais vivem em pastoreio.

É possível aumentar a formação dos tratadores.

A PRODUÇÃO DE BOVINOS DE CARNE PODE TER IMPACTOS AMBIENTAIS

LEGISLAÇÃO ACTUAL

A legislação actual define <u>MÍNIMOS</u> que têm como objectivo evitar alguns problemas ambientais associados à criação de bovinos, como a poluição da água e do solo.

ONDE SE PODE IR MAIS ALÉM

É possível fornecer incentivos à criação de bovinos em sistemas mais amigos do ambiente

Estes sistemas são considerados sustentáveis e importantes para a preservação da paisagem.

São também importantes para evitar a desertificação e os fogos florestais

A UNIÃO EUROPEIA TEM REGRAS MUITO EXIGENTES EM TERMOS DE SEGURANÇA DOS ALIMENTOS DESDE A EXPLORAÇÃO ATÉ AO MOMENTO EM QUE CHEGAM AO CONSUMIDOR.

LEGISLAÇÃO ACTUAL

Por exemplo:
- Só podem ser usados antibióticos aprovados pelas autoridades;
- As autoridades controlam o uso de antibióticos nas explorações através de inspecções e análises periódicas;
- São feitas análises periódicas à carne nos matadouros.

ONDE SE PODE IR MAIS ALÉM

Reduzir o nível de resíduos de antibióticos permitidos na carne

Estabelecer um maior controlo do uso de antibióticos nas explorações

Estabelecer um maior controlo de resíduos de antibióticos na carne

Appendix 5

Example of a choice set

Please choose between the available beef products:		
Certified Beef 1	**Certified Beef 2**	**Current Beef**
  	  	
21.98€/kg	12.98€/kg	9.98€/kg