How differentiated is the Scottish Beef? An Analysis of Supermarket Data Panel

Cesar Revoredo-Giha[1], Chrysa Lamprinopoulou[1], Philip Leat[1], Beata Kupiec-Teahan[1], Luiza Toma[2], and Luca Cacciolatti[1]

[1] Food Marketing Research Team, Land Economy and Environment Research Group, Scottish Agricultural College (SAC), UK, e-mail: Cesar.Revoredo@sac.ac.uk, Chrysa.Lamprinopoulou@sac.ac.uk, Philip.Leat@sac.ac.uk, Beata.Kupiec@sac.ac.uk Luca.Cacciolatti@sac.ac.uk

[2] Bio-economics And Rural Strategy Team, Land Economy and Environment Research Group, Scottish Agricultural College (SAC), UK, e-mail: Luiza.Toma@sac.ac.uk

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[2] Bio-economics And Rural Strategy Team, Land Economy and Environment Research Group, Scottish Agricultural College (SAC), UK, e-mail: Luiza.Toma@sac.ac.uk

Abstract. The Scottish red meat industry is a major part of the Scottish agricultural economy and is known for producing high quality beef and lamb. Beef and lamb which are produced and processed in Scotland and according to a quality assured production specification, carry the EU 'Protected Geographical Indications' (PGI) name of 'Scotch'. In addition, red meat in Scotland has to compete with high quality imported products (e.g., from Brazil or Argentina) or with meat from elsewhere in the United Kingdom. This paper focuses on the situation of Scotch beef and how differentiated it is in the eyes of consumers. For this purpose we use two years' retailing data for Scotland (and by socio-economic group) from a major supermarket to estimate the conditional demand for beef products from different origins. Results indicate that Scotch beef competes with the premium category and also with the supermarket own label product. The paper concludes by considering the marketing implications of these findings.

Keywords: Beef supply chain, Scottish agriculture, product differentiation, demand models.

1. Introduction

The Scottish red meat industry is a major part of the Scottish agricultural economy and enjoys a well-deserved reputation for producing high quality beef and lamb [24]. Scotland's livestock are raised on fine pastures in a pristine environment, by farmers with generations of livestock production expertise.

Additionally, the Scottish red meat industry is supported by a fully integrated assurance programme, which guarantees high welfare and quality standards and ensures complete traceability throughout the entire chain of production and processing [25]. Furthermore, beef and lamb which is produced and processed in Scotland and according to the mentioned production specifications, carries the PGI (Protected Geographical Indications) denomination 'Scotch', which is an EU-wide protected registered name [29].

It is important to note that red meat in Scotland, and other parts of the United Kingdom, faces a fierce market environment where Scottish products have to compete with high quality imported products (e.g., from Brazil or Argentina) or with meat from elsewhere in the United Kingdom, which in some instances has similar EU registered names such as Orkney beef (PDO, i.e., Protected Designations of Origin), Orkney lamb (PDO), Shetland lamb (PDO), Welsh Beef (PGI), and Welsh lamb (PGI). Despite the competition, between May 2007 and May 2009 retailer sales of Scottish brands within Great Britain increased by £0.3 billion, constituting a 21 per cent rise. In Scotland they increased by £76 million, an 18 per cent rise. Furthermore, Scotch Beef was the top selling Scottish brand in both Great Britain and Scotland; thus, retailer sales of Scotch beef increased by 12 per cent in Great Britain and 22 per cent in Scotland [44].

Whilst continuous improvements in cost reduction and efficiency are important to maintain a competitive industry, these are on occasions translated into lower returns for producers as productivity improvements become the norm across the industry (e.g., see Cox et al. for the case of the pork supply chain, although relevant to the other red meat products [14]). This situation is even more dramatic when one considers the market coverage of multiple retailers in the UK, which now accounts for approximately 80 per cent of the

total expenditure on products with a beef or lamb content [35], and the price pressure which continuously bears on meat suppliers to be more price competitive.

Within this market environment, it is clear that a product differentiation strategy that secures a price premium over similar competitive products, or which at least maintains a sustainable demand, is a vitally important strategy within a resilient supply chain. Furthermore, the Scottish Government is keen on promoting the consumption of Scottish products along the supply chain e.g. so as to maintain the economic performance of Scottish producers and the well being of rural areas [43].

This paper centres on the situation of Scottish beef and how differentiated it is in the eyes of Scottish consumers. For this purpose we analyse two years' retailing data from a major supermarket using economic demand theory. In this sense, our approach is different to what can be found in the literature, where consumers' attitudes towards PGI products are measured by means of surveys. Instead our approach is based on analysing actual behaviour.

Supermarket data is a useful source of information because the available consumer surveys (e.g., UK's Expenditure and Food Survey) do not have enough disaggregation at the product level to distinguish products according to their origin. In addition, their regional information is based on a small number of observations, which makes it difficult to analyse the consumption behaviour of different regions and socio-economic groups. Furthermore, according to Cotterill, supermarket scanner information is a really promising data source for demand analysis and analysis at the level of product category [13].

The structure of the paper is as follows. First, we present a literature review focused on the analysis of the demand for beef at the level of the PGI and PDO. Second, in the empirical section, we first present the data used in the analysis and its main characteristics and second the empirical demand model used in the estimation. Next, the results are presented and discussed, and finally conclusions are offered.

2. Literature review

Beef consumption in developed countries has declined over recent decades [41, 2]. This has been due to a number of reasons, including higher prices compared to other meat products, loss of consumers' confidence due to recent food safety scares (e.g. BSE crisis, and "foot and mouth disease") [34] and changing consumer preferences towards healthy eating [12], food safety and quality assurance guarantees [23, 4, 36]. This increased concern of consumers on nutrition value, food safety, welfare, ethical and environmental issues [31] has also increased the importance of credence attributes over the experience and search attributes of foods [9]

To counter declining beef consumption and, especially in Europe, to restore consumer confidence [47, 5, 21, 36], both producers and corporate retailers have had to differentiate their products in terms of quality, authenticity, safety and origin [1, 2, 36]. In response to the demand of consumers to know the origin and production standards of food purchased [7], product differentiation was a proper choice as a marketing strategy for the beef industry, given its mature stage in the product life cycle [17].

According to Boccaletti [9], information about the origin of food can "serve as a quality indicator for undetectable attributes, therefore making product and price differentiation easier". His argument is based on Steenkamp's findings [48] that consumers evaluate food products in terms of their quality, price, freshness, brand and guarantees. Certification labels for quality and geographic origin, even a brand name itself, work as guarantees for quality attributes difficult to detect [9, 36].

In 1992, the EU Regulation 2081/92 for protected designation of origin (PDO) and protected geographical indications (PGI) was introduced, aiming to identify superior quality characteristics of food products which are unique and exclusively linked to a specific geographical region and production methods used within this region [20]. Thus, PDO/PGI labels were introduced as a mechanism to assure consumers of the product's uniqueness and high quality that is attributable to the regional distinctiveness of "a particular geographical environment with its inherent natural and human factors" [28, 37], the unique, artisanal production methods employed and a stricter supply chain control [36]. The strong association of the product with a specific territory of origin and its tradition, which is recognised as exceptional and deserves to be preserved, is a fundamental implicit assumption or condition for PDO/PGI labels [20]. In fact, this association is transformed into property rights [40] and facilitates the establishment of a monopoly market structure [10] by setting institutional entry barriers to producers outside the designated geographical area, and those not complying with a registered code of practice. Within the area, legally protected

geographical indicators such as PDO/PGI labels have "public good characteristics of non-rivalry and non-exclusion"[10] (p.82) and facilitate the collective creation of value [3]. Overall, the EU Regulation 2081/92 was designed to certify and regulate the high quality of food products attributed to a particular geographical origin and traditional methods of production, while the ultimate goal was to protect these products against non-authentic copies [45, 39] and promote the marketing strategy, credibility and consumers' awareness of these products' special features [11, 20].

In a discussion of the impact of PDO/PGI labels on product differentiation, especially as a safety and quality assurance guarantee, empirical evidence is mixed. Research on Spanish, Scottish and Portuguese consumers' perceptions suggests that geographical designations constitute an important quality cue [33, 32] together with the information provided by the butcher, the type of outlet, and price [28, 50, 15]. Moreover, the presence of PDO/PGI labels appears to create increased quality expectations [8], indicating high quality, safety and control [32, 15] and in turn, mitigated beef consumption reduction during the BSE crisis [5, 50]. Evidence also suggests that in France, Germany and Spain [41, 16] consumers facing food scares placed more importance on geographical designation labels that they had previously experienced than private brands for beef [50].

However, even in France where a long tradition in quality signals for regional speciality foods exists (e.g. Label Rouge (LR) and Appellations d' Origine Controlee (AOC)), PDO/PGI labels are unclear or unknown to a large percentage of end-consumers [26]. Similar findings have been reported in studies conducted in Portugal [30, 32], Spain and Italy (Mora et al., 2006), and Greece [22]. Furthermore, evidence supports the notion that with the exception of Parma ham, Parmigiano Reggiano, Camembert, and Porto, the differentiation advantage derived from the regional identity of most PDO/PGI products cannot be fully exploited in markets outside the home country. A possible explanation is that distant consumers may have limited knowledge of the regional demarcations, the product and traditional techniques employed for its production [6].

To study consumers' perceptions, attitudes and buying behaviour relating to PDO/PGI products, and beef in particular, researchers have used both qualitative and quantitative methodologies, including face to face interviews, focus groups, and surveys. The analysis of quantitative data collected in such studies has used frequency distribution analysis, principal components analysis [50] factor and cluster analysis [32, 38] to explore underlying dimensions in consumers' perceptions and to segment consumers according to their perceptions and attitudes towards PDO/PGI products. Roosen et al. [41] used an ordered probit model and a double bounded logit model to estimate the impact of consumer characteristics on their preferences between private brands and geographical designations. Based on the hedonic price approach, Steiner [49], Loureiro and McCluskey [28], and Hassan and Monier-Dilhan [18] estimated the premium that consumers are willing to pay for PDO/PGI labels. To assess the effectiveness of these labels as a rural development policy tool, Loureiro and McCluskey [27] analysed consumers' perceptions of PGI meat products using a simple utility maximisation model. Finally, Anova and t-tests [15], contingency tables and chi-squared analysis [50], as well as a multinomial logit model [39] or a dichotomous choice model [46] were employed to identify the socio-demographic characteristics of consumers that influence their perceptions and attitudes relating to beef geographical designations and their willingness to pay for such labels.

Features that dictate the success of a PDO/PGI label are consumers' experience and familiarity with the product, and its peculiarities attributed to the region of origin and production method, as well as the quality signs [9, 37]. Moreover, consumers' skills in identifying differences in quality attributes, and differentiating products accordingly, seems crucial for the importance placed on geographical designations [9, 36]. However, a lack of recognition of PDO/PGI labels indicates that European consumers are generally insufficiently informed about them [51], an observation extended to producers, processors, wholesalers and retailers [20, 37]. At the same time, the proliferation of quality signals tends to cause confusion rather than promoting an understanding of the product's distinctive features [27, 31]. Therefore, advertising and educational campaign programs are needed to stimulate consumers' awareness of PDO/PGI labels.

From the suppliers' side, delivering consistently high quality is required for trust with the customer to build and for the PDO/PGI label to be accepted as a reliable signal of quality and authenticity [37]. Therefore, controls and penalties need to be introduced to solve the free-riding problem, where some producers entitled to use the geographical designation label do not fully comply with the code of practice, and deliver inferior product quality [9]. The higher the product's collective reputation, the more effective is

the geographical designation. For domestic consumers, the image of the cooperative or consortia holding the PDO/PGI label, and the body that certifies it, constitutes the basis of confidence [28].

Overall, these studies indicate that whilst the PDO/PGI system has in particular instances conferred a range of benefits on producers, other supply chain participants and consumers, complications do still exist in terms of widespread consumer recognition and understanding of the attributes they embody.

3. Data and model

In this section we start describing the data used in the analysis followed by a brief description of the estimation methodology.

3.1. Data

The information used in the paper for the demand analysis, i.e., Scottish prices and purchases, was provided by the Centre for Value Chain Research (VCR[2]) at the Kent Business School for the project "An Exploration of the Use of a Dataset of Supermarket Purchases for the Analysis of Red Meat Purchases in Scotland" [42]. The dataset provides information about the evolution of the total weekly purchases from a panel of loyalty customers from one of the "big-4" supermarkets in the UK.[1] The analysis was performed for Scotland by socio-economic household groups (i.e., affluent, poorer, intermediate).

The data consisted of information on the value of beef sales in GBP (£), number of units purchased, number of customers and prices (£ per unit). The base for establishing the beef categories was to consider all those products that were competing through use of the Scotch beef designation. These were: brisket joint, stewing steak, fillet, ribeye, roasting joint, rump steak, sirloin and steak mince. Within each category four different brands were found: Scotch beef, highest quality, own label, and Aberdeen Angus.

As regards the data availability, it consisted of 104 points of weekly data starting at the week of the 4th of December 2006 and ending at the 24th of November 2008, for ten socio-economic groupings (using CAMEO-UK, a geo-demographic classification system for assessing the socio-economic and demographic characteristics of residential neighbourhoods[2]). Due to the sparsity of information for some of the socio-economic groups, the ten groups were merged into three groups (Group A=affluent group, Group B=middle group, and Group C=poorer group). The descriptive statistics of the data are presented in Table 1.

Whilst the results cited by the Scottish Government on the growth of Scotch beef sales in Scotland, our figures show a mixture of fortunes for the number of purchased units during the period of study. Thus, during the period, brisket joint prices increased by 26.1 per cent and the number of units decreased by 0.8 per cent, for stewing steak prices went up by 37 per cent and units down by 22 per cent, fillet's prices increased by 5.2 per cent and units decreased by 15.1 per cent, ribeye's prices increased by 21.7 per cent and units too by 2.9 per cent, roasting joint's prices increased by 12.7per cent and number of units went down by 23.5 per cent, rump steak went up by 6.6 per cent and units also increased by 10.3 per cent, sirloin's prices went up by 10.5 per cent and number of units down by 25.0 per cent and steak mince's prices increased by 60.6 per cent and number of units decreased by 24.0 per cent. It should be noted that these results are not necessarily contradictory with those from the Government, as this information only corresponds to one supermarket and the period of comparison is different. Furthermore, the Scottish Government figures show value of sales up and for several of these products the same will still be true (i.e., price increase outweighs fall in quantities sold).

As shown in Table 1, the purchases of bread per customer are relatively similar amongst the different groups, although in all cases the most affluent group shows the highest purchase levels per customer.

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[1] The "big-4" supermarkets in the UK are Tesco, Asda, Sainsbury's and Morrisons. They represent approximately 75 per cent of sales in the groceries market.
[2] More information about the CAMEO-UK groups can be found at http://www.eurodirect.co.uk/pages/cameo-analysis.

Table 1. Descriptive statistics

	Affluent group											Middle group										
	Scotch beef		Highest quality		Own Label		Aberdeen Angus		Expenditure per customer 1/	Average Price (£/unit)	Number of units 1/	Scotch beef		Highest quality		Own Label		Aberdeen Angus		Expenditure per customer 1/	Average Price (£/unit)	Number of units 1/
	Price (£/unit)	Units 1/	Price (£/unit)	Units 1/	Price (£/unit)	Units 1/	Price (£/unit)	Units 1/				Price (£/unit)	Units 1/	Price (£/unit)	Units 1/	Price (£/unit)	Units 1/	Price (£/unit)	Units 1/			
Brisket Joint	4.0	38.4	5.0	3.3	8.6	1.1	--	--	178.6	4.2	42.8	4.1	19.4	6.4	2.4	7.6	1.9	--	--	106.4	4.6	23.7
St. dev.	0.6	9.0	1.7	2.1	2.9	0.4	--	--	35.9	0.6	9.0	0.7	6.7	2.4	1.4	2.6	0.7	--	--	30.1	0.8	6.9
Min	2.8	18.3	1.3	1.0	1.9	1.0	--	--	94.6	2.9	20.3	2.8	6.6	1.3	1.6	2.1	1.6	--	--	52.9	3.1	11.5
Max	5.9	63.0	11.2	9.2	10.7	3.1	--	--	284.1	5.9	66.1	6.3	36.2	8.8	9.9	9.4	6.6	--	--	184.9	6.7	39.5
Stewing Steak	3.0	87.9	3.7	3.0	3.7	2.7	3.4	5.1	302.7	3.1	98.7	3.1	66.3	4.0	2.5	3.4	4.1	3.8	1.9	233.5	3.1	74.8
St. dev.	0.4	18.8	1.6	2.2	1.8	1.9	0.4	2.8	76.4	0.4	19.5	0.5	18.5	1.6	2.0	1.2	2.4	0.5	1.1	78.1	0.5	19.6
Min	2.2	58.0	0.8	1.0	1.5	1.0	1.7	4.1	184.0	2.2	65.1	2.1	36.2	1.3	1.6	0.6	1.6	1.3	1.6	111.8	2.0	41.1
Max	4.1	181.0	6.6	11.2	8.3	9.2	3.5	16.3	711.5	4.0	188.1	4.4	159.5	5.7	18.1	5.5	11.5	4.0	11.5	678.8	4.4	166.1
Fillet	7.9	90.4	9.6	13.8	9.1	2.5	--	--	869.1	8.1	106.8	7.3	64.5	8.5	8.4	9.0	3.0	--	--	563.3	7.4	76.0
St. dev.	0.9	14.0	2.0	4.8	6.2	1.6	--	--	162.3	0.9	15.7	0.8	14.8	3.5	5.0	4.8	1.8	--	--	146.0	0.8	17.5
Min	6.6	60.0	3.1	1.0	2.3	1.0	--	--	590.7	6.6	65.1	5.2	34.5	3.1	1.6	2.5	1.6	--	--	219.5	5.8	37.8
Max	11.1	146.4	15.4	30.5	23.1	7.1	--	--	1,653.2	11.2	161.7	10.2	106.9	25.7	32.9	17.1	8.2	--	--	1,156.9	11.0	138.1
Ribeye	5.9	56.9	--	--	13.2	1.7	11.0	2.5	378.0	6.3	61.1	5.4	36.8	--	--	11.6	2.2	14.1	2.0	245.8	6.1	41.1
St. dev.	0.9	29.9	--	--	6.9	1.8	2.0	1.4	147.0	0.8	31.2	1.0	17.6	--	--	8.7	1.0	3.2	1.3	85.0	1.0	17.6
Min	4.1	38.6	--	--	1.8	1.0	4.4	2.0	212.7	4.4	41.7	3.8	18.1	--	--	1.7	1.6	3.9	1.6	110.3	4.1	21.4
Max	8.0	325.4	--	--	20.6	16.3	11.8	9.2	1,519.1	8.3	343.7	8.2	169.4	--	--	23.9	6.6	15.3	11.5	799.5	8.4	172.7
Roasting Joint	6.8	59.9	8.4	6.3	9.6	1.8	--	--	463.0	7.0	68.0	7.2	39.5	10.6	3.8	9.3	2.3	--	--	333.1	7.5	45.5
St. dev.	1.0	25.2	2.5	4.0	3.2	1.3	--	--	150.8	1.0	27.1	1.1	19.5	6.5	2.5	2.8	1.3	--	--	113.6	1.1	20.4
Min	4.4	31.5	3.7	1.0	4.2	1.0	--	--	246.9	4.5	36.6	4.5	16.4	2.4	1.6	1.3	1.6	--	--	150.3	4.6	19.7
Max	9.7	257.2	17.6	27.5	13.7	7.1	--	--	1,209.4	9.8	271.5	10.9	200.6	24.5	11.5	12.2	8.2	--	--	967.9	10.6	210.5
Rump Steak	3.3	42.5	7.8	3.3	14.6	1.1	12.5	1.3	187.9	3.9	48.2	3.2	34.3	9.1	2.5	11.8	1.9	5.4	1.9	159.3	4.0	40.5
St. dev.	0.5	9.0	5.8	2.7	6.9	0.3	3.2	0.8	38.8	0.6	9.3	0.5	8.5	5.9	1.5	5.8	0.7	0.7	1.0	36.1	0.6	8.8
Min	2.5	21.4	1.4	1.0	1.6	1.0	1.9	1.0	106.8	2.8	28.5	2.0	16.4	1.4	1.6	1.7	1.6	1.6	1.6	77.4	2.6	21.4
Max	5.9	85.4	20.8	16.3	19.0	3.1	13.8	5.1	316.2	6.5	89.5	5.5	55.9	16.5	11.5	16.5	4.9	5.6	8.2	295.8	5.8	60.9
Sirloin	6.8	97.2	8.6	16.2	9.7	1.6	9.0	2.6	823.3	7.1	117.6	6.2	74.3	7.6	8.2	13.4	2.1	13.8	2.3	569.4	6.6	86.9
St. dev.	0.9	27.6	2.1	6.4	4.6	1.0	1.1	4.0	172.0	0.8	29.8	0.9	20.2	2.7	5.2	7.2	1.1	2.8	1.9	140.3	0.9	22.4
Min	4.8	63.0	4.4	5.1	2.1	1.0	4.4	1.0	517.4	4.9	70.2	4.3	37.8	1.8	1.6	1.4	1.6	3.6	1.6	336.1	5.0	46.0
Max	9.2	185.1	15.4	36.6	15.6	7.1	9.4	17.3	1,528.3	9.7	207.4	9.9	144.7	14.3	28.0	19.3	6.6	14.9	11.5	1,162.7	11.0	167.8
Steak Mince	2.3	337.9	--	--	2.5	6.5	--	--	788.6	2.3	344.4	2.2	221.4	--	--	2.4	11.5	--	--	517.2	2.2	232.8
St. dev.	0.3	45.1	--	--	0.7	3.7	--	--	107.2	0.3	44.8	0.3	28.3	--	--	0.6	5.0	--	--	75.0	0.3	28.5
Min	1.6	250.1	--	--	1.1	1.0	--	--	581.7	1.6	255.2	1.5	167.8	--	--	1.1	1.6	--	--	379.9	1.5	171.0
Max	2.9	495.2	--	--	4.3	20.3	--	--	1,025.1	2.9	500.3	2.9	340.4	--	--	4.2	26.3	--	--	679.5	2.9	353.6

Continues

Table 1. Descriptive statistics (cont.)

	Poorer group											Altogether										
	Scotch beef		Highest quality		Own Label		Aberdeen Angus		Expenditure per customer 1/	Average Price (£/unit)	Number of units 1/	Scotch beef		Highest quality		Own Label		Aberdeen Angus		Expenditure per customer 1/	Average Price (£/unit)	Number of units 1/
	Price (£/unit)	Units 1/	Price (£/unit)	Units 1/	Price (£/unit)	Units 1/	Price (£/unit)	Units 1/				Price (£/unit)	Units 1/	Price (£/unit)	Units 1/	Price (£/unit)	Units 1/	Price (£/unit)	Units 1/			
Brisket Joint	4.1	53.2	5.9	4.2	5.8	3.0	--	--	254.0	4.3	60.3	4.1	39.0	5.4	3.4	6.8	2.0	--	--	187.8	4.3	44.4
St. dev.	0.6	12.8	3.0	3.0	2.5	1.8	--	--	50.3	0.6	12.2	0.6	8.1	1.3	1.6	1.6	0.7	--	--	30.5	0.6	8.0
Min	2.8	24.9	1.8	1.1	1.7	1.1	--	--	145.9	3.0	31.7	3.0	21.8	3.2	1.2	3.3	1.2	--	--	118.8	3.4	26.3
Max	5.6	83.7	13.0	13.6	11.9	10.2	--	--	456.8	5.7	88.2	5.7	58.2	11.0	9.3	11.2	5.7	--	--	288.7	5.8	61.0
Stewing Steak	2.9	173.8	5.5	2.9	2.8	9.1	3.0	1.7	545.4	2.9	187.6	3.0	113.3	4.2	2.9	3.0	5.4	3.4	3.1	372.4	3.0	124.6
St. dev.	0.4	35.5	4.9	2.9	0.7	3.4	0.3	1.6	150.2	0.4	36.2	0.4	23.0	1.8	1.9	0.7	1.8	0.4	1.8	97.4	0.4	23.7
Min	2.0	123.3	1.1	1.1	1.8	1.1	1.9	1.1	326.7	2.1	134.6	2.1	79.6	2.2	1.2	2.0	1.6	2.0	2.4	236.2	2.1	87.6
Max	3.8	387.8	15.0	19.2	5.3	18.1	3.2	9.0	1,509.9	3.8	398.0	3.9	249.6	9.1	15.8	5.2	10.1	3.5	12.5	988.6	3.9	257.7
Fillet	7.2	81.4	8.8	7.8	6.7	3.3	--	--	675.8	7.3	92.4	7.5	80.8	9.1	10.3	7.7	2.9	--	--	725.0	7.7	94.1
St. dev.	0.8	14.2	2.9	3.8	1.9	1.8	--	--	142.5	0.8	15.3	0.7	13.5	1.5	3.1	2.5	1.0	--	--	131.3	0.7	13.5
Min	5.8	62.2	3.2	1.1	1.0	1.1	--	--	469.4	5.9	73.5	6.4	61.8	6.5	3.6	3.2	1.2	--	--	515.8	6.5	68.3
Max	9.6	157.2	18.8	19.2	13.8	9.0	--	--	1,485.6	9.6	179.8	10.1	136.9	14.5	19.4	17.8	5.7	--	--	1,471.4	10.1	162.0
Ribeye	5.1	76.1	--	--	5.5	3.1	13.2	1.4	414.0	5.2	80.6	5.5	58.8	--	--	8.6	2.3	12.3	2.0	358.4	5.7	63.1
St. dev.	0.7	33.7	--	--	3.3	2.8	3.0	0.9	147.0	0.7	35.9	0.7	27.4	--	--	3.2	1.6	2.4	1.0	122.3	0.6	28.7
Min	3.5	39.6	--	--	1.8	1.1	2.3	1.1	222.6	3.6	41.8	4.0	37.2	--	--	4.0	1.2	3.6	1.6	227.8	4.1	40.0
Max	7.5	357.3	--	--	13.7	26.0	14.2	6.8	1,376.7	7.5	384.5	7.4	298.5	--	--	16.4	16.2	13.3	6.1	1,291.5	7.8	316.2
Roasting Joint	6.3	71.4	7.9	5.7	8.8	3.1	--	--	513.1	6.5	80.3	6.6	59.0	8.4	5.5	9.0	2.4	--	--	449.0	6.8	66.9
St. dev.	0.9	33.6	2.3	4.0	3.0	2.2	--	--	206.6	0.8	36.4	0.9	26.1	1.6	2.9	2.2	1.3	--	--	152.5	0.9	28.0
Min	4.5	36.2	2.2	1.1	1.8	1.1	--	--	302.4	4.7	40.7	4.6	33.5	4.9	1.2	5.1	1.2	--	--	265.7	4.7	39.6
Max	8.2	340.4	14.2	27.1	14.2	10.2	--	--	1,788.6	8.4	368.6	8.8	273.0	13.7	18.6	13.4	6.5	--	--	1,357.0	8.9	291.2
Rump Steak	2.6	87.0	7.3	2.4	13.1	1.7	11.5	1.2	272.7	3.0	92.3	2.9	56.3	7.2	2.8	12.4	1.5	9.8	1.4	211.2	3.4	62.0
St. dev.	0.2	14.6	5.8	1.7	13.3	1.2	2.1	0.2	47.0	0.3	14.7	0.3	9.1	3.1	1.4	5.7	0.5	1.8	0.5	32.5	0.3	9.1
Min	2.2	57.7	1.1	1.1	1.4	1.1	2.9	1.1	177.6	2.4	62.2	2.5	37.2	2.5	1.2	2.6	1.2	2.3	1.2	144.4	2.8	43.6
Max	3.4	154.9	18.4	11.3	33.3	6.8	12.2	3.4	436.3	4.1	158.3	4.6	103.0	18.6	8.1	22.9	3.2	10.5	3.2	316.7	5.2	107.0
Sirloin	5.5	107.4	7.1	10.3	5.9	3.6	9.4	2.1	691.9	5.7	123.4	6.2	95.2	7.9	12.1	8.4	2.4	10.7	2.3	714.0	6.5	112.1
St. dev.	0.6	31.9	2.2	5.4	2.5	2.4	1.7	2.5	176.6	0.6	34.4	0.6	25.8	1.5	4.8	2.7	1.1	1.8	2.8	147.1	0.6	27.9
Min	4.2	67.8	3.8	2.3	1.9	1.1	3.3	1.1	486.8	4.3	81.4	4.7	65.0	5.3	4.0	3.6	1.2	5.3	1.2	503.5	4.9	77.5
Max	6.9	205.8	15.5	31.7	12.1	10.2	10.1	12.4	1,461.7	6.9	237.5	7.5	182.6	13.0	26.7	15.7	7.7	11.5	11.7	1,369.6	7.7	208.4
Steak Mince	2.1	488.1	--	--	2.5	12.2	--	--	1,058.5	2.1	500.2	2.2	362.9	--	--	2.4	9.8	--	--	818.3	2.2	372.7
St. dev.	0.3	50.1	--	--	0.5	4.7	--	--	137.4	0.3	49.8	0.3	38.9	--	--	0.4	3.2	--	--	100.8	0.3	38.6
Min	1.4	350.5	--	--	1.1	1.1	--	--	738.7	1.4	361.8	1.6	266.2	--	--	1.6	2.4	--	--	617.7	1.6	272.6
Max	2.7	671.7	--	--	4.1	24.9	--	--	1,396.5	2.7	688.6	2.7	520.2	--	--	3.5	19.4	--	--	1,044.7	2.7	531.5

Source: Based on data provided by the Centre for Value Chain Research (VCR^2), Kent Business School.
Notes:
1/ Units and expenditure are figures per customer on the group. All the figures are multiplied by 1E+05.

3.2. Model

The conditional demand system used was the dynamic version of the so-called Linear Approximation of the Almost Ideal Demand System (LA/AIDS). This section will only present the model briefly, as it is a well-known model in the economic literature and extensive information about its characteristics can be found elsewhere, e.g., Edgerton et al. [52] where it was applied to food demand in the Nordic Countries. The reason for using the dynamic version of the LA/AIDS model and not the static version is that the results from the estimation of the latter showed significant autocorrelation problems. In the LA/AIDS model the share equations are given by (1):

$$\omega_{i,t} = \alpha_0 + \sum_{j=1}^{n} \phi_j \omega_{j,t-1} + \sum_{j=1}^{k} \alpha_{ij} \cdot \log\left(P_{j,t}\right) + \alpha_{ik+1} \cdot \log\left(\frac{E}{P}\right)_t + \mu_{i,t} \tag{1}$$

Where $\omega_{i,t} = \dfrac{P_{i,t} \cdot Q_{i,t}}{E_t}$ is the expenditure share of the brand i in time t, $P_{i,t}$ denotes the price of the brand i at time t, $Q_{i,t}$ is the quantity purchased of i at t and E is the expenditure in the category (e.g., total expenditure in beef filet) and $\mu_{i,t}$. P is a geometric price index (Stone price index) defined as $\log\left(P_t\right) = \sum_{i=1}^{k} \omega_{i,t} \cdot \log\left(P_{i,t}\right)$. Similar to the Rotterdam demand system, the dynamic LA/AIDS model needs to satisfy a number of constraints in order to be consistent with the economic theory. These are given in (2):

$$\sum_{i=1}^{k} \alpha_{ik+1} = 1; \sum_{i=1}^{k} \alpha_{ij} = 0 \ \left(\text{Adding-up}\right)$$
$$\sum_{j=1}^{k} \alpha_{ij} = 0 \ \left(\text{Homogeneity}\right) \tag{2}$$
$$\alpha_{ij} = \alpha_{ji} \ \left(\text{Symmetry}\right)$$

In addition, in order to identify the model, additional constraints to those presented in (1) need to be imposed to it. In this paper, we follow Edgerton et al. [52] and use $\sum_{j=1}^{n} \phi_j = 0$.

The Marshallian elasticities are given by ε_{ii} (own price elasticity), ε_{ij} (cross price elasticity and η_i (expenditure elasticity) in (3) :

$$\varepsilon_{ii} = -1 + \frac{\alpha_{ii}}{\omega_i} - \alpha_{ik+1}$$
$$\varepsilon_{ij} = \frac{\alpha_{ij}}{\omega_i} - \alpha_{ik+1} \frac{\omega_j}{\omega_i} \tag{3}$$
$$\eta_i = 1 + \frac{\alpha_{ik+1}}{\omega_i}$$

The own ($\widetilde{\varepsilon}_{ii}$) and cross price Hicksian (i.e., compensated) elasticities ($\widetilde{\varepsilon}_{ij}$) are given by (4):

$$\widetilde{\varepsilon}_{ii} = -1 + \frac{\alpha_{ii}}{\omega_i} - \omega_i$$
$$\widetilde{\varepsilon}_{ij} = \frac{\alpha_{ij}}{\omega_i} + \omega_j \tag{4}$$

As mentioned, the model to be estimated is a conditional one (i.e., conditional to the expenditure of the different beef categories) and it was applied for each one of the categories (brisket joint, stewing steak, fillet, ribeye, roasting joint, rump steak, sirloin and steak mince). The previously described models were estimated using Iterative Seemingly Unrelated Regressions.

4. Results and discussion

The results of the estimation are presented in Tables 2 and 3. Table 2 reports the Marshallian or uncompensated elasticities and Table 3 the Hicksian or compensated elasticities. In both cases the elasticities were evaluated at the mean values of the expenditure shares.

While all the elasticities are of interest (and they are reported in the tables) we shall concentrate the discussion on the Scotch beef elasticities. These are highlighted in the table by a rectangle.

Despite the data problems all the own price elasticities for Scotch beef (and most of those for the other brands, too) were statistically significant at 1 per cent and with the right sign (i.e., negative).

As shown in Table 2, the values of most of the own price elasticities for Scotch beef fluctuated around one, fluctuating within a very narrow range. Thus, the lowest elasticity (in absolute value) for Scotland (i.e., 'Altogether') was found in the case of roasting joint (-0.88) and the highest elasticity in absolute value was for the brisket joint (-1.11). This result indicates that changes in the price of Scotch beef will produce little or no percentage change in the revenue from the sale of the good as the change in price will be offset by the change in quantities.[3]

The Marshallian cross price elasticities, which are measures of whether the different products are gross substitutes or complements, were found to be quite low (although different than zero), indicating that consumers differentiate Scotch beef from the other brands.

In addition, some of the Marshallian cross price elasticities showed a statistically significant negative sign, indicating that some of the other brands are complements to Scotch beef. This is not a strange result and can be found, for instance, in Hayes et al. [19] and Cotterill [13]. While the explanation can be found in the fact that consumers might be buying more than one brand within a category, it can also be due to the fact that the dataset comprises aggregated transactions. Under this situation, Hayes et al. recommend establishing the substitution or complementarity of products based on the Hicksian cross price elasticities.

As regards the differences between the different socio-economic groups, the own price elasticities for Scotch beef were found to be very similar in terms of value and range to what was observed for the Scottish average.

With respect to the expenditure elasticity for Scotch beef, these were for most of the categories and socio-economic groups slightly above one, indicating that an increase in the amount of money allocated to the category (recall that this is a condition demand system) will slightly increase the quantity purchased of Scotch beef (exceptions to this were the elasticities for fillet steak for the affluent and middle groups, which were slightly below one).

All the own price Hicksian elasticities showed the appropriate negative sign and those cross price elasticities that were significantly different than zero, were positive, indicating that the other brands are net substitutes for the Scotch beef (but similar to the Marshallian case the values were quite low indicating that Scotch beef is seen closely as an independent product).

The estimated own price Hicksian elasticities were much lower than the Marshallian ones, indicating that the income effect corresponding to the change in the own price was important.

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[3] This result comes from the fact that $\varepsilon_i^R = 1 - |\varepsilon_{ii}|$, where ε_i^R is the revenue (or expenditure from the point of view of the consumer) elasticity with respect to the price of the good i and ε_{ii} is the own price elasticity for the good i. This also assumes that the cross price elasticities are equal to zero.

Table 2. Marshallian elasticities (ε)

	Affluent group															Middle group														
	Price elasticities												Expenditure elasticity	St. dev.	Sig.	Price elasticities												Expenditure elasticity	St. dev.	Sig.
	Scotch beef			Highest quality			Own Label			Aberdeen Angus						Scotch beef			Highest quality			Own Label			Aberdeen Angus					
	ε	St. dev.	Sig.	ε	St. dev.	Sig.	ε	St. dev.	Sig.	ε	St. dev.	Sig.				ε	St. dev.	Sig.	ε	St. dev.	Sig.	ε	St. dev.	Sig.	ε	St. dev.	Sig.			
Brisket Joint																															
Scotch beef	-1.01	0.03	*	-0.05	0.02		-0.04	0.00	*	--	--		1.09	0.03	*	-1.07	0.03	*	-0.10	0.02	*	-0.11	0.01	*	--	--		1.28	0.03	*
Highest quality	-0.03	0.28		-0.60	0.20	*	0.00	0.04		--	--		0.63	0.27	*	0.18	0.14		-0.51	0.08	*	-0.01	0.04		--	--		0.33	0.13	*
Own label	-15.80	0.09	*	-1.66	0.06	*	-1.39	0.04	*	--	--		18.84	0.08	*	-5.23	0.08	*	-1.02	0.04	*	-1.41	0.05	*	--	--		7.66	0.07	*
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Stewing Steak																															
Scotch beef	-1.08	0.02	*	-0.01	0.01		0.00	0.01		0.05	0.01	*	1.05	0.01	*	-0.99	0.02	*	-0.01	0.01		-0.03	0.01		0.01	0.01		1.03	0.01	*
Highest quality	-0.27	0.29		-0.54	0.15	*	-0.12	0.09		-0.04	0.08		0.97	0.18	*	-0.05	0.22		-0.59	0.12	*	-0.02	0.11		-0.09	0.05		0.75	0.09	*
Own label	0.22	0.28		-0.14	0.11		-0.84	0.14	*	-0.11	0.11		0.87	0.15	*	-0.45	0.21		-0.03	0.08		-0.52	0.15	*	-0.03	0.04		1.03	0.09	*
Aberdeen Angus	-14.32	0.20	*	-0.63	0.05	*	-0.57	0.06	*	-2.64	0.16	*	18.15	0.07	*	-27.03	0.19	*	-1.40	0.07	*	-1.84	0.08	*	-2.06	0.13	*	32.34	0.06	*
Fillet																															
Scotch beef	-0.80	0.05	*	-0.15	0.03	*	-0.02	0.01	*	--	--		0.97	0.04	*	-0.85	0.04	*	-0.11	0.02	*	-0.02	0.01	*	--	--		0.99	0.03	*
Highest quality	-1.07	0.25	*	-0.18	0.16		0.01	0.03		--	--		1.24	0.22	*	-0.89	0.23	*	-0.26	0.14		0.00	0.04		--	--		1.14	0.21	*
Own label	-36.25	0.41	*	-6.39	0.22	*	-1.43	0.10	*	--	--		44.08	0.39	*	-19.66	0.21	*	-2.79	0.11	*	-1.54	0.08	*	--	--		23.99	0.18	*
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Ribeye																															
Scotch beef	-1.05	0.02	*	--	--		-0.02	0.01	*	0.01	0.01		1.07	0.02	*	-1.08	0.02	*	--	--		-0.08	0.01	*	-0.02	0.01		1.19	0.02	*
Highest quality	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Own label	-0.11	0.22		--	--		-0.52	0.08	*	-0.20	0.06	*	0.82	0.19	*	0.10	0.09		--	--		-0.31	0.03	*	0.03	0.04		0.18	0.09	*
Aberdeen Angus	-11.34	0.15	*	--	--		-0.78	0.04	*	-1.94	0.09	*	14.06	0.11	*	-6.46	0.13	*	--	--		-0.84	0.04	*	-1.87	0.10	*	9.17	0.10	*
Roasting Joint																															
Scotch beef	-0.95	0.03	*	-0.08	0.02	*	-0.01	0.01		--	--		1.03	0.02	*	-0.95	0.02	*	-0.07	0.01	*	-0.04	0.01	*	--	--		1.06	0.02	*
Highest quality	-0.36	0.24		-0.43	0.19		0.01	0.05		--	--		0.78	0.18	*	-0.39	0.16		-0.56	0.10	*	0.08	0.04		--	--		0.86	0.16	*
Own label	-25.50	0.27	*	-3.27	0.17	*	-1.78	0.15	*	--	--		30.55	0.18	*	-12.87	0.17	*	-1.44	0.07	*	-1.57	0.11	*	--	--		15.88	0.13	*
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Rump Steak																															
Scotch beef	-1.03	0.04	*	-0.06	0.01	*	-0.05	0.00	*	-0.02	0.01		1.16	0.04	*	-1.07	0.03	*	-0.10	0.01	*	-0.11	0.01	*	0.00	0.01		1.27	0.03	*
Highest quality	-0.33	0.24		-0.65	0.08	*	-0.08	0.03	*	-0.01	0.04		1.07	0.27	*	-0.06	0.14		-0.43	0.05	*	-0.04	0.03		-0.07	0.02	*	0.60	0.15	*
Own label	0.20	0.05	*	-0.02	0.02		-0.42	0.02	*	-0.02	0.03		0.26	0.06	*	0.06	0.07		-0.01	0.02		-0.41	0.03	*	-0.01	0.02		0.37	0.08	*
Aberdeen Angus	-8.87	0.15	*	-1.32	0.05	*	-1.08	0.03	*	-1.80	0.09	*	13.06	0.16	*	-9.95	0.16	*	-2.06	0.04	*	-2.04	0.04	*	-1.86	0.13	*	15.92	0.12	*
Sirloin																															
Scotch beef	-0.94	0.04	*	-0.11	0.03	*	-0.01	0.01		0.01	0.02		1.06	0.03	*	-0.96	0.03	*	-0.06	0.02	*	-0.03	0.00	*	0.01	0.01		1.03	0.03	*
Highest quality	-0.34	0.18		-0.39	0.1	*	-0.04	0.02		-0.02	0.06		0.79	0.14	*	-0.71	0.22	*	-0.59	0.13	*	-0.06	0.03		-0.02	0.07		1.37	0.21	*
Own label	0.06	0.27		-0.35	0.2		-0.42	0.08	*	0.15	0.19		0.56	0.18	*	-0.05	0.11		-0.04	0.06		-0.48	0.03	*	0.07	0.06		0.50	0.09	*
Aberdeen Angus	-30.49	0.63	*	-6.60	0.4	*	-0.58	0.13	*	-2.14	0.60	*	39.81	0.40	*	-14.80	0.26	*	-1.92	0.13	*	-0.81	0.05	*	-2.23	0.19	*	19.77	0.23	
Steak Mince																															
Scotch beef	-1.00	0.01	*	--	--		-0.01	0.00		--	--		1.01	0.01	*	-0.98	0.02	*	--	--		-0.04	0.01	*	--	--		1.02	0.02	*
Highest quality	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Own label	-47.94	0.50	*	--	--		-1.73	0.21	*	--	--		49.68	0.43	*	-18.17	0.39	*	--	--		-1.29	0.18	*	--	--		19.46	0.36	*
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	

Table 2. Marshallian elasticities (ε) (cont.)

	Poorer group															Altogether														
	Price elasticities												Expenditure elasticity	St. dev.	Sig.	Price elasticities												Expenditure elasticity	St. dev.	Sig.
	Scotch beef			Highest quality			Own Label			Aberdeen Angus						Scotch beef			Highest quality			Own Label			Aberdeen Angus					
	ε	St. dev.	Sig.	ε	St. dev.	Sig.	ε	St. dev.	Sig.	ε	St. dev.	Sig.				ε	St. dev.	Sig.	ε	St. dev.	Sig.	ε	St. dev.	Sig.	ε	St. dev.	Sig.			
Brisket Joint																														
Scotch beef	-1.11	0.04	*	0.00	0.02		-0.01	0.01		--	--		1.12	0.04	*	-1.13	0.04	*	0.00	0.02		-0.01	0.01		--	--		1.14	0.03	*
Highest quality	0.85	0.29	*	-0.79	0.15	*	-0.17	0.08		--	--		0.11	0.31	*	0.70	0.27	*	-0.92	0.19	*	-0.12	0.08		--	--		0.34	0.22	*
Own label	-12.95	0.26	*	-1.68	0.11	*	-1.65	0.14	*	--	--		16.28	0.26	*	-11.50	0.19	*	-1.54	0.11	*	-1.74	0.11	*	--	--		14.79	0.15	*
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Stewing Steak																														
Scotch beef	-0.98	0.01	*	-0.01	0.00		-0.05	0.01	*	0.01	0.00		1.03	0.01	*	-1.06	0.02	*	0.00	0.01		-0.01	0.01		0.02	0.01	*	1.04	0.01	*
Highest quality	0.09	0.18		-0.46	0.09	*	-0.20	0.10		-0.02	0.03		0.60	0.13	*	0.47	0.24		-0.80	0.13	*	-0.17	0.12		-0.16	0.07		0.66	0.13	*
Own label	-0.92	0.21	*	-0.10	0.04		0.14	0.19		0.00	0.05		0.89	0.07	*	-0.07	0.25		-0.12	0.08		-0.64	0.19	*	0.04	0.09		0.80	0.08	*
Aberdeen Angus	-97.00	0.47	*	-2.45	0.07	*	-5.08	0.27	*	-2.79	0.35	*	107.31	0.11	*	-31.09	0.27	*	-1.23	0.08	*	-1.49	0.15	*	-2.61	0.19	*	36.42	0.07	*
Fillet																														
Scotch beef	-0.95	0.04	*	-0.05	0.02	*	-0.02	0.01	*	--	--		1.02	0.03	*	-0.91	0.04	*	-0.09	0.02	*	-0.02	0.01		--	--		1.01	0.03	*
Highest quality	-0.39	0.29		-0.47	0.14	*	-0.06	0.05		--	--		0.93	0.29	*	-0.59	0.23	*	-0.43	0.16	*	-0.01	0.04		--	--		1.03	0.19	*
Own label	-26.90	0.37	*	-3.16	0.15	*	-1.28	0.12	*	--	--		31.34	0.36	*	-28.14	0.31	*	-4.27	0.19	*	-1.52	0.12	*	--	--		33.93	0.26	*
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Ribeye																														
Scotch beef	-1.00	0.01	*	--	--		-0.02	0.01	*	-0.02	0.01	*	1.04	0.01	*	-1.05	0.02	*	--	--		-0.02	0.01	*	0.01	0.01		1.06	0.01	*
Highest quality	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Own label	-0.55	0.24		--	--		-0.49	0.11	*	0.04	0.07		0.99	0.23	*	-0.18	0.19		--	--		-0.57	0.10	*	-0.14	0.07		0.88	0.14	*
Aberdeen Angus	-20.93	0.16	*	--	--		-0.79	0.06	*	-1.71	0.09	*	23.43	0.14	*	-12.43	0.14	*	--	--		-0.84	0.05	*	-2.04	0.08	*	15.31	0.10	*
Roasting Joint																														
Scotch beef	-0.88	0.03	*	-0.08	0.02	*	-0.05	0.01	*	--	--		1.02	0.02	*	-0.89	0.03	*	-0.10	0.02	*	-0.05	0.01	*	--	--		1.03	0.02	*
Highest quality	-0.85	0.24	*	-0.43	0.17	*	0.23	0.10		--	--		1.05	0.17	*	-0.70	0.22	*	-0.44	0.19		0.27	0.09	*	--	--		0.86	0.13	*
Own label	-16.50	0.28	*	-1.16	0.15	*	-1.49	0.17	*	--	--		19.15	0.20	*	-18.68	0.27	*	-1.51	0.18	*	-1.70	0.18	*	--	--		21.89	0.14	*
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Rump Steak																														
Scotch beef	-1.02	0.02	*	-0.03	0.00	*	-0.05	0.00	*	-0.03	0.00	*	1.13	0.02	*	-1.10	0.03	*	-0.04	0.01	*	-0.05	0.01	*	-0.02	0.01	*	1.20	0.03	*
Highest quality	-0.13	0.28		-0.48	0.07	*	-0.03	0.04		-0.04	0.02		0.68	0.31	*	0.17	0.24		-0.67	0.09	*	-0.09	0.04		0.04	0.03		0.55	0.25	*
Own label	0.12	0.17		0.00	0.03		-0.31	0.03	*	-0.05	0.01	*	0.24	0.19	*	0.39	0.11	*	-0.06	0.04		-0.42	0.04	*	-0.01	0.02		0.10	0.12	
Aberdeen Angus	-16.56	0.07	*	-1.06	0.01	*	-1.29	0.01	*	-1.43	0.04	*	20.33	0.06	*	-12.05	0.11	*	-1.33	0.04	*	-1.36	0.03	*	-1.82	0.06	*	16.56	0.11	*
Sirloin																														
Scotch beef	-0.97	0.04	*	-0.06	0.02	*	-0.02	0.01		0.02	0.01		1.03	0.02	*	-0.96	0.05	*	-0.07	0.03		-0.02	0.01	*	0.02	0.02		1.04	0.02	*
Highest quality	-0.26	0.26		-0.52	0.18	*	-0.04	0.06		0.06	0.06		0.75	0.18	*	-0.23	0.24		-0.60	0.20	*	0.00	0.04		0.03	0.06		0.80	0.14	*
Own label	-0.56	0.38		-0.15	0.21		-0.30	0.16		0.09	0.12		0.92	0.27	*	-0.40	0.30		0.02	0.19		-0.64	0.11	*	0.30	0.15		0.71	0.16	*
Aberdeen Angus	-33.50	0.46	*	-3.87	0.24	*	-1.13	0.14	*	-3.01	0.34	*	41.51	0.27	*	-26.57	0.48	*	-4.25	0.28	*	-0.64	0.13	*	-2.85	0.37	*	34.31	0.23	*
Steak Mince																														
Scotch beef	-1.00	0.01	*	--	--		-0.02	0.00	*	--	--		1.02	0.01	*	-1.00	0.01	*	--	--		-0.01	0.01		--	--		1.01	0.01	*
Highest quality	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Own label	-34.34	0.38	*	--	--		-1.27	0.17	*	--	--		35.61	0.39	*	-33.42	0.35	*	--	--		-1.54	0.21	*	--	--		34.96	0.31	*
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	

Source: Based on data provided by the Centre for Value Chain Research (VCR[2]), Kent Business School.

Table 3. Hicksian elasticities (η)

	Affluent group — Price elasticities												Middle group — Price elasticities											
	Scotch beef			Highest quality			Own Label			Aberdeen Angus			Scotch beef			Highest quality			Own Label			Aberdeen Angus		
	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.
Brisket Joint																								
Scotch beef	-0.07	0.02	*	0.05	0.02	*	0.02	0.00	*	--	--		-0.14	0.02	*	0.08	0.02	*	0.06	0.01	*	--	--	
Highest quality	0.51	0.19	*	-0.54	0.20	*	0.03	0.03		--	--		0.43	0.09	*	-0.46	0.08	*	0.04	0.04		--	--	
Own label	0.32	0.06	*	0.05	0.06		-0.38	0.04	*	--	--		0.35	0.06	*	0.04	0.04		-0.39	0.05	*	--	--	
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Stewing Steak																								
Scotch beef	-0.16	0.02	*	0.02	0.01	*	0.03	0.01	*	0.10	0.01	*	-0.10	0.02	*	0.03	0.01	*	0.03	0.01		0.04	0.01	*
Highest quality	0.58	0.21	*	-0.50	0.15	*	-0.09	0.09		0.02	0.08		0.61	0.19	*	-0.56	0.12	*	0.02	0.11		-0.07	0.05	
Own label	0.98	0.22	*	-0.11	0.11		-0.82	0.14	*	-0.06	0.11		0.45	0.19	*	0.01	0.08		-0.46	0.15	*	0.01	0.04	
Aberdeen Angus	1.64	0.18	*	0.01	0.05		-0.03	0.06		-1.62	0.16	*	1.12	0.16	*	-0.09	0.07		0.01	0.08		-1.04	0.13	*
Fillet																								
Scotch beef	0.00	0.03		-0.01	0.03		0.00	0.01		--	--		-0.03	0.02		0.01	0.02		0.02	0.01	*	--	--	
Highest quality	-0.05	0.16		0.00	0.16		0.04	0.03		--	--		0.07	0.14		-0.12	0.14		0.05	0.04		--	--	
Own label	0.15	0.23		0.27	0.22		-0.42	0.09	*	--	--		0.35	0.12	*	0.15	0.11		-0.50	0.08	*	--	--	
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Ribeye																								
Scotch beef	-0.12	0.01	*	--	--		0.03	0.01	*	0.08	0.01	*	-0.14	0.02	*	--	--		0.03	0.01	*	0.11	0.01	*
Highest quality	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Own label	0.62	0.11	*	--	--		-0.48	0.08	*	-0.14	0.06		0.25	0.05	*	--	--		-0.29	0.04	*	0.05	0.04	
Aberdeen Angus	1.01	0.10	*	--	--		-0.09	0.04		-0.92	0.09	*	0.79	0.09	*	--	--		0.04	0.04		-0.83	0.09	*
Roasting Joint																								
Scotch beef	-0.06	0.03		0.04	0.02		0.02	0.01	*	--	--		-0.07	0.02	*	0.04	0.01	*	0.02	0.01		--	--	
Highest quality	0.30	0.19		-0.34	0.19		0.04	0.05		--	--		0.33	0.10	*	-0.47	0.10	*	0.14	0.04	*	--	--	
Own label	0.63	0.22	*	0.12	0.17		-0.75	0.15	*	--	--		0.32	0.13		0.22	0.07	*	-0.54	0.11	*	--	--	
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Rump Steak																								
Scotch beef	-0.18	0.02	*	0.07	0.01	*	0.04	0.00	*	0.07	0.01	*	-0.21	0.02	*	0.06	0.01	*	0.06	0.01	*	0.08	0.01	*
Highest quality	0.45	0.08	*	-0.53	0.09	*	0.01	0.01		0.07	0.04		0.35	0.05	*	-0.36	0.05	*	0.04	0.03		-0.03	0.02	
Own label	0.39	0.03	*	0.01	0.02		-0.40	0.02	*	0.00	0.03		0.31	0.04	*	0.04	0.02		-0.36	0.03	*	0.02	0.02	
Aberdeen Angus	0.68	0.09	*	0.10	0.05		0.00	0.03		-0.78	0.09	*	0.88	0.12	*	-0.07	0.04		0.03	0.04		-0.85	0.13	*
Sirloin																								
Scotch beef	-0.10	0.04	*	0.06	0.03		0.01	0.01		0.03	0.02		-0.14	0.02	*	0.05	0.02	*	0.02	0.00	*	0.07	0.01	*
Highest quality	0.29	0.14		-0.26	0.14		-0.03	0.02		0.00	0.06		0.39	0.14	*	-0.44	0.13	*	0.00	0.02		0.05	0.07	
Own label	0.50	0.24		-0.25	0.17		-0.41	0.08	*	0.16	0.19		0.35	0.08	*	0.01	0.05		-0.46	0.03	*	0.10	0.06	
Aberdeen Angus	1.03	0.63		-0.02	0.38		0.11	0.13		-1.12	0.60		1.03	0.21	*	0.10	0.13		0.09	0.05		-1.22	0.18	*
Steak Mince																								
Scotch beef	-0.02	0.00	*	--	--		0.01	0.00	*	--	--		-0.01	0.01		--	--		0.01	0.01		--	--	
Highest quality	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Own label	0.72	0.21	*	--	--		-0.72	0.21	*	--	--		0.26	0.18		--	--		-0.26	0.18		--	--	
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	

Table 3. Hicksian elasticities (η) (cont.)

| | Poorer group — Price elasticities | | | | | | | | | | | | Altogether — Price elasticities | | | | | | | | | | | |
| | Scotch beef | | | Highest quality | | | Own Label | | | Aberdeen Angus | | | Scotch beef | | | Highest quality | | | Own Label | | | Aberdeen Angus | | |
	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.	η	St. dev.	Sig.
Brisket Joint																								
Scotch beef	-0.16	0.03	*	0.10	0.02	*	0.06	0.01	*	--	--		-0.18	0.03	*	0.11	0.02	*	0.07	0.01	*	--	--	
Highest quality	0.94	0.17	*	-0.78	0.14	*	-0.16	0.08		--	--		0.98	0.21	*	-0.89	0.19	*	-0.09	0.08		--	--	
Own label	0.84	0.18	*	-0.23	0.11		-0.61	0.14	*	--	--		0.85	0.16	*	-0.13	0.11		-0.73	0.11	*	--	--	
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Stewing Steak																								
Scotch beef	-0.03	0.01		0.02	0.00	*	-0.01	0.01		0.02	0.00	*	-0.12	0.02	*	0.03	0.01	*	0.03	0.01	*	0.05	0.01	*
Highest quality	0.64	0.14	*	-0.44	0.09	*	-0.18	0.10		-0.02	0.03		1.06	0.20	*	-0.78	0.13	*	-0.14	0.12		-0.14	0.07	
Own label	-0.11	0.19		-0.08	0.04		0.18	0.19		0.01	0.05		0.64	0.22	*	-0.09	0.08		-0.61	0.19	*	0.06	0.09	
Aberdeen Angus	1.79	0.44	*	-0.04	0.07		0.04	0.27		-1.79	0.35	*	1.67	0.24	*	-0.15	0.08		0.09	0.15		-1.60	0.19	*
Fillet																								
Scotch beef	-0.06	0.02	*	0.05	0.02	*	0.01	0.01		--	--		-0.06	0.03		0.04	0.02		0.02	0.01		--	--	
Highest quality	0.42	0.14	*	-0.38	0.14	*	-0.03	0.05		--	--		0.27	0.16		-0.29	0.16		0.02	0.04		--	--	
Own label	0.36	0.17		-0.10	0.15		-0.26	0.12		--	--		0.42	0.21		0.08	0.18		-0.50	0.12	*	--	--	
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Ribeye																								
Scotch beef	-0.04	0.01	*	--	--		0.01	0.01	*	0.03	0.01	*	-0.12	0.01	*	--	--		0.03	0.01	*	0.08	0.01	*
Highest quality	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Own label	0.37	0.14	*	--	--		-0.45	0.11	*	0.09	0.07		0.60	0.13	*	--	--		-0.52	0.10	*	-0.08	0.07	
Aberdeen Angus	0.63	0.11	*	--	--		0.07	0.06		-0.70	0.09	*	1.08	0.11	*	--	--		-0.06	0.05		-1.02	0.08	*
Roasting Joint																								
Scotch beef	-0.01	0.03		0.01	0.02		0.00	0.01		--	--		0.00	0.03		0.00	0.02		0.00	0.01		--	--	
Highest quality	0.06	0.19		-0.35	0.17		0.29	0.10	*	--	--		0.03	0.20		-0.35	0.19		0.32	0.09	*	--	--	
Own label										--	--		0.00	0.25		0.67	0.18	*	-0.67	0.18	*	--	--	
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Rump Steak																								
Scotch beef	-0.08	0.01	*	0.03	0.00	*	0.02	0.00	*	0.03	0.00	*	-0.17	0.01	*	0.07	0.01	*	0.05	0.01	*	0.06	0.01	*
Highest quality	0.44	0.08	*	-0.44	0.07	*	0.01	0.04		-0.01	0.01		0.59	0.09	*	-0.62	0.09	*	-0.04	0.04		0.07	0.03	*
Own label	0.32	0.04	*	0.01	0.03		-0.29	0.03	*	-0.03	0.01	*	0.47	0.05	*	-0.05	0.04		-0.42	0.04	*	0.00	0.02	
Aberdeen Angus	0.47	0.04	*	-0.01	0.01		-0.04	0.01	*	-0.42	0.04	*	0.71	0.07	*	0.10	0.04	*	0.00	0.03		-0.80	0.06	*
Sirloin																								
Scotch beef	-0.10	0.03	*	0.04	0.02		0.01	0.01		0.04	0.01	*	-0.12	0.04	*	0.07	0.03		0.01	0.01		0.05	0.02	*
Highest quality	0.37	0.19		-0.44	0.18		-0.02	0.06		0.08	0.06		0.42	0.21		-0.50	0.20	*	0.02	0.04		0.06	0.06	
Own label	0.22	0.28		-0.05	0.21		-0.27	0.16		0.11	0.12		0.18	0.26		0.12	0.19		-0.62	0.11	*	0.32	0.15	
Aberdeen Angus	1.51	0.41	*	0.34	0.25		0.13	0.15		-1.98	0.34	*	1.27	0.47	*	0.26	0.28		0.29	0.14		-1.82	0.37	*
Steak Mince																								
Scotch beef	-0.01	0.00		--	--		0.01	0.00		--	--		-0.02	0.01	*	--	--		0.02	0.01	*	--	--	
Highest quality	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	
Own label	0.27	0.16		--	--		-0.27	0.16		--	--		0.52	0.21	*	--	--		-0.52	0.21	*	--	--	
Aberdeen Angus	--	--		--	--		--	--		--	--		--	--		--	--		--	--		--	--	

Source: Based on data provided by the Centre for Value Chain Research (VCR[2]), Kent Business School.

5. Conclusions

The Scottish red meat industry is a major part of the Scottish agricultural economy and enjoys a well-deserved reputation for producing high quality beef and lamb. The purpose of the paper was to test, using data from one of the major supermarkets in the UK, whether the PGI product 'Scotch beef' was differentiated from other brands in the eyes of consumers. This is, to infer this from consumers' actions instead of consumers' opinions regarding their preferences for Scotch beef. To do this a demand system was estimated and the own and cross price elasticities analysed.

The results indicated that Scotch beef is seen as a differentiated product from other competing brands (highest quality, own brand and Aberdeen Angus). This could be inferred from the fact that although some of the Hicksian cross price elasticities were significant and positive, they were quite close to zero. This finding may represent some evidence of the success of promotional efforts to differentiate the Scotch beef name from competitor products in the eyes of consumers.

In addition, the fact that the Marshallian own price elasticities were close to one indicates that changes (decreases or increases) in the price for Scotch beef will not affect the revenues received from the sale of the product. This also may indicate that the increase in the sales of Scotch beef reported by the Scottish Government may be due to an increase in the preferences for Scotch beef as a reflection of the promotion of the category. However, this is something left for future research.

Acknowledgment

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